Transport Fuel Taxes and Urban Air Quality

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In developing country cities, fuel use for transport is a growing contributor to air pollution and environmental health risks. One way of applying the “polluter pays” principle to transport is to adjust fuel taxes to reflect environmental externalities. But in setting tax rates on fuels, many factors need to be considered. As outlined in this note, they include the government’s revenue requirements, efficiency of resource use, the need to finance road maintenance, road congestion impacts, equity, the use of fuels in sectors other than transport, and the impact of the fuel tax structure on other economic activities and on the poor.

Fuel Taxes – Too Many Objectives?

Taxes on transport fuels typically seek to satisfy multiple objectives, including:

- Raising government revenue for general (nontransport) expenditure purposes
- Efficiently allocating resources to and within the transport sector
- Financing road provision and maintenance
- Reducing congestion
- Reducing the environmental externalities of road transport
- Redistributing income.

It is not possible to achieve all these objectives simultaneously through fuel tax policies alone. Most governments complement fuel taxation with other policy instruments—in particular, to correct for externalities. The challenge of meeting the various objectives is especially difficult in low-income countries, where fewer policy instruments are available. In determining the levels and structure of fuel taxation, important compromises have to be made between the effects on government revenue generation, income...
Although other (nontax) instruments price differential decreases with increasing annual kilometers traveled, making diesel the fuel of choice for high-mileage vehicles. Vehicles fueled by compressed natural gas (CNG) and liquefied petroleum gas (LPG), two of the cleanest fuels, are more expensive to purchase; only if these fuels are sufficiently lower in price than other fuels will vehicles using them be economically viable.

In setting fuel taxes, the goals of such taxation, and the tradeoffs among them, need to be considered.

**Raising revenue**

Fuel taxation is important for generating government revenue, particularly in low-income countries with poorly developed direct taxation systems. In these countries, taxes on hydrocarbons can account for as much as one-fifth of all tax revenue (Bacon 2001). Fuel taxes are also a reliable revenue source because fuel has a low overall elasticity of demand, and the tax can be collected cheaply. Furthermore, fuel taxation can have attractive distributional characteristics (see "Redistributing income," below). The main danger—that the tax can be inflationary because of its pervasive impact on a wide range of basic consumption goods—applies to most forms of indirect taxation. It should be kept in mind that, where interfuel substitution is technically possible (as between diesel and gasoline for light- and medium-duty vehicles), widely different tax rates are likely to distort transport fuel demand in favor of the fuels with lower taxes, thus decreasing tax revenue for the government unless overall tax rates are raised for all fuels.

**Promoting efficient use of resources**

Avoiding economic distortions is particularly important in poor economies. In this respect, the first of the general
principles of taxation discussed in Box 1 suggests that fuel taxation should be concentrated on gasoline, which is used predominantly by private cars as a consumption good, rather than on diesel, which is used in large quantities by freight and public transport vehicles as a producer good. However, the realities that not all consumption goods are taxed and that producer goods are associated with transport and environment-related externalities argue against zero taxes on diesel or subsidies to it. A number of factors need to be taken into account in determining the extent to which diesel should be taxed (see “Avoiding Diversion and Perverse Interfuel Substitution,” below).

**Financing road maintenance**

Many developing countries have poor-quality road systems because of underfunding of maintenance. A fuel tax, or surcharges on the fuel tax that are designated specifically as road user charges, may be the most obvious and acceptable proxy for direct charging, especially when the revenues are transferred directly to a user-managed road fund (Gwilliam and Shalizi 1999). Fuel taxes, however, have certain shortcomings in regard to this objective: they do not reflect accurately the road deterioration caused by different vehicle categories, and they provide inefficient signals on vehicle size and weight. Even within the automotive diesel fleet, a tax on diesel needs to be supplemented by some charge on vehicle axle loadings, preferably levied on the basis of distance traveled. In principle, users ought to pay the long-run marginal costs of road use, including the costs of capital. For this reason, recent studies have suggested a roads component within a fuel tax up to US$1 per gallon (World Bank 1996) if no other direct charges are being levied.

**Reducing congestion**

A fuel tax is not efficient as a charge for congestion because variations in congestion over time and space are only weakly reflected in variations in fuel consumption. Moreover, the fuel tax is usually determined by, and accrues to, the central government, whereas control of urban congestion is a municipal responsibility.

**Reducing air pollution**

The transport sector contributes up to 25 percent of worldwide greenhouse gas emissions. The transport-related pollutants of greatest concern in developing countries, however, are health-threatening emissions of fine particles and lead (from the combustion of leaded gasoline).

Fuel taxes are not very efficient in reducing externalities from emissions (except for the greenhouse gas carbon dioxide, emissions of which are directly linked to fuel consumption). Emissions and their environmental externalities depend not only on fuel choice but also on vehicle technology, vehicle maintenance, the vehicle driving pattern, and the location and time of emissions. Some examples of the effects of these factors are illustrative: (a) although diesel is generally the “dirtiest” transport fuel, “clean diesel” technology can be nearly as clean as CNG; (b) poorly maintained vehicles generally have much higher emissions; and (c) emissions occurring only in densely populated areas harm public health disproportionately. The high degree of differentiation of environmental damages from the same fuels across various users, technologies, and locations limits the effectiveness of fuel taxes for controlling air pollution (Lvovsky and Hughes 1999).

**Redistributing income**

Many developing countries have very unequal income distribution and weak systems for direct taxation. Given the concentration of car ownership and use in the upper-income groups, a high incidence of taxation on gasoline makes for a very progressive tax. By the same token, where the impact of taxation on diesel has been studied, it has been found to be mildly regressive—that is, the total expenditures of poor households rise more in percentage terms than those of the rich when the price of diesel is increased. This is one reason why a number of governments rely primarily on a high tax on gasoline to raise revenues from oil products.

**Avoiding Diversion and Perverse Interfuel Substitution**

One problem with differential fuel taxation concerns the effects of interfuel substitution. In the long run, diesel, gasoline, CNG, and automotive LPG are all technologically possible substitutes. The common combination of a high gasoline tax and a low diesel tax may encourage vehicle owners to switch from gasoline to environmentally more damaging diesel when they buy or replace light-duty vehicles. To avoid this anomaly, a low tax on diesel fuel might be supplemented by a high tax on light-duty diesel vehicles, particularly those used primarily in intracity transport. Because of the significant impact of higher taxation on nonautomotive uses of diesel—in rail transport, agriculture, and industry, for example—it may be sensible to give rebates on the higher diesel tax to industrial and agricultural users of diesel.

The effect of differential taxation on consumption of nontransport fuels further complicates the matter. Imposing very different tax rates on close substitutes, and subsidizing certain fuels used by poor households, invites diversion of the low-priced fuel to other sectors and creates an incentive
for fuel adulteration (Kojima and Bacon 2001). For example, the diversion of rationed, low-priced kerosene to transport uses (as an adulterant in diesel and gasoline) reduces the amount of kerosene available for the poor, who need it for lighting and cooking. The shortage of kerosene in turn leads to further externalities, as the poor are forced to turn to biomass—a significant source of indoor air pollution and health damage—for cooking.

Conclusions

These considerations suggest that in the absence of any other direct charges for road use, pump prices of transport fuel should cover the resource cost of the fuel, the costs of road use (both road damage and occupation of road space), and some portion of the environmental costs associated with the fuel (with the balance to be recovered by other means). Although fuel taxes can strongly affect fuel consumption patterns, they have other significant welfare impacts, including spillover effects. This points to the need to address externalities from air pollution not through the single instrument of fuel taxes but through a combination of instruments, including environmental regulations.

Some critical guidelines for taxing should be kept in mind.

- More precisely targeted alternatives to fuel taxes should be considered wherever possible, in view of the limitations of fuel taxes in achieving multiple objectives. A number of these objectives require fine-tuning on the basis of location- and situation-specific conditions, which cannot be accomplished through taxes set at the national or state level.
- Environmental externalities should be corrected for by taxing polluting goods, not by subsidizing nonpolluting alternatives.
- There is a strong case for setting the gasoline tax above the general tax rate on commodities. Rich households spend a higher proportion of their budgets on gasoline than do poor households; gasoline vehicles give rise to a number of externalities; and emissions from gasoline engines may affect poor households more than rich households.
- There is also a strong case for a diesel tax. Although some diesel is used as an intermediate good, the taxation of even this segment of the market is justified if it is the principal way of charging heavy vehicles for wear and tear on the road and if the final goods (for which diesel is an input) are not necessarily taxed. Given diesel's high long-run substitutability for gasoline in light-duty vehicles and its strongly negative externalities in urban areas, the tax rate on automotive diesel should be set so as to raise the price toward that of gasoline. The only counter-argument is the highly regressive impact of raising the price of diesel.
- Tax policies for petroleum fuels should take careful account of and minimize the possibilities for socially undesirable interfuel substitution, such as the dieselization of light-duty vehicles.

References


Newbery, David, and Nicholas Stern, eds. 1987 The Theory of Taxation for Developing Countries New York: Oxford University Press.


For more information, please visit the following Internet sites:

“Petroleum Taxes: Trends in Fuel Taxes (and Subsidies) and the Implications” by Robert Bacon

“Abuses in Fuel Markets: How to Protect Consumers and Public Health” by Masami Kojima and Robert Bacon

In Focus no. 7, “Environmental Challenges of Fuel Use” by Kseniya Lvovský and Gordon Hughes