Designing a Supportive Fiscal Framework

The fragmentation of decisionmaking in transport among so many private and financially motivated agents (including private individuals) puts great emphasis on getting the prices right. Where there are uncharged-for external effects, as in the case of air pollution, it is likely to be necessary to make appropriate adjustment of relative prices through fiscal measures. This may take the form of taxes, subsidies, or direct capital expenditures. An appropriate set of supporting fiscal policies can increase the effectiveness of administrative and regulatory measures. Developing country cities may improve the effectiveness of their attempts to reduce air pollution by using existing powers or by seeking new powers to use fiscal instruments.

Direct Taxation on Emissions

The economic ideal would be a system of direct taxation on emissions. If such a system could be devised, it would not be necessary to have complex administrative controls, because there would be strong incentives for all agents to limit their emissions levels. Choice of vehicle and fuel technology would both be driven straightforwardly by these economic incentives. Insofar as the level of emissions is determined by the vehicle design (including the fuel for which it is designed), taxation on the capital cost of vehicles is an approach along these lines. For vehicle-manufacturing countries it would also be possible in principle to use a system of tradable emissions certificates to harness market incentives to encourage economic, clean technology. For non-manufacturing countries it could be embodied in import duties that vary according to the vehicle’s emission characteristics. However, even this does not affect the way in which vehicles are maintained and operated, and it would still be necessary to have some other complementary taxation on the vehicles in use.

Fuel Taxation

Unfortunately, for vehicles in use, the continuous measurement of emission levels and application of variable taxation levels are technically a long way off. It will therefore be necessary to devise the best proxy tax or taxes. Because many pollutants are emitted in rough proportion to the amount of fuel burned, fuel taxation is an obvious candidate (Gwilliam and others 2001).

The incentive properties of fuel taxation

One way of assessing the potential of transport fuel taxation as an environmental instrument is to look at its efficacy with respect to reducing vehicle km travelled, fuel consumption per km, and emissions per unit of fuel consumed:

- **Reducing overall vehicle km traveled.** High taxation on transport fuels will encourage a reduction in trip numbers and trip lengths as well as favor public over private transport modes. Although the mode shift effects themselves may be small because of the range of different dimensions of adjustment, the overall price elasticity of demand for gasoline may be between −0.5 and −0.8, although that for diesel is likely to be considerably lower.

- **Reducing fuel consumption per km.** A high tax on fuel will encourage the use of more fuel-efficient vehicles. But the level of congestion is the most important factor in determining fuel consumption, and the fuel tax is not very efficient as a charge for congestion.

- **Reducing emissions per unit of fuel consumed.** 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).
Fuel tax has good incentive properties for reducing the amount of vehicle kilometers traveled and encouraging the use of fuel-efficient vehicles, but it fails to reflect the location of emissions.

The multiple objectives of fuel taxation

In many developing countries, fuel taxation is usually the responsibility of central government and taxes on hydrocarbons can account for as much as one-fifth of all central government tax revenue (Bacon 2001). These taxes are usually considered a reliable revenue source because fuel has a low overall elasticity of demand with respect to price and the taxes can be collected cheaply. But they usually are expected to fulfill at least four functions:

- **Revenue function.** They are primarily aimed at raising revenue for general (non-transport) expenditure purposes.
- **Road user charge function.** Taxes on transport fuels are often the primary means through which vehicles can be charged for the use of roads, and some part of fuel tax revenue is often earmarked for financing road provision and maintenance.
- **Redistributive function.** As part of central government policy, their redistributive characteristics might also be of great importance.
- **Environmental function.** In the absence of direct charges for air pollution they may be expected to be a surrogate environmental charge.

It is clearly not possible to achieve so many objectives simultaneously and efficiently through a single tax. The challenge of satisfying multiple objectives is especially difficult in low-income countries, where fewer policy instruments are available. **In the use of fuel taxes, compromises have to be made between the effects on government revenue generation, income distribution, the efficient use of roads, and air pollution.**

The principles of fuel taxation

Some useful guidance for evaluating these compromises can be obtained from the general principles of optimal commodity tax theory, which focus on minimizing the loss of welfare to consumers in raising a given sum of money for the government through commodity taxation (Newbery and Stern 1987). A **fundamental principle is that in order to avoid economic distortions taxes should, as a rule, be levied on final consumption goods rather than on intermediate goods.** This principle 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.

Such a prescription, however, has three major difficulties. First, not all consumption goods (for which diesel is an input) are taxed and it may be necessary to tax the inputs instead. Second, freight transport of producer goods generates air pollution, but operators have less incentive to use less fuel (lower fuel consumption would normally lower overall emissions) when fuel is cheap. However, by far the greatest problem with differential fuel taxation concerns the effects of inter-fuel 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 diesel when they buy or replace light-duty vehicles (as has already happened in some countries such as France, and is being advocated for fuel economy reasons in the United States). While “clean diesel” in the EU and North America may mitigate the impact of such fuel switching, the same phenomenon in developing countries would most certainly mean much higher particulate emissions.

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1 A recent study by M. Cubed, commissioned to provide economic and technical input into California Assembly Bill 2076, argues that because diesel passenger vehicles are typically 35 to 50 percent more fuel efficient than similar-sized gasoline vehicles, a shift to diesel vehicles could substantially reduce the state’s dependence on petroleum. The full report is available online at www.dieselforum.org.

2 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 intra-city transport.
A complementary principle is the well-known “Ramsey pricing” rule, which proposes that tax rates on consumer goods be set so as to be inversely proportional to the goods’ own price elasticities of demand in order to minimize the overall loss of welfare. Normally, application of this principle in its pure form is likely to be distributionally perverse, since the demand for most basic necessities (such as staple foods) is inelastic, while that for nonessential goods is likely to be more elastic. However, this is less of a problem in urban transport. Demand for fuel for private cars is believed to be (mildly) inelastic. Given the concentration of car ownership and use in the upper-income groups in developing countries and weak systems for direct taxation, a high incidence of taxation on gasoline makes for a very progressive tax. Hence, if the basic distribution of income is viewed as inequitable, indirect taxes may be structured to have a greater impact on the goods that make up a relatively larger share of the budgets of higher-income households than on the goods that are more important for low-income households. For these reasons, relatively high taxes on gasoline can be both economically efficient and distributionally attractive.

Not all efficiency arguments militate in the direction of high differentiation between gasoline and diesel tax rates. In principle, users ought to pay the long-run marginal costs of road use, including the costs of capital. 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). As wear and tear is caused primarily by heavy vehicles, which are fueled primarily by diesel, this suggests that diesel tax might be an appropriate proxy for direct road maintenance charges. Diesel tax, however, has serious shortcomings in this respect. It does not accurately reflect the road deterioration caused by different vehicle categories and provides 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.

From the point of view of air quality, diesel vehicles are typically much more damaging than gasoline vehicles, especially when compared to gasoline vehicles equipped with three-way catalytic converters, an increasingly common phenomenon as developing countries move to 100 percent unleaded gasoline. Heavy-duty vehicles worldwide run on diesel, but light-duty vehicles can run on either gasoline or diesel. For vehicles of comparable size, diesel vehicles are more expensive to purchase, but if diesel tax is markedly lower, fuel cost savings can compensate for the higher purchase price of diesel vehicles. Diesel vehicles are especially suitable for high annual km vehicles. Diesel fuel should be properly taxed in order to reflect the marginal social damage caused by increasing air pollution. This is likely to mean that in nearly all developing countries, the tax on diesel would need to be raised to capture marginal social damage per liter of fuel.

Aside from political opposition from truckers and other heavy users of diesel, one concern about increasing diesel tax is the impact on the economy, and on the poor in particular. The share of expenditure on all fuels as a percentage of total household expenditure consists of direct consumption of fuels and indirect consumption through purchases of goods and services that have fuels as inputs. Direct consumption tends to be concentrated at the top of the income distribution for both gasoline and diesel, but the indirect effect is more important for lower income groups for diesel because it is an important input to many goods and services. Studies that have examined the impact of raising diesel tax on household expenditures in developing countries have shown a modest impact which is 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, although these effects are small. Because of the significant impact of higher taxation on non-automotive 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.
Taxation on Vehicles

Given the complexity just outlined, it is not possible to structure taxation on fuels to simultaneously satisfy all of the policy objectives. For instance, fuel taxation discriminates relatively poorly between vehicles of different axle weights, which is critical in determining the amount of road damage done by vehicles and hence the appropriate charge for their use of roads. For that reason differentiation of annual license duties among vehicle categories is common. Where that is the case, it is sensible to consider the possibility of using differentiation of vehicle license duties to encourage cleaner technologies.

Another common source of revenue for governments is import duties on vehicles. Usually the level of such duties is motivated either by revenue maximization or by protection of local manufacturers. In either event, the result is typically that duties are based on the market values of vehicles so that those on new vehicles are greater than those on old, and duties on sophisticated vehicles greater than on those of simpler technology. Even if duties are differentiated to reflect differing exhaust emission levels, different age limits can provide a loophole. In Sri Lanka, for example, diesel vehicles carry higher import duties than gasoline vehicles, but the age limit is three for cars and five for dual-purpose vans, so that there has been a steady shift from gasoline cars to diesel vans (Cambridge Economic Policy Associates 2002). The overall effect is to discourage best-practice technology from an air quality viewpoint. The impacts on air quality should be borne in mind when determining the structure of duties on vehicle imports.

Similar considerations apply to physical measures on imported vehicles where it is common to be more restrictive on the import of new vehicles than old. In some countries importing secondhand engines and chassis and putting new bodies on them is one way of bypassing emission standards for new vehicles. While maintaining type approval control of import of new vehicles, it is important to concentrate effort on controlling imports of old vehicles or rehabilitated components.

Constructing a Road Transport Tax Package

In the absence of 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 the environmental costs associated with the fuel use if not otherwise charged for (some costs might be recouped through differential vehicle taxation). Although fuel taxes can strongly affect fuel consumption patterns, they have other significant welfare impacts, including spillover effects. Some basic guidelines for fuel taxing follow from this:

- In addition to fuel taxes, more precisely targeted alternatives (such as differentiated vehicle taxes and road user charges) should be considered wherever possible, in view of the limitations of fuel taxes in achieving multiple objectives.
- Environmental externalities should be corrected for by taxing polluting vehicles and fuels, not by subsidizing less-polluting alternatives. If the objective is to achieve a certain amount of pollution reduction by reducing demand for polluting goods, subsidizing less-polluting alternatives costs society more than increasing taxes on polluting goods.

Sale of imported secondhand diesel engines is common in developing country cities.
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, tax policies for petroleum fuels should take careful account of, and minimize, the possibilities for socially undesirable interfuel substitution, such as the so-called dieselization of light-duty vehicles.

**Property Taxation and Fees**

The land use objective to minimize transport emissions is to promote contiguous and dense development. A standard *ad valorem* property tax is probably the best fiscal tool to achieve this. Confiscatory capital gains taxes on real estate, while appearing equitable because they concern “unearned income,” in fact have a disastrous effect on land use efficiency. Increasing capital gains tax increases the threshold for the profitability of land conversion; as a result, obsolete, inefficient, and low-intensity land uses are maintained for a much longer time than they would be in the absence of such tax. Impact fees on new construction, whether for business or residential purposes, should cover the public costs of improving infrastructure (roads, drainage, sewerage, public utilities). Insofar as these are higher for dispersed and greenfield site development than for densification or infill, such fees would discourage urban sprawl. *Tax incentives may be important in influencing the land use structures that, in their turn, influence transport demand and emissions.*

**Public Expenditure Policies**

**Environmentally oriented investment policies**

Fiscal policies include policies on public expenditure as well as on taxation. Taxes, road tolls, parking charges, tax rebates on public transport fuels, and capital investment in transit infrastructure may all be directed at achieving environmental ends. The most important consideration is that any such allocation needs to be justified in terms of the benefits that it actually achieves. *Air pollution reduction is one of the benefits that should be systematically taken into account in assessing urban public expenditure priorities.*

**Public transport subsidies**

The imposition of stringent emission and other vehicle standards, without simultaneously introducing bus priority measures to improve efficiency, tends to increase capital costs without offering compensating reduction in operating costs. This raises the problem of the financial sustainability of service. Many industrial country cities subsidize public transport fares. While this may seem to be a reasonable approach, it is not generally cost-effective as an environmental policy. First, there is strong evidence that up to half of any subsidy “leaks” to benefit transport industry interests including owners and employees. Second, because most car owners’ use of their vehicles is not sensitive to public transport fare levels—cross-elasticity being of the order of 0.1—there is little shift of travelers from private to public transport. Third, because the modal shift is small but the subsidy is paid to all, *subsidizing public transport fares, however desirable on other grounds, is not likely to be a cost-effective way to reduce environmental impact.*

Given the poor public image of public transport, subsidies to improve public transport quality might be somewhat more effective in affecting mode choice, particularly in countries where car ownership is restricted to the relatively rich. But even for higher-income groups, regulatory reform to encourage express or air-conditioned buses to attract car owners is likely to be more effective than giving subsidies, as experience has shown in cities of varying average income levels such as Bangkok, Buenos Aires, Dhaka, and
Seoul. Some liberalization of market entry is likely to be the most effective way of developing public transport services to attract patronage from private cars.

**Subsidies on clean fuels**

The most direct approach would be to subsidize cleaner vehicles and fuels. However, the need to ensure financial sustainability applies. The cleaner vehicles must be capable of being operated reliably and economically. This may require not only an initial capital subsidy but also substantial investment in training and maintenance facilities for the new technology, as well as fiscal effort to keep the price of the fuel attractive. If that is the case, then it is necessary to ask which alternative policies (for example, investment in busways) might have been introduced at the same cost to the government as the fuel-duty loss involved in subsidizing clean fuels.

Several countries follow the policy of keeping fuel taxes relatively low and giving positive incentives for the use of relatively cleaner fuels. This has been the approach of promoting fuel from agricultural crops in the United States and promoting CNG in a number of countries. But such measures can be expensive to the public budget and, to the extent that fuel prices that consumers face are lower, encourages excessive use of fuel. As far as externalities are concerned, the generally accepted philosophy (Sandmo 1975) is therefore that tax rates on goods that have external costs should be adjusted upward to reduce their consumption to a social optimum, and any additional revenue collected used to adjust general tax rates downward.