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Taxes on Motoring

By far the most significant 'environmental' taxes in the UK (and virtually all other countries) in terms of revenue raised are on motoring—in particular, taxes on petrol and diesel, but also taxes on car ownership. UK fuel duties were expected to raise £27 billion and vehicle excise duty to raise a further £6 billion in 2010–11—about 6% of all tax revenues.[1]

Road transport is responsible for many environmental and other spillovers, the most costly of which is congestion. Others include accidents (the annual death toll on the roads is about 2,600 in the UK[2] and well over 30,000 in the US[3]), local air pollution (carbon monoxide, nitrogen oxide, and particulates), noise pollution, harm to the landscape and biodiversity, and greenhouse gas emissions (cars are responsible for 13% of the UK's carbon dioxide (CO_2) emissions, with other forms of road transport responsible for a further 9%[4]).

That said, none of the existing taxes on motoring was introduced for environmental purposes. The first taxes on road fuel in the UK were raised in 1909 and the Road Fund Licence (the precursor of the current vehicle excise duty) was first introduced in 1921 as a charge hypothecated to the maintenance and construction of roads. But taxes on motoring should now

[1] HM Treasury, 2010b, table C11.

[2] 2008 figure from http://www.roadsafetycouncil.com/stats.htm and http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/pgr/statistics/datatablespublications/accidents/casualtiesmr/rcgbmainresults2008/.

[3] National Highway Traffic Safety Administration, http://www-nrd.nhtsa.dot.gov/Pubs/811291.PDF.

[4] Quoted by King (2007).

be considered in light of their effectiveness in addressing the various spillovers created by driving. From this perspective, we look at the issues around the design of motoring taxes, and in particular at congestion charging and 'second-best' options in the absence of such charging.

12.1. DESIGNING TAXES ON MOTORING

Two problems make the optimal design of taxes on motoring especially difficult. First, driving causes multiple spillovers, and different instruments are likely to be appropriate for the different problems. Second, for a number of the externalities that driving causes, there is no simple link between either the amount of fuel consumed or the distance driven and the cost imposed on society. Greenhouse gas emissions are approximately proportional to the quantity of fuel consumed and so a tax on petrol and diesel should capture this effect directly. Congestion costs, on the other hand, depend on when and where driving takes place. The cost of adding to local air pollution varies both by location and by the particular features of the vehicle. The relationship between accidents and amount of driving is unclear.

Table 12.1 reports some (now rather dated) estimates of the spillover costs of driving an extra kilometre. It illustrates three points. First, there are several different costs. Second, there is considerable uncertainty over the

Table 12.1. Estimated marginal external costs of driving (pence per vehicle-kilometre, 1998)

Externality	Low estimate	High estimate
Operating costs	0.42	0.54
Accidents	0.82	1.40
Air pollution	0.34	1.70
Noise	0.02	0.05
Climate change	0.15	0.62
Congestion	9.71	11.16

Source: Sansom et al., 2001.

costs, as illustrated by the differences between the high and low estimates. Third, congestion costs are, by some distance, the most important. (Note that the climate change costs were calculated before recent upward revisions to estimates of climate sensitivity, but more up-to-date figures would still show that congestion is a far more costly spillover.)

As always, it is important to consider tax instruments in the wider context of available policy instruments. In the EU, Japan, and the US, vehicle emissions levels are also targeted by a range of regulations and voluntary agreements with manufacturers. These may be relatively effective ways of meeting environmental objectives, especially where consumers are less than fully informed over (or do not take full account of) the long-term costs of their buying decisions. Indeed, the evidence that is available does suggest that such regulation has an important place alongside the tax system and that costs of the regulation are often much more modest than expected.[5]

One interesting example of regulation was the requirement to fit catalytic converters to new cars.[6] This led to a reduction in particulate emissions, forced all new cars to move to unleaded fuel, and encouraged the adoption of fuel injection and electronic engine management—both technological advances that further reduced emissions. Simultaneously, a tax incentive encouraged owners of existing cars to move from leaded to unleaded petrol. Regulating to make all cars run on unleaded petrol would have resulted in a significant amount of uneconomically early scrapping of cars that could not readily be altered to run on unleaded petrol. Introducing a tax differential in favour of unleaded petrol, by contrast, provided incentives to alter engines or buy new cars capable of running on unleaded petrol, without forcing swift and costly scrapping of all old cars. In that sense, it was a good example of a well-designed environmental tax change introduced alongside regulation.

The UK now has only two significant taxes on motoring (plus the company car tax regime discussed in Section 12.3.2). Fuel duty raises the cost of driving an extra mile or of buying a less fuel-efficient car. Vehicle excise duty (VED) is levied annually and varies according to the CO_2 emissions—and hence fuel efficiency—of the vehicle. This variation can be seen as an incentive to encourage the purchase of more efficient cars and the early scrapping of less efficient ones. Fuel duty and VED between them may be

[5] Harrington, Morgenstern, and Nelson, 1999; King, 2008.

[6] From 1993 in the EU.

effective in influencing emissions, but they are not at all well targeted on congestion, local air pollution, noise, or accidents. Cars that use very little petrol or diesel create just as much congestion as gas guzzlers. Congestion would be equally problematic even if entirely new forms of car that produced no pollution on the road—electric, for example—replaced the existing stock. Electric cars incur no fuel duty and are not subject to VED, so the current tax system provides no discouragement to driving them even though they still add to congestion, which is the biggest spillover cost of driving.

Considering the different spillovers suggests that we, in principle at least, might want:

- a tax on fuel varying with the output of all harmful emissions;
- a congestion charge varying with the time and place of driving;
- a noise charge varying according to time and place of driving;

plus perhaps:

- an *ad valorem* tax on the accident-related element of insurance premiums.

We do not focus on all these issues, but rather on the biggest—the case for a congestion charge.

12.2. CONGESTION CHARGING

Taxing just fuel consumption and car ownership, no matter how the taxes are differentiated by emissions and engine size, cannot result in anything approaching an optimal tax because neither is a good proxy for the impact of car use on congestion. Many journeys occur on relatively empty roads. These journeys are overtaxed because the congestion costs imposed on other road users are minimal. In that sense, rural road users are overtaxed relative to those who regularly drive in towns during busy periods. The result is too much driving in towns relative to the amount of driving in less congested areas.

The economic costs of congestion are very large. Estimates generated for the UK government suggested that annual welfare benefits of up to £28 billion (or about 1% of national income) may be available by 2025 if a

road pricing scheme could be implemented that could vary charges by place and time of day to accurately reflect actual congestion levels and costs.[7] These numbers assume a very sophisticated system, and are themselves subject to considerable uncertainty, but they do indicate that the scale of possible gains is very substantial.

Another reason to favour congestion charging (and one that might persuade a government to risk the attendant unpopularity) is that, over time, fuel duty will do a less and less good job of capturing the externalities associated with driving. At current rates, it will also raise less revenue as time goes by. The Committee on Climate Change (2008) has estimated that additional action to improve vehicle fuel efficiency could reduce revenues from fuel duty by £2.5 billion annually by 2020, on top of reductions to be expected anyway as cars become more efficient. The Committee envisages a future after that in which technology drives petrol and diesel cars off the roads almost entirely. In that world, no tax will be levied on driving, yet the main externality—congestion—will remain, and indeed is likely to grow. In addition, governments are unlikely to view the loss of £27 billion of fuel duty revenues with equanimity. Developing other forms of charging, preferably congestion charging, is a matter not just of economic efficiency. It is also likely to be viewed as a matter of fiscal necessity.

Of course, this makes the economic efficiency case for congestion charging even stronger. If we cannot tax car use effectively through a tax on fuel—and do not replace that tax—then, in the absence of a congestion charge, we would offset, through pricing, few if any of the negative spillovers created by driving.

Introducing national road pricing would be a huge and complex undertaking. It would involve significant political risks. But the scale of gains available is enough to persuade us that further steps towards road pricing must be a priority.[8] With the congestion costs of driving an extra mile varying dramatically according to when and where people travel, the current

[7] Estimated benefits are in 2002 prices. The scheme modelled allowed 75 different levels of charges, capped at 80p/km, varying by time of day, area, and road type. Of the £28 billion in welfare benefit, about £15 billion was estimated to show up in higher national income. Source: Department for Transport, 2006.

[8] As it has persuaded many others, including Sir Rod Eddington in his review for government of priorities for transport (Eddington, 2006).

range of taxes is nowhere close to being able to reflect the costs that different motorists impose on others. Moving to a system of charges would also open up the possibility of changing quite radically how the highway network is owned and financed. Proposals to switch to a system of user charges for a road system owned, regulated, and charged for in much the way we currently charge for other utilities deserve to be taken seriously.[9]

Experience of road pricing of one kind or another is quite widespread internationally, from long-established tolls on motorways in much of Europe, to time- and place-varying charges in Singapore and radical proposals for the Netherlands. Up to now in the UK, we have only one significant experience of road pricing in an urban area—the London Congestion Charge. This is a very crude scheme involving a single payment triggered when a vehicle enters the central zone between 07:00 and 18:00 hours, Monday to Friday. Beyond this, it does not vary according to where, when, and how far people drive. Even this has been described as 'a triumph of economics. It represents a high-profile public and political recognition of congestion as a distorting externality and of road pricing as an appropriate policy response'.[10] The same author suggests that traffic delays within the zone decreased and journey time reliability improved.

This and international experience suggest that, short of a full national scheme, significant benefits could come from making the London scheme more responsive to traffic conditions, introducing schemes in other congested cities, and introducing charges on some main trunk routes.[11]

Politicians are likely to be wary of such reforms. In December 2008, the people of Manchester rejected congestion charging by a remarkable four-to-one majority despite the promise of a big increase in public transport investment alongside the scheme. Inevitably, potential losers from such a scheme will resist its introduction, and there seem to be widespread concerns, and misperceptions, about the levels of taxes on motoring, the distributional consequences of change, and the impact on privacy.

The facts that fuel duty is not targeted at congestion and that it is excessive relative to the emissions of vehicles imply that it should be reduced if a

[9] See e.g. Newbery and Santos (1999) and Newbery (2005).

[10] Leape, 2006, 158.

[11] The example of the M6 Toll—building a toll road parallel to an existing road— is unlikely to be widely copied due to lack of space.

coherent congestion charge policy is introduced. Linking reductions in fuel duty to the introduction of congestion charging would also increase the chances of gaining political acceptance. One problem with a piecemeal, city-by-city approach is that the appropriate policy would be to accompany the introduction of charging with local offsetting reductions in fuel duty. But fuel duty almost certainly has to remain uniform across the country—reducing it only where congestion charging was introduced would encourage drivers to drive to that area specifically to fill up.

However it is done, we do not underestimate the political difficulties of introducing road pricing nationally. But in addition to the long-standing case for such a move, we need urgently to wake up to the fact that, if the UK and other countries are to meet their targets for reductions in greenhouse gas emissions, petrol and diesel use by motor vehicles is likely to have to fall and eventually end as alternative technologies are introduced. This will leave the UK with no tax at all on the very high congestion externalities created by motorists. So, if we all end up driving electric cars, it seems that we shall have no choice but to charge for road use. It will be much easier to introduce such charges while there is a quid pro quo to offer in terms of reduced fuel taxes.

12.3. SECOND-BEST OPTIONS

Congestion charging will not be with us on a substantial scale for some years, even if government and voters have the courage to commit to it now. In the meantime, we face more immediate choices over the level and structure of taxes on motoring. Are current tax levels too high, too low, or about right? How should taxes vary across different fuels? And can other taxes play a role?

12.3.1. The Level of Taxes

Determining the correct level of taxes is not straightforward, in part because the taxes are such poor proxies for the damages being caused. The

Table 12.2. Marginal external costs and taxes paid by road users (pence per kilometre)

	Marginal external cost of congestion	Environment and safety costs	Fuel duty and VAT on duty	Uncovered externality
2000	7.3	2.2	5.2	4.3
2010	12.3	1.6	3.9	10.1

Source: Department for Transport, 2004, figure B1.

appropriate tax on the fuel consumed by someone driving mostly in central London would be many times that for someone driving mostly in rural Yorkshire. However, if we take either the figures quoted in Table 12.1 from the study by Sansom et al. or the figures shown in Table 12.2 that underlie the government's feasibility study of road pricing, current levels of fuel duty are somewhat below their optimal level on average.[12] The last column in Table 12.2, the uncovered externality, shows government estimates of the gap between the optimal tax per kilometre and the actual tax charged. Note in particular how much this rises over time both as traffic increases, and therefore the congestion level rises, and as cars become more fuel efficient so that fuel duty falls *per kilometre driven*. This gap grows the further into the future we look. For example, analysis for the Eddington Review, again from within UK government, suggested that total vehicle-kilometres travelled might rise by 31% and congestion by 30% between 2003 and 2025, while fuel costs could fall by 26% as a result of improved vehicle efficiency.[13]

One response to this analysis is to conclude that, *in the absence of a major shift to congestion charging*, there is a case for increasing fuel duties in the UK (despite the fact that fuel taxes in the UK are high by international standards). The case becomes stronger year by year as increasing fuel efficiency reduces the effective tax on driving and more driving creates higher congestion costs. (The fact that emissions of harmful particulates

[12] In contrast, Parry and Small (2005) find that UK fuel taxes are excessive. One factor explaining this difference in result is that Parry and Small use a central estimate of 2.9p/km for the marginal external cost of congestion. This is much smaller than the figures reported in Table 12.2.

[13] Department for Transport, 2006, table 2.1 and page 24. Congestion is measured as seconds lost per vehicle-kilometre relative to the free-flow speed.

(PM_{10}) and nitrogen oxides are expected to continue falling[14] is not enough to outweigh these effects.) The case against, of course, is that the congestion component of the tax on fuel would also fall on users of non-congested roads. This would penalize them needlessly and unfairly. Fuel duty is a very blunt instrument—which returns us to the long-term case for congestion charging.

These observations are made against the background of taxes (and some other costs of motoring) having fallen in recent years after very sharp increases over the 1990s. This is illustrated in Figure 12.1. The pattern is illustrative of some of the difficulties associated with continuing to increase duties ahead of inflation. The turnaround in real duty levels from 2000 followed nationwide protests at fuel prices and duty levels. The impact of these protests on policymaking is clearly visible for several years afterwards.

Estimates suggest that a 10% rise in the petrol price cuts the amount of petrol consumed by 2.5% in the short term and by 6% in the long term, once

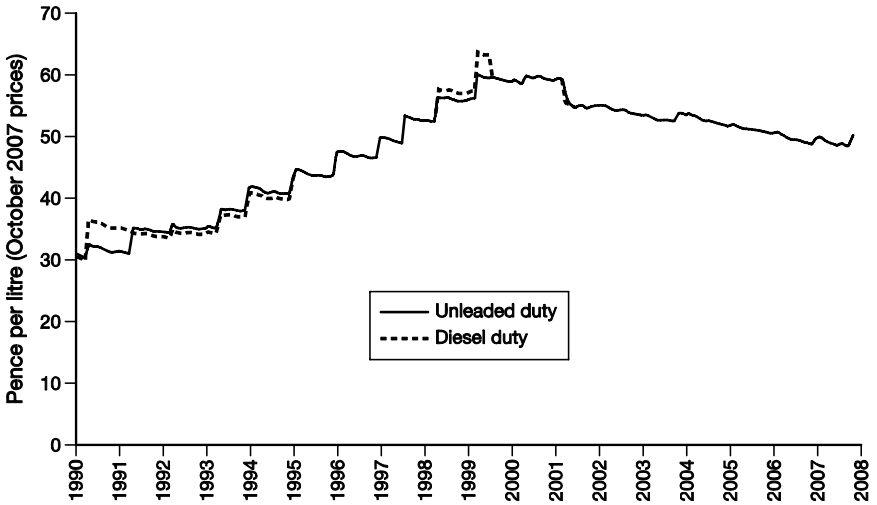

Figure 12.1. Real petrol and diesel duty over time

Notes and source: Calculated from Department for Business, Innovation, and Skills (BIS; formerly the Department for Business, Enterprise, and Regulatory Reform, BERR) data; duty rates are deflated to October 2007 prices using the all-items retail price index. This graph updates figure 5.5 of Leicester (2006).

[14] By 53% and 60% respectively between 2003 and 2025, according to Department for Transport (2006, table 2.1).

people have the chance to switch to smaller or more fuel-efficient cars.[15] This suggests that if fuel duties had remained at their 1999 peak in real terms, petrol consumption might now be around 10% lower than current levels. Encouraging the purchase of smaller or more efficient cars also means that the impact on petrol consumption in the long term is bigger than the impact on miles driven, underlining the fact that fuel duties are more effective at reducing CO_2 emissions than reducing driving or congestion.

The fact that fuel duties are very imperfectly targeted at the externalities created by driving is one objection to the conclusion that fuel duties should be raised. But what of the fact that pre-tax fuel prices have risen substantially over the last decade? Estimates suggest that a 10% rise in prices leads to about a 1% reduction in vehicle-miles travelled in the short term.[16] If higher fuel prices reduce traffic levels, then the optimal fuel duty level will fall as price rises (though not by much). This suggests that there is some economic case for varying fuel duty with the fuel price. The same logic suggests that fuel duties should increase over time since the amount of driving, and therefore the amount of congestion, rises with income.

Another consideration, as with other environmental taxes, is that increasing fuel duty may result in undesirable distributional consequences. On average, these might not be too severe. In the UK at least, car ownership is strongly related to the level of household expenditure. Over 90% of the highest tenth of households ranked by expenditure are car owners; indeed, half of them own more than one car. By comparison, fewer than 30% of the lowest tenth of households by expenditure own a car, and very few (less than 5%) in this group own more than one car.[17] However, we need to be careful before drawing conclusions from these figures. The poorest households also tend to own the oldest cars. These cars are less efficient and more polluting than comparable new cars. This makes the tax charge per mile driven higher and these cars attract the highest rates of VED. Furthermore, the recent introduction of increased differentiation of VED has reduced the market value of many of the old cars owned by poorer households. For some, this has represented a significant reduction in wealth—an unintended consequence of well-intentioned legislation.

[15] Hanly, Dargay, and Goodwin, 2002.
[16] Hanly, Dargay, and Goodwin, 2002.
[17] Fullerton, Leicester, and Smith, 2010.

We have so far ignored the fact that there are different fuels that motor vehicles use—primarily unleaded petrol and diesel, but also biofuels. Many countries charge a lower rate of tax on diesel than on unleaded petrol. The UK is unusual in not following this practice.[18] There are also significantly lower tax rates on biofuels, although so far these have had very limited market penetration.

Carbon emissions from a litre of diesel are less than those from a litre of petrol, which might suggest a lower tax on diesel. On the other hand, the local health impacts of diesel are larger because of higher particulate emissions. Newbery (2005) estimates that, taking account of these two offsetting effects, there is a case for a tax on diesel about 4p a litre higher than that on petrol. More recent higher estimates of the social cost of carbon might narrow that differential, but there seems at first sight no environmental case for having a lower tax on diesel.

In practice, it may be the fact that diesel is the main fuel used by commercial vehicles which leads many countries to charge lower taxes on it. Commercial vehicles are frequently driven across national borders, which gives a choice of where to buy fuel. In the UK, Northern Ireland provides a relevant case study. HM Revenue and Customs (2010d) estimates that between 25% and 32% of diesel used had non-UK duty paid, i.e. it was bought across the border in the Irish Republic, with revenue losses of between £140 million and £180 million in 2008–09. This cross-border shopping for fuel constrains the extent to which UK policy can deviate from that of our neighbours. The greater opportunities that exist in countries with longer land borders may explain the relatively lower taxes on diesel in those countries.

The environmental case for a lower tax on biofuels is unresolved. There has been recent controversy over whether biofuels do indeed provide environmental benefits, or whether they can be positively harmful. Until this question is resolved, there is a potential danger involved in creating an

[18] Even without fiscal incentives, diesel's share in the UK fuel market rose from 38% of fuel sales in 1997 to 53% in 2008 as improved engine technology made diesel cars more appealing (figures derived from figures 3.3 and 3.4 at http://www.ukpia.com/files/pdf/ukpia-statistical-review-2010.pdf).

incentive through a lower tax without a full understanding of the likely effect.[19]

12.3.2. Taxes on Car Ownership

It is the use of vehicles which creates externalities. But most countries impose taxes not just on petrol but on the ownership of motor vehicles. In the UK, vehicle excise duty is such a tax, levied annually and varied according to CO_2 emissions, with higher rates of duty on the more polluting cars.

The case for an annual tax such as this is perhaps unclear. A tax on car *purchase*, differentiated by car size or level of CO_2 emissions, might have an effect additional to annual vehicle excise duty by virtue of its visibility and timing. There is evidence[20] that consumers give much more weight to the purchase cost of a vehicle than to future fuel and other costs. If this is the case, it justifies the introduction from 2010 of high first-year VED rates for more polluting cars in the UK. It certainly explains the introduction of legislation in France which, from January 2008, sees those purchasing cars with the lowest emissions receiving *rebates* of up to €1,000, while those buying the highest-emitting vehicles pay a purchase tax of up to €2,000.

From an environmental perspective, VED is poorly targeted and does not raise the marginal cost of driving (and hence causing negative spillovers). It is an observable fact that the proportions of new cars in the different VED bands have changed. In 1997, 45% were in the top two, most polluting bands. This had fallen to 10% by 2009. The proportion in the top three bands fell from 77% to 21%. Average new car emissions fell over the period from 190 grams of CO_2 per kilometre to 149.5g/km.[21] But there is no evidence of the role played by differential VED rates in this, as opposed to the role played by higher petrol taxes and prices and exogenous increases in car engine efficiency.

One last part of the tax system which may also have played a role in changing fuel efficiency is that which applies to the taxation of company

[19] See Gallagher (2008) for a comprehensive review.

[20] Quoted by King (2007 and 2008).

[21] Society of Motor Manufacturers and Traders, 2010.

cars.[22] In 2006 in the UK, purchases of new cars for private use accounted for only 44% of sales. Sales for fleets and business use accounted for the remaining 56%.[23] The tax rules applied to company cars matter in determining the composition of the car fleet, and those rules have changed over time to impose higher taxes on cars with higher CO_2 emissions—though with higher taxes on diesel cars than on petrol ones, reflecting their effects on the local environment. Again, we know of no robust evaluation of the impact of these rules.

12.4. CONCLUSIONS

Driving imposes a range of spillover costs on other road users, local residents, and the local and global environment. Getting the structure and level of taxes correct requires understanding and estimating each component of these costs, and designing taxes and charges that are equal to the costs. By some distance, the biggest spillover cost created by driving, especially in a crowded country such as the UK, is on other road users through congestion—and hence wasted time.

Taxes on fuel use and car ownership are not well designed to target congestion costs, which vary by the time and location of journeys. Nevertheless, most countries rely almost exclusively on such taxes. If we continue to rely on them, they will need to rise, and at an annual rate well above inflation. The amount and costs of congestion are rising and the fuel efficiency of cars is also rising. In addition, we in all likelihood start with fuel taxes below the optimum.

Much better would be to make real progress towards congestion charging. This is complex and potentially expensive, but has huge potential welfare benefits. In any case, the current system of motoring taxes will simply become unsustainable in the medium term. Fuel consumption per mile

[22] HM Revenue and Customs describes a company car as follows: 'There is a tax charge where, because of their employment, a car is made available to and is available for private use by a director or an employee earning £8,500 a year or more, or to a member of their family or household'.

[23] Source: Society of Motor Manufacturers and Traders data service.

driven is falling and will continue to do so, possibly at an accelerating rate, eventually falling close to zero as new technologies replace petrol and diesel engines. A tax system based on fuel consumption will lose the ability to capture any of the remaining spillover costs created by driving. Of all the challenges raised in this volume, this seems to us one that is simply inescapable. It may be another ten years before change becomes urgent, but urgent it will become and the sooner serious advances are made to move the basis of charging to one based on congestion the better.