Using Environmental Taxation for Transport Demand Management

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Transport Policy and Taxation

In a number of countries, road transport taxation has been reformed to address environmental and transport policy goals. Some of these policy goals concern the choice of vehicle, others the choice of fuel and yet others to the choice of mode or the level of demand for travel. These are three crucial groups, with only the last one representing Transport Demand Management (TDM). There is a tendency for TDM policies to focus only upon choice of travel mode, but this is just one factor in the traffic/congestion generating mix. There are a group of factors that constitute transport demand.[1]. These factors include the total number of trips, trip length, mode used and vehicle occupancy. Policies for reducing congestion also require a consideration of the location and time of travel. So, when looking at the role of taxation in transport policy it should be recognised that there are important tax measures which primarily influence vehicle technology, the type of fuel used and fuel economy. These should be viewed separately from tax measures that influence travel demand. Some tax measures are capable of affecting both vehicle/fuel choice and travel demand, but conceptually it is important to distinguish the two.

Positioning of Taxation Measures

As well as understanding what part of traffic/congestion generating system would be influenced by a tax measure, a crucial issue is to position the measure in the system where it will have the most direct impact. This positioning relates to whether the objective of a measure is mainly to manage vehicle choice or use. There are three crucial taxation points:

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[1] S Potter, 'Sustainability, energy conservation and personal transport'. Chapter 1 (pp 9-35) of Warren, J, (Ed) *Managing Transport Energy,* (2007), Oxford University Press.

- Tax on the initial purchase of a vehicle;
- Annual registration 'Circulation' Tax on the ownership of vehicles, and
- Tax on the use of vehicles (fuel, tolls, roadspace, parking).

Purchase and circulation taxes can have a strong influence on the choice of vehicle and the fuel it uses. Circulation taxes also largely have an impact upon vehicle choice rather than use. Taxes on the use of vehicles (such as fuel, road user charges and parking) have the strongest impact upon decisions to use a vehicle once purchased. Aspects of the personal and corporate taxation regime can also influence commuting and business travel). Although this paper is largely focusing on travel demand aspects, it first briefly covers the role of taxes affecting vehicle ad fuel choice.

Purchase and Circulation Taxation Measures

In some countries, existing car purchase taxes have been reformed to promote cleaner and low carbon vehicle technologies. For example, as noted in a review of European car taxation by Skinner et al[2], the Netherlands introduced a series of reforms to their original 42% car purchase tax. From mid 2006 the registration taxes were reduced for the most fuel-efficient cars (rated A or B under the national fuel efficiency/CO_2 emissions labelling system). The reductions amount to €1000 ($750 US) for A-labelled cars and €500 ($380) for B-labelled cars, while cars in the least efficient bands (D to G) faced an increase in tax of up to €540 ($400).

This tax structure is similar to a trail which ran in 2002. An evaluation of the trial[3] found that, compared to 2001, the market share of the A-labelled cars in 2002 increased from 0.3% to 3.2%, while that of B-labelled cars rose from 9.5% to 16.1%. This was a much greater increase than had been anticipated[4]. The loss of the incentive in 2003 resulted in a drop in market share for these vehicles, but with a lag effect remaining.

In Belgium, tax incentives for the purchase of low CO_2-emitting cars were introduced in January 2005. The tax reduction is equivalent to 15% of the sale price, up to a limit of €4350 for a car emitting less than 105gCO_2/km. For cars emitting between 105 and 115gCO_2/km the tax reduction is 3% of the sale price (up to a limit of €850 ($640) and 3%). The

[2] I Skinner, M Fergusson, C Valsecchi, S Potter and G Parkhurst, G *Car Taxation and CO2 in Europe.* Report for the Energy Saving Trust,, (2006). Institute for European Environmental Policy, London, November.

[3] VROM, Evaluatie studie Energiepremie. Notitie van de staatssecretaris van VROM aan de Tweede Kamer dated 20 October 2003

[4] EEA, *Market-based instruments for environmental policy in Europe* Technical Report No 8/2005 (2005), European Environment Agency (EEA).

tax incentive works by reducing the purchaser's personal taxable income rather than refunding the purchase tax.[5] This is an example of how the personal tax system can be used to address environmental goals, and one theme in this paper is the growing use and potential of personal taxation (as well as taxation on goods or licence fees) to address transport's environmental effects.

Annual registration (or 'circulation' or 'licence plate') taxes exist in many countries and there have been some reforms to circulation tax to address fuel efficiency or environmental policy objectives. Germany (which does not have a purchase tax) links circulation tax liability to the Euro emission standards, with the least polluting car paying only 20 percent of the rate of the most polluting car. However, as the overall tax is low at only about €50 ($40) per car, its impact on car choice is negligible.

Britain has had a CO_2 emission-based circulation tax ('Vehicle Excise Duty') for cars since 2001. Initially the band of charges was small, but this has gradually been refined and widened such that by 2008 it covered a range from no charge at all for low carbon vehicles in band A, up to £400 ($690 US) for vehicles in the highest emitting band G (Table 1). From April 2009, VED will be restructured into 13 narrower CO2 bands with a new top band of over 255 g/km and the separate 'Alternative Fuel' bands will be phased out by 2011.

Table 1: UK 'Circulation' Tax (Vehicle Excise Duty), 2008-09 (£ per year)

VED Band	CO_2 (g/km)	Petrol and Diesel Cars	Alternative Fuel Cars
A	100 and below	£0	£0
B	101-120	£35	£15
C	121-150	£120	£100
D	151-165	£145	£125
E	166-185	£170	£150
F	186-225	£210	£195
G*	Over 225	£400	£385

*For cars registered on or after 23rd March 2006.

Source: DirectGov, http://www.direct.gov.uk/en/Motoring/ (accessed 17..10.08)

A selective form of circulation tax exists in some countries through the personal taxation treatment of company cars. In some countries, company-registered vehicles form a substantial part of the car fleet. Where the company car is available

[5] ACEA, *Tax Guide: Motor Vehicle Taxation in Europe* (2006) European Automobile Manufacturers Association (ACEA), Brussels.

for private use, this 'income-in-kind' can be subject to an annual income tax charge. In the UK, a major reform of company car taxation took effect in 2002, with the tax charge for a company car related to a car's value weighted by its CO_2 emissions. An assessment of the impact of this tax change[6] showed that, in the first year of the new system, average CO_2 emissions of new company cars decreased from 196 g/km in 1999 to 182 g/km in 2002. The number of business miles has reduced by over 300 million miles per year and the overall effect has been to reduce the emissions of carbon from the company car fleet; by around 0.5 percent of *all* CO_2 emissions from road transport in UK.

This demonstrates the importance and influence of eco-reforms to the personal taxation system. Other countries are starting to follow the UK's example in reforming company car tax. Skinner et al, 2006[7], notes that in Belgium there is a tax on company car CO_2 emissions and fuel type. However, the tax is on employers rather than employees, so linking transport taxation into the corporate taxation regime. In France, the 'TVS' tax (*'Tax sur les Véhicules de Société'*) was adjusted from 2006 to take account of CO_2 emissions of the vehicles purchased, to incentivise the purchase and use of lower emission vehicles. Also from 2006, the amount that companies can set against depreciation for tax purposes has also been related to CO_2 emissions.

Whether it is an annual charge, or is delivered via the personal or corporate taxation systems, the post-purchase positioning of a circulation tax means that it has only an indirect impact on the type of vehicle acquired. It can, however, be a useful complementary measure to car purchase tax and for countries such as the UK and Germany that have no purchase tax, this second-best, indirect alternative may be the only tax available to influence purchasing decisions. A notable UK development is the further reform of its VED circulation tax. As well as widening the range of charges (detailed above), from April 2010, a 'first-year' rate of VED is planned. For new cars with emissions under 160 g CO2 /km the first year rate is no different, but it will be higher than the normal rate for new cars with emissions over 160 g CO2 /km. This is effectively a purchase tax of up to £495 ($850) for the most polluting cars.

For both purchase and circulation taxes, the size of the tax is important. The strong impact of the UK company car taxation reform was because it is a major cost to users. A car costing £20,000 ($34,000US) used mainly for business

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[6] Inland Revenue, *Report of the Evaluation of Company Car Tax Reform*, (April 2004) Inland Revenue, London.

[7] I Skinner, M Fergusson, C Valsecchi, S Potter and G Parkhurst, G *Car Taxation and CO2 in Europe.* Report for the Energy Saving Trust,, (2006). Institute for European Environmental Policy, London, November.

purposes under the old system would have cost an employee paying the standard rate of income tax about £690 ($1,190) a year. Under the reformed system, it would require a lower level of CO_2 emissions to keep the tax bill the same, and moving to a car with higher CO_2 emissions would result in the tax bill more than doubling to £1,600 ($2,750) per annum. Eco-reforms to small taxes (as the small circulation tax in Germany), have had no discernable impact.

Overall, experience indicates that complementary purchase and circulation tax measures can have a significant policy impact on the type of cars purchased. Potter and Parkhurst[8] note that the combined effect of well-established highly graded purchase and circulation tax systems in Italy and Denmark helps to explain why their car fleets have a 20% better fuel economy than the UK. The use and refinement of such tax systems can play an important role in the uptake of cleaner vehicle technologies and low carbon fuels.

Second order impacts of Purchase and Circulation Taxes on Travel Demand

Although purchase and circulation taxes primarily affect vehicle and fuel choice, they can have a second order impact on travel demand. A characteristic of low carbon vehicles is that they have high capital costs and lower running costs than petrol or diesel cars. A key way to stimulate their use is to provide purchase and circulation tax cuts to reduce fixed costs, coupled with fuel tax concessions on the cleaner fuels. The net impact is that fuel-efficient low carbon cars have very low running costs, reducing the marginal cost of motoring and so stimulating car use. As will be noted in the next section, fuel price elasticity studies[9] indicate a short term elasticity of 0.4, so a 33% drop in fuel cost (about the amount resulting from policy objectives for low carbon cars) might be expected to increase the volume of car travel by about 13%. This 'rebound' effect means that if the tax system only addresses the supply side, then it will raise transport demand, counteracting any savings in CO_2 emissions from low carbon vehicles. If used on their own, purchase and circulation tax measures will have a negative second order effect on TDM. Environmental taxation (and other policy measures) need to impact upon both vehicle design *and* vehicle use.

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[8] S Potter and G Parkhurst, 'Transport Policy and Transport Tax Reform'. *Public Money and Management* (2005) 25 (3), June 171-178.

[9] These include S Glaister and D Graham, The Effect of Fuel Prices on Motorists (2000). (Basingstoke: The AA Motoring Policy Unit) and PB Goodwin, 'Are fuel prices important?' (2002) Chapter 5 in G Lyons and K. Chatterjee, *Transport Lessons from the Fuel Tax Protests of 2000*. (2002), Ashgate.

Tax on car use

TDM environmental taxation measures need to be positioned to influence decisions about the amount of travel and mode of transport used. In most countries, the main tax on the use of vehicles is upon fuel. There may also be other taxes and charges affecting use, including road and bridge tolls and city congestion charges. Parking charges are a further significant cost that can be influenced by policy, but are not generally subject to a specific tax measure. As already noted, there can also be aspects of the personal and corporate taxation systems that can influence both car purchase, but also these can influence travel behaviour as well.

Fuel tax has for long provided a useful and steady income to national and (in some federal countries) regional governments. It is important to distinguish fuel tax from standard sales taxes (such as VAT in the EU). Sales taxes apply to all goods and are levied at a percentage of the price. Fuel tax (or duty) is in addition to any sales tax. It is charged not as a percentage of the sales price, but at a rate per unit of fuel; per litre (or gallon in the USA) for liquid fuels and per kilogramme for gaseous fuels. The rate can differ according to the type of fuel, often favouring 'cleaner' fuels. Some Scandinavian countries have a CO_2 levy as well as fuel tax, but this is also at a fixed rate per unit of fuel.

Fuel tax rates vary considerably between countries, affecting the overall retail price. Table 2 shows this information for the EU-15 states (by way of comparison, petrol in the USA is about €0.55 a litre).

Table 2 Tax and retail price of premium unleaded petrol, October 2008

	Tax as % of retail price	Retail price (Euros per litre)		Tax as % of retail price	Retail price (Euros per litre)
Netherlands	64	1.63	United Kingdom	67	1.36
Denmark	62	1.58	Finland	64	1.33
Belgium	61	1.55	Austria	56	1.27
Germany	65	1.47	Luxembourg	54	1.27
Portugal	60	1.46	Irish Republic	57	1.23
France	64	1.45	Spain	53	1.23
Italy	61	1.45	Greece	47	1.20
Sweden	63	1.45			

Note: This data covers all tax on petrol (including VAT).

Sources of data: www.aaroadwatch.ie/eupetrolprices/ (accessed 16..10.08) and Transport Statistics Great Britain, 2007, Table 10.8.

Fuel Tax and Transport Policy

Road Fuel Tax was never originally intended to be a transport policy measure, and in some countries (including in Japan and the USA) it remains as a dedicated tax, the revenue from which funds road construction and maintenance. In many other countries (particularly in Europe), Road Fuel Tax is a source of general revenue. In the last 20 years many countries have adapted road fuel taxation to promote fuel efficiency and the use of cleaner and low carbon fuels. For example, a differential tax rate on unleaded petrol was used successfully in several countries in the 1990s to promote unleaded petrol and more recently to speed the transition to low sulphur road fuels. Differential rates of fuel tax are about fuel switching and promoting low carbon vehicles and , although this is a valuable part of addressing transport's environmental impacts, it does not affect the volume and modal distribution of travel. Indeed, as noted in the previous section, this will have a negative 'rebound' TDM impact. To address transport demand requires not a differential in fuel tax, but a policy affecting the overall price of fuel.

In the UK, the adoption of fuel tax as a transport demand measure formally took place in 1992 when the government replaced the UK's ten percent Car Purchase Tax with the *Fuel Duty Escalator*. Under this policy, UK Road Fuel Duty was increased annually at above the rate of inflation, initially by 5 percent per annum and, from 1997, 6 percent per annum. This was coupled, for example, with the intention for regulated rail fares to rise at 1 percent *below* the rate of inflation, thus over time increasing the real cost of travel by car and reducing that of rail. Other European countries have also adopted a policy to raise the overall price of road fuels, in some cases with an increase in public transport subsidies to reduce fares and/or considerable investment in public transport capacity. The Netherlands is a prime example of this.

Fuel tax has thus emerged as a policy instrument to promote modal shift. However, by affecting the price of travel, fuel tax also influences other key determinants of the volume of travel, including trip length, vehicle occupancy and trip linking. As was noted earlier in this paper, TDM needs to be more than modal shift. Only a minority of the rise in the volume of car traffic is due to trips shifting from public transport, walking and cycling. Increasing trip length, declining car occupancy and a shift in travel purposes towards car-dominated leisure activities are more important in generating traffic growth. If these elements are not addressed by TDM, then modal shift alone will have little impact on overall transport

demand[10]. The level of fuel tax will affect all components of transport demand. In addition high fuel taxes will automatically favour cars with a better fuel economy - so fuel taxes have an impact on the type of vehicle purchased as well as the amount of use.

The Effectiveness of Fuel Tax as a TDM measure

The effectiveness of fuel tax as a general pricing mechanism will depend on the context in which it is applied. As noted above, some counties have combined a policy to increase fuel taxes with subsidies to reduce public transport fares (or the rate of fare rises). This shows that the TDM impact of fuel taxes will very much depend of the overall pricing context. Fuel tax would be expected to have a stronger TDM impact if there were complementary policies to reduce public transport fares (and also increase public transport coverage) than if such complementary measures were absent.

In the UK, the general context has been one where, compared to other European countries, both fuel taxes and public transport fares are high. Changes in traffic growth before and after the introduction of the Fuel Duty Escalator policy provides evidence of the effect of this policy in such a context. In the six years from 1987 to 1993 (before the Fuel Duty Escalator) UK road traffic grew by 18 percent, but only by 13 percent in the six years between 1993 and 1999 when the Fuel Duty Escalator was in operation. Economic growth was actually stronger in the latter period, and so the reduction in the rate of traffic growth is the more notable. Detailed fuel demand elasticity studies[11] suggest that the tax increases resulted in 10 percent less demand for fuel in 2000 than if the duty rates had only increased at the same rate as inflation. The UK Government[12] estimated that the TDM effects of the fuel duty escalator saved between 1 and 2.5 million tonnes of carbon emissions.

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[10] TH Kwon and J Preston, 'The driving force behind the growth of per capita car driving distances in Great Britain (1970-2000)' (2005). *Transport Reviews*, 25:4, 467-490. Also S Potter, S, 'Sustainability, energy conservation and personal transport' Chapter 1 (pp 9-35) of Warren, J, (Ed) *Managing Transport Energy* (2007), Oxford: Oxford University Press.

[11] S Glaister and D Graham, The Effect of Fuel Prices on Motorists (2000). (Basingstoke: The AA Motoring Policy Unit) and PB Goodwin, 'Are fuel prices important?' (2002) Chapter 5 in G Lyons and K. Chatterjee, *Transport Lessons from the Fuel Tax Protests of 2000*. (2002), Ashgate.

[12] Cited in G Marsden, Fuel taxes and the environment-economy trade off. Chapter 4 in G Lyons and K Chatterjee, *Transport Lessons from the Fuel Tax Protests of 2000*. (2002), Ashgate.

The UK Fuel Duty Escalator was abandoned in 2000 following farmers and truck drivers blockading oil refineries to protest at the increase in road fuel duty. The government cut fuel duties and abandoned the Fuel Duty Escalator. By 2005 all road tax revenues had dropped by over £2 billion[13]. Most other European Union states have had a version of the 'escalator', but with a lower level of annual rises in fuel tax. The net effect is that, as shown in Table 2, the UK no longer has the highest fuel price (indeed it is in the middle of the range of EU petrol prices). The more gradual escalators used in some other EU states have faced lesser difficulties that the UK experienced. However, in the context of the 2007-08 rapid rise in oil prices it is now becoming politically difficult to raise road fuel taxation any further and there have been protests in a number of European nations and calls for road fuel tax to be cut. If the oil price remains high, it seems that the further use of fuel tax as a policy instrument will be severely curtailed. Indeed the inability to raise fuel tax to fund a rising bill for highway construction and maintenance is why some USA state authorities, led by Oregon, are now moving towards road user charging[14].

There is a fundamental problem with fuel tax as a TDM measure. To be most effective, price needs to be varied by geographical area (e.g. in city centres where congestion is greatest or where new development is taking place), by parts of the road network (e.g. particularly congested roads), by journey types (e.g. work and school trips) and by time (e.g. congested peak hours). Fuel duties cannot be targeted in any of these ways. At best, in federal countries where individual states can set fuel duties, there can be a crude geographical variation, but differentials can produce border effects, with motorists travelling to exploit lower fuel prices in adjacent states. This certainly happens in the USA and similar border effects occur in the European Union and elsewhere. In Singapore (where fuel duties are high), border controls check motorists driving into Malaysia, who are legally required to have a nearly full tank in order to stop them border hopping to fill up on cheap fuel.

To some degree, fuel tax can have a TDM impact if it varies by type of user. An example might be having a lower rate of duty or an exemption for public transport vehicles; this will lower operator costs, which could result in lower fares and enhanced services. This modal shift effect is, however, rather diffuse and such a general rebate or exemption may be absorbed within the cost structure of operators, with little or no TDM policy benefit. The design of the rebate/exemption is crucial. This can be illustrated by the case of the rebate mechanism in the UK, where bus operators receive a grant

[13] S Potter and G Parkhurst 'Transport Policy and Transport Tax Reform' (2005) *Public Money and Management* 25 (3), June 171-178.

[14] E Deakin and R Cervero, The challenge of urban transportation in California. Access, University of California, Spring 2008, pp 10-17.

according to how much fuel each operator uses. This design of subsidy has been subject to criticism because it rewards fuel use regardless of patronage. The UK Commission for Integrated Transport (CfIT) has supported research to explore rebate designs that would link more directly to TDM policies. Their studies[15] suggested a payment per passenger would incentivise operators to grow patronage. One CfIT study indicated that if the existing fuel tax rebate were reallocated to this redesigned system, demand could increase by 4.7%, with 20% to 40% of the newly generated passenger trips transferring from cars[16]. Bristow et al[17] notes that an even more targeted approach is possible if some funds from the fuel duty rebate is more finely targeted to support service enhancements specifically to achieve TDM impacts, as has happened with the UK 'Kickstart' programme to support bus service enhancements. This investment has produced a growth in patronage averaging over 20% in the first year of operation, considerably higher than the 4.7% estimated by the less targeted design in the CfIT study.

Overall, the TDM effect of fuel tax is as a general pricing measure applicable at a national level. It is not really possible to target the TDM impacts of collecting fuel tax, but rebate mechanisms can be used promote targeted TDM policies. In practice most countries that have a rebate for public transport do not target this in any way. Targeting fuel tax rebates according to TDM principles can be important and is a neglected policy area..

Targeting TDM tax measures

The consideration of fuel tax as a TDM measure raises some key issues about the design criteria for an environmental tax. As a TDM measure, fuel tax has an impact at the national level and its influence is upon the overall pricing context. Fuel tax exerts a broad positive impact upon the full range of traffic generating factors, including not just modal choice, but also the other structural components determining travel volume, such as trip length, vehicle occupancy and trip linking. However, fuel tax policies need to be applied consistently and with political sensitivity. Their effects build up slowly and their effectiveness will also depend on the pricing context - particularly relative costs to public transport and

[15] Commission for Integrated Transport *Public Subsidy for the Bus Industry* (2002), Commission for Integrated Transport.

[16] FaberMaunsell, *Bus Subsidy Simulation Study,* (2002) Report prepared for the Commission for Integrated Transport. (London: Commission for Integrated Transport).

[17] A Bristow et al, *Monitoring Kickstart Schemes*: *Report to the Department for Transport,* (2007) Transport Studies Group, Loughborough University.

other travel alternatives. If constantly applied over time, high fuel taxes become part of the everyday transport landscape, and so people adjust long term behaviour and expectations accordingly.

Targeting the collection of fuel tax is possible for policies to promote fuel switching and the adoption of low carbon vehicles but the targeting of the collection of fuel duty is not really possible to serve TDM objectives. A rise in fuel tax will affect some trip types more than others, impacting upon discretionary trips more and those where mode shifting and trip avoidance is most viable. These may, or may not, be the sort of trips that are desirable for TDM policies. The area where some targeting is possible is in rebates to public transport and other users. The careful design of rebates can address TDM goals, but this has not tended to take place. This neglected aspect could be a valuable TDM tool.

Overall, fuel taxes can thus provide a foundation upon which other, more targeted, TDM measures can be placed - be they fiscal, regulatory, organisational or infrastructure provision. These can include other targeted tax or charging measures such as road and bridge tolls or city congestion charging schemes. Such measures can also include the treatment of transport by the personal and corporate tax regimes. As noted previously in this paper, the personal and corporate taxation system is becoming increasingly involved in transport eco-tax reforms and is particularly becoming involved as part of sustainable travel behaviour policies.

In a number of countries employers, hospitals, schools and other sites responsible for generating major transport flows have been encouraged to develop programmes with their employees and users to reduce car travel. Such programmes go under a number of names - in the UK they are called *Travel Plans* (part of a ranger of so-called *Smart Choices*)[18], elsewhere in the EU they are part of the concept of *Mobility Management* and are part of local city TDM programmes in the USA. The tax system can be used to enhance such initiatives.

In the UK, Ireland and the USA, the tax system treats commuting as a private activity, so any employer support to commuting is liable to income tax. Legislation in the USA provides tax exemption for employers to subsidise public transport fares or vanpool costs of their staff (a vanpool is a company-owned minibus, driven by an employee who picks up others in their 'pool' on the way into work). If the employer does not subsidise public transport fares, individuals can buy tickets from their pre-tax income up to a specified allowance. In the UK, a number of travel plan measures have been removed from the tax net, including private works buses, subsidies to improve the quality, coverage and reduce fares on

[18] M Enoch, Marcus and S Potter, 'Travel Planning', Chapter 4 (pp 121-149) of J Warren, (Ed): *Managing Transport Energy,* (2007): Oxford University Press.

bus services to an employer's site, and the provision of bicycles. Although bus fares can be subsidised tax free by employers, subsidies for train, metro or tram fares remain taxable. Ireland has adopted a simpler and more comprehensive approach. In 2000 a tax reform was introduced whereby company provision of monthly or annual public transport season tickets became tax free.

In most mainland European countries the tax treatment of commuting is a tax-deductible expense, so any employer support for commuting is already tax free. The tax rules concerned can have a major influence on travel choices. For example, in Germany, up to 2001, commuters could deduct a generous kilometre rate for car commuting, whereas public transport commuters claimed the actual fares paid. Motorists felt they profited by this tax relief, and this system was widely viewed as encouraging car commuting. Consequently, in 2001 the tax rules were changed to provide the same kilometre rate for car and public transport. In 2004 the Netherlands similarly introduced reforms to provide the same tax relief rate for car and public transport commuting, together with some additional allowances to favour public transport and cycling commuting.

Overall, as detailed in Potter et al. 2006[19], such tax reforms have provided additional tax relief to employees for using more sustainable methods of transport for commuting. However tax relief aimed at employers or developers is less well advanced. Consequently, if the employer feels they have little to gain in providing tax-free travel benefits to their staff, then the employee tax concessions will count for nothing. This is a weak link, and it seems likely that future tax concessions will need to concentrate on employers to complement the existing tax concessions to their staff. One example of such an approach comes from the USA state of Oregon, where businesses can receive a 35% tax credit for their investments in trip-reduction activities[20].

Towards a new transport taxation regime?

The current road transport taxation regime is under stress and this paper has documented a number of factors that could well converge to significantly change it. A key theme is that eco-reforms to traditional transport taxation are only a second-best solution. Transport and environmental policy requires a much stronger targeting and tailoring of tax measures than can be delivered by existing taxation measures. This is why road user charges could well emerge to become a major

[19] S Potter, M Enoch, T Rye, C Black and B Ubbels, Tax treatment of employer commuting support: an international review. *Transport Reviews,* (2006) Vol 26, No 2 pp 221-237, March.

[20] T Litman, 'Commute trip reduction (CTR): programs that encourage employees to use efficient commute options', *TDM Encyclopedia* (2001) Victoria Transport Policy Institute, http://www.vtpi.org

part of the taxation system in many countries. Some places have implemented city-centre area and cordon-changing schemes (pioneered by Singapore, followed by several Norwegian cities, London, Rome and Stockholm). However these are local supplementary charges applying to a tiny minority of vehicle trips. What is now emerging is that a number of nations and states are exploring or implementing *general* road user charges. Schemes for road freight transport have been implemented first (notably in New Zealand, Germany, Switzerland and Austria), but in the Netherlands, and in Oregon, USA, schemes for generalised car road user charges are progressing, and are seriously proposed in the UK.

A key reason behind this move towards general road user charging is that, unlike fuel tax, road user charges can be targeted on the places and times road congestion occurs. An additional point is that the increasing diversity of transport fuels produces administrative difficulties and raises equity issues. How can the taxation of gas or electricity be at one rate for domestic use and at a much higher rate for road transport use? In the longer term this will be even more of an issue were hydrogen to become a major transport fuel. A further long-term pressure is that, in the era of high oil prices, it has become politically difficult to increase road fuel taxes, so reducing government revenues.

The emergence of a new road transport taxation regime centred upon road user charging raises the question as to what role fuel taxes have, if any, in this new transport taxation landscape. Should road user charges replace fuel tax? Should they be in addition to fuel tax - or be used in conjunction with carbon taxation? The freight road user charge schemes have replaced previous annual registration taxes either fully or in part. In the Oregon and Dutch proposals for private motorists, road user charges replace fuel taxes (with the Dutch proposal also intended to replace car purchase tax as well); in the UK this has yet to be decided. For existing city road user charging schemes, such as in London, Oslo and Singapore, the charges are in addition to fuel, circulation and purchase taxes.

In considering such questions, there is the point made at the beginning of this paper that fuel (and purchase/ownership) taxes serve important transport and environmental policy objectives other than TDM. If fuel and vehicle taxation were entirely removed then this would sweep away the existing incentives for fuel efficiency and the promotion of low carbon fuels. This suggests that, rather than phasing out fuel tax, a shift to a carbon tax would be a more appropriate reform.

A second issue is that studies modelling the impacts of a national road user charge in the UK have suggested that the revenue-neutral replacement of fuel tax with road user charging would fail as a TDM measure because it would result in motoring costs falling in less congested areas where traffic growth is already rising rapidly (e.g. rural areas and city

fringes). It would also lead to activity patterns redistributing to low charge areas[21]. Foley and Fergusson's modelling work[22] indicates that such a revenue neutral change (with the road user charge replacing fuel tax) would help to redistribute traffic and ease pressure on congestion hot spots, but would not necessarily lead to an overall decrease in traffic levels or CO_2 emissions. In the context of the real costs of motoring continuing to fall, a revenue neutral road user charge would worsen overall traffic levels and CO_2 emissions.

Conclusions

Purchase, circulation and fuel taxation, together with some aspects of the personal and corporate taxation systems, can all be used to promote a variety of transport and environmental policy goals. In exploring the use of these tax measures it is important to distinguish between policy measures to influence vehicle characteristics (technology, the type of fuel used and fuel economy) as opposed to vehicle use. Well designed purchase and circulation taxes can stimulate cleaner car technologies and fuels, but their position within the tax system means that they are not an appropriate TDM measure. Indeed, if successful in isolation, they will have negative TDM effects.

Taxation on road vehicle use and on factors influencing travel behaviour is set to become key areas for reform. A fuel or carbon tax is an appropriate and effective general TDM measure. Within this broad context there needs to be more targeted measures. These include targeted rebates and concessions as well as tax measures. In particular there are important developments in personal and corporate tax concessions, including the tax treatment of company cars, business travel and tax concessions to support travel planning and targeted fuel tax rebates. Such measures are gradually emerging, but remain a neglected opportunity.

Overall, to address transport's environmental impacts requires not the reform of existing transport taxation measures (useful though such reforms have been), but the transition to a new transport taxation regime. For example, rather than replacing fuel tax with a road user charge, evidence is mounting that to manage transport demand (as well as effectively address other sustainable transport policy goals) any new fiscal measure needs to complement and not replace fuel and vehicle taxes. It may be that a sustainable transport future requires TDM measures that blend carbon taxation and road user

[21] A Wenban-Smith, 'Road User Charging – wider purposes and effects', in Seminar on Road User Charging: the big picture (2006) Transport 2000, February.

[22] J Foley and M Fergusson, Putting the Brakes on Climate Change: A policy report on road transport and climate change, (2003) IPPR.

charging with targeted personal and corporate tax concessions to reward green travel behaviour. We are only just beginning to realise the difficulty of this task and the real challenge is now to manage the transition towards an effective new transport taxation regime in a way that can win political and economic acceptance.