Taxes on Road Transport in Southern African Countries[1]

Stephen Smith, Department of Economics, University College London

5.1 Introduction

In most African countries, as in Europe, road transport is treated in a distinctive way within the fiscal system, through the imposition of special excises on motor fuels and vehicles. In particular, motor fuels are taxed considerably more heavily than most other goods and services, and the excises on motor fuels frequently raise large revenues. The initial motivation for these taxes has generally been the scale and buoyancy of the potential revenues, and the relative ease of tax assessment and enforcement. In particular, high rates of tax can be levied on motor fuels at low administrative cost and with limited risk of evasion, if large-scale commercial oil importing and refining activities can be closely controlled and monitored by the revenue authorities.

While the revenue potential of these taxes will continue to be important, wider considerations relating to efficient infrastructure charging and environmental effects are also likely to influence future policy decisions about the level and structure of road transport taxes. Individual road users impose various costs on other road users, and on society as a whole, through the effects of their travel and transport decisions on pollution, traffic congestion, accidents, and the physical deterioration in the road infrastructure. Taxes on fuels and on vehicles can be used to ensure that individual travel and transport choices reflect the costs that individual road users impose on others - for example, by taxing motor fuel to reflect vehicle pollution, or by charging the users of heavy trucks for the costs of repairing the damage they cause to the road surface. Ideally, an efficient structure of road taxes might aim to charge every road user for the precise social costs incurred as a result of their decisions, although in practice the available tax instruments can only approximately reflect the various social costs of road transport.

Formulating appropriate policies towards the taxation of road transport is, however, far from straightforward, due to the varied range of social costs (externalities) associated with road use, and the complex interactions between road transport taxes, the pricing of other modes of transport, the provision of road infrastructure, and issues of spatial development. There are also important equity issues in the taxation of road transport and its substitutes, since in most countries private motoring is associated with richer households, while poorer households are more dependent on public transport. In some countries, too, the revenues generated from taxes on road transport provide the funds used to build or maintain the road infrastructure, and the design and structure of road taxes then affects the adequacy of resources for road building and maintenance.

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This multiplicity of objectives means that designing road transport taxes will involve some difficult tradeoffs and compromises. This chapter tries to identify some of the main considerations that will need to be taken into account, focussing in particular on those likely to be most relevant to the policy context in African countries. Following this introduction, the chapter is in six main sections. Section 5.2 characterises the range of possible taxes that can affect road transport use and externalities. Section 5.3 discusses the criteria for efficient revenue-raising through taxes on road transport, and section 5.4 considers how far road taxes can be structured to achieve efficient pricing of environmental externalities and other uncharged social costs. Section 5.5 discusses issues of distributional equity raised by the taxation of road transport. Section 5.6 considers a number of specific policy options, identifying the key issues involved in selecting an appropriate balance between different motor fuel taxes, or between "fixed" and "variable" charges on motor vehicles. Section 5.7 discusses the issue of "earmarking" which is of particular importance in this context. Should road transport taxes be assigned to a "road fund" or to the general budget, and if the road fund approach is to be adopted, what implications should it have for the level and pattern of taxation? Section 5.8 draws some conclusions.

5.2 Taxes on Road Transport

A wide variety of taxes is levied on road transport in African countries, including taxes on both vehicles and fuels, levied on both import and on sale (at various stages), as well as a variety of charges for annual vehicle registration or road use.

- Substantial ***excise duties*** are generally levied on motor fuels. These either take the form of specific duties, in terms of a fixed amount per litre of fuel, or *ad valorem* duties, at a rate which depends on some measure of price.[2] In addition, in some countries the value added tax (VAT) is levied on motor fuels. Within the tax structure, diesel fuel is frequently taxed at a different (usually lower) rate than petrol. Some countries have different rates of excise for different grades of petrol.

- ***New motor vehicles*** may be subject to the general VAT or other sales tax. In addition, or instead of the VAT, special vehicle sales taxes may be levied, based either on the value, or other attributes such as weight or engine capacity.

- ***Annual fees*** for the registration or use of motor vehicles may take the form of an annual fixed amount for all vehicles of a certain type (e.g., private cars), or may be differentiated more finely according to vehicle characteristics. In most countries the taxes levied on commercial vehicle sales, ownership and use are higher and more complex than the taxes on private cars, reflecting amongst other things the greater variety in size and use amongst commercial vehicles. These annual fees are sometimes the responsibility of regional or local governments.

[2] Ghana, for example, switched from specific excises to an *ad valorem* regime in the late 1980s, to ensure that the real value of the excises was not eroded by inflation (Terkper, 2001)

- ***Import (customs) duties*** may be levied on vehicles and fuels. Where a country is both a producer and an importer, these import (customs) duties may either replace the domestic excise charged on domestically-produced products, or may be in addition to it.

- ***Tolls and fees*** may be charged for using certain parts of the transport infrastructure, such as inter-urban highways, bridges or ferries.

Table 5.1. South Africa, Mauritius and Kenya:
Examples of Taxes on Motor Vehicles and Motor Fuels

South Africa	**<u>Motor fuel taxes</u>** Transport fuels are subject to five different specific excise duties: • The general fuel levy (R1.01 per litre for petrol, R0.85 / litre for diesel), which accrues to the government's National Revenue Fund, used for general government expenditure • Road Accident Fund Levy (R0.215 / litre) which finances third-party insurance for motor vehicle accidents • Customs and Excise Levy (R0.04 / litre), which goes to the Southern African Customs Union (SACU) pool • Equalisation Fund Levy (zero in 2003), which has been used in the past to mitigate domestic fuel price fluctuations due to changes in international crude oil prices • A tracer levy of R0.02 cents per litre on diesel, which funds the marking and dyeing of illuminating paraffin (kerosene) to combat the illegal blending of diesel with illuminating paraffin. Non-transport petroleum products are subject to standard-rate VAT (14%), except for illuminating paraffin which is zero-rated. Transport fuels are zero-rated for VAT. **<u>Motor vehicle sales taxes</u>**. The sale of new motor vehicles is subject to standard-rate VAT (14%). In addition an *ad valorem* excise is charged on the sale of new cars and light commercial vehicles based on the recommended retail-selling price. **<u>Motor vehicle use taxes</u>** Provinces impose charges for motor vehicle registration and licensing, at various rates. There are no central charges or taxes on motor vehicle use. **<u>Import duties</u>** No duty is imposed on crude oil. Imported petroleum products are taxed on the same basis as domestically-produced products. Motor vehicle imports are taxed at an *ad valorem* rate of 38%. **<u>Tolls</u>** Tolls are charged on some inter-urban roads.

Mauritius	**Motor fuel taxes** An excise duty and a road fund duty are charged on motor fuels. The rates of the excise duty are Rs9.80 per litre (petrol) and Rs3.00 per litre (diesel). Rates for the road fund duty are Rs0.25 and Rs0.15 per litre, respectively. Fuel oil used for non-transport purposes is subject to an excise duty of Rs2.00 per litre. VAT is applicable on petroleum products at 15% up to the retail stage. **Motor vehicle sales taxes**. An *ad valorem* excise duty on cars is levied at rates which vary according to engine size. Applicable rates are 90% (for petrol-engined vehicles up to 1250cc cylinder capacity), 130% (1251-1500cc), 180% (1501-2000) and 250% (above 2000cc). For diesel vehicles, the engine size bands differ. A registration duty of 11% is charged on first registration of a new motor vehicle. **Motor vehicle use taxes** An annual road tax is charged. For cars, the annual road tax is differentiated by vehicle size, and according to whether the vehicle is owned by an individual or a company. For individuals the annual road tax is Rs3,500 for cars below 1600cc and Rs8,000 above this level. For company-owned vehicles rates of Rs4,500 and 10,000 apply, respectively. Heavy goods vehicles are charged between Rs3,000 and Rs18,000 per annum, depending on weight. **Import duties** No customs import duty is imposed on motor fuels.
Kenya	**Motor fuel taxes** Excise duty is levied on petrol at rates defined per 1000 litres at 20°C. The rates are Kshs19,445 for premium petrol, Kshs19,055 for regular petrol, and Kshs10,005 for diesel. Industrial use of diesel oil is taxed at Kshs3,400 per 1000 litres, and fuel oil at Kshs600. VAT is not charged on petroleum products. **Motor vehicle sales taxes**. VAT is charged on new motor vehicle sales at 18%. **Motor vehicle use taxes** A road license fee is charged on private cars at Kshs1,250 (up to 1000cc), and Kshs12,600 (1001 - 3500cc). For commercial vehicles, the road-license fee is weight-based at rates of Kshs1,250 (below 1000kg) and Kshs24,650 (1001-20000kg). **Import duties** An import duty of between 10% and 50% of the CIF value is levied on motor vehicles. Precise rates depend on vehicle seating and engine capacity.

Source: Country Survey Questionnaires, Southern African Conference on Excise Taxation (2003)

Not all of these taxes are encountered in every country, and the precise definition of the taxes, and the rates at which they are levied, both vary widely. Table 5.1 describes the taxes levied on road transport in three African countries, South Africa, Mauritius and Kenya.

Tables 5.2 and 5.3 provide some comparative analysis of the tax burden on motor fuels and the annual taxation of motor vehicles, in a selection of countries in sub-Saharan Africa. Table 5.2 shows the level of excise taxation on premium petrol (gasoline) and on diesel fuel in 1991, drawing on the data provided in Bolnick and Haughton (1998). For comparative purposes the excise levels are presented as the equivalent of *ad valorem* tax rates, even for countries where the motor fuels excises are levied as specific taxes per litre of fuel. The unweighted average of excise rates on petrol is 80 per cent (of the pre-tax price), and five of the countries shown (Angola, Cameroon, Ghana, Ivory Coast and Senegal) have petrol excises in excess of 100 per

cent. The lowest petrol excise rates are in Nigeria (5 per cent) and Zambia (23 per cent). The unweighted average of diesel fuel tax rates is 45 per cent, and nine of the countries shown have diesel excise rates below 25 per cent. Table 5.3 presents data, reported by Metschies (2001), comparing the rate of annual vehicle taxation on a typical small passenger car in a number of African countries; the average across the countries shown is US$36. The annual taxes on motoring go under a number of different names in different countries, and (as shown in Table 6.1) can be differentiated according to vehicle characteristics.

As a result of the special excises, spending on motor fuels in most African countries is subject to substantially higher taxation than spending on most other goods and services, and the excises on motor fuels often make a substantial contribution to total tax revenues. Gupta and Mahler (1994) show that the share of total revenues contributed by taxes on petroleum products (mainly motor fuel) in developing countries can be as high as 30 per cent, with some African countries, including the Ivory Coast, Kenya, Tanzania and Uganda, among those with particularly high revenue shares. Chen, Matovu and Reinikka (2001, p.19) show that the 20 per cent of total tax revenue contributed by taxes on petroleum products in Uganda in 1998/99 was broadly equivalent to the total revenue yield from taxes on income and profits. For comparison, motor fuel excises in the EU countries typically raise 5 per cent or less of total tax revenues.

One important exception, however, arises in a limited number of African countries where motor fuel prices are subject to administrative regulation, or where petroleum importing, refining and distribution activities are publicly-owned. In these circumstances the administered prices may depart from world market prices and costs, and if publicly-owned importers and refiners are allowed to operate at a loss, motor fuels may be sold at a price below the world market level. Then, even if motor fuels are subject to significant excises, the net overall fiscal impact on their price, taking account of the distorted selling price as well as the tax, may well be substantially less than appears by considering the rates of tax alone. Also, if the public budget has to make good the deficits of a loss-making petroleum industry, the cost of subsidy must be offset against the revenues from excise taxation.

Metschies (2001) points out that, as a result of political and other pressures, it is often difficult for administered prices to be adjusted in line with high inflation and currency devaluations. As a result, in countries where large devaluations occur, there is a tendency for administered fuel prices to fall in relation to world prices, implying a fiscal subsidy which may cancel out a large part of the impact of fuel taxes and duties. He describes the impact of the 50% devaluation of the CFA Franc in January 1994, and observes that in those CFA Franc Zone countries that did not immediately adjust local fuel prices there was a loss in public revenues from fuel taxation. Metschies also identifies a number of countries which effectively subsidise at least some categories of motor fuel (typically diesel fuel) at a price below what would be the "normal" market price in the absence of any special taxation. Many of the countries he identifies as subsidising diesel fuel are oil-producing countries, and relatively few are in Africa. Examples of African countries identified by Metschies as having diesel prices significantly below the market baseline include Angola (a producer) and Ghana (non-producer).

Hossain (2003) observes that the international (border) prices of fully-tradable commodities such as petroleum products measure the opportunity cost to the economy of their domestic use, and

presents estimates of the economic subsidy to domestic sale of petroleum products in Nigeria, as a percentage of the estimated border price. He calculates that domestic sales of petrol and diesel both are subsidised by some 26 per cent, and kerosene by about 30 per cent. The overall cost of the economic subsidy amounted to 1.8 per cent of GDP. In addition, of course, the opportunity to raise substantial tax revenues from these products was foregone.

The discussion in this paper focuses in particular on two categories of tax: excise duties on motor fuels, and one-off or recurrent taxes on motor vehicle ownership. These together constitute the most significant potential sources of revenue (apart from the application of general consumption taxes such as VAT to road transport).

Table 5.2. Sub-Saharan Countries: Levels of Excise Taxation (expressed as an *ad valorem* tax equivalent) for Motor Fuels, around 1991

	Premium petrol	Diesel fuel	Differential in favour of diesel
Angola	218	82	136
Botswana	39	28	11
Burkina Faso	85	72	13
Cameroon	174	19	155
DRC	n/a	n/a	n/a
Ethiopia	40	12	28
Ghana	111	n/a	n/a
Ivory Coast	174	131	43
Kenya	n/a	21	n/a
Lesotho	37	35	2
Madagascar	39	24	15
Malawi	39	35	4
Mauritius	92	44	48
Mozambique	39	5	34
Namibia	61	59	2
Nigeria	5	5	0
Rwanda	75	74	1
Senegal	258	164	94
South Africa	56	46	10
Swaziland	30	30	0
Tanzania	37	19	18
Uganda	92	57	35
Zambia	23	21	2
Zimbabwe	30	11	19
Unweighted average	80	45	35

Source: *Ad valorem* tax rates for premium petrol and diesel from Bolnick and Haughton (1998), Tables 5d and 5e, except Madagascar and South Africa. Madagascar figures are for 1996 and are taken from Haughton (1998). South Africa figures for 1991 are computed from data provided in Country Survey Questionnaire, Southern African Conference on Excise Taxation, 2003. Differentials and average: author's calculation.

Table 5.3. Sub-Saharan Countries: Annual Vehicle Licence Fee for a Small Passenger Car, November 2000 (US dollars)

Angola	n/a
Botswana	17
Burkina Faso	0
Cameroon	20
DRC	7
Ethiopia	7
Ghana	n/a
Ivory Coast	13
Kenya	16
Lesotho	25
Madagascar	9
Malawi	19
Mauritius	n/a
Mozambique	10
Namibia	17
Nigeria	3
Rwanda	46
Senegal	82
South Africa	16
Swaziland	9
Tanzania	n/a
Uganda	16
Zambia	n/a
Zimbabwe	11

Note: The table shows the Annual Vehicle Licence Fee or other annual taxation for a small passenger car such as a Toyota Corolla.
Source: Metschies (2001), p. 75.

5.3 Efficient Revenue-raising Through Road Transport Taxes

As shown in the previous section, most countries treat road transport in a distinctive way within the fiscal system, generally levying excises on motor fuels and vehicles, imposed in addition to the standard consumption tax. How far is this special tax treatment justified, both in purely revenue-raising terms, and in terms of the impact on the various areas of government policy, such as transport and environmental policies, and policies towards growth and distribution, that are affected by road transport taxation?

The fiscal case for differential taxation, through the imposition of special excise taxes on certain commodities, is reviewed by Sijbren Cnossen (chapter 1, this volume). In some circumstances, special taxes on certain commodities may be able to raise government revenues at lower cost (in terms of the distortionary impact on private sector economic activity) than confining

consumption taxes to a single-rate broad-based VAT. The argument of Ramsey (1927) indicates that, under certain circumstances, higher taxes on inelastically-demanded goods could raise a given revenue requirement at lower economic cost than a uniform sales tax. For certain motor fuel uses, at least, this argument could justify above-average taxation, although this may conflict with distributional objectives in tax and social policy.

Historically, in African countries as elsewhere, the special excises on motor fuels are mainly due to an even more straightforward, and practical, observation - that these are commodities where high taxes can be levied, at low administrative cost, and with little risk of significant evasion (Due, 1994). Since many countries are wholly dependent on imports for their oil supplies, oil can be subject to close fiscal control from the border to the point of tax imposition. Even where this is not the case, oil refining typically involves substantial economies of scale and takes place in large plants, which can be monitored by the revenue authorities at relatively low cost.[3]

Further efficiency arguments for above-average taxation of certain commodities, noted by Cnossen, have to do with the potential for using taxes to meet the external costs associated with consumption or production but not accounted for in price, and to discourage the generation of such costs. In recent years, the use of taxation to reflect the various environmental externalities associated with road transport has become a vigorous subject for debate in many countries. This has been prompted partly by the growing awareness of the local, regional and global environmental problems arising from motor fuel use - for example, urban lead pollution, acid rain damage, and global warming, respectively. Higher taxation of motor fuels, and tax incentives to encourage fuel switching towards less-polluting motor fuels, may make an important contribution to reducing the pollution damage from road transport. In addition, by - in effect - charging for road use, road transport taxes may also have a role to play in ensuring efficient use of transport infrastructure. These issues are discussed further in the next section.

In broad terms, revenue-raising taxes should be levied over and above any level of taxes imposed for purposes of correcting externalities (Sandmo, 1976). Where significant revenues are raised from externality-correcting taxes, it will of course be possible to set lower rates of purely revenue-raising taxes.

A complication arises in the case of motor fuel excises which has no significant counterpart in the determination of the optimal tax structure for the other major excises on alcoholic drinks and tobacco, namely that motor fuels are used as an intermediate good (i.e., an input to production) as well as sold for final household consumption. Public transport and the distribution of goods by road both use significant quantities of motor fuels, and in poorer developing countries these uses account for a large part of total consumption of motor fuels.

Diamond and Mirrlees (1971) have shown that, in the absence of externalities, and provided certain general conditions hold, intermediate goods should not be subject to taxes levied for the purpose of revenue-raising. This means that it will be appropriate for vehicles and motor fuels used as production inputs to be taxed less heavily than vehicles and fuels used by final consumers. Any purely revenue-raising indirect taxes should apply to the latter, but not to the

[3] See, for example, Okello (2001, p. 8) for an outline of the administration and control procedures for the motor fuel excise in Kenya.

former. Where externalities are present, the implication of the above principle is that externality-correcting taxes should be imposed both on intermediate and final consumption commodities (if these generate the same level of externality), but the purely revenue-raising component of taxation should be imposed on final consumption uses only.

The Diamond and Mirrlees requirement that the burden of revenue-raising taxes should be confined to final consumption is achieved automatically through the operation of a VAT. Business purchasers of a taxed commodity can, in effect, reclaim the tax they have paid, as an offset to their liability for tax on the value of their sales. This provision for VAT-registered businesses to deduct "input" VAT in computing "output" VAT liability means that such businesses do not perceive VAT as a cost. As a result, VAT is good at handling intermediate goods issues with a purely revenue-raising tax. By the same token, however, use of the VAT system is a poor way of reflecting externalities in the tax system, if the externalities are generated by both intermediate and final consumption uses of the commodity. Higher rates of VAT will only be perceived as a cost by final consumers and not by business purchasers of the good. Excise duties provide a more efficient tax instrument for reflecting environmental and other external costs, since they raise the effective price of the good to business purchasers as well as to final consumers.

5.4 Social Costs of Road Transport

The social costs of road transport include four main categories of uncharged external cost:

- **environmental costs** - these include both global and local air pollution of various forms, including the contribution of vehicles to emissions of carbon dioxide and other greenhouse gases, nitrogen oxides which contribute to acid rain, and particulates (soot, etc.) which can cause health problems. In addition to air pollution, road transport also generates noise pollution, and aesthetic "pollution" in terms of transport-related effects on the rural landscape and the urban environment. (See Button, 1990; Maddison *et al*, 1996).

- **accident costs** - the costs of injury and accident fatalities caused to pedestrians and other road users; the damage to physical property; the costs of treating accident victims in publicly funded health services. (See Jones-Lee, 1990)[4].

- **congestion costs** - the costs in terms of extra journey time which road users impose on each other when roads become congested. (See Newbery, 1990).

- **consumption of the road infrastructure** - in the form of "marginal road damage costs": the physical wear and tear caused by vehicles using the roads (See Newbery, 1988; World Bank, 1988).

[4] In some countries the total economic cost of road traffic accidents is very high. South Africa had over 500,000 road accidents in 1997, and nearly 10,000 people were killed. The economic cost of these accidents, including the costs of hospital treatment, property damage, lost income and traffic delays to other road users has been estimated at some 1.8 per cent of GDP. (Pretorius Prozzi *et al*, 2000)

It is desirable that these social costs should be reflected in the costs of road use faced by individual road users, so that individual decisions (about vehicle ownership, and about whether, when and how to make individual journeys) are taken in the light of the full social costs, including environmental costs, road damage costs, etc., and not just on the basis of the private costs of vehicles and vehicle fuel. In principle, the taxation of road transport might be used to reflect the sum of the various externalities involved in vehicle use.

However, it is not possible to restructure existing taxes on vehicles or fuels so as to reproduce exactly the first-best structure of incentives, with road users charged an amount for each journey which reflects its full marginal social cost. This is principally because the various environmental costs differ in how closely they are related to the characteristics of vehicles or fuels. Some, such as the global warming potential of vehicle use, are closely (and broadly linearly) related to fuel consumption. Others, including the costs of particulate emissions, and noise, are related to the location, and in some cases the time of day, of vehicle use. Fuel taxes would be a poor proxy for these components of the environmental costs. Likewise, although vehicle sales taxes, taxes on initial registration, and annual vehicle registration taxes or license fees can be structured so that heavier and more polluting vehicles pay more, these taxes are unrelated to vehicle use. While they may influence vehicle use through their impact on vehicle sales or ownership, they do not influence individual journey decisions by vehicle owners.

As a result, taxation of vehicles or motor fuels can only provide an approximate reflection of the marginal social costs incurred as a result of individual transport decisions. The available tax bases are only loosely linked to the various social and environmental costs which policy might aim to control. In such a "second best" context, it will generally be appropriate to make use of a wide range of instruments, to produce the closest possible approximation of the tax incentives to the structure of the various social costs. This approach might include, for example, higher charges on parking in central urban areas, and subsidy to public transport, to discourage private car journeys in congested urban road-space. In addition, direct regulation of vehicle characteristics and vehicle use will be an important supplement to the incentives that can be given by vehicle and motor fuel taxation.

5.5 Distributional equity and taxes on road transport

The distributional incidence of taxes on motor fuels will include the direct distributional impact of additional tax on households' spending on motor fuels, and the indirect incidence arising through the impact of motor fuel tax on transport costs in production, and hence on the prices of other goods and services.

In developed countries, the direct distributional impact of taxes on motor fuel varies, depending on the level and pattern of car ownership, and the use made of public transport. These are in turn related to the spatial pattern of settlement and economic activity. In most European countries (especially in urban areas), motor fuel taxes tend to be mildly progressive, with higher rates of car ownership and use among higher-income households, and poorer households making relatively more use of public transport. In much of the United States (US), however, private

motoring provides the only available form of mobility, and motor fuel spending appears to have the demand characteristics of a necessity in household budgets. Taxes on motor fuels in the US thus may have a regressive distributional incidence (Congressional Budget Office, 1990), although there is debate about the degree of regressivity, with work by Poterba (1990) showing that motor fuel taxes appear substantially less regressive if a life-cycle incidence approach is taken to distributional incidence.

The available evidence for African countries suggests that the direct distributional incidence of motor fuel and vehicle taxation is strongly progressive, with vehicle ownership and use concentrated among better-off households, and negligible among the poor.

Younger et al (1999) examine the distributional incidence of a range of direct and indirect taxes in Madagascar.[5] The taxation of households' direct purchases of motor fuel, and of purchases of motor vehicles, both have a highly-progressive distributional effect, and much more progressive than the VAT (which in Madagascar is also found to be progressive in its distributional incidence). In addition, they find that the *indirect* distributional impact on households of the taxation of motor fuel used by public transport is also strongly progressive, although less progressive than the taxation of direct motor fuel purchases. Most use of public transport is by urban households, rather than by poorer rural households. Taxing all motor fuel at the same rate, including that used by public transport as well as that purchased directly by households, substantially increases the tax base compared to the taxation of direct sales to households, and results in a tax which is still significantly-more progressive than most other taxes in the tax system, including VAT. On the other hand, the taxation of kerosene (illuminating paraffin), which is predominantly used as a fuel for cooking and lighting by households with no electricity, is one of the few clearly-regressive components of the Madagascar tax system, because kerosene spending forms a much larger part of the budgets of poorer households than of the better-off. A system of general taxation of petroleum or petroleum products (for example petroleum import duties), covering kerosene as well as motor fuels, would then contribute substantially-less progressivity to the tax system than taxes on motor fuels alone.

Younger (1996) and Chen, Matovu and Reinikka (2001) find similar results for Ghana and Uganda, respectively. In particular, taxes on direct motor fuel sales to households have a highly-progressive distributional impact, while taxing kerosene (paraffin) has a highly-regressive impact, because it is such a significant part of the spending by poorer households in rural areas.

Taking account of the distributional impact of taxes on motor fuel used in public transport generally weakens the estimated progressivity of motor fuel taxes somewhat (since poorer households may make greater use of public transport than private cars), though the overall impact remains progressive.[6]

[5] Younger et al (1999) analyze the progressivity of different taxes by comparing tax concentration curves and using the criterion of "welfare dominance" proposed by Yitzhaki and Slemrod (1991).

[6] A particular issue arises in South Africa as a result of the pattern of settlement imposed by the previous apartheid regime, which located black townships well away from the main urban areas. This means that many residents of these townships must make long daily journeys by public transport. Pretorius Prozzi et al (2002) show that townships located around the major South African cities were on average 28 km from the central business district of the cities, and residents of these townships had average one-way journey times to the city centre of 69 minutes.

A number of studies point out that various mechanisms may reduce the progressivity of motor fuel taxes, especially when the consequences of taxes on goods transport are taken into consideration. For Uganda, Chen, Matovu and Reinikka (2001) calculate the distributional impact of motor fuel taxes working through goods prices, on the assumption that the additional cost of goods transport is passed forward to consumers. Taking this effect into account reduces the estimated progressivity of taxes on motor fuels, although they remain clearly progressive in their distributional impact. On the other hand, Addison and Osei (2001), in a discussion of taxation and fiscal reform in Ghana, take a different view of where the burden of motor fuel taxes on goods transport will fall. They argue that much of the incidence of motor fuel taxes on the transport of agricultural products will fall on poor, rural producers rather than better-off urban consumers, because supply is rather inelastic, while demand for these products is elastic. However, they present no empirical evidence to support this line of argument, and it is difficult to assess how far, if true, it would diminish the sharply progressive impact of motor fuel taxes observed in other studies.

Finally, Nicholson et al (2003) discuss the potential distributional impact of a doubling of the fuel tax in Mozambique, and describe a number of channels by which this may affect the living standards of poorer households. They conclude that the higher fuel tax would increase the number of people below the poverty line by about 28,500 (about 0.15 per cent of the total population). However, they present little quantitative detail on the distributional impact of the fuel tax, and, crucially, do not assess whether raising the same revenue through other taxes would have a greater impact on the poverty rate. The clear implication of the other studies is that fuel taxes, apart from taxes on domestic kerosene, have substantially less impact on poorer households than most other potential revenue sources.

5.6 Some Policy Options

This section seeks to draw together the various considerations outlined above in a discussion of a number of specific policy issues concerning taxes on motor fuels and vehicles. These include the implications of an increase in the overall rate of motor fuel taxes, the role of taxes on motor vehicle sale or ownership within an efficient and equitable system of taxes for road transport, the determination of the optimal tax differential between petrol and diesel fuels, and the potential role of taxation in accelerating the diffusion of less-polluting alternative fuels and alternative-fuel vehicles.

5.6.1 Higher motor fuel taxes

Higher motor fuel prices would have three main effects:

(i) **reductions in vehicle ownership**. For some owners of motor vehicles, a higher petrol price would make ownership no longer worthwhile. The number of vehicles owned would fall, as a result of fewer purchases of new vehicles, and/or earlier scrapping of existing vehicles;

(ii) **reductions in vehicle use**. The cost of each journey made would increase, and "marginal" or inessential journeys would be discouraged;

(iii) **higher fuel efficiency of the vehicle stock**. Higher petrol prices would tend to encourage manufacturers to design more fuel-efficient motor vehicles, and to encourage purchasers of new cars to choose more fuel-efficient vehicles. Also, high petrol prices might encourage the more rapid scrapping of "gas-guzzling" older vehicles.

However, the evidence on demand responses (see Goodwin, 1992) suggests that the impact of motor fuel price changes through changes in taxation is likely to be quite low. There is clearly likely to be a greater impact on fuel use and vehicle emissions than on vehicle use and congestion, particularly in the long run as the fuel efficiency of the car stock improves. Elasticity evidence for African countries appears relatively sparse,[7] but the available estimates seem broadly in line with the pattern in other countries. To the extent that motor fuel demand is relatively price-inelastic, an efficient structure of revenue-raising commodity taxation would tax motor fuels more heavily than other, more price-elastic, commodities.

Price inelastic demand for motor fuels also means that the tax rate which maximises revenue is high. The revenue maximising tax rate is the point at which the additional tax revenue from a higher rate of tax on each litre sold is exactly offset by the tax revenue lost on the reduction in consumption caused by the higher tax rate. It will be noted that this revenue-maximising tax rate is generally not the same tax rate as that which would be imposed in an efficient system of commodity taxes (generally the efficient rate will be lower than the revenue-maximising rate), but calculation of the revenue-maximising rate for highly-taxed commodities is important, to ensure that the rate of tax has not been raised to counter-productive levels.

Based on econometric estimates of the elasticity of demand for motor fuels, Haughton (1998) calculates the long-run revenue-maximising rates of motor fuel excises in Madagascar to be 104% for regular petrol, compared with an actual rate of 39% in 1996, and 81% for diesel fuel, which was actually taxed at a rate of 24% in 1996. In the short-run (meaning a period of one or two years), higher rates than these would yield even higher revenues, but the higher revenue would then be eroded over time by behavioural responses by fuel users. Similarly, Osoro, Mpango and Mwinyimvua (2001) estimate that the revenue-maximising rate of motor fuel excises in Tanzania is in excess of 100 per cent, even in the long-run. Table 6.2 shows that in the early 1990s the *ad valorem* equivalent of the actual excises on motor fuels in Tanzania was 37 per cent for petrol and 19 per cent for diesel.

If these estimates of the revenue-maximising level of taxation in individual countries are representative of the position in other African countries, they suggest that there is, in most countries, considerable potential to raise further revenues from the motor fuel excise. Only five of the 22 petrol tax rates reported in Table 6.2 exceed 100 per cent, while all but three of the diesel excise rates lie below 80 per cent.

[7] Some estimated own-price elasticities for motor fuel in African countries are reported by Bolnick and Haughton (1998).

An important issue bearing on motor fuel taxation in the African context is the taxation of kerosene, widely used by poorer households for cooking and lighting. Motor fuels and domestic kerosene are at least partially substitutable, and a wide tax differential between the two leads to significant diversion of domestic kerosene for use in motor vehicles. There are two powerful reasons for taxing kerosene and motor fuels very differently, however. One is that the pricing of kerosene affects the use of firewood, and hence the environmental damage caused by deforestation. Some authors have advocated subsidizing the use of kerosene as a means of reducing deforestation, and taxing kerosene on the same basis as other petroleum products would run directly counter to this recommendation.[8] Also, taxing kerosene has a highly-regressive distributional impact, in the sense that the tax burden is borne disproportionately by poorer households (Chen, Matovu and Reinikka, 2001).

From the perspective of distributional equity, therefore, there would be grounds for taxing kerosene much less heavily than motor fuels. Taxing motor fuels heavily, while having lighter taxes (or even subsidies) for kerosene, is liable to lead to inefficient tax-induced substitution towards kerosene in motor vehicles, with consequent revenue erosion. Various measures could be employed to limit this diversion for example by dyeing or chemical marking of kerosene, and spot-check inspections of the contents of vehicle fuel tanks, and while they may not be completely successful in eliminating diversion, they may make it possible to sustain a considerable tax differential between the two groups of fuels.

5.6.2 Taxes on motor vehicle sale or ownership

Many African countries levy special import duties on new motor vehicles and/or higher rates of tax on the sale of new motor vehicles than on the sale of other goods. Also, most countries have some form of annual taxation on road vehicles, in the form of an annual vehicle registration or license fee (Table 5.3). Taken together, these various taxes have considerable revenue potential (if they can be effectively enforced). In broad terms they also are likely to have similar distributional characteristics to the excises on motor fuels, since vehicle ownership, like vehicle use, will tend to be concentrated amongst the better-off.

What contribution can or should these taxes make to the achievement of an overall structure of pricing for road transport in which users face the full marginal costs of their journeys, in terms of road damage costs, pollution, etc.? At first sight it may seem to be attractive to place the burden of taxation on vehicle use rather than ownership, since the possession of a car, in itself, generates few externalities, while many of the external costs of motor vehicles are directly proportional to use. Thus it would seem that there would be benefits from what is sometimes termed the "variabilisation" of motoring taxes - turning fixed costs into charges based on use. Thus, it might be suggested that the special taxes levied on vehicle sales and annual taxes on ownership might be reduced or abolished, and the foregone revenue replaced through higher taxes on motor fuels.

At the margin, for a motor vehicle owner, this would increase the cost of vehicle use, and, where a suitable public transport alternative exists, increase the incentive for this to be used. Variabilisation might also be attractive on distributional grounds, since it would tend to benefit infrequent users of motor vehicles, which may include poorer households. However, the impact

[8] See the quantitative discussion of this issue in Hossain (2003).

on overall motor vehicle use, and hence the environmental consequences, are less clear-cut. While shifting the burden of taxes away from the fixed cost of vehicle ownership towards the use-related cost will discourage use by existing vehicle owners, it will reduce the cost of vehicle ownership, and may therefore increase the number of vehicle owners. Once a vehicle is owned, it may well be used, and the additional vehicle use by these additional vehicle owners could outweigh the reduced use by existing owners.

The environmental consequences of shifting the balance of taxation away from annual charges on motor vehicle ownership towards use-related taxes may be particularly unappealing on environmental grounds, although correspondingly attractive on distributional grounds. The effect of abolishing the annual charge on vehicle ownership might well be that vehicles which would otherwise have been scrapped are retained within the vehicle stock (perhaps being sold to poorer households, who would not have owned a vehicle at all when an annual tax is imposed on ownership). Older vehicles may be significantly more polluting than the average, both because they may have been designed at a time when environmental demands were lower, and because wear and tear, and poor maintenance, tends to reduce environmental performance.[9]

There are further environmental arguments for retaining a significant fixed tax element on vehicle sales and ownership. These taxes have the potential to be differentiated in ways which reflect particular attributes of the vehicle, including its size (weight or cylinder capacity), purpose (private car or commercial vehicle?), attributes (fitted with a catalytic converter?), emissions characteristics (based on a measured emissions check), etc. This differentiation has the potential to influence car purchasers' decisions towards vehicles with particular characteristics. It also allows some partial reflection of aspects of road use that cannot be proxied by fuel price alone. As Newbery (1990) notes, road damage costs are roughly proportional to the fourth power of the axle load, which means that practically all damage to the road surface is caused by heavy trucks. Diesel taxes alone cannot reflect this, because the additional fuel used by a heavier vehicle is by no means proportionate to the very much higher road damage that they cause. For commercial vehicles, the annual charges provide an important way of reflecting the greater road damage they cause than a lighter diesel-powered vehicle using the same amount of fuel.

Also, where there is a large volume of cross-frontier freight transport, lump-sum road-use charges for foreign-registered vehicles may be important. Taxes on fuels may be much less effective at channelling revenues to the countries whose roads are being used, especially where there are fuel tax differences across countries, which encourage hauliers to fuel their vehicles in low-tax countries. Modern trucks can be fitted with large-capacity fuel tanks, allowing them to travel 1000 kilometres without refuelling. As a result, a country that sets a relatively high tax on diesel may derive very little revenue from the diesel fuel used by trucks on its roads in international transit. International transit fees, collected on trucks at the border, are thus needed if countries are to derive revenues from international road haulage.[10]

[9] Some European countries, including Italy and France, have operated fiscal incentives for the scrapping of older motor vehicles. These incentives might be justified on environmental grounds, although in practice they seem to have been introduced primarily to stimulate the motor vehicle market, by accelerating vehicle replacement.

[10] Balcerac de Richecour and Heggie (1995) discuss procedures which may help to ensure efficient collection of international transit fees.

While there is potential for considerable complexity in vehicle sales taxes and annual license fees, to reflect aspects of the road and environmental damage caused by different kinds of vehicle, Haughton and Bolnick (1998) caution against undue differentials in the tax treatment of closely-substitutable vehicles, because they provide scope for a range of straightforward avoidance activities. They point out that Kenya appears to have lost a substantial proportion of the potential revenues from its vehicle sales tax in the early 1990s, when tax rates varied from 77 per cent to 275 per cent, depending on engine capacity. The large tax differentials between vehicles provided scope for simple avoidance activities based on mis-classifying vehicles to lower-tax categories. In more recent years, Haughton and Bolnick (1998) report that Kenya reduced the tax differentials between vehicles, and revenues increased.

Simplicity in taxation is desirable for a number of reasons. In general, straightforward, clearly-defined taxes will be less costly to operate, both for the revenue authorities and taxpayers. Differences in the tax treatment of similar commodities can lead to costly disputes and litigation between taxpayers and the revenue authorities over where the tax boundary between commodities should be drawn. A tax system which includes a complex set of different tax provisions and exemptions will be vulnerable to further degradation through lobbying by special interests, and may be particularly exposed to corruption in application.[11]

5.6.3 The excise differential between petrol and diesel

Many African countries (like many countries in Europe) tax diesel fuel less heavily than petrol (gasoline). Table 5.2, based on data from Bolnick and Haughton (1998), shows the percentage tax differential in favour of diesel fuel, expressed as a percentage of the pre-tax price. On average, across the countries shown in Table 5.2, petrol is taxed at levels equivalent to an *ad valorem* rate of 80 per cent, while diesel fuel taxation is equivalent to an *ad valorem* rate of 45 per cent. The average differential in favour of diesel is therefore some 35 per cent.[12] How far is such a sizeable tax discount in favour of diesel fuel justifiable in terms of the various theoretical considerations and principles outlined earlier in this chapter?

The origins of this differential appear to lie in two groups of justifications. Firstly, it may reflect governments' concern about the impact of high diesel duties on the costs of industry, and hence on the prices of goods produced for sale both domestically and in export markets. Although the benefits to exporters are probably negligible (especially when account is taken of the opportunity for exchange rate adjustments), there is often strong political lobbying behind this argument. A related line of argument has, however, rather stronger logic. As discussed in section 5.2 above there are good reasons for motor fuels used in commercial vehicles to be taxed less heavily than motor fuels used by private consumers. The former use (like any other intermediate goods and services used in the course of production) should not bear taxes intended purely for purposes of

[11] The decision as to whether a particular activity or product falls into a category that is taxed at a high rate, or another category taxed at a lower rate, confers considerable power on revenue officials. Wrongly classifying the activity in the low-tax category may be a relatively risk-free act of corruption for an individual official, especially where the tax boundary is so complicated that mistakes (or, indeed, genuine differences of opinion) are plausible excuses.

[12] This is not an exact measure of the tax-induced difference in the selling price of the two fuels, since the pre-tax prices of petrol and diesel will differ.

revenue-raising (although both uses should bear appropriate externality taxes). Revenue-raising taxes should be confined to products sold to final consumers. To the extent that commercial vehicles use diesel, and private cars use petrol, a tax differential between petrol and diesel can be justified in these terms. However, it will be noted that the distinction between diesel and petrol-engined vehicles does not exactly coincide with the distinction between commercial and private uses of motor fuels.

The second group of reasons for lower taxes on diesel have to do with enforceability. While petrol has no major uses outside the transport sector, diesel fuel and fuels closely-related to diesel are widely used in other applications, including as industrial fuels and for domestic heating and lighting. Domestic paraffin/kerosene can be blended and used to power diesel vehicles, at a substantial saving in running cost, if motor fuel uses are taxed heavily, while non-fuel uses are taxed much less. A number of governments, including South Africa (see Table 5.1), use chemical marking to enforce the fiscal boundary between motor diesel and other similar fuels. However, the potential for substitution may constrain the ability of governments to tax diesel fuel, while no such constraint acts (at least in the short term) on the taxation of petrol. Over the longer term, of course, the much lower taxation of diesel than of petrol is liable to lead to erosion of the petrol tax base, as purchasers of new motor vehicles prefer diesel vehicles to petrol vehicles. The substantial differential in favour of diesel fuel in European countries and elsewhere has contributed to the growth of a significant market for diesel powered passenger cars. As a result, the tax differential in favour of diesel increasingly benefits private car users[13].

The differential between excise levels on diesel fuel and petrol might also be considered in the light of the environmental attributes of the two fuels. In fact, the relative environmental damage caused by petrol and diesel engined vehicles is complex. Emissions of some pollutants, especially those affecting urban air quality, tend to be higher from diesel- than from catalyst-fitted petrol cars (and in some cases petrol cars without catalysts), whilst emissions of greenhouse gases may be rather higher. Whether diesel should be preferred to petrol on environmental grounds, or vice versa, thus depends partly on the relative weighting given to various different environmental problems.

Emissions of carbon monoxide, nitrogen oxides and total hydrocarbons from diesel engines are substantially lower than from conventional petrol engines. Figures given in QUARG (1993, p. 6) suggest that diesel engined cars emit only some 3 per cent of the carbon monoxide emitted per kilometre by cars with conventional petrol engines, 50 per cent of the nitrogen oxides, and 10 per cent of the total hydrocarbons. Three-way catalytic converters sharply reduce emissions of each of these pollutants from petrol cars. Nitrogen oxides emissions are reduced to about half the level of equivalent diesel engines, and hydrocarbons emissions to two-thirds of the diesel level; on the other hand, even with a catalyst, petrol cars have more than double the carbon monoxide emissions of diesel engines (these figures relate to warmed-up engines).

The potential advantages of diesel engines in respect of emissions of these regulated pollutants is declining as new petrol-engined vehicles fitted with three-way catalytic converters enter the vehicle stock. Furthermore, diesel engines, especially when poorly adjusted, are substantial

[13] One way of reducing the impact of the fuel tax advantage for diesel cars would be to levy a higher annual road tax on diesel cars than on petrol cars.

sources of emissions of black smoke and fine particulates; these are implicated in respiratory ailments, and also include known carcinogens. QUARG (1993, p. 6) observes that particulates emissions from petrol cars are so low that they are not routinely measured; particulate emissions from diesel cars "may be an order of magnitude higher" than from catalyst-fitted petrol cars.

Calthrop (1995)[14] estimates the health externality per litre of each fuel in the United Kingdom, as shown in Table 5.4. Although the monetary values shown in Table 5.4 are specific to the UK context, and reflect UK incomes and environmental conditions, the broad picture of the relative pattern of marginal external costs across types of fuel is likely to be more broadly applicable to other countries. It is clear that the external health costs are non-trivial, and that they vary widely across different motor fuels. If motor fuel taxes are to provide appropriate incentives for vehicle users to take these external costs into account, significant levels of motor fuel excises would be justified, and these excises would need to vary considerably across different fuels.

In addition to the external health costs, the contribution of motor fuels to global warming also varies across fuel types. Carbon dioxide emissions from motor vehicles are closely linked to the amount of fuel used, and its carbon content. Diesel engines are substantially more fuel efficient than equivalent petrol engines; on the other hand, diesel fuel has a higher carbon content per litre than petrol. Drawing a balance between these two effects, a diesel engine needs to have an efficiency advantage of at least 11 per cent over an equivalent petrol engine for the diesel to have lower carbon dioxide emissions. Estimates given in QUARG (1993, p. 14) suggest that at a speed of about 40 miles per hour, carbon dioxide emissions from petrol cars (without catalytic converters) and diesel cars were broadly similar; carbon dioxide emissions from petrol cars fitted with three-way catalytic converters were higher, by about one third.

Table 5.4. United Kingdom: Marginal External Health Costs per Litre of Fuel

	In UK pounds, 1993 prices	In 2003 prices, converted to US dollars
Petrol (leaded)	£0.43	$0.89
Unleaded petrol	£0.09	$0.19
Standard diesel	£0.84	$1.73
Low-sulphur "City diesel"	£0.33	$0.68

Source: Calthrop (1995) and Maddison et al (1996). Final column, author's calculation. Unleaded petrol figure assumes use in car with catalytic converter.

The implication of the above is that differential excise duties which favour diesel fuel over petrol are inconsistent with the relative environmental damage caused by diesel and petrol-engined vehicles.

[14] A discussion of these estimates can be found in Maddison, *et al* (1996).

The position is further complicated if the excise tax on fuel is partly regarded as an approximation to a road user charge. On the one hand, diesel powered vehicles are more fuel-efficient (in terms of km/litre) than petrol-engined vehicles, which would indicate a higher road-user charge per litre on diesel than on petrol. On the other hand, much diesel fuel is used by heavy vehicles, which cause disproportionately-high levels of road damage. In the absence of any better way of charging for this higher-than-average road damage, there would be an argument for a higher road-user charge element in the excise tax on diesel than on petrol.

As discussed above there are good reasons for revenue-raising taxes levied on motor fuels to be concentrated on fuels used by private motorists. However, this argument does not support the very large duty differential in favour of diesel observed in many countries. Apart from a lower rate of carbon dioxide emissions per kilometre, diesel has considerably poorer environmental qualities, especially when used in poorly-maintained vehicles in urban areas, and from an environmental point of view should not be taxed less than petrol. Likewise, as a proxy for a theoretically-ideal road user charge, diesel used in private cars might arguably be taxed less than petrol. However, given that the heaviest vehicles cause most road damage, the efficient use of motor fuel taxes to proxy road user charges should probably give higher weight to approximating the optimal road use charge on heavy commercial vehicles. A higher rate of tax on diesel than on petrol might then be justified as the only feasible way of adequately reflecting the higher road damage costs caused by heavy vehicles.

5.6.4 Tax incentives for "alternative" fuels

Over the medium term there is considerable scope for the development of vehicles powered by alternative fuels of various sorts, which may have lower emissions of certain pollutants. Michaelis (1995) reviews the market potential for such vehicles. Many of the available alternative fuels require specially-adapted vehicles or different engine technologies, although some, including reformulated gasoline, can be used in existing vehicles. For the former group of fuels, Michaelis argues that the main market is likely to be in light-duty vehicle fleets. Use of alternative fuels by private car drivers is likely to be mainly in the form of fuels which can be used in existing vehicles.

The tax policy issues raised by the two groups of alternative fuels vary. For fuels which can be used in existing vehicles, the main issue will be the relative taxation of these fuels and existing motor fuels, so as to reflect their relative environmental attributes. An example where the relative taxation of motor fuels was explicitly used to encourage more rapid diffusion of a new fuel with lower environmental damage was the tax differential in favour of unleaded petrol in EU countries during the 1990s, introduced with the aim of accelerating the phase-out of leaded petrol from the market. Leaded petrol has now been removed from normal sale within the EU. Encouraging greater use of unleaded petrol by introducing a differential tax rate may have contributed to the phase-out, although the relative contribution of the tax differential and other policy measures is unclear. Laws requiring all new cars to be equipped with catalytic converters, which means that they can only use unleaded petrol, are likely to have led to a substantial

increase in the market share of unleaded petrol, even without the fuel tax differential (Lofgren and Hammar, 2000).

In principle, a relatively small tax differential in favour of unleaded petrol would have been expected to lead to large effects on the relative market share of the two fuels, because leaded and unleaded petrol are very close substitutes for many vehicles. If the two fuels were perfect substitutes, even a small differential would be expected to induce consumers to switch to the lower taxed variety. However, the rate of take up has been complicated by the fact that some vehicles required modification or engine adjustment to be able to use unleaded petrol, and this may not have been costless. Whilst this may have slowed the rate of diffusion of unleaded petrol, diffusion rates may have been accelerated by the preference of some consumers for using the more environmentally benign fuel.[15]

Where alternative fuels require major adaptation or replacement of existing vehicles, their rate of diffusion will depend on both vehicle and fuel costs. Policies to extend diffusion could act on either or both of these costs, by setting a lower rate of tax on the sale or licensing of alternative fuelled vehicles, or by a motor fuel tax differential in favour of alternative fuels. Frequently, the capital costs of alternative fuel vehicles will be higher, while the fuel may be cheaper. In this case it may be profitable for high-mileage users to convert, without any fiscal inducement. The role of any fiscal incentive will then to be to encourage greater diffusion, beyond the high-mileage users who would convert in any case. Here, however, considerations of efficiency and "cost-effectiveness" of policy may conflict. If environmental costs are directly proportional to fuel use, an efficient pattern of additional use of alternative fuel vehicles will be achieved purely by reducing the tax on the fuel. However, this may involve "non-additional deadweight", in the sense that a large part of the benefit of the tax reduction (and hence the "tax expenditure") may be paid to high-mileage users who would choose the alternative fuel in any case. Subsidising vehicles rather than fuels, or targeting subsidy on certain categories of users may reduce this deadweight.

5.7 Earmarking Revenues to a Road Fund

Africa as a whole faces major problems in maintaining an efficient road network. Many countries are landlocked, and except in a few parts of the continent there is no rail network. Long-distance road transport, using the road network of neighbouring countries, provides the main channel for trade in goods across the continent. However, in much of Africa there are major difficulties in ensuring efficient provision of road infrastructure and its effective maintenance. The inadequate road network imposes substantial costs, and acts as a brake on development, especially in areas remote from major markets.

The obstacles to efficient road infrastructure provision and maintenance include geographical and climatic factors, which can lead to frequent and rapid deterioration of roads. From the point of view of individual countries, too, there may be little benefit from incurring large costs in maintaining roads which are used as through routes by long-distance hauliers. Even if a system

[15] Tax differentiation may encourage such altruistic, "pro-green" behaviour by signalling which goods have lowest environmental cost.

of charging for such road users is put in place, it may be difficult to enforce effectively. However, a further factor contributing to the poor state of the continent's road infrastructure has been the institutional failure to devote resources to systematic and regular road maintenance.

In many African countries, some of the revenue raised from taxes on road transport is "earmarked" to a Road Fund which finances the construction and maintenance of the road network. Often some part of the fuel excise is assigned to the road fund, and in a number of African countries the fuel excise is formally composed of a number of separate taxes with different names, reflecting the various purposes to which parts of the revenue are assigned.

The earmarking of revenues to road funds – like any hypothecation of tax revenue to particular purposes – can be criticized from a number of perspectives. In particular, tying such a significant source of revenue to a particular purpose reduces macroeconomic flexibility. It also significantly diminishes the revenues available to other public budgets, without any process for assessing whether the revenues allocated to the road fund might yield higher benefits if deployed elsewhere. There is no particular reason to believe that the need for expenditures on road maintenance corresponds precisely to the level of revenues from the fuel excise; more or less maintenance expenditure than the assigned revenues might be warranted. And it is far from clear, in practice, that the earmarking of some proportion of the revenue from the motor fuel excise does confer the intended stability and predictability of revenues on the road fund. Delays and inefficiency in excise collection, and the manipulation of cash flows as part of a process of inter-agency bargaining, can both undermine budget planning for road maintenance.

The costs of failure to maintain the road network are substantial. Harral and Faiz (1988) show that delaying maintenance expenditures can have costly consequences; if the condition of a road is permitted to deteriorate to the point where major reconstruction is required, the cost of restoring the road to its original condition is around 3 to 5 times higher than the cost of maintaining the original condition through regular maintenance. Likewise, vehicle-operating costs can be greatly increased by poorly-maintained roads. Heggie (1995) estimates that expenditure on road maintenance has an economic return, in the form of savings in vehicle operating costs, between 2 and 4 times the maintenance expenditure.

In the last decade the idea of earmarking revenues to a road fund has enjoyed something of a renaissance, and recommendations to overcome some of the difficulties of earlier road funds have been developed by World Bank work (Balcerac de Richecour and Heggie, 1995). Several African countries have established new arrangements for road maintenance, based on a road fund of rather different design than earlier funds. These road funds are intended to have some of the characteristics of privatisation in other areas of government, through mechanisms to ensure that decisions about the provision of roads and road maintenance reflect the demands of "customers" (road users), and through a financing mechanism intended to function as closely as possible to a price for the level of service supplied (i.e., as a user charge). Again, these funds are financed from earmarked revenues, although typically a mix of lump-sum annual taxes on various categories of vehicles or road users contributes the bulk of the revenues, augmented in some instances by a part of the fuel excise. Arrangements are established to ensure that the revenues are paid as directly as possible into the fund. Management of the fund is under the control of a

board representing user interests, which has responsibility both for determining the level of charges, and for decisions about expenditures.

Gwilliam and Shalizi (1999) discuss the functioning of these "second generation" road funds in terms of three groups of criteria. From the point of view of fiscal control and allocational efficiency the arguments for and against earmarking are largely conventional and familiar: earmarking revenues to a particular budget risks their use in ways that do not maximize benefits; but equally, there is no guarantee that discretionary public budget-making processes achieve an efficient allocation of funds across different areas of public spending. As far as management incentives for operational efficiency are concerned, Gwilliam and Shalizi argue that road funds with a stable source of revenues can make better use of more-efficient private sector contracting arrangements for road maintenance. Third, they argue that a user-managed fund, financed from taxes that are reasonable approximations to benefit taxes, can properly reflect the interests of users in better-quality services (for which they would be willing to pay), while reducing the influence of non-users who have little interest in the service (other than minimising its cost). There are, for example, instances in a number of African countries where road hauliers have been willing to accept a fuel surcharge where it could be demonstrated that it would lead to a programme of identified improvements in road quality.

5.8 Conclusions

Taxes on road transport make a major, and buoyant, contribution to government revenues in many African countries. The taxation of motor fuels, in particular, contributes a substantially larger share of revenues in Africa than in most developed countries. Typically, excises on motor fuel contribute 5 per cent or less of total tax revenues in countries in western European countries, while in a number of African countries motor fuel excises contribute 20 per cent or more of total revenues. Given the revenue significance of these taxes in African countries, the optimal design of motor fuel excises - and of road transport taxes more generally – is a matter of considerable economic significance. It is perhaps surprising that the existing academic and policy literature on the economic aspects of road transport taxation in Africa is not more extensive.

However, as noted in earlier contributions on this topic, economic theory provides some useful guidance for designing an efficient structure of road transport taxes – in other words, a system of taxes which raises required revenues while causing the minimum possible collateral damage to the efficient functioning of the economy. In particular, commodity taxes levied for revenue-raising purposes should not be imposed on intermediate goods (i.e., goods and services used as inputs to production), but should be confined to final consumption goods (i.e., goods sold to households). This principle, which derives from Diamond and Mirrlees (1971), has clear implications for the taxation of road transport, since some motor vehicles and fuels are used as industrial inputs (e.g., to transport goods), while others are final consumption (e.g., private motoring). The implication is that higher taxes should be levied on the latter uses of motor fuels than the former. This outcome may be roughly approximated by setting lower rates of excise on diesel fuel than on petrol (gasoline), on the grounds that commercial vehicles generally use diesel fuel, while most petrol is used in private cars. Most African countries do indeed tax petrol significantly more heavily than diesel. However, diesel fuel is not only used as an intermediate

good. Diesel-powered private cars are now increasingly common, and a strong tax advantage for diesel will be liable to give further artificial impetus to this market.

Taxes on motor fuel and vehicles are often considered to approximate a user charge for the use of the road infrastructure. The efficient user charge would be set at the level of the marginal damage caused by each road user, which will generally imply much higher levels of charge for heavy vehicles (which are responsible for a disproportionate amount of road surface damage). Neither annual registration taxes on vehicles nor motor fuel taxes are able to match this ideal charge exactly. Annual vehicle taxes do not reflect the amount the vehicle is used; on the other hand, motor fuels taxes do reflect use, but are cannot differentiate between vehicle types. A combination, however, of fuel and vehicle taxes may provide the best available approximation to charges for road infrastructure consumption. Such taxes are frequently earmarked to road funds in Africa, and there seem to be powerful arguments to support some form of earmarking, to ensure that the road network is adequately maintained. Nevertheless, since taxes on motor fuels are one of the few reliable and fecund sources of tax revenue in African countries, earmarking motor fuel tax revenues to road maintenance funds has a particularly significant opportunity cost, in terms of the reduced revenue available for the broad range of other public policies with pressing revenue needs.

The externalities associated with road transport, in terms of environmental pollution, accidents and traffic congestion provide further efficiency arguments for higher taxes on motor fuels than on other goods. Many of the environmental problems of urban areas can be attributed to road transport. Motorcars are major sources of local pollutants, such as lead, carbon monoxide and noise. Road congestion exacerbates these problems, and also imposes direct costs on road users, in the form of the time and money wasted in traffic jams and slow-moving urban traffic flows. Motor vehicles are responsible for many deaths, both of road users and pedestrians, each year. They also make a significant contribution to global environmental problems, through emissions of carbon dioxide and other greenhouse gases. Many of these problems are growing rapidly, as rising incomes lead to an increasing demand for road transport. While direct regulation may be able to control some aspects of these environmental problems, there is a growing view that efficient regulation of road transport externalities requires the use of the pricing mechanism, by levying a tax on the use of motor vehicles at a level that approximates the social costs arising from each journey. Motor fuel taxes may provide a reasonable, and practicable, approximation to this form of externality charging.

From the perspective of distributional equity, too, there are strong arguments for taxing motor fuels heavily in the African context. The available quantitative studies for African countries show that taxes on motor fuels have a strongly-progressive distributional incidence (i.e., the tax burden is a larger share of the spending of better-off households than of poorer households), even where the effects of motor fuel taxes on public transport costs, and on the costs of production and distribution, and hence on the prices of other goods, are taken into account.

As a revenue source, excises on motor fuels are reasonably stable, and over time are likely to be able to contribute rising, rather than diminishing, revenues. The motor fuel excise tax base is buoyant, because road transport is likely to grow more than in proportion to economic growth.

Finally, there is the purely pragmatic, but very compelling, observation that large-scale commercial oil importing and refining activities can be closely controlled and monitored by the revenue authorities, allowing high rates of tax to be levied on motor fuels at low administrative cost and with limited risk of evasion. There are thus a number of good arguments for taxing motor fuels heavily. Although motor fuel taxes already make a large revenue contribution in many African countries, there is good reason to believe that this contribution should remain high – or indeed grow. Bolnick and Haughton (1998) argue that revenue from excise taxes as a whole can and should be doubled in most African countries. In most countries (other than the highest-taxed countries) there seems clear scope for this to apply to the motor fuel excise.

If the revenue potential of road transport taxes is to be efficiently exploited, four conditions may be suggested.

First, the institutional mechanisms for motor fuel pricing, which set the baseline on which the tax is then applied, need to be responsive to developments in world market conditions. A number of African countries find themselves in a position where motor fuels (especially diesel) are being sold at prices that are little higher than (and in some cases below) the border price. Subsidising (or making good losses) in oil import and refining activities to maintain these low prices can dissipate much of the revenue that can be obtained from motor fuel excises.

Second, for various good practical reasons, motor fuel excises are often denominated in specific terms (i.e., as a certain sum per litre of fuel), rather than as an *ad valorem* tax (percentage of price). There is a need for prompt (and, ideally, automatic) indexation of nominally-denominated specific excise rates in response to changes in the domestic price level and exchange rates, if the real value of excise duties is not gradually to be eroded through the effects of inflation.

Third, in some parts of Africa, neighbouring countries set significantly-different rates of motor fuel excises, leading to problems of smuggling and some diversion of activity. Administrative cooperation (and, in some cases, rate harmonisation) can help to avoid the revenue potential of motor fuel excises being undermined by smuggling and the inefficient diversion of transport routes and economic activity to or through countries where motor fuel duty is lower, or inadequately enforced.

Fourth, while some of the analysis in this paper might suggest a complex and highly-differentiated structure of taxes on motor fuels and vehicles, it will in practice be desirable to avoid excessive complication. The literature contains a number of cautionary tales about the consequences of special provisions within the tax structure. Exemptions and special tax treatments for certain categories of fuel user create opportunities for fraud and the illegal diversion of low-taxed fuel to higher-taxed uses. Likewise, an unduly complex tariff for taxes on motor vehicle import, sales and annual licensing creates opportunities for fraud and avoidance activities which can significantly undermine the level of revenues collected.

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