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INCENTIVES FOR CO2 EMISSION REDUCTIONS IN CURRENT MOTOR VEHICLE TAXES

This paper compares CO2-related tax rate differentiation in motor vehicle taxes in OECD member countries – drawing on information available in the OECD/EEA database on instruments used for environmental policy, www.oecd.org/env/policies/database.

The paper should be read in conjunction with the paper "The scope for CO2-based differentiation in motor vehicle taxes – in equilibrium and in the context of the current global recession", available at www.oecd.org/env/transport.

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FOREWORD

This paper, prepared by Nils Axel Braathen of the OECD Secretariat, compares CO₂-related tax rate differentiation in motor vehicle taxes in OECD member countries – drawing on information available in the OECD/EEA database on instruments used for environmental policy, www.oecd.org/env/policies/database.

The paper should be read in conjunction with the paper *The scope for* CO_2 -based differentiation in motor vehicle taxes – in equilibrium and in the context of the current global recession, available at www.oecd.org/env/transport.

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INCENTIVES FOR CO₂ EMISSIONS REDUCTIONS IN MOTOR VEHICLE TAXES

1. Introduction

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1. A number of OECD member countries are now applying some form of CO_2 -related tax rate differentiation in their taxes on either the purchase or the use of motor vehicles. There are also a number of countries where the tax rates in motor vehicle taxes depend on the fuel efficiency of the vehicles in question – which is closely linked to the CO_2 emissions caused.

2. The present paper compares the use of CO_2 - or energy efficiency tax rate differentiation in OECD countries at present. It should be read in conjunction with the paper *The scope for co₂-based differentiation in motor vehicle taxes – in equilibrium and in the context of the current global recession*, that discusses on a more theoretical basis "the role" of CO_2 -related tax rate differentiation in motor vehicle taxes.

2. Overview of current CO₂-related tax differentiation in motor vehicle taxes

3. Table 1 provides an overview of the use of CO₂- or fuel efficiency based tax rate differentiation in motor vehicle taxes in member countries, based on information available in the OECD/EEA *database on instruments used for environmental policy*, cf. www.oecd.org/env/policies/database.

4. In all, information is available regarding 16 such taxes in 14 member countries.¹ In three of these taxes, the tax rates depend on the fuel efficiency of the vehicles,² while in the 13 other cases, the tax rates vary with the CO_2 emissions per km driven. 9 of the taxes are levied one-off, at the time of the purchase or first registration of the vehicle, while the 7 others are recurrent, annual, taxes that the owners of the vehicles have to pay in order to be allowed to use their vehicles.

In addition, several Swiss cantons have introduced, or are planning to introduce, differentiation in recurrent motor vehicle taxes, with tax reductions for low-emission vehicles. See for example <u>http://etat.geneve.ch/dt/voiturepluspropre/accueil.html</u>.

² Given that the carbon contents of the fuels cannot be "cleaned" in any practical way, there is a direct relationship between fuel efficiency and CO_2 emissions.

		One-off or	CO ₂ or fuel	
Country	Name of tax	recurrent	efficiency	Comments
				Flat rate for diesel (petrol)
				vehicles using more than 10 (11)
Austria	Vehicle registration tax	One-off	Fuel eff.	litres per 100 km.
				Gradually increasing taxes for
				vehicles with low fuel efficiency.
				Until 31.12.08: Also bonuses for
Canada	Green Levy	One-off	Fuel eff.	vehicles with high fuel efficiency.
				Different, progressive, rates for
Denmark	Passenger car fuel consumption tax	Recurrent	Fuel eff.	petrol- and diesel-driven cars
				Tax as % of retail value:
Finland	Car tax – passenger cars	One-off	CO ₂	(0.1 * gram CO ₂ per km)+4
	Tax on vehicle registration for high			
France	CO ₂ emitters	One-off	CO ₂	Bonus – malus system
				2€ per gram CO₂ per km, above
Germany	Motor Vehicle Tax	Recurrent	CO ₂	120 gram per km (until 2011).
				Same, progressive rates for all car
Ireland	Vehicle Registration Tax	One-off	CO ₂	categories
				Same, progressive rates for all car
Ireland	Motor Vehicle Tax	Recurrent	CO ₂	categories
				Different, progressive, rates for
Luxembourg	Motor Vehicle Tax	Recurrent	CO ₂	petrol- and diesel-driven cars
				Information is lacking in our
Netherlands	Car registration tax	One-off	CO ₂	database.
				Same, progressive rates for all car
Norway	Motor vehicle registration tax	One-off	CO ₂	categories
				Different, progressive, rates for
_				petrol-, diesel-, LPG- and hybrid-
Portugal	Excise tax on motor vehicles	One-off	CO ₂	driven cars
_		_		Same, progressive rates for all car
Portugal	Motor vehicle circulation tax	Recurrent	CO ₂	categories
				Same, progressive rates for all car
Spain	Tax on vehicle registration	One-off	CO ₂	categories
		_		Different, fixed rates for petrol-
Sweden	Motor Vehicle Tax	Recurrent	CO ₂	and diesel-driven cars
United		_		Different, progressive, rates for
Kingdom	Vehicle excise duty	Recurrent	CO ₂	petrol- and diesel-driven cars

Table 1. CO₂- or fuel efficiency based tax rate differentiation in motor vehicle taxes

Source: www.oecd.org/env/policies/database.

3. Differentiation in one-off taxes on motor vehicle purchases

5. Differentiating motor vehicle purchase taxes according to the fuel-efficiency or the CO_2 emissions of the vehicle can give potential (and possibly 'myopic') vehicle purchasers an immediate incentive to buy a vehicle that causes relatively few CO_2 emissions when being used.

6. Figure 1 compares the tax rates (or bonuses) per vehicle applied in some countries, differentiated according to the number of gram CO_2 the vehicle (on average) emits per km it is driven.³ Austria⁴, Canada

³ In addition to the CO₂-related element, the *Motor vehicle tax* in Norway also contains a cylinder volume part and a kW-based part – that apply to the same vehicles. The total tax that a car purchaser would have to pay is thus *significantly* higher than what is described in this comparison – a comparison that only focuses on the carbon element embedded in the tax.

⁴ In order to compare the energy efficiency-based taxes in Austria and Canada with the CO₂-based taxes in other countries, it has been assumed that combustion of one litre of petrol leads to 2.3434 kg CO₂ emissions, while the corresponding figure for a litre of diesel is 2.682 kg CO₂ emissions.

and Portugal apply different tax rates for petrol- and for diesel-driven cars, and in order to simplify the presentation, tax rates for petrol-driven vehicles are shown in the upper panel, and tax rates for diesel-driven vehicles in the lower panel. In Austria, Ireland, Finland and Spain, the tax per vehicle also depends on the price of the vehicle. For illustration purposes, Figure 1 shows tax rates for vehicles with net-of-tax prices of either $10,000 \in$ or $25,000 \in$.





7. As *e.g.* can be seen in the case of Portugal, where there are differences in tax rates depending on the fuels used, tax-rates for diesel-driven vehicles are higher than the tax rates applicable for petrol-driven vehicles.

8. In order to highlight the differences between countries, Figure 2 zooms in on taxes and bonuses in the range -5,000 to 16,000 \in , for the case of petrol-driven vehicles. One can see that Canada, France and Norway give bonuses (subsidies) for the purchase of vehicles with relatively modest CO₂ emissions per km driven. In Canada, neither bonuses nor taxes apply for petrol-driven vehicles with emissions between 160 and 310 gram per km, while increasing tax rates are levied on vehicles with (*even*) higher emissions per km. In France, the bonuses gradually decrease, and increasing taxes are levied for vehicles with emissions larger than 160 gram CO₂ per km. In the Norwegian case, *rapidly* increasing taxes apply for petrol-driven vehicles with CO₂ emissions per km exceeding 120 gram per km.

9. While no bonuses apply for low-emission vehicles, *rapidly* increasing taxes also apply to vehicles with emissions higher than 120 gram per km in Portugal.⁵ In Ireland, relatively significant taxes are levied also on the vehicles with the lowest CO_2 emissions, with increasing tax rates applying in the range 120 to 225 gram CO_2 emitted per km driven. In Finland, the tax rates increase monotonically almost from zero CO_2 emissions per km, with tax rates for expensive vehicles being higher than the tax rates for cheaper vehicles. The tax rates increase with vehicle prices also in Austria, Ireland and Spain – but at lower levels than in Finland.



Figure 2. One-off vehicle taxes -- Tax per petrol-driven vehicle Tax rates as of 01.01.09

⁵ In both Norway and Portugal, the tax rates per vehicle rapidly exceed the upper "limit" of 16,000€ used in Figure 2.

10. By making assumptions regarding how far a vehicle is driven over its lifetime, one can also calculate tax rates expressed per tonne CO_2 each vehicle will emit over its lifetime. This is done in Figure 3, for petrol- and diesel-driven vehicles respectively – *assuming* for simplicity that all vehicles are driven 200,000 km over their lifetime.⁶

11. One can notice that while the tax per tonne of lifetime CO_2 emissions is *relatively* similar for vehicles that emit up to 170 gram CO_2 per km they are driven, vehicles that have higher emissions per km are strongly "penalised" in Norway and Portugal. One could argue that each tonne of lifetime CO_2 emissions causes the same environmental damage – and thus ought to be taxed equally – but to the extent that vehicles with large emissions per km are driven more over their lifetime than vehicles with lower emissions per km (thus invalidating the assumption that all vehicles are driven 200,000 km), some "penalisation" could be called for. Nevertheless, it is difficult to see arguments from an economic efficiency point of view for such a strong "penalisation" of high-emission vehicles as these two countries apply.

12. One can also notice that the tax per tonne of lifetime CO_2 emissions in (especially) Portugal is significantly higher for diesel-driven vehicles than for petrol-driven vehicles. While such a "preference order" makes good sense from a local air pollution perspective, it is difficult to see environmental or economic arguments for taxing equal lifetime CO_2 emissions differently, depending on the fuel type being used.

13. Figure 4 zooms in on bonuses and tax rates per lifetime CO₂ emissions in the range -200€ to 400€, in order to better show differences between (most) countries – in this case, for diesel-driven vehicles. One can distinguish between three groups of countries. Norway and Portugal are clear "outliers", with very high tax rates per tonne lifetime CO₂ emissions for vehicles with high CO₂ emissions per km driven. In Finland and Ireland, the tax rates for diesel-driven vehicles with net-of-tax prices like 25,000€ (about 100-150 €) are clearly exceeding the tax rates per tonne lifetime CO₂ emissions found in the remaining cases (where the rates in most cases vary between 20€ and 80€ for high-emission vehicles).⁷

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It is probably not realistic to assume that all vehicles are driven the same number of km over their lifetime – for example, small vehicles tend to be driven less than larger ones, and diesel-driven vehicles tend to be driven longer than petrol-driven vehicles. For vehicles actually driven *more* than 200,000 km over their lifetime, the real tax rate per tonne lifetime CO_2 emissions will be *lower* than shown in Figure 3.

A higher net-of-tax price than 25,000€ would yield even higher taxes than those depicted here.



Figure 3. One-off vehicle taxes -- Tax per tonne lifetime CO₂ emissions Petrol-and diesel-driven vehicles.



Figure 4. One-off vehicle taxes -- Tax per tonne lifetime CO₂ emissions Diesel-driven vehicles

4. Differentiation in recurrent taxes on motor vehicles

14. Differentiation of recurrent (annual) taxes on motor vehicle use in relation to the CO_2 emissions of the vehicles will also provide (potential) car owners with an incentive to choose a vehicle causing lower emissions than otherwise – but somewhat less directly so at the time of vehicle purchase than differentiated one-off purchase taxes. On the other hand, a recurrent tax also give owners of used cars an incentive to switch to vehicles with lower emissions, while this is not the case with one-off taxes.⁸

15. Figure 5 illustrates the use of CO_2 -related tax rate differentiation in recurrent motor vehicle taxes in the 7 OECD countries that apply such differentiation. One can see that these taxes are generally very modest for vehicles with CO_2 emissions below 100 (diesel) to 120 (petrol) gram per km driven. Beyond these emission levels, the taxes due per year increase significantly – and more so for diesel-driven than for petrol-driven vehicles in Denmark, Luxembourg and Sweden.

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Both types of taxes could also have impacts on net-of-tax prices for new and used vehicles, with higher taxes causing some downward pressure on net-of-tax prices.



Figure 5. Recurrent motor vehicle taxes -- Tax per year Petrol- and diesel-driven vehicles, tax rates as of 01.01.09

Note: In the case of Germany, the CO₂-related tax rate differentiation came into effect from 01.07.09.

16. By assuming that each vehicle is driven 200,000 km over its lifespan, and by also assuming that the lifespan of each vehicle is 15 years, one can also calculate tax rates per tonne CO_2 emitted by the vehicle over its lifetime. Figure 6 provides an illustration, with separate panels for petrol-and diesel-driven vehicles.





17. One can make several observations based on these graphs. One is that a flat tax rate per year for vehicles with CO_2 emissions over a certain limit, as applied in Ireland, UK and Portugal, (obviously) translates into a tax rate per tonne lifetime CO_2 emissions that decreases with increasing CO_2 emissions per km driven. Hence, in all three countries, the tax rates per tonne CO_2 emitted over the lifetime of a vehicle emitting 400 gram CO_2 per km is lower than the rate for a vehicle emitting 220 gram per km.

18. By comparing Figure 6 to Figure 3, one can also see that (with the exceptions of the very high one-off taxes on high-emission vehicles in Norway and Portugal) the tax rates per tonne lifetime CO_2 emissions tend to be higher in recurrent taxes than in one-off taxes.

19. However, no discounting of future tax payments has been made in Figure 6. In Figure 7, the impacts of four different discount rates on the present value of the tax payments over 15 years are illustrated, for the case of petrol-driven vehicles.



Figure 7. Recurrent motor vehicle taxes -- Tax per tonne lifetime CO₂ emissions -- Discounting Petrol-driven vehicles, 0%, 4%, 7% and 15% discounting

20. Clearly, applying a positive discount rate reduces the present value of recurrent motor vehicle tax payments. And while a 15% (real) discount rate would be considered very high in terms of *e.g.* a social cost-benefit analysis, it is not unconceivable that households actually apply such a high rate of discounting when considering choices between different motor vehicle models. If that is the case, the differences between the bulk of the one-off lifetime CO_2 tax rates of Figure 3 and the recurrent lifetime CO_2 tax rates of Figure 7 are relatively small.

21. To facilitate comparisons, Figure 8 illustrates tax rates per tonne CO_2 emitted over a vehicles' lifetime in one-off and recurrent motor vehicle taxes at selected CO_2 emission levels, for both petrol- and

diesel-driven vehicles. No discounting is used here regarding the recurrent taxes. Where tax rates in one-off taxes vary with vehicle price, a net-of-tax price of 10,000€ has been used.





5. Discussion and conclusions

22. The present comparison illustrates that some sort of CO_2 -related tax rate differentiation is now included in the motor vehicle taxes in a number of OECD countries, in particular in Europe. Such tax rate differentiation is applied in either one-off taxes on motor vehicle purchases or in recurrent taxes on vehicle ownership or use – and two countries (Ireland and Portugal) have such rate differentiation in both categories of taxes.

23. The comparisons made above make it clear that the tax rates applied per tonne CO_2 emitted over a vehicle's lifetime varies significantly between countries – with Norway, Portugal, Ireland and Denmark having particularly high tax rates for high-emission vehicles.⁹ While there are good reasons to increase the tax rates *per vehicle* (in the case of one-of taxes) or *per year* (in the case of recurrent taxes) with increasing CO_2 emissions per vehicle driven, it is more difficult to see strong reasons why the tax rate *per tonne lifetime* CO_2 *emissions* should increase with increasing emissions per km driven.¹⁰ Given the much lower marginal abatement costs for other CO_2 emission mitigation options in the respective countries (*e.g.* as regards industry – cf. the CO_2 emission permit prices in the EU's Emission Trading System, that have been below 15€ per tonne CO_2 in recent months), one can question why *so* strong incentives are provided in these countries to abate CO_2 emissions from some motor vehicles.¹¹

24. One can also notice that several countries apply different tax rates per tonne CO_2 emitted over the lifetime of petrol- and diesel-driven vehicles, with the higher rates being applied for the latter category. From a *local air pollution* perspective, it makes good sense to tax diesel-driven vehicles more heavily than petrol-driven ones. However, a given tonne of CO_2 does the same harm regardless of the fuel-type it is stemming from. Hence, one can again question the rationale for some of the current practices.

25. The price of a vehicle is not a good indicator of the environmental harm it causes. Hence, from an environmental point of view, the arguments for applying a higher tax rate per tonne CO_2 emitted from an expensive vehicle than from a cheaper one seem weak. It is probably equity concerns that explain the use of such tax rate differentiation in several countries.

⁹ The highest *total* tax rate per tonne CO₂ emitted over the vehicle's lifetime (776.5€) relates to vehicles emitting 226 gram CO₂ per km driven in Ireland.

¹¹ In addition, one should keep in mind that there are also separate CO₂ elements in the motor fuel taxes in several of these countries.

¹⁰ One possibility could in principle be that vehicles with high emissions per km driven tend to be driven longer distances over their lifetime than vehicles causing lower emissions per km. The Secretariat does not have data to confirm or reject this possibility – but the differences in km driven would have to be very large in order to "compensate" for some of the differences described in this note.

The taxes per tonne lifetime CO_2 emissions in some of these countries are also rather high compared *e.g.* to the development over time of the price that emitters would need to be charged for each tonne of GHG emissions to induce them to reduce emissions enough to keep global emission trends on track with a scenario that OECD recently elaborated, that stabilises the CO_2 concentration in the atmosphere at 450ppm, cf. www.oecd.org/dataoecd/31/55/41751042.pdf.