CHAPTER 1

Summary for Policymakers

Many energy prices in many countries are wrong. They are set at levels that do not reflect environmental damage, notably global warming, air pollution, and various side effects of motor vehicle use. In so doing, many countries raise too much revenue from direct taxes on work effort and capital accumulation and too little from taxes on energy use.

This book is about getting energy prices right. The principle that fiscal instruments must be center stage in "correcting" the major environmental side effects of energy use is well established. This volume aims to help put this principle into practice by setting out a practicable methodology and associated tools for determining the right price. The book provides estimates, data permitting, for 156 countries of the taxes on coal, natural gas, gasoline, and diesel needed to reflect environmental costs. Underpinning the policy recommendations is the notion that taxation (or tax-like instruments) can influence behavior; in much the same way that taxes on cigarettes discourage their overuse, appropriate taxes can discourage overuse of environmentally harmful energy sources.

BACKGROUND

Energy use is a critical ingredient in industrial and commercial production, and in final consumption, but it can also result in excessive environmental and other side effects, with potentially sizable costs to the economy. For example,

- If left unchecked, atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases (GHGs) are expected to raise global temperatures by about 3–4°C by the end of the century (IPCC, 2013). Temperature changes of this magnitude are large by historical standards and pose considerable risks.
- Outdoor air pollution, primarily from fossil fuel combustion, causes more than 3 million premature deaths a year worldwide, costing about 1 percent of GDP for the United States and almost 4 percent for China (National Research Council, 2009; World Bank and State Environment Protection Agency of China, 2007; World Health Organization, 2013).
- Motor vehicle use leads to crowded roads, accidental death, and injuries. Drivers in the London rush hour, for example, impose estimated costs on others that are equivalent to about US$10 per liter ($38 per gallon) of the fuel they use through their contribution to traffic congestion, and traffic accidents cause an estimated 1.2 million deaths worldwide (Parry and Small, 2009; World Health Organization, 2013).

The Need for Fiscal Policies

Given the seriousness of the problems associated with fuel use, addressing them with carefully designed policy instruments is critical. Ideally, these policies should do the following:

- Be *effective*—exploit all opportunities for reducing environmental harm and mobilizing private investment in clean technologies
- Be *cost-effective*—achieve environmental objectives at lowest cost to the economy
- Strike the right balance between the *benefits* and the *costs* of environmental improvement for the economy, thereby maximizing the net benefits.

All three features are important for balancing trade-offs between environmental protection and economic growth and enhancing prospects for sustaining and scaling up efficient policy. *Fiscal instruments*—environmental taxes or similar instruments (primarily emissions trading systems with allowance auctions)—can fully meet these criteria (in conjunction with complementary measures, such as research and development and investment in transportation infrastructure).

Fiscal instruments targeted directly at the sources of environmental harm promote the entire range of possibilities for reducing that harm. They can also produce a substantial revenue gain and, so long as this revenue is used productively—for example, to reduce other taxes that distort economic activity—environmental protection is achieved at lowest overall cost to the economy. Finally, and not least, if these instruments are scaled to reflect environmental damage, they avoid either excessively burdening the economy or, conversely, forgoing socially worthwhile environmental improvements.

Getting Prices Right

"Getting prices right" is convenient shorthand for the idea of using fiscal instruments to ensure that the prices that firms and consumers pay for fuel reflect the full costs to society of their use, which requires adjusting market prices by an appropriate set of "corrective" taxes. In practice, many countries, far from charging for environmental damage, actually subsidize the use of fossil fuels. For many others, energy taxes—if currently implemented at all—are often not well targeted at sources of environmental harm, nor set at levels that appropriately reflect environmental damage. Clearly there is much scope for policy reform in this area, but there are also huge challenges, both practical and analytical.

From a practical perspective, higher energy prices burden households and firms and, even with well-intentioned compensation schemes, can be fiercely resisted. These challenges—not to understate them—are largely beyond the scope of this book; however, a complementary volume (Clements and others, 2013) distills lessons to be drawn from case studies of energy price reforms. Moreover, getting energy prices right need not increase the overall tax burden; higher fuel taxes could partially replace broader taxes on income or consumption (or environmentally blunt taxes on energy), broadening support for the

policy. Where new revenue sources might be needed, corrective energy taxes are an especially attractive option because, unlike most other options, they improve economic efficiency by addressing a market failure.

The main focus here is on assessing the analytical challenges, that is, the pricing that needs to be put into practice. For the vast majority of countries, there has been no attempt to measure the magnitude of environmental damage across fossil fuel products—yet these measures are critical for actionable guidance to be given on how countries can get energy prices right.

The corrective energy tax estimates presented in this book should be treated with a good deal of caution, given data gaps, and controversies—for example, about the valuation of climate damage and the link between air quality and mortality risk. Nonetheless, the estimates provide a valuable starting point for dialogue about policy reform, scrutiny of the key uncertainties, and cross-country comparisons estimated on a consistent basis.[1] Moreover, the impact of alternative assumptions on corrective tax estimates can be derived from accompanying spreadsheets.[2] Although tax assessments may change significantly as evidence evolves and data improve, the basic findings—most notably, the strong case for substantially higher taxes on coal and motor fuels in many countries—are likely to remain robust.

Defining an Efficient Set of Energy Taxes

From the perspective of effectively reducing energy-related CO_2 emissions, local air pollution, and broader side effects from vehicle use, energy tax systems should comprise three basic components:

- A charge should be levied on fossil fuels in proportion to their CO_2 emissions multiplied by the global damage from those emissions (alternatively, the charge could be levied directly on emissions), though there are reasons why some governments (e.g., in low-income, low-emitting countries) may not wish to impose such charges.
- Additional charges should be levied on fuels used in power generation, heating, and by other stationary sources in proportion to the local air pollution emissions from these fuels but with credits for demonstrated emissions capture during fuel combustion, given that net emissions released are what determine environmental damage (another possibility again is to charge emissions directly).
- Additional charges for local air pollution, congestion, accidents, and pavement damage attributable to motor vehicles. Ideally, some of these charges would be levied according to distance driven (e.g., at peak period on busy roads for congestion), and doing so should become increasingly feasible as

[1]The estimates take into account extensive feedback from leading specialists and from participants at an expert workshop held at the IMF in April 2013.
[2]See www.imf.org/environment.

the technology needed for such programs matures. Until then, however, reflecting all of these costs in motor fuel taxes is appropriate and is the approach taken here.

In practice, there are complex political reasons why the bases and rates of energy taxes may diverge from the ideal, and why regulatory instruments are often the preferred approach. But a necessary first step for understanding the trade-offs involved between all the policy choices, and how political constraints might be met with minimal compromise to environmental, fiscal, or other objectives, is to provide some quantitative sense of the corrective energy tax system for different countries, which provides a benchmark against which alternative policies should be evaluated.

METHODOLOGY

The techniques used for assessing various types of environmental damage are straightforward conceptually, although they require extensive data compilation.

Climate Damage

The volume does not add to the contentious debate on climate damage but simply uses an illustrative damage value of $35 per metric ton of CO_2 (US Interagency Working Group on the Social Cost of Carbon, 2013), combined with data on the carbon content of fuels, to derive carbon charges for all countries. (The implications of different damage assumptions, including zero damage for low-income, low-emitting countries, are easily inferred.)

Air Pollution

The major problem from local air pollution is elevated mortality risks for exposed populations. For coal plant emissions, damage is assessed by first estimating how much pollution is inhaled by people in different countries based on combining data on power plant location with data indicating how many people live at different distance classifications from each plant (smokestack emissions can be transported over considerable distances). This pollution intake is then combined with baseline mortality rates for pollution-related illness and the latest evidence on the relationship between exposure and elevated risks, though substantial uncertainties surround this relationship. Health effects must then be monetized, which is a contentious exercise, but is done for illustrative purposes using evidence on how people in different countries value the trade-off between money and risk from numerous studies analyzed in OECD (2012). Finally, damage is expressed per unit of energy content or fuel use using country-level data on emission rates. The same approach is used to measure air pollution damage from natural gas plants. Damage from vehicle and other ground-level sources (which tend to remain locally concentrated) is extrapolated from a city-level database on pollution intake rates.

Congestion and Accidents

Traffic congestion costs imposed by one driver on other vehicle occupants are approximated by using a city-level database to estimate relationships between travel delays and various transportation indicators and extrapolating the results using country-level measures of those same indicators. Travel delays are monetized using evidence about the relationship between wages and how people value travel time. Accident costs are estimated based on country-level fatality data and assumptions about which types of risks drivers themselves might take into account versus those they do not, and extrapolations of various other costs, such as those for medical expenses, property damage, and nonfatal injury.

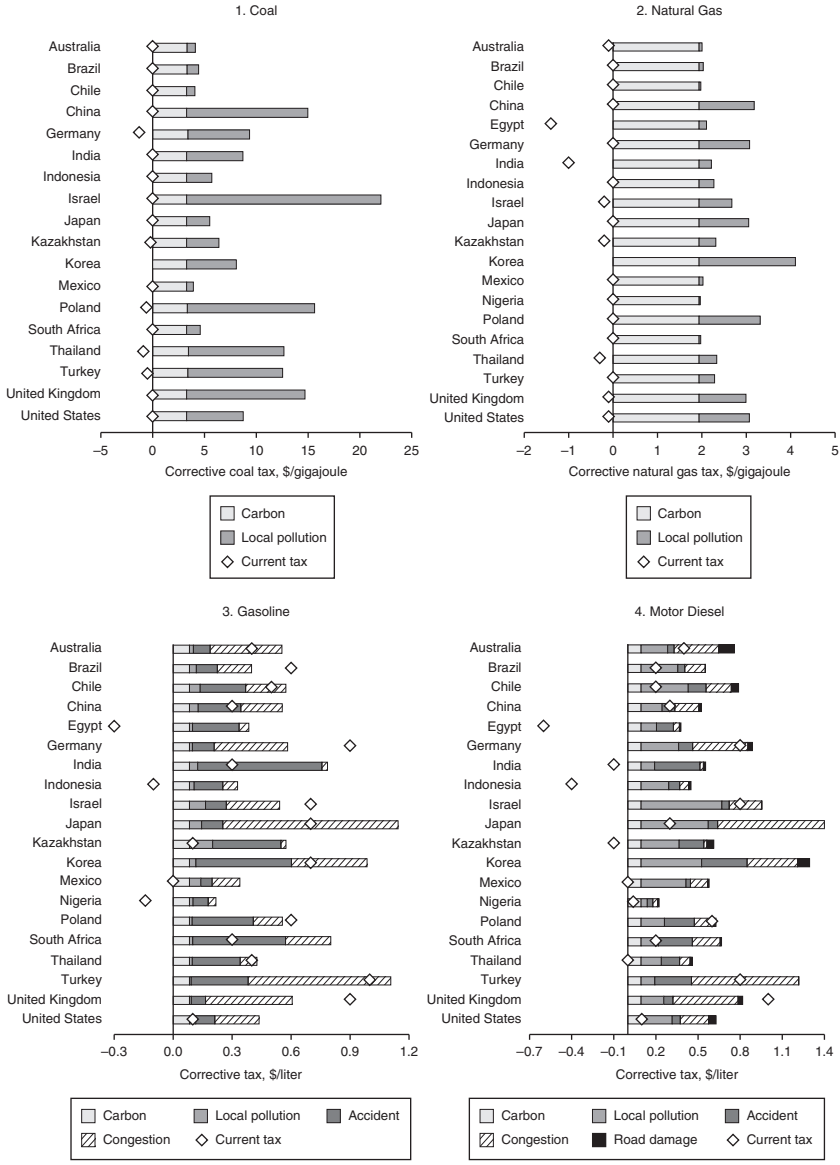
MAIN FINDINGS

The main policy messages include the following:

- **Coal use is pervasively undercharged, not only for carbon emissions, but also for the health costs of local air pollution.** Illustrative charges for CO_2 amount to about $3.3/gigajoule (GJ) of energy from coal combustion, a substantial sum when set against average world coal prices of about $5/GJ in 2010, and what are at best minimal taxes on coal at present.[3] The corrective taxes for local air pollution can also be substantial—they exceed the carbon charge for 10 of the 18 countries illustrated in panel 1 of Figure 1.1—though they vary considerably across countries with population exposure, emission rates, and the value of mortality risks. These corrective taxes for local air pollution are, however, based on current emission rates averaged across plants with and without control technologies. Appropriate crediting would provide strong incentives for all plants to adopt control technologies.
- **Air pollution damage from natural gas is modest relative to that from coal, but significant tax increases are still needed to reflect carbon emissions.** Corrective charges for local air pollution from natural gas are about $1/GJ or less for most countries shown in panel 2 of Figure 1.1. The carbon component is also smaller: natural gas produces about 40 percent less CO_2 per GJ than coal, though charges needed to cover carbon emissions, about $2/GJ (40 percent of average world gas prices), are well above current tax levels.
- **Higher taxes on motor fuels are warranted in many countries, though more to reflect the costs of traffic congestion and accidents than carbon emissions and local air pollution.** Corrective gasoline taxes are about $0.40/liter (about $1.50/gallon) or more in 17 of the 20 countries illustrated

[3]All corrective tax estimates are for 2010 and, to facilitate cross-country comparisons, are expressed in 2010 U.S. dollars. Purchasing-power-parity (PPP) exchange rates should be used to express these figures in local currency (see www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx).

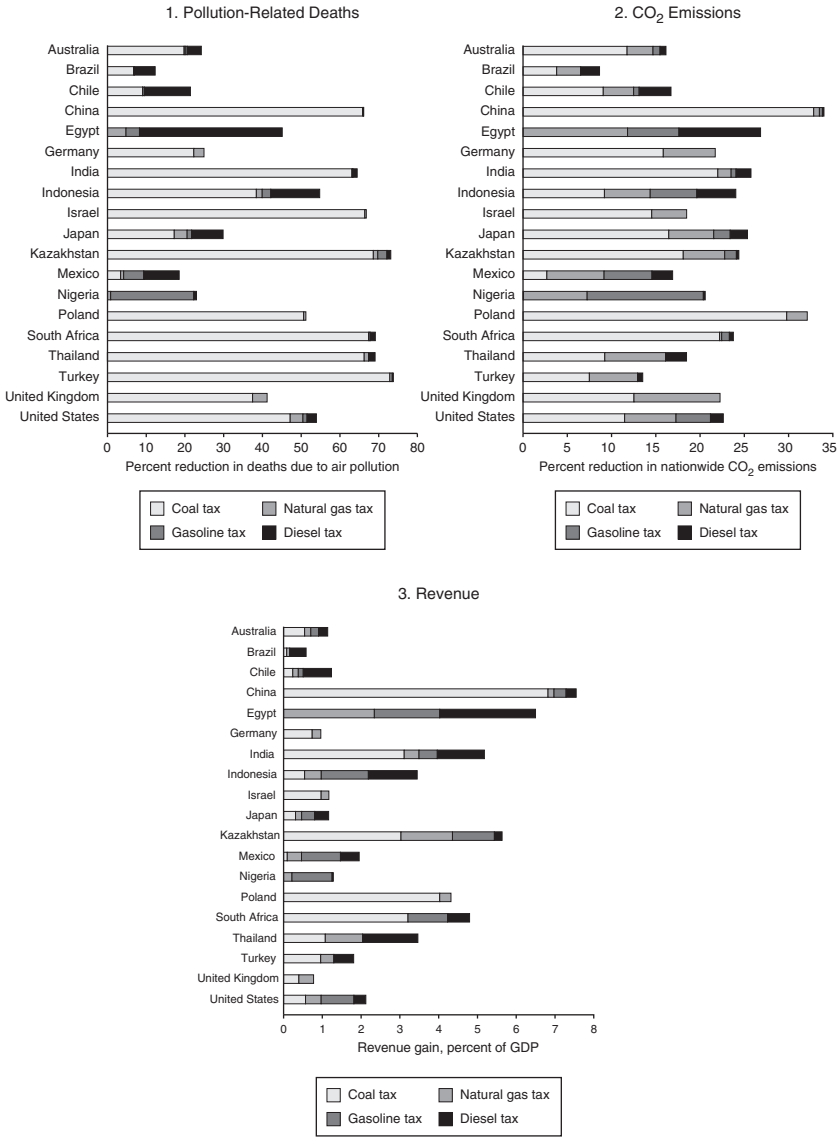
Figure 1.1 Corrective Fuel Taxes to Reflect Environmental Costs, Selected Countries, 2010



Source: Authors, based on methodology described in the book.

in panel 3 of Figure 1.1, and they exceed current excise taxes in 15 of these countries, with congestion and accidents costs together accounting for about 70–90 percent of the corrective tax. CO_2 emissions contribute $0.08/liter in all cases and local pollution typically less. Corrective taxes for diesel fuel (primarily used by trucks but also by some cars) are often somewhat higher than for gasoline (panel 4 of Figure 1.1), so there appears to be little

Figure 1.2 Impacts of Fuel Tax Reform, Selected Countries, 2010



Source: Authors, based on methodology described in the book.

systematic basis for the common practice of taxing motor diesel at lower rates than gasoline.

- **Corrective taxes can yield substantial reductions in pollution-related deaths and in CO_2 emissions, and large revenue gains**:
  - ***Fuel tax reform can reduce worldwide deaths from outdoor, fossil fuel, air pollution by 63 percent.*** The vast majority of avoided deaths for countries shown in panel 1 of Figure 1.2 result from corrective taxes on coal.

- ***Tax reforms could reduce CO_2 emissions by 23 percent globally.*** For all but five countries shown in panel 2 of Figure 1.2, coal (because of its high carbon intensity and high corrective taxes) accounts for more than 50 percent of the CO_2 reductions, and about 75 percent or more in seven countries.
- ***Potential revenue from implementing corrective taxes averages 2.6 percent of GDP globally.*** Corrective taxes on coal could be a significant revenue source for many countries shown in panel 3 of Figure 1.2, especially coal-intensive ones such as China (though revenue projections are necessarily very approximate). In other countries, such as Brazil, Egypt, Indonesia, Japan, Mexico, Nigeria, and the United States, higher motor fuel taxes are the dominant source of potential revenue gains (including subsidy elimination in some cases).
- ***In short, the case for substantially higher energy taxes does not rest on climate change alone.*** Decisive action need not wait on global coordination.

SUMMARY AND CONCLUSION

Getting energy prices right involves a straightforward extension of widely accepted and easily administered motor fuel taxes—better aligning the rates of these taxes with environmental damage and extending similar charges to other fossil fuel products (or their emissions). There are complications (e.g., charges should be based on emissions net of any application of emissions control technologies), but the issues should be manageable. The findings of this volume suggest large and pervasive disparities between efficient fuel taxes and current practice in developed and developing countries alike, with much (in fact, a huge amount in many countries) at stake for fiscal, environmental, and health outcomes.

The main challenge is how to get it done—how to build support for energy price reform. International organizations and others have an important role to play, first in promoting dialogue about best practice, and second in providing solid analytical contributions quantifying the benefits of pricing policies relative to alternative approaches, and assessing distributional implications to inform the design of compensating measures.

OUTLINE OF THE VOLUME

The main findings of the report—the corrective tax estimates by fuel and by country, and rough estimates of the fiscal, environmental, and health benefits from tax reform—are presented in Chapter 6, which can be read without reading the preceding chapters for those who prefer to go straight to these results. The other chapters are organized as follows: A quick overview of energy systems, the nature of environmental side effects, and major fiscal policies affecting energy is provided in Chapter 2. Chapter 3 describes the case for and design of fiscal

instruments to address environmental side effects. Chapter 4 then discusses the measurement of global, and in particular local, air pollution damage from fossil fuel use. The measurement of congestion, accident, and road damage costs associated with vehicle use is discussed in Chapter 5. Chapter 7 offers brief concluding remarks.

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