Vehicle Purchase Taxes and Feebates

Introduction

This record of evidence forms part of the work undertaken by UKERC's Technology and Policy Assessment team relating to its project on policy strategy for carbon emissions reduction in the passenger transport sector. The material was produced alongside the project's main report and since it supports that report, it was judged appropriate to make this material available to a wider audience. The main report itself '*What Policies are Effective at Reducing Carbon Emissions from Surface Passenger Transport*?', and the supporting evidence can be found at:

http://www.ukerc.ac.uk/ResearchProgrammes/TechnologyandPolicyAssessment/TPAProjects.aspx

Explanation of Content

Evidence on this policy measure has been collected by the TPA team on the basis that it has, or may have, the potential to result in carbon dioxide emissions reductions in the passenger transport sector. This evidence document begins with a summarised description of the policy measure. The evidence itself follows the summary and is presented in table form.

Each piece of evidence has been assigned a separate row and tabulated using four columns:

- Year of publication, arranged chronologically, beginning with the most recent year
- Name of author, including where applicable additional cited authors (and year); and a Reference ID number.
- Type of evidence:
  - Evidence containing quantitative information is denoted by the letter 'Q'
  - Qualitative evidence is denoted by the letter 'C' for 'comment'
- The evidence itself

The evidence was originally gathered and assessed using several sub-headings. The purpose of this was primarily internal i.e. to facilitate the handling of evidence and the production of the main report. These sub-headings have been retained here as follows:

- Policy Measures and Carbon Savings
- Other potential CO_2 Impacts i.e. outside of the immediate policy influence
- Other Benefits e.g. air quality improvement or traffic congestion reduction
- Policy Costs and/or Revenues i.e. to local or national government
- Business and Consumer Costs
- Unintended Consequences e.g. rebound effect
- Reasons/Arguments for Carbon Savings Achievement or Failure
- Policy Suitability for the UK

A list of references follows the evidence tables. Note that the Reference ID numbers are allocated by Reference Manager, the referencing software used by the TPA team.

Any charts, figures and tables referenced in the evidence are not reproduced here but can be found in the original publication or evidence material.

Where no relevant evidence was found for a particular sub-heading, this has been noted.

Policy Description

The evidence recorded here covers taxes and incentives for vehicle purchasing but does not include company car or circulation taxes. Vehicle purchase tax is a charge that is levied when vehicles are purchased. The tax can be applied on the first purchase or at anytime the vehicle is bought and sold. The magnitude of a vehicle purchase tax is generally linked to purchase price or a vehicle characteristic – e.g. weight, power, class etc.

Virtually any vehicle purchase tax will have some influence on CO_2 emissions through decreasing demand for private cars. This section focuses on evidence of those vehicle purchase taxes which specifically aim to reduce CO_2 emissions per kilometre by linking the level of taxes directly or indirectly to this metric (indirect links include: fuel efficiency, engine size, power to weight ratio).

The evidence also covers 'feebates', a tax structure where buyers are offered a rebate for choosing lower emissions vehicles and are penalised for purchasing worse performing ones.

Evidence Tables

Carbon Savings and Policy Measures

Year	Author	Type	Evidence
2007	Anable and Bristow (ref 11297) citing Van den Brink and Van Wee, 2001	Q	In a modelling study in the Netherlands a car purchase tax policy based on fuel consumption would result in a 4% fuel consumption efficiency gain across the Dutch car fleet as a whole by 2010.
2007	Lane (ref 11328) citing IEEP, 2006 and McManus, 2007	Q	A California feebate gradient of £11/gCO2/km was estimated in a modelling study to reduce gCO2/km by 27%.
2006	Smokers (ref 11268) citing VROM, 2003	Q	The Dutch vehicle purchase taxation saved approximately 0.6-1 million tonne CO2/year– 2-3% total transport GHG sector in the Netherlands (Harmsen, 2003). The scheme offered consumers incentives to purchase cars in the two most energy efficient categories – rebates for category "A" cars were €1000 while category "B" car purchasers received a €500 rebate. In one year the market share of category A cars increased from 0.3% to 3.2%, while that of category B cars rose from 9.5% to 16.1%. The withdrawal of the incentive after 1 year resulted in a drop in market share, but their share still remained higher than the pre-incentive year.
2006	Smokers (ref 11268) citing ADAC, 2005	C	The Dutch energy efficiency rating system includes 7 energy efficiency classes from A to G, with additional coloured description from green via yellow to red, based on the relative energy efficiency (%). The energy efficiency classes are illustrated as arrows named from A

Year	Author	Type	Evidence
			to G and coloured from green, via yellow to red, similar to the format of the energy efficiency label, which is already used for household appliances. The relative energy efficiency is defined as the percentage to which the CO2 emissions of a car is higher or lower than a reference CO2 emission value. This reference CO2 emission value is calculated as follows: Reference CO2 emission value (g/km) = 0,25 x "Average CO2 emission value of all new passenger cars" + 0,75 x "Average CO2 emission value of all new passenger cars of the same size".
2006	Smokers (ref 11268) citing ADAC, 2005	Q	In Denmark, a fuel efficiency increase of 4.1 km/l for diesel vehicles and 0.6 km/l for gasoline vehicles was observed during the period a fuel efficiency based vehicle purchase tax was in place (1998 – 2002).
2006	Smokers (ref 11268) citing TIS, 2002	Q	There may also be an impact on CO2 as a result of reduced car ownership. Smokers (2006) cites an elasticity of -0.144 (from TIS, 2002) for response to vehicle purchase taxes (i.e. a 10% increase in vehicle purchase taxes would lead to 1.44% decrease in car ownership).
2005	Langer (ref 11241) citing CEC, 2002	Q	A US national feebate of $1825 per gallon per 100 miles was estimated to reduce new vehicle fuel consumption by 16% by 2010 and by 28% by 2020 .
2005	Greene et al. (ref 11427)	Q	In a modelling study Greene et al (2005) estimate that a $1000/0.01 gallon per mile feebate would overcome the market failure of consumers not taking account of lifetime fuel efficiency benefits. The effect of this feebate would be to raise light-duty vehicle MPG to 32 – approximately 24% improvement (assuming that the characteristics of vehicles other than fuel economy and price remain constant; and that manufacturers have had time to fully implement engineering and design changes to vehicles under a normal schedule of redesign and retooling).
2005	Potter et al (ref 11565)	Q	Countries where new car sales tax is linked to vehicle size or performance (crude proxies for efficiency), show on-road efficiencies[1] that are better than the UK (e.g. in Italy, Denmark and the Netherlands by 25%, 15%, 11% respectively). In the period 1970 to the mid 1990s fuel economy in the UK improved by 5%, with the Netherlands registering a 15% improvement and Italy a 20% improvement. [1]Average on-road car fuel economy measures actual fuel usage per vehicle km, based on data for total vehicle kilometres per year and fuel consumed per year. As such, some authors argue it is a more accurate measure of vehicle efficiency than new car fuel economy based upon a test cycle.
2003	Harmsen (ref 11449)	Q	The Dutch vehicle purchase taxation scheme saved approximately 0.6-1 million tonne CO2/year – 2-3% of

Year	Author	Type	Evidence
			total transport sector GHG in the Netherlands.
2003	Harmsen (ref 11449)	C	Studies have indicated that it is costly to reduce CO2 emissions by means of high registration tax, while a budget neutral CO2 differentiation of the road tax is less costly (Harmsen, 2003 citing Naturvårdsverket, 2002).
2002	COWI (ref 11264)	Q	In a modelling study COWI (2002) concludes that the purchase tax differentiation required to achieve 1 percentage point reduction in new vehicle gCO2/km of reduction in new vehicle CO2 emissions is €35-48/g CO2 for gasoline cars and €13-67/gCO2 for diesel cars.

Other CO2 Impacts

Year	Author	Type	Evidence
			No relevant evidence collected.

Other Benefits

Year	Author	Type	Evidence
1999	Johnstone (ref 1108)	C	A vehicle purchase taxes or feebate linked to fuel efficiency (or gCO2/km) is likely to also achieve a small reduction in emissions of hydrocarbons, nitrogen oxides and carbon monoxide.

Policy Costs and/or Revenues

Year	Author	Type	Evidence
2007	Anable and Bristow (ref 11297)	C	The setup and running costs of vehicle purchase taxes are low and likely to be offset by the revenue which is generated .
2007	Anable and Bristow (ref 11297) citing Jacobsen et al, 2003	Q	Vehicle purchase taxes can be very effective at raising revenue – the Danish vehicle purchase tax is estimated to have raised €2.1 billion in 2000.
2007; 2002; 1997	Greene (ref 11427); COWI (ref 11264); Koopman (ref 7677)	C	Feebate systems can be designed to be revenue neutral, revenue enhancing or a net cost to the government and net subsidy to industry and consumers (Greene, 2007; Koopman, 1997; COWI, 2002).
2006	Smokers (ref 11268)	C	In the long term, the increased fuel efficiency of vehicles due to vehicle purchase taxes or feebates can lead to a reduction in tax revenues from fuel excise duty.
2003	Harmsen (ref 11449)	Q	In 2001 the Dutch tax raised approximately €2.5 billion.

Business and Consumer Costs

Year	Author	Type	Evidence
2007	Greene (ref 11427)	C	Depending on how a feebate system is designed, some consumers/manufacturers will be net receivers of rebates while others will be net payers of fees.
2003	Harmsen (ref 11449)	C	The structure and size of vehicle taxes aim to affect the size and structure of the demand for vehicles, thereby inciting the supply side to accommodate these demand patterns by means of e.g. technological developments. Thus there will be transaction costs to manufacturers involved in adapting to new taxation structures (or changes in existing structures).

Unintended Consequences

Year	Author	Type	Evidence
2006; 2007	Smokers (ref 11268); Greene (ref 11427)	C	Vehicle downsizing tends to result in welfare loss (Smokers, 2006), particularly for families with children and rural families because of their tendency to prefer larger (and therefore less fuel-efficient) cars. However, Greene (2007) notes that most of the effect of vehicle purchase taxes is achieved through fuel efficiency, not vehicle downsizing.
2003	Harmsen (ref 11449)	C	If a new vehicle purchase tax (or changes to an existing tax) results in some people not being able to afford a car, they will suffer a welfare loss. However, feebates could be used as a remedy to meet this equity impact when seeking to (re-design) tax structures to incite the purchases of CO2 efficient vehicles.

Reasons/Arguments for Carbon Saving Achievement or Failure

Year	Author	Type	Evidence
2007	DfT (ref 11494)	C	Within the UK, there is a strong relationship between car ownership and use: households with cars travel further and more often by car.
2007	Johnson (ref 3003); and citing Greene et al., 2005 and Johnson, 2006	C	The political viability of feebates is reduced by their tendency to create a large disparity between the cost faced by larger/heavier vehicles and smaller/lighter vehicles (since weight is loosely correlated to fuel efficiency). Johnson (2007) points out that the primary market response to a fuel efficiency-based feebate would be to improve emissions technology, and only a small fraction (e.g., 5–10%) of the emissions reduction would come from consumers choosing smaller vehicles (citing Greene et al., 2005). Thus, the downsizing incentive provides little environmental benefit, but it significantly limits the feebate's political viability. Feebates could be constructed to focus the regulatory incentive more exclusively on technology e.g. emissions per vehicle tonne could be used

			as the tax base (Johnson, 2006).
2007	Anable and Bristow (ref 11297)	C	Purchase taxes can be more effective than vehicle circulation taxes because people tend to discount their costs in future years. If a vehicle circulation tax only applies to new vehicles, then it will take at least 10-15 years from the instrument is fully implemented until the full effect is obtained.
2006	Johnson (ref 3009)	Q	In a modelling study, Johnson (2006) found that a feebate could increase the marginal incentive to reduce emissions by a factor of 10 relative to a simple purchase tax. Eliminating the weight disparity allows for another factor of 3 increase.
2006	Langer (ref 11241)	C	Experience with feebates in Ontario, Canada highlights the need to ensure the scheme is visible to consumers, has strong differentiation and covers all vehicle classes.
2006; 2005	Smokers (ref 11268) citing Eriksson, 1993; Greene et al. (ref 11427)	C	There is an important market failure with respect to consumers' decision-making about fuel economy (consumers do not fully account for fuel savings over the life of a vehicle, tending to consider savings over the first three years only (Smokers 2006 citing Eriksson, 1993; Greene, 2005) which means vehicle purchase taxes based on CO2 emissions are likely to be more effective than information policies (Greene, 2005).
2005	Greene et al. (ref 11427) citing Gordon and Levenson, 1989	C	A key advantage of feebates over fuel economy standards is that they provide a continuing incentive to increase fuel economy as new technologies are developed (citing Gordon and Levenson, 1989). Contrast with fuel economy standards, where, once they are met, there is no incentive for manufacturers to make further increases.
2005	Wallis (ref 11564)	C	European countries with purchase tax regimes favouring smaller cars tend to have more fuel efficient national fleets compared to countries without the tax regime in place.
2003	Jacobsen et al. (ref 11566)	C	Vehicle purchase tax in Denmark has contributed to reducing the number of privately owned vehicles throughout the fleet as a whole, the average car size, and reduced the emissions of greenhouse gases, including carbon, associated with car usage (11566 Jacobsen et al. 2003).
2003	Kageson (ref 2003); and citing DRI, 1995	C	Vehicle purchase taxes would be more effective if they linked to fuel efficiency or gCO2/km in a non-linear (rather than linear) fashion because otherwise the tax paid will form a progressively smaller proportion of the total purchase price (citing DRI, 1995) of the vehicle (since the price of cars does not increase linearly with fuel consumption).
2003	Kageson (ref 2003	C	Purchase taxes can slow down renewal of the car fleet – and therefore delay new technology entering the market. This policy failure can be overcome by using feebates instead of a simple purchase tax.
2003	Harmsen (ref 11449)	C	The extent to which feebates could provide both a stable investment climate depends on how frequently changes are made to the vehicle tax systems as this would erode

			the credibility of government policy substantially with a possible consequent weaker effect of tax changes.
2002	COWI (ref 11264)	C	Given political constraints, feebates can create stronger incentives for consumers to purchase more fuel-efficient cars (or producers to introduce more efficient technology) than a purchase tax alone.
2002; 1999	COWI (ref 11264); Johnstone (ref 1108)	C	Vehicle purchase taxes based directly on a vehicle's specific CO_2 emissions (i.e. gCO2/km) will be more effective than taxes which are only indirectly linked (Johnstone, 1999; COWI, 2002).
1999	Johnstone (ref 1108)	C	Vehicle purchase taxes can be subject to political interference and distortion when they are applied in countries with powerful vehicle manufacturing lobbies.

Policy suitability for UK

Year	Author	Type	Evidence
2008	House of Commons EAC (ref 11511)	C	The UK House of Commons Environmental Audit Committee appears supportive of purchase taxes, and in particular feebates: "we further recommend that the Treasury examine the merits of some kind of "feebate" system, similar to the "bonus/malus" scheme in France, in which levies on high emission cars are accompanied by subsidies on low emission cars".
2007	Anable and Bristow (ref 11297)	C	The absence of major vehicle manufacturers in the UK reduces the political barriers to introduction of a vehicle purchase tax.
2007; 2006	Anable and Bristow (ref 11297); Smokers (ref 11268)	C	The European Union policy context is not conducive to introduction of new registration taxes. Although a proposal from the Commission for a Council Directive which would have phased out registration taxes (and force Member States to link circulation taxes to CO2 emissions) has not been accepted by the Council, it is still a clear indication that the European Commission perceives registration taxes to be an instrument which "impedes the proper functioning of the Internal Market". (Smokers, 2006; Anable and Bristow, 2007).
2007; 2006	Anable and Bristow (ref 11297) LowCVP (ref 11568)	C	The EU has expressed a preference for circulation taxes over purchase taxes/feebates, due to the latter's effects on competition in the intra-EU car market according to LowCVP (2006) and Anable & Bristow (2007).
2003	Harmsen (ref 11449)	C	A budget neutral CO2 differentiation of an existing tax scheme can be implemented within a relatively short time horizon, while it takes a longer implementation period to make substantial changes to the tax levels (often this would require a gradual implementation over several years).
1999	Johnstone (ref 1108)	C	Adaptation of existing taxes (i.e. vehicle excise duty and/or fuel excise duty) could make introduction of vehicle purchase tax more straightforward.

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