TØI report 434/1999
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Oslo 1999, 31 pages Norwegian language

Summary

Alternative systems for initial duty on passenger cars

The present system of levying an initial duty on passenger cars is progressive in terms of weight, engine volume and output, and affects the car buyers' choice of car and engine size. From economic theory, we know that a duty that influences allocations within the economy can give efficiency losses, and a general result from economic theory states that efficiency losses are minimised by levying the highest taxes on the least elastic goods (see, e.g., Atkinson & Stiglitz, 1987). Any system of duties should therefore be designed with this in mind. If it is incorrectly dimensioned, however, there will be an unnecessarily large loss of efficiency.

American studies of the car market indicate that demand for larger, and generally more expensive cars is less flexible than demand for small cars (see, e.g., Berry *et. al*, 1995 and Bordley, 1993). Since we have no similar Norwegian studies, and there is no reason to believe that this will differ significantly in Norway, we must assume that the current system of initial duty on passenger cars at least has the correct structure.

The purpose of this project has been to find out whether alternative forms of initial duties on passenger cars can influence allocations and produce economic, environmental and/or safety gains compared with the present system. In this study, we have evaluated four alternatives to the present system:

1. A revenue-neutral[1] specific duty
2. A revenue-neutral proportional system of duties
3. A revenue-neutral optimal system of duties.
4. A non-revenue-neutral fuel-/weight-based system of duties.

Background

As a response to high prices on safety and eco-friendly equipment in new cars due to taxation, the system of levying an initial duty on passenger cars was reformed in 1996. Instead of being levied on the car's weight and value, the new system is based on a combination of weight, cylinder volume and horsepower. The new system is strongly progressive as regards the vehicles' weight in kilograms, engine performance measured in kilowatts (kW)[2] and engine volume measured in cubic centimetres (ccm). One consequence of the change made to the system of duties has

[1] Revenue neutral med hensyn på engangsavgiften.
[2] 1 kilowatt (kw) = 1.36 horse power (HP)

therefore been that heavy cars with powerful engines are now subject to very high duties. The system of duties favours small cars and cars with small engines. The question is whether the taxation of large cars has become so strongly progressive that the system of duties generates an unnecessarily large efficiency loss, and if so, may it thus be justified on the basis of external effects.

Random investigations conducted by the National Institute of Technology (Bang, 1997), however, would tend to indicate that cars with large engines do not necessarily pollute more than cars with small engines. One explanation is that catalysts are designed to satisfy specific minimum emission requirements. In addition, cars with under-dimensioned engines will often be overstrained and fuel consumption will thus not be optimal.

Furthermore, a study by the Swedish insurance company FOLKSAM (1999) indicates that large cars on average provide better protection for passengers involved in collisions than small cars, a finding which is also supported by similar international studies (e.g. Euro NCAP).

Method

In order to study the effects of a reform of the system of levying duties on new passenger cars in a consistent and objective manner, we require a systematic framework and approaches to how the calculations shall be implemented in each individual segment of the new car market. In order to meet this requirement, we have developed a simple demand model for the new car market in Norway.

New car prices are exogenous and are calculated on the basis of import price, mark-up, initial duty and value-added tax. The model calculates the demand for each make of car based on these prices. The demand for each type of car is sensitive to all car prices, with special emphasis on cars within the same segment. Our division of segments follows the division in the FOLKSAM study, which has five segments, divided into small cars, large small cars, medium-sized cars, large cars and mini-vans. The model comprises 236 of a total of 900 different types of cars on sale in Norway in 1998. The 236 types of cars, distributed by make, model and variant, account for over 90% of the total Norwegian new car market in 1998.

From the prices and demand functions we can calculate the consumers' surplus,[3] mark-up, and revenue from the initial duty and value-added tax for the entire new car market and thus determine the economic surplus. By linking coefficients for emissions and collision safety to the demand functions, we have created a demand model that calculates average collision safety and emissions of CO_2, CO, VOC og NO_x from the total fleet of new cars. The total welfare effects consist of the economic surplus, emissions and collision safety. Emissions and safety are not calculated in monetary terms.

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[3] Consumers' surplus is the difference between the consumers' total valuation of goods measured in monetary terms (valued according to individual willingness to pay) and the amount they actually pay for the goods. Willingness to pay depend on both utility and ability to pay, and if there are differences in the ability to pay, there is a distribution problem. As an example, in the market for new cars, there is a correlation between income and the choice of car size.

Results

We have studied four alternatives to the present system of levying an initial duty on new cars. Three are revenue-neutral as far as the initial duty is concerned, while the fourth affects revenues. In the case of the specific duty, the fixed duty per car is set at NOK 80,800 so that the revenue from the initial duty remains unchanged. The three other alternative systems of duty are shown in tables 2–4. The present system are shown in table 1.

The most important results obtained from calculating the four alternative systems of duty, in terms of changes in emissions, collision safety and socio-economic effects, are shown in table 5. These effects are seen in relation to the present tax system.

Table 1 The present system of initial duty on new cars

Engine volume		Performance *		Weight	
< 1200 ccm	7,28 NOK per ccm	< 65 kw	95,27 NOK per kw	< 1150 kg	23,9 NOK per kg
1200 – 1800 ccm	19,07 NOK per ccm	65-90 kw	347,5 NOK per kw	1150 – 1400 kg	47,9 NOK per kg
1800-2200 ccm	44,84 NOK per ccm	90-130 kw	695,22 NOK per kw	> 1400 kg	95,7 NOK per kg
> 2200 ccm	56,03 NOK per ccm	> 130 kw	1176,7 NOK per kw		

**One kilowatt hour = 1,36 horse power*

Table 2. Revenue-neutral proportional system of initial duty on passenger cars

Weight duty, NOK per kg	27
Performance duty, NOK per kW	401
Engine volume duty, NOK per ccm	0

Table 3. Revenue-neutral optimal system of initial duty on passenger cars

Engine volume		Performance		Weight		Fuel consumption	
< 1200 ccm	NOK 0 per ccm	< 90 kW	NOK 407 per kW	< 1150 kg	NOK 16 per kg	< 0.5 litres per 10 km	1000 per dl
1200–1800 ccm	NOK 0 per ccm	90–130 kW	NOK 655 per kW	1150–1400 kg	NOK 47 per kg	0.5–0.85 litres per 10 km	1000 per dl
1800–2200 ccm	NOK 0 per ccm	>130 kW	NOK 896 per kW	> 1400 kg	NOK 65 per kg	> 0.85 litres per 10 km	1000 per dl
> 2200 ccm	NOK 0 per ccm						

Table 4. Fuel-/weight-based system of duty with no revenue-neutrality

Engine volume		Performance		Weight		Fuel consumption	
< 1200 ccm	NOK 0 per ccm	< 90 kW	NOK 0 per kW	< 1150 kg	NOK 20 per kg	< 0.5 litres per 10 km	2014 per dl
1200–1800 ccm	NOK 0 per ccm	90–130 kW	NOK 0 per kW	1150–1400 kg	NOK 80 per kg	0.5–0.85 litres per 10 km	5000 per dl
1800–2200 ccm	NOK 0 per ccm	>130 kW	NOK 0 per kW	> 1400 kg	NOK 95 per kg	> 0.85 litres per 10 km	5383 per dl
> 2200 ccm	NOK 0 per ccm						

The three revenue-neutral systems of duty are designed so that the economic surplus is maximised assuming certain conditions with regard to the structure of the duty system. It is assumed in the case of the specific duty that the duty is revenue-neutral and flat. In the proportional system, it is assumed that the duties shall be proportional and revenue-neutral, and in the case of the optimal system, it is only assumed that only the revenue will remain unchanged.

Maximising the economic surplus yields a system of duty with smaller differences between the initial duty levied on large cars with large engines and the initial duty levied on smaller cars with small engines. To meet the requirement of revenue-neutrality, lower duties on larger cars means that the duty levied on small cars is higher in the case of the three revenue-neutral systems. Since the fourth system does not require revenue-neutrality, we get almost exclusively lower prices, even for small cars with small engines. However, the reduction in duty levied on small cars will not be as great as the reduction in the duty levied on the larger cars.

The flat-rate, specific duty levied on all cars regardless of the elasticity of demand will not yield an optimal adjustment in the new car market. In relation to the present duty system, this leads to large reductions in the total economic surplus. On the other hand, levying a specific duty produces large reductions in emissions and improvements in collision safety, but this is because the system produces a dramatic reduction in the demand for new cars.

The two other revenue-neutral alternatives, proportional and optimal duties, will produce economic gains, lower emissions and increased collision safety in relation to the present system of duties. This indicates the possibility of welfare gains in both of these systems compared with the present system of duty. The disadvantage is that these systems would raise the cost of small cars and may perhaps have a socially unacceptable profile.

The last system of duty only takes into account fuel consumption[4] and weight, and both duty elements are progressive. Unlike the other three systems, this system will lead to a reduction in state revenues from the levying of an initial duty and value-added tax on new passenger cars. However, the system will yield great economic gains, and the demand for new cars will increase. For this reason, we will also see increased emissions from the new cars, but the increase will not be as great as the

[4] Fuel consumption is calculated on the basis of an EU mix, a driving cycle including both urban and rural driving. Standardised consumption figures for each type of car.

increase in demand. Seen in relation to the fact that there will be a shift towards large cars and larger engines, this would indicate that the larger engines do not necessarily pollute more than the cars with smaller engines, and that one may even see an environmental gain since engine performance will be better adapted to car size. Finally, this alternative would also produce improvements in average collision safety among new cars.

Table 5. Welfare effects of alternative duty systems for the initial duty in relation to the present initial duty for passenger cars

	Revenue-neutral specific duty	Revenue-neutral proportional duty	Revenue-neutral optimal duty	Non-revenue-neutral fuel-/ weight-based duty
Change in the total demand for new passenger cars	-15.7%	-4.6%	-2.8%	+2.6%
Socio-economic benefit	Mill NOK –1949	mill NOK +58	mill NOK +74	mill NOK +494
Change in duty revenue**	-0.8% * (-92 mill NOK)	0%	0%	-7% (-763 mill NOK)
Average collision safety	+30.6%	+10.6%	+6.7%	+6.2%
Emissions of CO_2	-11.5%	-2.7%	-1.7%	+2.5%
Emissions of CO	-14.2%	-4.8%	-3.8%	+0.3%
Emissions of No_x	-13.7%	-4.2%	-3.1%	+1.0%
Emissions of VOC	-14.4%	-4.8%	-3.6%	+0.4%

* Owing to reduced revenue from value-added tax

** The change in revenues from duties is included in the socio-economic gain in the row above

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