CHAPTER 9

Is Reducing Subsidies on Vehicle Fuel Equitable? A Lesson from Indonesian Reform Experience

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Today, fuel consumption is still subsidized in many parts of the world. It is estimated that fossil fuel related consumption subsidies amounted to US$ 557 billion in 2008. A recent assessment projected that phasing out these subsidies by 2020 would result in a reduction in primary energy demand at the global level of 5.8% and a fall in energy-related carbon dioxide emissions of 6.9%, compared with a baseline in which subsidy rates remain unchanged (IEA/OPEC/OECD/World Bank 2010, p. 4).

There are many reasons to call for reductions in fuel subsidies: Fuel subsidies create distortion by disregarding the economic value of the fuel, creating excess consumption, and discouraging energy substitution. They are also regarded as a major cause of environmental problems, not only from the pollution created by excessive fossil fuel combustion by industry and vehicles, but also due to excessive traffic and the inconvenience it causes. Fuel subsidies also discourage development of a more traffic-free public transport infrastructure. In most big Indonesian cities, this is already a major public concern.

In addition to the efficiency-related problem stated above, fuel subsidies are often deemed inequitable, as vehicle owners benefit greatly from the subsidy. Fuel pricing reform has been widely advocated as a means of promoting efficiency as well as equity.

However, in the Indonesian context, the biggest concern is the fiscal burden of the subsidy. In 2009, the Indonesian government spent more than US$ 6 billion to subsidize fuel consumption. This was almost 8% of total government spending. In a country with much more pressing issues such as poverty, education, and health, the allocation of such a large share of public spending on subsidizing fuel consumption seems to be inconsistent with rational resource allocation principles. However, the current situation has improved compared to the past few years. For example, in 2000 the fuel subsidy amounted to 40.9 trillion rupiah, or almost a third of total central

TABLE 9-1 Fuel Subsidy, Government Budget, and Oil Prices, 1999–2010.

	1999	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
Fuel Subsidy (Rp Trillion)	40.9	53.8	68.4	31.2	30.0	59.2	89.2	62.7	83.8	139.1	54.3	59.0
Government Spending (Rp Trillion)	201.9	188.4	260.5	322.2	376.5	430.0	411.6	470.2	504.6	693.4	696.1	699.7
Percent	20.3	28.6	26.3	9.7	8.0	13.8	21.7	13.3	16.6	20.1	7.8	8.4
World crude oil price ($/barrel)	17.1	27.1	22.7	23.5	27.1	34.6	49.9	60.3	69.7	97.0	61.0	60.0

Source: Ministry of Finance (2010), and IEA (2010)

government spending (see Table 9-1). Since the government always has a political constraint against reducing this subsidy, spending has been heavily limited by the fluctuation in the world oil prices.

When the world oil price started to increase rapidly from 2004 onward, the government saw no option but to reform its fuel pricing policy radically. In October 2005, the government made a big adjustment in fuel prices, increasing retail fuel prices for gasoline, kerosene, and diesel. The price of gasoline was increased by 87.5%, diesel by 104.7%, and—surprisingly—kerosene by 185.7%.

Over the past few years, reduction of the fuel subsidy has been one of the Indonesian government's main agendas. Gradual reform in fuel pricing policy through adjustments in fuel prices has been undertaken since 1999 (see Figure 9-1).

However, strong opposition from the people and parliament has slowed the reform. Most arguments against the reform are based on the concern that an increase in fuel prices would translate into an increase in other prices that would reduce purchasing power and exacerbate poverty. The fear is that the rise in fuel prices would create a chain reaction, affecting other costs such as transportation and other important commodities, thereby hurting the economy and those most vulnerable. In addition, some concerns are also related to the reform's effect on household income. Since economic activity is dependent on fuel, the increase in price of fuels would translate into an economic slowdown, reducing employment or real factor returns. It is common to see arguments that the impact through this channel will hurt the most vulnerable in society. These two possible channels through which a reduction in fuel subsidy will have an impact on households suggest that the economic consequences of reform as discussed above are inherently general equilibrium issues.

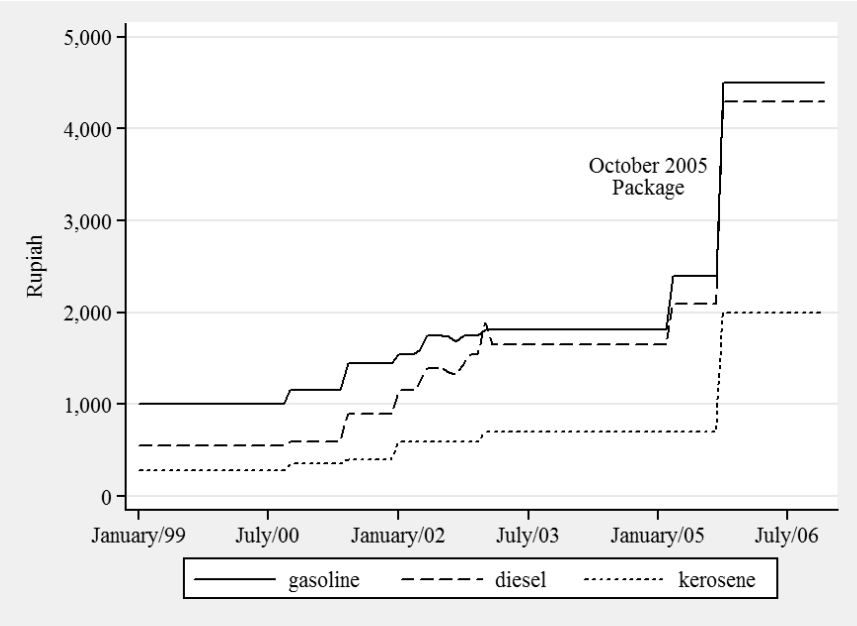

FIGURE 9-1 Prices of Gasoline, Diesel, and Kerosene around the Period of the Reform, 1999–2006.

Source: PERTAMINA (2008).

The main objective of this chapter is to analyze the distributional impact of fuel pricing reform using the Indonesian experience as implemented in October 2005 with its focus on vehicle fuel prices. Questions addressed are whether a reform of reducing the vehicle fuel subsidy in Indonesia constitutes a progressive reform and through which channel such a distributive impact can be explained. INDONESIA-E3, a computable general equilibrium (CGE) model with highly disaggregated household, is used for the analysis.

The chapter is organized as follows: the next section discusses relevant previous work. The subsequent section briefly describes the model, followed by discussions of the scenarios and results before a brief conclusion.

Previous Studies

World Bank (2006) is the only available study that assesses the distributional impact of the October 2005 package. Other studies exist but do not explicitly analyze the October 2005 reform. These are Clements et al. (2003), Sugema et al. (2005), and Ikhsan et al. (2005), all published before the October 2005 package was implemented.

World Bank (2006) looks at the impact of the increase in various fuel prices on household expenditure using data from the 2004 National Socioeconomic Survey (SUSENAS). The result suggests that in the absence of any compensatory measures, the October 2005 package would have led to a 5.6% increase in poverty incidence. Compensation in the form of an unconditional cash transfer to poor and near-poor households would have, on average, more than offset the negative impact of the fuel price increase.

Ikhsan et al. (2005) analyzes the distributional impact of the March 2005 fuel price adjustment that increased the price of kerosene to industry[1] by 22.22%, gasoline by 32.60%, diesel for transportation by 27.27%, diesel for industry by 33.33%, and diesel oil and fuel oil by 39.39%. Ikhsan et al. (2005) used a combination of a CGE model[2] and a simulation using household survey data. That result suggested that poverty rises by 0.24% without compensation, whereas poverty falls by 2.6% with fully effective compensation, and by 1.89% with compensation that is 75% effective (Ikhsan et al. 2005, Table 9). The policies simulated slightly reduce inequality.

The March 2005 fuel price adjustment is also analyzed by Sugema et al. (2005), where the poverty impact analysis is carried out using a SUSENAS-based micro-simulation, and the macro impact is analyzed using an ORANI-based CGE model. The result suggests poverty would rise by 1.95%. This poverty impact seems relatively high considering the petroleum price only rises by 29%.

Clements et al. (2003) examine the scenario of increasing the price of petroleum products by 25% using a CGE model. The study suggests aggregate real household consumption falls from 2.1% to 2.7% following a 25% increase in the price of petroleum products. Urban and high income households suffer the most, indicating the progressivity of the reform.

From a methodological point of view, the weaknesses of these studies lie in either the incompleteness or inaccuracy of the distributional analysis. In a market economy, the effect of a policy shock on a household's welfare works through both the market of commodities (through changing commodity prices) and the market of factors of production (through changing factor prices or employment). The change in real expenditure of various households then depends on both expenditure and factor ownership patterns of each of the respective households. Taking into account one without the other provides only a one-sided story. This incompleteness could be solved by an economy-wide framework, by using a model that has highly disaggregated households to maintain accuracy in the distributional story. It is very important to acknowledge that commodity prices, household expenditure, factor prices, and household income are all endogenous and solved simultaneously in the model. Household heterogeneity is also inherent and should be integrated in the model.

The World Bank's (2006) assessment, then, is a partial equilibrium story which overlooks the factor-income effect. The Ikhsan et al. (2005) study, despite combining a CGE model and a micro-simulation, is a top-down approach where commodity prices are exogenous in the micro-simulation, and commodity prices from the CGE model are determined by a single representative household. There is no connection between the economy-wide model and SUSENAS micro-simulation in the Sugema et al. (2005) study. Finally, the Clements et al. (2003) study is only based on 10 representative households, preventing accuracy in distributional analysis.

The innovation used in the model for this chapter is that of including highly disaggregated households within one integrated economy-wide framework. Because the households are classified by centile of real expenditure per capita, the model is not only able to capture expenditure and factor ownership patterns of households but also to assess the distributional impact more accurately. The cumulative density function (CDF) of real expenditure per capita before and after the shock can be pictured. Therefore, an objective answer to the question of whether a policy shock is progressive or regressive is readily available. This is the first time this model has been used for Indonesia. Warr (2006), for example, used this approach for Laos in assessing the poverty impact of large-scale irrigation investment.

The Computable General Equilibrium (CGE) Model

The analysis uses the INDONESIA-E3 (Economy-Equity-Environment) model, a CGE model with a strong focus on distributional analysis. The structure of the model is built based on the ORANI-G model (Horridge 2000) with two significant modifications. The first is allowing for substitution among energy commodities, and also between primary factors (capital, labor, and land) and energy. In this respect, this model has 38 industries and 43 commodities with detailed energy sectors. Energy commodities include coal, natural gas, gasoline, automotive diesel oil, industrial diesel oil, kerosene, LPG, and other fuels. Second, the model has been adapted to have multiple households not only on the expenditure or demand side of the model but also on the income side of the households. The household demand system follows the Linear Expenditure Demand (LES) system, and its parameters are estimated econometrically.[3]

The integration of highly disaggregated households into models adequate for accurate distributional analysis is made possible by constructing an Indonesian Social Accounting Matrix (SAM) 2003, which serves as the core database for the CGE model. The SAM is specially constructed and consists of 181 industries, 181 commodities, and 200 households (100 urban and 100 rural households grouped by centile of real expenditure per capita). The SAM (with a size of 768 x 768 accounts) constitutes the most disaggregated SAM for Indonesia yet to date at both the sectoral and household levels. The data used for constructing the SAM include the Indonesian Input-Output Table and—most important—household level survey data from SUSENAS. A detailed description of the SAM can be found in Yusuf (2006).

Scenario and Simulation Strategy

The scenario to be simulated is increasing the price of gasoline by 87.5% and diesel by 104.7%, as implemented by the Indonesian government in October 2005. To exactly represent the rate of the price increase as announced by the government on October 1, 2005, in the simulation the price of fuels is set exogenously and the subsidy rate is set to be determined endogenously in the model.

The simulation is carried out with the following three assumptions: (1) Capital is specific or immobile across sectors representing the short-run scenario to be reflected in the analysis; (2) All kinds of labor are mobile across sectors, but wage rigidity allows for aggregate employment to change; and (3) To isolate only the impact of the fuel subsidy reduction, the government revenue from the reduction of the subsidy is saved by endogenizing the government budget surplus.

Results and Discussion

This section looks first at macroeconomic and industry results before examining distributional results.

Macroeconomic and Industry Results

Table 9-2 shows the impact of the simulation on selected macroeconomic variables and income from each factor of production. GDP declines by 1.72% relative to the baseline, mostly due to the decline of aggregate employment (–3.32%). Aggregate real consumption expenditure falls by 2.61% relative to baseline. It should be noted, however, that this contractionary effect greatly reflects the short-run scenario represented by the assumption of wage rigidity as well as the amount of extra revenue from the reduction of subsidy which is kept as a budget surplus by the government.

The simulated impact on income from the ownership of factors of production reveals a distinct picture. Capital income falls much more proportionately than labor income, and among labor income categories, the fall in urban labor income is relatively larger than that of rural labor income. The fall in formal labor income is relatively larger than that of informal labor income. A plausible explanation is related to how the decline in output varies across sectors, as will be explained later. As we will see, this also has important implications for the distributional impact across various household groups through the income channel.

As shown in Table 9-3, industry output falls as a result of the increase in the price of vehicle fuels. The increase in fuel prices lowers fuel demand, resulting in an immediate reduction in the output of the refinery industry.

TABLE 9–2 Simulated Macroeconomic and Factor Market Results (% Relative to Baseline).

Macroeconomic		*Income from Factor Ownership*	
Real Gross Domestic Product	–1.72	Capital	–6.76
Real Household expenditure	–2.61	Agriculture, rural, formal labor	–1.20
Export (volume index)	–1.72	Agriculture, urban, formal labor	–0.87
Import (volume index)	–2.38	Agriculture, rural, informal labor	–1.05
Aggregate Employment	–3.32	Agriculture, urban, informal labor	–1.09
Consumer Price Index	1.12	Production, rural, formal labor	–2.20
		Production, urban, formal, labor	–3.93
		Production, rural, informal, labor	–2.06
		Production, urban, informal, labor	–2.58
		Clerical, rural, formal labor	–2.10
		Clerical, urban, formal, labor	–3.06
		Clerical, rural, informal, labor	–2.62
		Clerical, urban, informal, labor	–2.75
		Managerial, rural, formal labor	–1.49
		Managerial, urban, formal, labor	–2.26
		Managerial, rural, informal, labor	–2.56
		Managerial, urban, informal, labor	–2.99

Source: Author's calculation.

The final (new equilibrium) reduction in the output of petroleum refineries is 4.57% (relative to baseline without the reform). Other industries which experience big reductions are those closely related to the petroleum refinery sector. These are road transportation (–3.53%), other transportation (–5.18%), utility sectors (electricity by –1.98%, and water and gas by –2.98%), and some manufacturing industries (automotive by –3.10% and rubber and its products by –3.34%). After simulating an increase in the price of petroleum products, Clements et al. (2003) report that industries that experience a large drop in output are similar to the types of industries just mentioned.

As shown by the data on the input intensity of each sector, the industries which experience relatively larger contractions are energy intensive sectors which, in general, happen to be capital intensive or skilled-labor intensive. This explains why returns to capital have declined more proportionately than returns to other inputs such as unskilled labor. This has an important implication on the distributional impact as it affects the functional distribution of income by the tendency to hurt households endowed with capital more proportionately.

TABLE 9-3 Input Share and Simulated Change in Output (% of Baseline).

	Share in Total Input					*% Change in Output*
	Labor	*Capital*	*Land*	*Energy*	*Other*	
Paddy	51.4	16.56	14.5	0.00	17.54	–0.57
Other food crops	57.36	17.35	15.2	0.01	10.09	–1.04
Estate crops	52.73	11.21	8.88	0.29	26.89	–1.57
Livestock	42.39	8.08	3.41	0.03	46.08	–1.67
Wood and forests	36.37	21.78	21.34	0.42	20.09	–0.96
Fish	38.96	8.77	27.19	1.98	23.09	–1.08
Coal	8.09	72.01		13.17	6.73	–0.06
Crude oil	5.8	80.74		6.41	7.06	–0.14
Natural gas	5.81	80.97		6.44	6.77	–0.19
Other mining	26.38	47.48		2.16	23.98	–0.52
Rice	6.17	8.32		0.02	85.49	–0.52
Other food (manufactured)	15.23	18.59		0.84	65.34	–1.91
Clothing	14.58	19.1		0.83	65.48	–2.14
Wood products	18.24	25.36		1.05	55.35	–1.1
Pulp and paper	13.92	22.79		1.51	61.79	–2.32
Chemical product	11.88	14.7		3.56	69.86	–2.79
Petroleum refinery	7.54	57.83		8.04	26.6	–4.57
LNG	1.66	51.77		40.05	6.51	–0.83
Rubber and products	15.8	14.82		1.82	67.56	–3.34
Plastic and products	7.81	20.26		0.82	71.11	–1.97
Nonferrous metal	20.4	34.71		6.82	38.07	–1.09
Other metal	9.9	14.06		1.79	74.26	–1.53
Machineries	9.35	13.31		0.63	76.71	–3.16
Automotive industries	15.67	29.73		0.8	53.8	–3.1
Other manufacturing	14.06	26.56		1.4	57.98	–2.36
Electricity	5.92	50.14		19.33	24.62	–1.98
Water and gas	17.27	26.37		13.42	42.93	–2.98
Construction	23.09	9.55		4.76	62.6	–0.15
Trade	35.27	26.83		1.48	36.42	–1.95
Hotel and restaurants	36.93	10.99		0.04	52.04	–2.13
Road transportation	21.4	22.11		8.31	48.17	–3.53
Other transportation	12.48	18.17		10.33	59.01	–5.18
Banking and finance	18.9	53.47		0.25	27.38	–1.63
General government	53.98	5.62		2.14	38.26	–0.08
Education	43.72	8.54		1.1	46.65	–1.58
Health	54.5	9.02		0.19	36.29	–1.5
Entertainments	17.24	18.11		0.1	64.55	–2.26
Other services	25.06	34.83		0.31	39.79	–2.36

Source: Author's calculation.

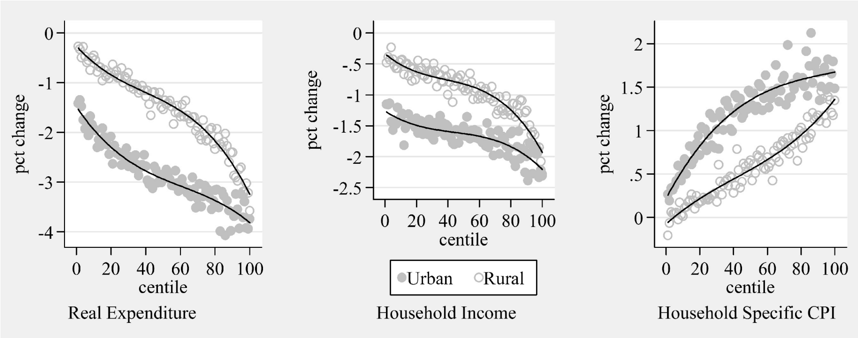

FIGURE 9-2 Incidence Curve and its Decomposition.

Source: Author's calculation.

Distributional Results

Figure 9-2 illustrates the impact of the reduction in vehicle fuel subsidy on household real expenditure, income, and household-specific consumer price index (CPI) for urban and rural households as well as across percentile of real expenditure per capita. The percentage change in real expenditure is used to calculate the Gini coefficient.

The change in the household nominal income and household-specific CPI indicates how the expenditure and factor income patterns of each household contribute to the distributional results. Household-specific CPI is a consumption-weighted average of the price increase of every commodity consumed by the respective household. It reflects the contribution of its household expenditure pattern and behavior. Still, the change in household income reflects changes in all sources of household income, comprising income from labor by skill types, capital, land, and transfers.

As clearly indicated by Figure 9-2, we can conclude that the reduction in vehicle fuel subsidy is progressive. The fuel subsidy on gasoline and diesel has been indeed inequitable, so that cutting the subsidy on these vehicle fuels would be a progressive reform. The progressivity of the reform is confirmed by the decline in the Gini coefficient (see Table 9-4). The calculation of the

TABLE 9-4 Simulated Distributional Impact (Gini Coefficient)

	Urban	*Rural*	*Urban + Rural*
Ex-ante Gini coefficient	0.347	0.277	0.350
Ex-post Gini coefficient	0.344	0.272	0.345
Change	–0.003	–0.005	–0.005

Source: Author's calculation.

Gini coefficient also suggests that when combining urban and rural households, the reform is also progressive, reducing overall inequality.

The declining pattern of the fall in real expenditure over centiles of expenditure as shown in Figure 9-2 illustrates the progressivity. This happens in both urban and rural areas. This progressivity is driven both by household consumption (by the pattern of the change in household CPI) and income pattern (by the pattern of the change in household income). High-income households spend more intensely on vehicle fuel and related services such as transportation than poorer households; hence they tend to experience a greater increase in consumer prices. The fall in income in high-income households is also higher compared to poorer households, reflecting the adjustment in the factor market which does not favor the factor endowment of high-income households.

Conclusion

Although the negative effect of distortionary fuel subsidies has been well known, they are still being implemented by governments in many parts of the world. The pressure to reform such policy has been discouraged by the concern over the distributional impact of such reform. The worry is that the increase in the price of fuels will reduce overall purchasing power of the most vulnerable households, and its contractionary impact on the economy will reduce employment and income. This line of argument is inherently a general equilibrium issue.

To contribute to this debate, using a CGE model with disaggregated households that allows for a rich and accurate distributional story, we simulate the impact of increasing the price of gasoline and diesel, part of the October 2005 reform package of the Indonesian government.

The result suggests that the reform is strongly progressive. Higher income households experience a greater decline in welfare than lower income households, reducing overall inequality. The novel feature of a general equilibrium analysis helps explain how this can be the case. The progressivity comes from both price and income channel. Higher income households tend to spend more intensively on vehicle fuel and commodities closely associated with it. They are also more dependent on income from factors of production, which are more intensively used in the production sectors that are heavily affected by the reform.

Notes

1 Kerosene for domestic household use was not increased.
2 It used The INDOCEEM model, an Indonesian CGE model based on ORANI-G, developed initially by Monash University and the Indonesian Ministry of Energy.
3 For a more detailed description of the model, please refer to Yusuf (2008).