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The social impacts of environmental taxes: removing regressivity

The Distributional Impacts of Economic Instruments to Limit Greenhouse Gas Emissions from Transport

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Abstract

The research reported in this paper was conducted under the project The Social Impacts of Environmental Taxes: Removing Regressivity, funded by the Joseph Rowntree Foundation under its Programme on Environment and Social Concerns. The project is investigating the social implications of environmental taxes and charges in relation to four environmental issues – the household use of energy, water, and transport, and the generation of waste. This is a report of the component on the household use of transport.

Traffic growth in the 1990s was lower than is expected for the period to 2010 because the fuel duty escalator made petrol and diesel prices rise much faster than inflation and suppressed the growth in traffic that would have otherwise take place (Glaister 2001). Because of the freeze in fuel duty since 1999, which is officially projected to continue for the rest of the decade, fuel prices are falling in real terms.

Transport is the only sector of the UK economy which has increased its emissions since 1990. Thanks to increasing fuel efficiency which offset the relatively small growth in traffic during the 1990s, emissions from road traffic did not increase substantially. The main cause of the increase was growth in domestic aviation (DfT 2003a).

An even more serious increase in transport emissions which is not even included in the national inventory is international air travel by UK residents. The increase in greenhouse gas emissions from the UK's international aviation between 1990 and 2010 is expected to be of the same order of magnitude as the 12.5 per cent reduction that the UK is committed to under the Kyoto protocol. In other words, the increase in international aviation will essentially negate the reductions in the other sectors, so that in reality the UK's emissions will have been roughly stable, rather than declining (Edinburgh Centre for Carbon Management 2002).

The decline in non-aviation emissions up to 2010 is not expected to continue beyond that date without further measures, particularly to restrain traffic growth. In addition, the

government is planning to permit the building of additional runways to enable massive growth in aviation.

Taxation of car use has been a particularly sensitive issue since the fuel protests of autumn 2000. Petrol taxes are not regressive in aggregate because poorer households are less likely to have a car. However, petrol taxes are regressive among motorists (Blow and Crawford 1997). Nearly a third of households do not have a car and non-car owning households are concentrated among the lowest income groups. Nearly two-thirds of households in the lowest income quintile do not have a car (Lucas, Grosvenor and Simpson 2001).

The distributional impacts of several possible measures to restrain the likely future increase in emissions from transport were investigated:

1. *Increasing fuel duties and abolishing vehicle excise duty (VED)*
2. *Increasing fuel duties and using the money to subsidise public transport*
3. *Increasing fuel duties and using the money to increase benefits*
4. *Graduated vehicle excise duty (VED)*
5. *Graduated car purchase tax*
6. *Congestion charging*
7. *Domestic tradable quotas*

If fuel duties are increased, the most effective of the three ways in terms of compensating low-income motorists would be to abolish VED. Increasing benefits would also have an effect, but not as much, while using the money to subsidise public transport would have almost no effect because households that have cars generally use public transport very little. However, if the aim is to be progressive, then increasing benefits is best, subsidising public transport is next best (because the poorest are more likely to use public transport than have a car) and abolishing VED is least good. The particular concern about increasing fuel duty is that it would have a negative effect on poor motorists in rural areas. People who live in rural areas tend to drive further and use more fuel than those who live in urban areas.

Another approach to limit emissions would be graduated VED or a graduated car purchase tax. In fact, VED graduated according to carbon dioxide emissions was introduced in 2001, but the maximum rate is only at 185g/km, which does not distinguish between ordinary family cars and 'gas guzzlers' such as four-wheel-drive vehicles. A higher rate of VED for 'gas guzzlers' would have little effect on poor households as few own such large inefficient vehicles.

A graduated car purchase tax could replace graduated VED, putting the entire cost at the beginning. The rationale is that car buyers greatly underestimate fuel costs and private buyers presently have little incentive to buy cars with a higher up-front cost that would save fuel in the long run. A car purchase tax would increase the price of second-hand vehicles (very few low-income households buy new cars), but it would be balanced by the abolition of VED. The weakness with a graduated car purchase tax is that it would only affect decisions about fuel efficiency, not about use.

The measure which has received the most attention in the last few years is congestion charging. A revenue neutral congestion charging system would lead to a redistribution of money from urban drivers to rural drivers. If revenue neutrality was achieved by the abolition of VED, then both congestion and emissions would be reduced (CfIT 2002), but if it was achieved through reduction in fuel duty then although congestion would fall, overall emissions would rise (Foley and Fergusson 2003). The problem is that the abolition of VED would only allow for a modest level of congestion charging, sufficient to offset a couple of years' traffic growth. Congestion charging that tackled traffic growth would have to be revenue raising. Revenue raising would also be necessary to fund the improvements in public transport that would be needed in order to cope with a modal switch due to congestion charging. That would inevitably mean that low-income urban households would have to pay more if they continued to drive.

The final approach considered was domestic tradable quotas (DTQs). The idea behind DTQs is that every adult resident would receive for free an equal number of carbon units to cover their annual carbon emissions, including private transport. Those who used less than their entitlement would sell their surplus units to others who wanted to use more.

The option of providing each adult with a full quota and each child with a half quota was also considered.

If a DTQ system covered only the carbon emissions from household energy use and motoring, then it would be progressive, but around 30 per cent of low-income households would be losers (because they use more than average amount of energy and would have to buy emissions permits to cover this use). If DTQs also covered greenhouse gas emissions from aviation (which are strongly skewed towards the wealthy, while the poorest fly very little) then around 25 per cent of low-income households would still lose. However, if only emissions from motoring and aviation were included then a smaller proportion of low-income households would lose out, no more than 10-15 per cent.

A system of DTQs covering motoring and aviation would be an efficient and progressive way of controlling carbon emissions from these sources. In their absence, and in a political context that makes increased fuel duties politically infeasible, at least partly because of their impact on low-income motorists, revenue-raising congestion charges could be used to control traffic growth and hence emissions, with low-income motoring households being compensated through the abolition of VED, and further compensation being given, if desired, through the benefits system.

1. Introduction

Transport is the only sector in the UK that increased its carbon emissions between 1990 and 2000. It is also the only sector that is expected to increase its emissions between 2000 and 2010 (Foley and Fergusson 2003). Increasing car traffic is the main cause of these projected increases. Car traffic has gone up by 79 per cent since 1980, from 215 to 384 billion vehicle kilometres. It grew sharply in the 1980s, but has been rising less quickly since. Road traffic grew by 14 per cent between 1990 and 2000 (DfT 2003a). It is projected to grow by another 20 to 25 per cent between 2000 and 2010 (DfT 2003b). The reason why car traffic growth in the 1990s was lower than is expected for the 2000s was because of the fuel duty escalator, which increased fuel duty by 5-6 per cent above inflation each year from 1993 to 1999, while fuel prices are now falling in real terms because fuel duty has been frozen. For the first time in a period of rapid economic growth, in the late 1990s traffic grew less quickly than GDP. Econometric analysis indicates that the fuel duty escalator revealed significant price elasticity (Glaister 2001).

The overall cost of motoring (including purchase, maintenance, petrol and oil, and tax and insurance) has remained at or below its 1980 level in real terms, although the real cost of fuel is now 12 per cent higher than in 1980, despite a fall in 2001. In contrast to overall motoring costs, public transport fares have risen in real terms over the last 20 years. In 2001, bus and coach fares were 31 per cent higher and rail fares 37 per cent higher than in 1980. Over the same period, average disposable income has gone up more than 80 per cent in real terms. Transport has therefore become more affordable, with a greater improvement in the affordability of car use than that of public transport (DfT 2003a).

Although the majority of the growth in transport over the last twenty years has been in travel by car, up from 388 billion passenger kilometres in 1980 to 624 billion in 2001 - an increase of 61 per cent, there were increases in travel by rail and domestic air, of 34 and 157 per cent respectively. Distance travelled by bus and coach fell by 17 per cent between 1980 and 1992, but it has since increased by around 7 per cent. Emissions of CO2 from transport end users increased from 28 to 37 million tonnes of carbon between 1980 and 1990 - a time when road traffic was growing quickly. Despite further growth in traffic since 1990, levels of CO_2 emissions from road transport have been growing at a much slower rate, due mainly to technological improvements and the use of cleaner fuels. Energy consumption by transport has increased continuously since 1981, from 34 to 55 million tonnes of oil equivalent by 2001 - up 62 per cent. Road transport accounted for most of the increase during the 1980s, but has since been fairly stable despite continued growth in traffic. Indeed, most of transport's increase in energy consumption during the 1990s was accounted for by domestic aviation, up from 7 to 12 million tonnes of oil equivalent (DfT 2003a).

Domestic aviation accounts for only 5 per cent of the UK's total aviation emissions, but emissions from international aviation are not included in government transport statistics or counted under the Kyoto Protocol. We have a situation where the Government's Climate Change Programme has policies to reduce emissions from other sectors, but aviation emissions are being ignored. The effect is far from trivial. The emissions from international aviation emanating from the UK are not included in the national inventory and are not counted under the Kyoto protocol. Carbon emissions from international aviation emanating from UK airports nearly doubled from 4.0 million tonnes of carbon (MtC) in 1990 to 7.8 MtC in 2000, and are projected to increase to around 12.3 MtC by 2010. The IPCC estimates that the global warming potential of emissions from aviation is 2-4 times that of the carbon emissions alone (because of the effect of the emission of water vapour and NOx at very high altitudes), so the increase between 1990 and 2000 was equivalent to 7.6-15.2 MtC. The expected increase 1990-2010 is equivalent in global warming potential to 16.6-33.2 MtC - or 8-16 per cent of UK baseline emissions. In other words, the UK's 12.5 per cent reduction in domestic emissions between 1990 and 2010 under the Kyoto protocol will be largely or more than offset by its increase in international aviation emissions. The middle traffic growth projection to 2020 would increase emissions to 18 MtC, equivalent to 36-72 MtC. That is a further 5.7 MtC, equivalent to 11.4-22.8 MtC or another 6-12 per cent of emissions. The rapid and uncontrolled rise in aviation emissions is likely to overwhelm the effect of other government policies to reduce carbon emissions (Edinburgh Centre for Carbon Management 2002).

However, there is no room for complacency about future road traffic growth. It was held back in the 1990s by the fuel duty escalator. Road traffic is predicted to grow by 20-25 per cent between 2000 and 2010. Because the average fuel efficiency of cars is projected to improve by 20 per cent over the same period, the result would be broadly stable carbon emissions (DfT 2003b). These conclusions have been questioned in a recent IPPR study (Foley and Fergusson 2003) which argued that the improvement in fuel efficiency predicted by the National Transport Model (DfT 2003b) was based on optimistic and somewhat dubious assumptions. The model also assumes that there will be no increase in fuel duty and a slight decrease in the price of oil over the decade.

Taxation of car use has been a particularly sensitive issue since the fuel protests of autumn 2000. Petrol taxes are not regressive in aggregate because poorer households are less likely to have a car. However, petrol taxes are regressive *among* motorists (Blow and Crawford 1997).

Nearly a third of households do not have a car and non-car owning households are concentrated among the lowest income groups. Sixty-three per cent of households in the lowest income quintile and 50 per cent in the second lowest do not have access to a car. By contrast, only 22 per cent of households in the third quintile, 12 per cent in the fourth quintile and 6 per cent in the top quintile are without access to a car (Lucas, Grosvenor and Simpson 2001). However, in all quintiles travel by car (whether as a driver or a passenger) accounted for most of the miles travelled. Some have claimed that this shows that public transport is inadequate for the mobility and accessibility requirements of a modern society so that even those on low incomes will attempt to own or have access to a car (ibid). Increasing car ownership has led to a decline in public transport, particularly buses, and to travel-intensive lifestyles which are considered to more or less require the use of a car. Some developments, for example of out-of-town supermarkets and hospitals, seem to reinforce these trends.

A group that is commonly identified as particularly vulnerable is low-income drivers in rural areas, who are particularly sensitive to price increases, but have fewer transport alternatives than people in urban areas. Only 41 per cent of low-income households (the bottom two quintiles) own cars, but 57 per cent of low-income households in rural areas own cars (Skinner and Ferguson 1998). Low-income car owners tend to spend less on fuel: 78 per cent of the average, and they drive 77 per cent of the average number of miles. Low-income drivers in rural areas drive 22 per cent further than other low-income drivers on average. They drive 94 per cent as many miles as the average among all drivers.

The research in this paper examines a number of options for the future taxation of cars and their use that have been under discussion in recent years. The rationale is that charging can be used to create economic disincentives for car use. The focus of the paper is the distributional effects of such measures and how to prevent regressivity. The options investigated were:

1. Increasing fuel duties and abolishing vehicle excise duty (VED)
2. Increasing fuel duties and using the money to subsidise public transport
3. Increasing fuel duties and using the money to increase benefits
4. Graduated vehicle excise duty (VED)
5. Graduated car purchase tax
6. Congestion charging
7. Domestic tradable quotas

The final approach takes a broader view of carbon emissions. Under domestic tradable quotas (DTQs), each individual would be provided with an annual allowance of carbon emissions. Those who emitted more than their quota would have to buy additional rights from those who produced less. It would apply to all direct carbon emissions, from use of domestic energy, motoring and air travel.

2. Increasing fuel duties and abolishing vehicle excise duty (VED)

An old favourite for reform of motoring taxation has been increasing fuel duties in a revenue-neutral fashion, returning the money to motorists through reduction or even abolition of vehicle excise duty (VED). The argument is that VED is a tax on ownership, while fuel duty is a tax on use. Conversely, it can be argued that once a household has purchased a car the marginal cost of use is usually substantially below the marginal cost of using public transport for the same journey, so car use is relatively inelastic to fuel price in the short term – in the longer term, fuel prices do have an effect on the choice of location to live and the model of car bought. It is the high fixed costs of car ownership that deter some households from taking up motoring. If the fixed costs are lowered, they may buy a car and switch almost entirely from public transport, as most car-owning households do.

The distributional impact of increasing fuel duties and abolishing VED was examined in some detail by Skinner and Fergusson (1998). Sixty-eight per cent of all households and 41 per cent of low-income households owned cars, but in rural areas 80 per cent of all households and 57 per cent of low-income households owned cars. Low-income drivers would on average be better off if there was a shift from VED to fuel taxation because they spent 78 per cent of the average figure on fuel and drove 77 per cent as much distance. However, rural low-income motorists on average spent 90 per cent of the average on fuel and drove 94 per cent of the average distance for all motorists. Skinner and Fergusson calculated that reducing or abolishing VED would on average benefit even rural low-income motorists. Low-income motorists would on average have benefited by £38 per annum and rural low-income motorists by £18 per annum. It is worth noting, however, that because of the variation in fuel used a minority of low-income motorists would have lost out. We calculate based on figures from the 2000-01 Family Expenditure Survey that about 30 per cent of low-income motorists (those in the lowest four deciles) would have been losers and about 17 per cent of motorists in the lowest two deciles would have been losers. We are not able to calculate the proportion of rural low-income motorists who would have been losers, although it would probably be nearly half. Since Skinner and Fergusson's research was conducted there has been a reform of VED so that it is no longer at a flat rate. Low-income motorists on average drive slightly smaller cars than motorists as a whole, although the difference between rural low-income motorists and the average is very small (ibid), so the proportion of low-income losers from the reform would be slightly higher now than calculated.

Another problem is the sensitivity of the public and politicians to increases in fuel duty. Certainly among politicians the level of fuel duty appears at the moment to have reached the limit of acceptability.

3. Increasing fuel duties and using the money to subsidise public transport

If the concern is to prevent regressive impacts, a way to compensate for an increase in fuel duty would be to recycle the money into subsidies for public transport. When the Chancellor of the Exchequer froze fuel duty in 1999 he promised that any future increases would be hypothecated into transport. What would be the distributional impact of putting the money into subsidies for public transport? An analysis was done using data from the Family Expenditure Survey 2000-01. It was assumed that a carbon tax equivalent to £10 per tonne of carbon dioxide (the effective standard rate of the Climate Change Levy for companies) would be imposed. The tax would raise approximately £633 million per year. The effect of the tax on each decile (using the McClements income equivalence scale) before any compensation measures is shown below:

Table 1: Carbon tax at £10/tonne on road fuels

Deciles	per cent	annual change £	per cent losers
1	10	-9.59	36
2	10	-8.30	35
3	10	-15.60	51
4	10	-17.88	58
5	10	-21.71	67
6	10	-25.36	73
7	10	-30.29	80
8	10	-31.77	78
9	10	-37.13	86
10	10	-40.65	80
All	100	-25.43	63

The 63 per cent of households shown as losers is slightly lower than the 72 per cent of households with at least one car (DfT 2003a). Because the FES is based on a diary of expenditure over a fortnight, that is presumably showing that not all households buy fuel every fortnight.

If the revenues were redistributed to lower public transport fares in proportion to expenditure, that would mean a 14.8 per cent reduction in fares. No elasticity of demand has been assumed. The winners and losers according to decile are shown below:

Table 2: Revenues from carbon tax to subsidise public transport

Deciles	per cent	Mean annual change £	per cent gainers	per cent losers
1	10	+5.93	33	32
2	10	+5.47	31	30
3	10	-3.13	26	44
4	10	-1.39	24	50
5	10	-1.32	24	55
6	10	-2.90	23	62
7	10	+0.58	24	64
8	10	-0.97	23	64
9	10	-7.80	24	68
10	10	+4.82	22	68
All	100	0.00	25	54

What is striking is that even in the bottom two deciles, there appear to be as many losers as gainers. However, since 63 per cent of households in the bottom quintile (the bottom two deciles) do not have a car, what the table is really showing is that a large proportion of the poorest households without a car on average travel by public transport less than once a fortnight as well. It is also apparent from the table that the smaller number of households that use public transport heavily tend to gain at the expense of the larger number of households that rely entirely or almost entirely on their cars. However, a significant number of wealthy households also benefit, particularly in the top decile, where the average gain is rather substantial.

Rail travel is concentrated in the higher deciles. The poorest tend to use buses and coaches rather than trains to travel. What would be the effect of putting all the money into subsidies for buses and coaches? The table below shows the outcome:

Table 3: Revenues from carbon tax to subsidise buses and coaches				
Deciles	per cent	Mean annual change £	per cent gainers	per cent losers
1	10	+19.82	32	31
2	10	+15.12	30	30
3	10	+6.75	26	42
4	10	+9.51	25	48
5	10	+6.12	25	53
6	10	+2.56	22	61
7	10	+0.53	21	67
8	10	-9.81	17	67
9	10	-10.05	20	71
10	10	-30.29	11	74
All	100	0.00	22	54

The distribution is significantly more progressive, but the number of losers in the lower deciles diminishes only very slightly. What instead happens is that the gainers in the lower deciles gain a lot more, while the gainers in the higher deciles gain less. That is because people in poorer deciles who use public transport tend to use buses and coaches, while people in higher deciles who use public transport tend to use trains.

Although both options are progressive, the fact that essentially all the households even in the poorer deciles that have cars lose out means that the measure does not address the objection raised to increasing fuel duties: that it would adversely affect car-dependent poorer households.

4. Increasing fuel duties and using the money to increase means-tested benefits

Would it be more effective to use the revenues to increase benefits instead? During the fuel tax protests of 2000, one of the present authors (Paul Ekins) was interviewed on the *Today* programme and he defended increases in fuel duty. He was challenged about the impact on poor rural motorists who did not have a practical option of using public transport. He suggested that they could be compensated through the benefits system.

Targeting benefit assistance at motorists only would be undesirable because it would create a perverse incentive to buy a car. Targeting assistance at people in rural areas would be strange because in other ways their cost of living is lower than for people in urban areas. We have simply examined the effect of using the revenues from the carbon tax on petrol and diesel described above to increase means-tested benefits.

The calculations below were performed on behalf of the authors by Holly Sutherland of Cambridge University using the POLIMOD model of the tax and benefits system linked to FES.

Table 4: Effect of carbon tax with partial take-up of existing benefits					
Deciles	%	annual change £	% of income	% losers	% losing > £2pw
1	10	-13.05	0.65	42.3	0.7
2	10	-12.22	0.10	44.9	0.7
3	10	-15.50	0.10	47.2	1.1
4	10	-17.16	0.11	53.0	1.1
5	10	-21.37	0.11	61.5	0.9
6	10	-27.20	0.12	68.3	3.7
7	10	-31.15	0.12	76.1	3.0
8	10	-35.36	0.12	77.3	4.2
9	10	-38.95	0.11	78.4	6.6
10	10	-41.96	0.08	76.9	10.2
All	100	-25.38	0.16	62.6	3.2
Households with children	29.1	-33.02	0.12	74.4	4.3
Hholds with pensioners	30.7	-14.14	0.08	46.2	1.2

The £633 million raised from the carbon tax are used to increase means-tested benefits. Income Support, means-tested Jobseeker's Allowance and Pension Credit are raised by £1 per week for a single person and £1.60 for a couple. The same level of increases are also made through Housing Benefit and Council Tax Benefit for households that are eligible for those benefits, but not for the means-tested income replacement benefits. Child Tax Credit is increased by 60p a week for each child and Working Tax Credit by £1 a week for each claim.

Table 5: Effect of a carbon tax with compensatory increases in means-tested benefits					
Deciles	%	average net change £/year	% losers	% gainers	% losing > £2pw
1	10	40.04	17.2	56.7	0.3
2	10	51.79	17.0	69.6	0.1
3	10	34.16	21.3	57.6	0.3
4	10	19.66	33.8	49.8	0.3
5	10	0.00	48.6	28.6	0.6
6	10	-14.72	61.9	19.1	3.1
7	10	-24.96	72.7	9.5	2.3
8	10	-30.78	74.2	6.0	3.4
9	10	-37.75	77.7	1.2	6.4
10	10	-40.25	75.8	1.6	9.5
All	100	0.00	50.0	30.0	2.7
Households with children	29.1	11.34	53.7	35.8	3.6
Households with pensioners	30.7	11.28	33.7	41.3	0.9

Using the revenues to increase means-tested benefits significantly reduces the number of poor households that lose from imposing a carbon tax on petrol and diesel, although about 47 per cent of low-income motorists (not shown in Table 5), and about 36 per cent of motorists in the lowest two deciles, remain losers. Very few lose out by a large amount, however. Increasing benefits is less effective than abolishing VED at compensating low-income drivers, although it is of course more progressive overall because it also helps the majority of those on low incomes who live in households without a car. Another problem is that the poor households that remain losers are likely to be those that are most car dependent. The particular concern that is often expressed is about poorer motorists living in rural areas where there is little public transport and it is necessary to travel long distances.

The calculations above assume only partial take-up of benefits. The calculations below more optimistically assume 100 per cent take-up of means tested benefits in order to see to what extent the problem is just of poor take-up.

100 per cent take-up of benefits alters the distribution of the deciles. The first table shows the effect of the carbon tax on the new deciles:

Table 6: Effect of carbon tax with 100 per cent take-up of existing benefits					
Deciles	per cent	annual change £	per cent of income	per cent losers	per cent losing > £2pw
1	10	-13.26	0.63	43.7	0.8
2	10	-12.69	0.10	45.1	1.0
3	10	-14.92	0.10	46.7	0.6
4	10	-17.26	0.10	52.5	1.1
5	10	-22.00	0.11	63.4	1.2
6	10	-27.14	0.12	68.4	3.5
7	10	-30.52	0.12	74.4	2.8
8	10	-35.46	0.12	76.9	4.4
9	10	-38.95	0.11	78.5	6.6
10	10	-41.96	0.08	76.9	10.2
All	100	-25.43	0.16	62.7	3.2
Households with children	29.1	-33.02	0.12	74.4	4.3
Households with pensioners	30.7	-14.14	0.08	46.2	1.2

The £633 million raised from the carbon tax are used to increase means-tested benefits. Income Support, means-tested Jobseeker's Allowance and Pension Credit are raised by £0.80 per week for a single person and £1.30 for a couple. The same level of increases are also made through Housing Benefit and Council Tax Benefit for households that are eligible for those benefits, but not for the means-tested income replacement benefits. Child Tax Credit is increased by 50p a week for each child and Working Tax Credit by 80p a week for each claim.

Table 7: Effect of a carbon tax with compensatory increases in means-tested benefits and 100 per cent take-up				
Deciles	average net change £/year	per cent losers	per cent gainers	per cent losing > £2pw
1	43.68	10.9	76.6	0.3
2	46.64	12.5	77.4	0.1
3	34.32	17.4	71.9	0.1
4	18.82	29.5	57.3	0.3
5	-0.99	46.7	32.3	0.9
6	-14.72	60.9	21.5	3.0
7	-23.87	70.1	11.5	2.0
8	-31.25	74.3	5.9	3.4
9	-37.60	77.2	1.5	6.4
10	-40.09	75.6	1.9	9.5
All	0.00	47.5	35.8	2.6
Households with children	11.44	49.2	42.1	3.5
Households with pensioners	10.66	31.0	51.4	0.8

Using the revenues to increase means-tested benefits significantly reduces the number of poor households that lose from imposing a carbon tax on petrol and diesel, although about 37 per cent of low-income motorists (not shown in Table 7), and about a quarter of motorists in the lowest two deciles, remain losers. Very few lose out by a large amount, however. Increasing benefits is less effective than abolishing VED at compensating low-income drivers, although it is of course more progressive overall because it also helps the majority of those on low incomes who live in households without a car. Another problem is that the poor households that remain losers are likely to be those that are most car dependent. The particular concern that is often expressed is about poorer motorists living in rural areas where there is little public transport and it is necessary to travel long distances.

It could also be argued that using the revenues in this way is not very efficient. Nonetheless, the exercise shows that benefits could be used to largely offset the negative effects of such a tax increase on the poorest households.

5. Reform of graduated vehicle excise duty (VED)

There are currently two systems of VED. For cars first registered before 1 March 2001, the rates are £110 for cars up to 1549cc and £165 for cars over 1549cc. The system for cars registered on or after 1 March 2001 is more complicated and described in Table 6 below:

Table 8: VED Bands Related to Carbon Emissions for Different Vehicles

Bands	Carbon dioxide emissions (g/km)	Diesel car	Petrol car	Alternative fuel cars
AAA	Up to 100	£75	£65	£55
AA	101-120	£85	£75	£65
A	121-150	£115	£105	£95
B	151-165	£135	£125	£115
C	166-185	£155	£145	£135
D	Over 185	£165	£160	£155

The only cars in Band AAA are hybrids: Honda Insight, Honda Civic IMA and Toyota Prius. City cars such as the Smart and the Suzuki Alto are in Band AA. Band A is mostly represented by diesel cars in the supermini and small car classes and petrol superminis. Band B is dominated by petrol superminis and small diesel cars. Band C is mostly small petrol cars and larger diesel cars. Band D is mostly larger petrol cars and big diesel cars. Diesel cars currently have much higher nitrogen oxides and particulates emissions than petrol cars, which is why the car tax rates for diesel cars with the same level of carbon dioxide emissions are slightly higher than those for petrol cars, although the smallness of the difference is controversial as diesel cars contribute disproportionately to urban air pollution. However, the Euro IV emissions standard for diesel cars will significantly reduce nitrogen oxides and particulates emissions.

Before the introduction of the 2001 reform, there was discussion about the VED system. One reason for choosing carbon dioxide emissions is that emissions of other pollutants are much higher in older cars that tend to be bought second-hand by the poorer than in newer cars, so any system based primarily on other pollutants would tend to be regressive (Skinner and Fergusson 1998). Emissions of other pollutants are determined overwhelmingly by legislation, whereas carbon dioxide emissions are largely a function of engine size.

From the rates set out in Table 6, it can be seen thatwith the new system does not really contain a really strong disincentive to buy a 'gas guzzler'. It was designed to be revenue neutral and to establish new incentives to buy more efficient cars. A disincentive to purchase vehicles with high carbon emissions could be introduced by creating an additional Band E with a significantly higher rate for cars with emissions above say 200 g/km that would apply to cars with 2 litre petrol engines and above.

Table 6 also shows that the difference in rates of VED is presently very small in relation to the purchase cost of new cars and so unlikely to make any impact significant impact on buying decisions. Increasing the rates would at present make little difference to poorer households because few of them own post-2001 cars, but over time it would have an impact. About 6 per cent of cars owned by low-income households have an engine capacity above 2000 cc, compared to about 8 per cent of cars owned by all households (Skinner and Fergusson 1998), so that the impact on poorer households of a new Band E would be not dissimilar in absolute terms to its impact on car-owners as a whole, while proportionally it could be greater. However, it is not clear that arguments based on 'need' apply to vehicles of this size.

VED could be more effectively related to CO2 emissions by replacing the bands that currently exist with a more graduated system along the lines of the reform to company car taxation made in 2002. Since April 2002, company car taxation has been calculated on the basis of the car's CO2 emissions and its list price when new. The tax rate starts at 15 per cent of the car's price, for a small car emitting 155 g/km of carbon dioxide, then rises in 1 per cent steps for every additional 5 g/km over 155 g/km - up to a maximum of 35 per cent of the car's price. Diesel cars are subject to a further 3 per cent surcharge, up to the 35 per cent maximum. The 155 g/km minimum will be reduced to 145 g/km in 2004/05.

If VED started at the present Band AAA rate for any car with emissions below 100 g/km and then increased by £5 for every additional 5 g/km then the amount of VED paid would remain almost exactly the same until a car had emissions above 200 g/km. Under such a scheme the present cap on VED for 'gas guzzlers' would be removed.

6. Graduated car purchase tax

The UK had a Special Purchase Tax on cars until its abolition in 1992. Many other European countries have a purchase tax on cars. It is widely perceived that new cars have been much more expensive in the UK than in other EU countries, but that does not take account of the fact that the prices quoted are pre-tax. This perception led to new cars being targeted in the Government's campaign against 'Rip-off Britain'. In reality, Denmark, Finland and Greece all have high rates of purchase tax on new cars, which encourage people in those countries to buy smaller cars, and car manufacturers attempt to compensate by offering some models at very low pre-tax prices, presumably cross-subsidised by charging higher prices in other countries that charge less tax. The Competition Commission (2000) found that levels of car taxation were similar to those in the UK in France, Germany and Italy. At that time, the pre-tax prices of new cars were on average 10-12 per cent lower in those countries than in the UK. In the past three years, UK new car prices have continued to fall. However, a perception seems to remain that new cars are more expensive in this country.

Low-income motorists buy very few new cars, but changes in the price of new cars are rapidly reflected in the second-hand market, so a graduated purchase tax would also increase costs for low-income motorists unless compensating measures were taken. The way to compensate for a graduated car purchase tax would be to reduce or abolish VED. The buyers of second hand cars have at best a small and indirect impact on the make-up of the car fleet. It is the buyers of new cars who choose the cars that will be on the roads for the next decade or so, even though new car buyers only own the cars for a few years themselves. Replacing VED with a car purchase tax graduated according to carbon dioxide emissions would mean that buyers of new cars would be faced with a significant direct incentive to choose more efficient vehicles. It would have much more effect on car purchasing decisions than VED because the equivalent of about 14 years of VED for the average life of a car (Burnham 2001) would be included in the sticker price of new cars and the variation in tax between models would amount to hundreds of pounds paid upfront. The change could not be made overnight as it would distort the market for new and used cars, but could it could be brought in with incremental increases in the car purchase tax and compensating reductions in VED for cars first registered in that year over a period of about five years.

About 50 per cent of all new cars sold in the UK are bought by company car drivers, who have been subject to taxation based on carbon dioxide emissions since 2002. Private car buyers of course have an incentive to buy more fuel-efficient cars in a way that company car drivers have not traditionally had, except through the power of fleet managers, but it is known that they tend to pay little attention to it in their purchasing decisions (Eriksson 1993). An upfront tax that varied according to the carbon dioxide emissions of the car might increase the significance of this factor in their car-purchase decisions.

The difficulty in introducing the measure might lie in the perception of the public and politicians that higher prices for new cars are an aspect of ‘Rip-off Britain’, even if the increase was compensated for in reductions in VED. New car buyers (who tend to be richer) would feel the effect immediately and would doubtless be vociferous in their complaints.

7. Congestion charging

In the last few years, the major focus for discussion in the area of motoring taxation has been congestion charging. The fuel tax protests of 2000 are widely perceived to have closed the door to any increases in fuel duty at least for the foreseeable future. Interest in road pricing has increased still further recently with the success of the congestion charging scheme introduced to central London. The revenues raised from the congestion charge are used to pay for improvements to public transport.

The case for a nationwide system of road charging with satellite tracking of vehicles using the Global Positioning System was put forward strongly in a report by the Commission for Integrated Transport (2002). Drivers would be charged for travelling on busy roads at different rates according to the road and the time of day, but travel on uncongested roads would remain free. CfIT started from the assumption that any system of road charging would at least initially have to be revenue neutral, so it proposed that VED and fuel duty should be reduced to compensate for congestion charges. A charging scheme was presented that would raise £5.7 billion per year, compared to the existing £27 billion per year raised from fuel duty and VED, compensated for with a reduction in fuel duty of 12p per litre or the abolition of VED and a reduction in fuel duty of 2p per litre. They presented the results of modelling which indicated that with the latter option the charge could in aggregate reduce congestion by 44 per cent and traffic by up to 5 per cent, while increasing travel speeds by 3 per cent. CfIT assumed that nationwide road charging would be introduced after the completion of the government's 10 Year Transport Plan in 2010.

CfIT's argument is that for transport policy to be effective road users should pay charges that reflect the marginal costs they impose on society. They cited an analysis by the Institute for Transport Studies at Leeds University which had estimated that most of the marginal cost of road transport is from congestion, while the contribution to climate change only accounts for a few per cent (ITS 1998). CfIT argued that fuel duty is a crude method of making road users pay for the external costs of their journeys because although it relates to carbon dioxide emissions, it does not relate to other external costs, including pollution and particularly the largest external cost, congestion. They also asserted that present car taxation is unfair because it often penalises those who can least afford it and those who have to rely on cars because of poor or non-existent public transport, for instance in rural areas. CfIT did not model the actual distributional effects of their nationwide road-charging scheme.

However, we can deduce that a revenue neutral congestion charging system would lead to a redistribution of money from urban drivers to rural drivers. If revenue neutrality was achieved by reducing fuel duty then essentially all urban drivers would lose and all rural drivers would gain. That would be the case for both richer and poorer motorists. If instead revenue neutrality was achieved by abolishing VED then low-mileage/off-peak urban drivers would generally pay less in congestion charges than they would gain, but high-mileage/peak-time urban drivers would generally lose and rural drivers would still gain.

IPPR (Foley and Fergusson 2003) has recently published the results of research they commissioned from Stephen Glaister and Dan Graham of Imperial College showing that a revenue-neutral congestion charging system offset by a 12p per litre reduction in fuel duty could actually *increase* road traffic in England by nearly 7 per cent and increase carbon dioxide emissions by 5 per cent. The effect of a revenue-neutral charge would be to make urban motoring more expensive, but it would make rural motoring cheaper. Roads in rural areas would experience a significant growth in traffic. By contrast, a revenue-raising charge would, according to their modelling, lead to a nearly 7 per cent decrease in total traffic and an 8 per cent decrease in carbon dioxide emissions from traffic. The IPPR report acknowledged that it would be politically challenging to introduce a revenue-raising charge, but suggested that VED be abolished in order to make it more acceptable to motorists. They also suggested that some of the additional revenues from congestion charging could be put into public transport. It is worth noting, although they did not, that an alternative policy of increasing fuel duty and compensating with the abolition of VED would do more to reduce overall traffic and carbon dioxide emissions, although it would not reduce congestion nearly so much and would have a disproportionate impact on low-income rural motorists with above average annual mileage.

A number of conclusions can be drawn. Reducing fuel duty in order to compensate for the introduction of congestion charging would actually *increase* traffic overall and have negative environmental consequences. It would increase the car dependence of society, particularly in rural areas, further increasing the social exclusion of the poorest and most marginalised members of society (who do not have cars). It would also make tend to make poorer urban motorists lose out, although poorer rural motorists would gain. Abolition of VED to compensate for congestion charging would be progressive overall because on average poorer motorists drive rather less than the average for all motorists. The poorer rural motorists who drive nearly as much as the average for all drivers would certainly gain because congestion charging would not affect them for most of their driving, but it would have a negative impact on a significant number of poorer urban motorists who drive at peak times. The effect that this level of congestion charging would have on overall traffic levels is not very great (a reduction of about 5 per cent), although it would reduce congestion by up to 44 per cent (CfIT 2002). Higher levels of congestion charging could be used to support public transport, but because households with cars use public transport so little the effect would be that almost all households with cars except those in uncongested rural areas would lose out financially. The intention is that better public transport would tempt people out of their cars. The reality is that people would switch to public transport only if congestion charging was imposed at a high enough rate that the marginal cost of public transport was lower than the perceived marginal cost of travelling by car. That would require high rates of congestion charge.

The success of the London congestion charging scheme in reducing traffic in central London has shown that congestion charging can work in the UK. Congestion charging has reduced the number of cars entering central London by 16 per cent and reduced congestion by about 30 per cent. Journey times in the charging zone have reduced by about 15 per cent. Only about 20 to 30 per cent of the traffic reduction in the zone has been diverted around it – 50 to 60 per cent has switched to public transport and 15 to 25 per cent has involved other adaptations (TfL 2003).

Car ownership is somewhat lower in London than in the UK as a whole at 60 per cent, compared to 70 per cent nationally. Only 18 per cent of London households who would be in the poorest decile nationally have a car, compared to 25 per cent in the UK as a whole. Among the London households that would be in the richest decile nationally, 94 per cent have a car, compared to 98 per cent nationally (Crawford 2000). London's richest 50 per cent of households provide 70 per cent of car-owning households and 88 per cent of those who drive to work in the city centre (ROCOL 2000).

The Institute of Fiscal Studies tried to work out what the congestion charge would cost households with differing earnings, using (rather dated) behaviour patterns from the 1991 London Area Transport Study and assuming no change in travel patterns as a result of the charge. It found that households in the top few percent of earnings drive, on average, once a week into the charging zone, so are likely to pay £5 weekly. The projected cost falls progressively as income falls - those in the top fifth of income distribution would pay roughly £2.50, households around the median £1, and those in the bottom fifth would pay, on average, about 10p a week. The average charge as a percentage of income was about 0.1 per cent for most of the lowest two deciles, it peaked at nearly 0.5 per cent in the fifth decile, just below the middle of the income distribution and then fell to between 0.3 and 0.4 per cent in the upper half of the income distribution (Crawford 2000). Nonetheless, the outcome was basically progressive. Because car ownership rises sharply as you go through the income deciles, the relative burden on the poorest *car owners* is greater than on richer car owners, although not by very much because in London poorer households drive much less than richer ones and drive into central London particularly infrequently. It is possible to calculate from the figures provided by Crawford (2000) that a car driver in the lowest two deciles would on average spend about 0.5 per cent of household income on the congestion charge. A car driver in the middle of the income distribution would on average spend about 0.8 per cent of household income. A car driver in the top fifth would on average spend about 0.4 per cent of household income. It would be interesting to know what the actual distributional effect of congestion charging has been, but there is as yet no data available on that.

London is not typical of the UK in its car ownership and driving patterns. What would be the impact on low-income motorists of congestion charging elsewhere? The only research that has been done on that is a study on the effect in Leeds of seven different hypothetical congestion charging schemes (Bonsall and Kelly 2003). The models simulated the characteristics of travellers from probabilities derived from a number of sources, most particularly the small area statistics available from the Census, but also the National Travel Survey, the Journey to Work Census, the Household Income Survey, the Household Expenditure Survey, the New Earnings Survey and a number of local travel surveys. Most of the data used applied to the situation in Leeds in the early 1990s, although information on incomes, total trip volumes and the transport network was from the late 1990s.

Three different cordons were drawn to simulate the effect of using each: one of the commercial, civic and retailing centre of Leeds; one just inside the inner ring road; and one just inside the outer ring road. Different kinds of charging scheme were used in conjunction with the different charging areas: a charge levied on inbound traffic at the morning peak hour (8 am to 9 am); a charge related to the total distance travelled within the appropriate cordon (either the inner or outer ring road); and a charge related to the time spent on the road within the appropriate cordon (either the inner or outer ring road). The idea behind a time-based charge is to create an incentive for drivers to avoid congested areas themselves. The charge for crossing the cordon just inside the inner ring road was £2 and the charges for the other options were set to raise an equivalent amount of revenue.

The effect of the charge on drivers with an annual income of less than £10,000 was examined. The figure was chosen because for these people a daily charge of £2 would amount to almost 5 per cent of their income. The effect on disabled, elderly, lone-parent, female and ethnic minority drivers was also examined. The disabled, elderly and lone parents were considered vulnerable in terms of access. Women and ethnic minorities were considered potentially vulnerable in terms of personal security.

Fewer people were affected by charges for crossing a cordon between 8 am and 9 am, but the charges they paid were therefore higher. Again, more people were affected by a distance or time charge for travel within the outer ring road than the inner ring road, but consequently average charges were lower. Indeed, the rates charged were so much lower that the maximum charges paid were also lower, despite the potential for much longer journeys. The policy which required the fewest low-income drivers to pay more than £2 (set as the threshold for concern about social exclusion) was a distance-based charge for travel within the outer ring road. However, this scheme meant that more elderly drivers had to pay at least £2 than in the scheme where charges were for the distance travelled within the inner ring road.

The study also considered the effect of different kinds of exemptions and the 'leakage' of revenue to groups that mostly do not have low incomes. For instance, it was found that only 8 per cent of disabled drivers had an income under £10,000. Most exemptions (e.g. for disabled drivers, hospital visitors, etc) did not reduce revenues much, but an exemption for residents of any charge zone would significantly reduce revenues, particularly where the charges were for distance or time travelled within the outer ring road.

Although the details of the effects of different charging schemes are of great interest for the design of a scheme in Leeds, they are not of great relevance nationally. What is important and likely to be relevant nationally is that the study showed that, for a given revenue raised, a policy under which charges are proportional to the distance driven within the charge area would have less serious consequences for at-risk groups and that, although the number of affected drivers is higher when the charge area covers a large area of the city, the number of low-income drivers having to pay significant daily charges is less than when the charge area is restricted to the city centre. Conversely, if the charge is based on drivers crossing a cordon, then the situation is reversed because a small cordon area affects fewer people, but to a greater extent as relatively few people drive into Leeds during morning rush hour compared to the number driving into the city centre from within Leeds. These findings are likely to be true for other cities. The research seems to strengthen the case for a satellite-based distance-charge system rather than a technologically simpler one based on a cordon.

On the other hand, the problem with sharing out the cost across as many people as possible is that the financial impact on individuals could be reduced to such an extent that it may have little effect on their driving patterns. People with cars may be induced to switch to public transport in large numbers if the *marginal* cost of travel by car is clearly greater than by public transport, as has been the case in London, but not if car travel still appears cheaper.

8. Domestic tradable quotas

The idea of domestic tradable quotas (DTQs) is rather different from the other schemes proposed. It does not take road travel in isolation, but instead looks at all the direct carbon dioxide emissions of households. The idea behind DTQs is that every adult resident would receive for free an equal number of carbon units to cover their annual carbon emissions, including private transport. Businesses and other organisations would have to buy their quota from government. Those who used less than their entitlement could sell their surplus units to others who needed more. (Fleming 1998).

Central to the DTQ scheme is a computer database in which the carbon unit account for all citizens and organizations is held, and in which all carbon unit transactions, be they issuing, surrendering, buying or selling, are recorded. All transactions are conducted electronically. For example, a customer purchasing petrol would simply have their smart card swiped by the petrol station attendant, thereby transferring the carbon units corresponding to their purchase from their carbon unit account to that of the company owning the petrol station. For those purchasers of fuel and electricity without carbon units to surrender at the point of sale, for example, foreign visitors and individuals who have used all their units, the relevant number of carbon units are simply purchased electronically on the national market by the fuel or electricity seller on behalf of the purchaser. The purchaser then pays the seller for these units and surrenders them in the usual manner (Anderson and Starkey 2003).

DTQs differ substantially from other instruments in their allocation of emission rights relating to citizens' direct purchase of fuel and electricity. Under other instruments such as a carbon tax these emission rights are effectively allocated on the basis of citizens' ability and willingness to pay, whereas under DTQs they are explicitly allocated on an equal per capita basis. DTQs therefore have the potential to be a more equitable method of rationing emissions than carbon taxes.

Assigning quotas would require a national population register, which has been a stumbling block to the idea because it would be expensive to set up. The government's current plans to create a national identity card mean that a national population register will be set up anyway over the course of the next decade. It would then be relatively easy administratively to assign quotas and create a system of DTQs.

Data on domestic energy consumption in the English House Condition Survey and the Family Expenditure Survey shows that once household size is taken into account, domestic energy consumption (and carbon emissions) hardly increases through the deciles (Dresner & Ekins 2003). Because of enormous variations in the efficiency of the building stock, mostly due to the standards to which homes have been built at different times, the variation in domestic energy consumption (and carbon emissions) *within* deciles is much greater than that *between* deciles.

First the distributional effect of a DTQ system that provided each individual with an allowance based on the *average* carbon emissions from domestic energy, petrol and diesel was examined. Emissions from trains, buses and aviation were not included. Since carbon emissions from cars are fairly progressive (meaning that low-income households produce proportionately less carbon emissions in relation to their income than richer households), while carbon emissions from domestic energy are regressive (meaning that low-income households produce proportionately more carbon emissions in relation to their income than richer households), it is interesting to examine what the effect of DTQs would be.

An issue which arises is the treatment of children. The proponents of DTQs believe that only each adult should be assigned a quota. Fleming (1998) has suggested that there could be an increase in child benefit to help parents pay for the carbon emissions due to their children, although he does not specify where the money to do that would come from. The proposal modelled here compares a scheme with adult-only DTQs with one in which each child also receives a quota of half the adult amount that would be administered by their parents.

The tables below show the effect for deciles with equivalent incomes of DTQs for domestic and motor fuel depending on whether or not children are assigned a half quota. For the sake of example, it is assumed that the value of a tonne of carbon dioxide on the quota market would be £10 per tonne:

Table 9: Effect of DTQs with a quota for each adult only				
Deciles	average net change £/year	per cent losers	per cent gainers	per cent losing > £1pw
1	18.00	25	75	5
2	15.73	29	71	3
3	16.23	30	70	4
4	11.32	35	65	5
5	5.57	43	57	7
6	-2.33	49	51	8
7	-1.03	53	47	10
8	-12.95	61	39	16
9	-10.47	57	43	16
10	-32.87	71	29	27
All	0.00	45	55	11
Households with children	-7.31	52	48	15
Households with pensioners	+14.96	31	69	2

Table 10: Effect of DTQs with a quota for each adult and half a quota for each child				
Deciles	average net change £/year	per cent losers	per cent gainers	per cent losing > £1pw
1	27.25	21	79	4
2	15.98	31	69	2
3	16.88	32	68	4
4	11.87	38	62	5
5	7.42	41	59	7
6	-1.95	50	50	8
7	-3.84	50	50	10
8	-14.83	62	38	18
9	-8.96	45	55	17
10	-37.55	77	23	31
All	0.00	47	53	11
Households with children	+12.21	37	63	10
Households with pensioners	+7.76	37	63	3

There is not much difference in the outcomes of the two methods in terms of the percentage of each decile that gains or loses, although quotas for children do lead to fewer losers in the bottom decile. The difference is mostly in which households gain or lose, rather than how many gain or lose at each income level. Quotas only for adults favours households without children over those with children. Quotas for children as well favours households with children over those without.

The objection to providing quotas for children is that it might encourage people to have children in order to get a bigger carbon quota. However, not providing quotas for children would be politically controversial, particularly in the light of government concern about child poverty and the fact that small children are especially susceptible to the health effects of low indoor temperatures. On the other hand, not providing quotas for children allows larger quotas for each adult, which helps another politically important and sensitive group, pensioners (37% of pensioner households are losers from the with-child quota scheme, compared to 31% from the without-child quota).

About thirty per cent of poorer households lose out if only domestic and motor fuel are covered under DTQs. Flying is the other major source of greenhouse gas emissions that could be directly accounted for. Public transport is a small source of emissions and from a carbon emissions point of view should be encouraged in order to substitute for car and plane travel, so emissions from public transport have not been covered by DTQs.

Figures presented below show that people on low incomes fly very little, while people on high incomes fly a great deal. The relationship is strongly progressive. Bringing emissions from aviation into the equation would not only make the effect of DTQs more progressive, it would do something to restrict the extremely rapid growth in emissions from aviation that is currently unchecked because international aviation is not covered under the Kyoto Protocol and the UK Government's Climate Change Programme.

The data on air travel in the FES does not accord very well with the data in the International Passenger Survey (IPS).[1] The IPS indicates that about 39 million international air round trips for non-business purposes were taken by UK residents in 2002. Of these, about 18 million were part of package holidays and 21 million were not part of package holidays. The FES data instead suggests that at least one member of about 15 million households went on a package holiday in 2001-2, but at least one member of only 4 million households flew abroad for non-business purposes not on a package holiday. These figures can best be reconciled if it is assumed that the respondents to FES took a broader interpretation of a package holiday than respondents to IPS. The FES asks respondents about expenditure on package holidays that they have undertaken in the last three months, but only about scheduled airline tickets they have bought in the two weeks of the diary. They may report holidays that are not strictly all-inclusive package holidays. Over forty per cent of all the purchases of personal air tickets in the sample (18 of 43) were by households in the top decile.

The Civil Aviation Authority only surveys a selection of airports each year, but its last survey of a wide range of English regional airports as well as the London airports and

Manchester recorded a similar pattern according to social class. Its statistics indicated that members of class A and B (the top 22 per cent) were around 8 times more likely to fly than members of social class E (the bottom 12 per cent). FES showed that members of the top two deciles were about 8 times more likely to have bought a package holiday in the last 3 months than members of the bottom decile.

The calculations that follow should therefore be taken as only a rough guide. It was assumed that the data on non-package holidays was too unreliable to be used because of the small numbers recorded and the degree of extrapolation required. Instead, data on air travel was based on the reported number of package holidays in each decile. It was assumed that each member of a household went on the holiday. The International Passenger Survey shows that the average length of the round trip for a package holiday is 1830 miles by a Great Circle route, equivalent to a London-Ibiza return flight. The average length of a round trip for a non-package leisure flight is slightly longer at 2060 miles by a Great Circle route, equivalent to a London-Malaga return flight. The site www.chooseclimate.org calculates the carbon dioxide emissions of a Great Circle route, allowing for the additional fuel used in take-off and landing as well as the cruise phase. It is also necessary to take account of the additional greenhouse warming potential of emissions from aviation. The Intergovernmental Panel on Climate Change estimates the greenhouse warming potential to be 2.7 times that of the carbon dioxide alone (IPCC 1999). A round trip of 1950 miles therefore has a greenhouse warming potential equivalent to 1.2 tonnes of carbon dioxide and that was the assumed length of each flight. These assumptions are rather conservative because richer people are much more likely to use long-haul travel, which accounts for a disproportionate quantity of emissions, but there was no way to quantify that given the limitations of the data available. Expenditure on package holidays varies much more in relation to the category of accommodation than to distance. These calculations are also unable to take account of people who fly more than once a year because that could not be quantified with the available data. The people who do that are probably strongly concentrated in the top two deciles, since 75 per cent of passengers on budget airlines are from social classes A and B (Bishop and Grayling 2003).

The following distributional impacts were calculated depending on whether or not children get quotas:

Table 11: Effect of DTQs including aviation with a quota for each adult only				
Deciles	average net change £/year	per cent losers	per cent gainers	per cent losing > £1pw
1	25.23	24	76	4
2	22.99	26	74	3
3	22.22	25	75	5
4	13.03	33	67	7
5	5.07	44	56	11
6	-4.47	52	48	12
7	-4.44	50	50	14
8	-18.34	65	35	19
9	-24.44	67	33	24
10	-37.86	77	23	31
All	0.00	46	54	13
Households with children	-12.54	56	44	22
Households with pensioners	+20.72	25	75	2

Table 12: Effect of DTQs including aviation with a quota for each adult and half a quota for each child				
Deciles	average net change £/year	per cent losers	per cent gainers	per cent losing > £1pw
1	36.31	18	82	3
2	23.55	27	73	2
3	23.10	27	73	4
4	14.48	34	66	7
5	7.32	43	57	8
6	-3.58	47	53	10
7	-7.32	54	46	13
8	-20.23	68	32	21
9	-29.60	75	25	27
10	-42.95	78	22	31
All	0.00	48	52	13
Households with children	+11.14	41	59	13
Households with pensioners	+12.33	32	68	2

The effect of including aviation makes the measure even more progressive, but about a quarter of low-income households still lose out, although only a few per cent lose a large amount. Including aviation has not had such a large effect in making DTQs more progressive as might have been hoped, although it should be borne in mind that the figures presented above are probably conservative and in reality would be somewhat more progressive.

Lumping together emissions from domestic energy, motoring and air travel in a DTQ system does not appear to be the best approach from the point of view of concern about the impact on the poor. Many poor households live in older properties that would be expensive to bring up to proper standards of energy efficiency. The emissions that they create to keep warm are for a basic need. By contrast, it is hard to argue that flying away on a foreign holiday is a basic need.

Finally, we consider DTQs that apply only to greenhouse gas emissions from motoring and aviation:

Table 13: Effect of DTQs for motoring and aviation emissions with a quota for each adult only				
Deciles	average net change £/year	per cent losers	per cent gainers	per cent losing > £1pw
1	17.24	15	85	2
2	18.43	11	89	1
3	13.40	21	79	2
4	8.06	28	72	3
5	1.86	35	65	6
6	-3.49	47	53	8
7	-5.62	51	49	8
8	-13.39	59	41	12
9	-17.71	66	34	14
10	-19.78	65	35	16
All	0.00	40	60	7
Households with children	-9.68	54	46	13
Households with pensioners	+18.50	6	94	0

Table 14: Effect of DTQs for motoring and aviation emissions with a quota for each adult and half a quota for each child				
Deciles	average net change £/year	per cent losers	per cent gainers	per cent losing > £1pw
1	22.21	11	89	1
2	18.68	12	88	1
3	13.80	21	79	2
4	8.71	27	73	3
5	2.87	37	63	4
6	-3.09	48	52	7
7	-6.92	46	54	7
8	-14.25	61	39	12
9	-20.03	68	32	14
10	-22.07	67	33	16
All	0.00	41	59	7
Households with children	+0.94	45	55	9
Households with pensioners	+14.74	8	92	0

Even with conservative assumptions, only a small percentage of low-income households lose out from either option, although allowing quotas for children is slightly more progressive than not doing so.

Lumping together emissions from domestic energy, motoring and air travel in a DTQ system does not appear to be the best approach from the point of view of concern about the impact on the poorest households. Many low income households live in older properties that would be expensive to bring up to proper standards of energy efficiency. The emissions that they create to keep warm are for a basic need. By contrast, it is hard to argue that flying away on a foreign holiday is a basic need. From the viewpoint of concern about social justice, a DTQ system that only covered motoring and aviation is preferable.

Another way to tackle the problem of rapidly increasing emissions from aviation would be through a tax on aviation emissions. The European Parliament has passed a resolution calling for the establishment of an environmental charge based on greenhouse gas emissions on all air travel inside the EU and to other destinations. The revenue would be collected by national governments to be earmarked to fund measures to offset the greenhouse gas emissions of air travel. It might be possible to ensure that such a tax did not cause poorer households in the UK collectively to lose out financially if a small percentage of the revenues were put in to supplement existing schemes to improve domestic energy efficiency among poorer households.

9. Conclusions

Decisions about what would be the best policies to pursue to reduce the environmental impact of transport without causing negative impacts on the poor depend particularly heavily on political judgements. Unlike domestic energy, water and waste disposal, motoring is not yet an essential need for most poor people in the UK. Nearly a third of households do not have a car and nearly two-thirds of households in the poorest quintile are without one. Measures which increase the cost of motoring are progressive, not regressive, on average. Concern about negative impacts on the poor has therefore been about the impact on the minority of the poor who own cars.

The same issue arises with taxation of air travel. People on low incomes travel relatively infrequently by plane. The rich account for the great majority of air travel. The aviation industry puts forward the populist argument that increasing the cost of air travel would price the poor, but not the rich, out of the skies. The problem with this kind of thinking is that it ignores the global context. It simply is not environmentally sustainable for everyone in the world to drive cars (using current technologies) or travel in aeroplanes (using any technology in prospect). Relatively poor people in the UK are still much better off materially than most of the people in the world. The negative impacts of climate change will be felt mostly by very poor people in developing countries. Arguments that we should not impose any restrictions on people's freedom to drive or fly out of concern for social justice miss the point and are frequently disingenuous. Nonetheless, it is reasonable to ask that policies to reduce the environmental impact of transport should not *disproportionately* impact the poor.

Of the various charging or taxation methods examined, VED is currently the least effective in restraining carbon emissions, notwithstanding its recent reformulation so that duty rates now reflect fuel efficiency. VED could be made more environmentally effective by increasing the rates or by allowing the rates on the least fuel-efficient cars to increase to reflect their greater carbon emissions.

Table 15 summarises the results of the various tax/compensation options for both reducing CO2 emissions and limiting the effects on low-income households or motorists. It can be seen that, in respect of increasing fuel duty, abolishing VED is a more effective approach to compensating poorer motorists than either subsidising public transport (which motorists tend not to use) or increasing benefits (which benefits non-motorists as well as motorists).

From an environmental point of view, it would be more effective to replace VED by a purchase tax graduated according to CO2 emissions. By effectively lumping together all the annual VEDs payable during a car's life into the purchase price, a significant difference in purchase price between low and high carbon vehicles would be created, which would be likely to influence purchase decisions more than when the payments are spread out over a number of years. However, although a graduated car purchase tax would be more effective than graduated VED at influencing vehicle-purchasing decisions in an environmentally favourable direction, it would not have much effect on vehicle use. It will encourage people to buy more fuel-efficient cars, but not discourage them from driving. Eriksson (1993) concluded that a combination of carbon taxes and a purchase tax based on carbon dioxide emissions was the best way to reduce emissions as car buyers substantially underestimate the cost of fuel in their purchasing decisions. Low-income motorists could avoid being made worse off if VED was replaced by a graduated car purchase tax by changing to more fuel-efficient vehicles.

Abolishing VED was also identified as the most effective way to compensate for congestion charging, which is the most sophisticated approach to the spatial consequences of traffic growth. It can vary the charge according to the expected driving conditions at any given time or place. It can be used to target urban motorists who have the most possibility to travel by public transport instead. Unfortunately, although congestion charging is effective at reducing congestion, it is less effective than fuel duty at restricting overall levels of traffic and their carbon dioxide emissions.

The Commission for Integrated Transport (CfIT 2002) has highlighted the argument that the marginal social costs of congestion are much greater than the marginal social costs of the pollution caused by cars. If the aim is to internalise external costs, then from the point of view of environmental economics, a congestion charge is better than fuel duty although it is less effective as an environmental measure.

Congestion charging may also be politically more acceptable than increasing fuel duty in the UK, even if VED were abolished to compensate. The public objection to higher fuel duty is frequently expressed in the form that people need an alternative before they can be taxed more highly for using their cars. The impact on those in rural areas would be emphasised, as it was during the protests in 2000. Congestion charging has the great advantage that it can be focused on places and times where there are public transport alternatives. People are not being penalised for something that is considered unavoidable, but being given an incentive to use public transport rather than their cars when possible. It is perceived as being much fairer.

A relatively small congestion charge that was compensated for with the abolition of VED would cut congestion significantly, but it would only reduce traffic and carbon dioxide emissions by 5 per cent at most (CfIT 2002), equivalent to a couple of years' traffic growth. As Foley and Fergusson (2003) argue, a congestion charge would need to be revenue raising in order to tackle traffic growth. The revenues that it would be necessary to raise to prevent traffic growth are substantial, of the same order of magnitude as the government spends on transport at the moment (Foley and Fergusson 2003). A revenue-raising congestion charge would mean that virtually all urban motorists would lose, although rural motorists would be only marginally affected. However, demand for public transport in urban areas would rise, requiring more investment rather than a decrease in VED, while demand for public transport in rural areas would fall as motoring would become cheaper there, making people in rural areas even more car dependent than they already are. In general, subsidies for public transport are an ineffective method of compensation for low-income motorists because most households that have cars hardly use public transport, but the experience in London shows that congestion charging can lead to a shift towards public transport when it is an easy alternative. A way to try to reduce the impact on low-income motorists would be to vary the size of the charge according to the size of the vehicle, although it would have only a limited effect because low-income motorists on average drive only slightly smaller vehicles than richer motorists. It is difficult to see how to restrain traffic growth through congestion charging without having some impact on low-income urban motorists.

As an alternative to taxation, emissions from households' transport and energy use could be limited through the use of DTQs. The paper shows that over two-thirds of households in the bottom two deciles, and nearly two-thirds of all households with pensioners and children, are made better off through a DTQ system involving motoring and household energy use that gives children half the adult quota. The percentages increase to around 90% if the DTQs involve motoring and aviation (reflecting the greater involvement of high-income households in these activities), except for households with children, when the percentage falls to 55%.

The conclusion from this research is that a system of DTQs covering motoring and aviation would be an efficient and progressive way of controlling carbon emissions from these sources. In their absence, and in a political context that makes increased fuel duties politically infeasible, at least partly because of their impact on low-income motorists, revenue-raising congestion charges could be used to control traffic growth and hence emissions, with low-income motoring households being compensated through the abolition of VED, and further compensation being given, if desired, through the benefits system. This could be combined with a charge on greenhouse gas emissions from aviation, as proposed by the European Parliament.

Table 15: Effects on households of various changes in taxation on motoring in order to reduce CO2 emissions

Tax/charge	Compensation method	Average effect on LIMs[1]	Mean annual change (£) (by decile number)	Percent gainers	Percent losers	Percent losing >£2 pw
Increase fuel duties (carbon tax)	None	Loss	1. –9.59 2. –8.30 3. –15.60 4. –17.88 All -25.43	na	36 35 51 58 63	na
Increase fuel duties	Abolish VED	Benefit LIMs: £38 pa LIRMs: £18 pa	na	na	30% (17%) in bottom 4 (2) deciles	na
Increase fuel duties	Subsidise public transport		1. +5.93 2. +5.47 3. –3.13 4. –1.39 All 0.00	33 31 26 24 25	32 30 44 50 54	na
Increase fuel	Subsidise buses and		1. +19.82	32	31	na

duties	coaches		2. +15.12 3. +6.75 4. +9.51 All 0.00	30 26 25 22	30 42 48 54	
Increase fuel duties	Increase means-tested benefits (100% take-up)		1. 43.68 2. 46.64 3. 34.32 4. 18.82 All 0.00	76.6 77.4 71.9 57.3 35.8	10.9 12.5 17.4 29.5 47.5	0.3 0.1 0.1 0.3 2.6
Reform VED (higher rates by CO2 emission)	None	Loss for those with large-engine vehicles	na	na	na	na
Graduated car purchase tax	Reduce or abolish VED	Loss for those with large-engine vehicles	na	na	na	na
Congestion charging (London)	None	Loss	1 & 2: All 0.1% Drivers 0.5% 5: All 0.5%			

			Drivers 0.8% 9 & 10: Drivers 0.4%			
Congestion charging	Abolish VED (reducing fuel duty not considered because it would increase emissions)	LIMs/LIRMs gain overall. Peak-time LIUMs could lose	na	na	na	na

[1] LIMs are low-income motorists; LIRMs are low-income rural motorists; LIUMs are low-income urban motorists

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Endnotes

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