

Road pricing and welfare

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Abstract

The Dutch government has announced a new long-term transport policy in which road pricing plays a central role. This note analyses the welfare effects of a kilometre charge and a congestion tax as parts of a general road pricing system. These effects appear to be positive, but they could be increased by focussing more on welfare maximisation. Full recycling of tax revenues can ensure that motorists also enjoy benefits from road pricing.

Introduction

Recently, the Dutch Cabinet presented the National Traffic and Transport Plan (NVVP), which describes transport policies in the next decades (Ministry of Transport, 2000). The plan's starting point is that transport will remain an indispensable factor in modern society. The plan tries to ensure that growth of transport will contribute to (economic) welfare through reducing negative side effects such as congestion, traffic accidents and environmental damage. Unlike the previous long-term transport plan, NVVP is not focussed on the *size* of transport, but on the *negative aspects* connected to it.

This change of focus has come about, in part, by the limited success of previous policies. In those policies, pricing played a minor role in practice, although it was meant to be an important element of the policy mix. For several years now, the Dutch government has wanted to increase car fuel taxes, but this intention has been hampered by Dutch consumers going to Belgium or Germany to buy fuel. Plans for toll charges have been postponed year after year in the face of public resistance.

The new NVVP has a strong focus on pricing, while changing the basis for pricing from fuel use and specific tolls to road use in general. Road pricing is considered to provide an important incentive for a better usage of the present infrastructure, thus reducing the need for new infrastructure. Rush-hour tolls on strongly congested roads will – if they are introduced at last – be a first step in this direction.

NVVP does not rely on road pricing alone; it also describes other policies. In this note, however, we focus on NVVP's road pricing plans. First, we describe different motives for road pricing and their consequences for price levels. Next, we present the welfare effects of road pricing. Finally, we draw some conclusions.

Motives for road pricing

Optimal allocation

A central result of welfare economics is that social welfare is optimised if the prices of economic activities reflect all social costs, including external effects. By taking into account all relevant costs, economic agents automatically make socially optimal choices. By confronting each transport user with the marginal social costs of his decision to use transport, road pricing policy leads to greater economic welfare. The consequence of optimal allocation for the pricing of transport is that prices must reflect the marginal social costs. For the Dutch situation with a passenger car on gasoline (with catalytic convertor), this implies a charge of 3.5 € cents per passenger-km (excluding congestion costs), while the existing variable charges amount to 3 € cents per passenger-km¹ (Bruinsma et al., 2000; CE, 1999).

Total cost recovery

According to this motive, all social costs (fixed and variable) of transport have to be paid by the sector itself. This can be argued in two ways. First, the transport sector is regarded as a 'normal' *economic* branch, where in the long run all costs must be met by prices.² A second argument for total cost recovery is that it is considered to be fair that car users 'pay their way' (equity).

Looking at *total cost recovery*, the owner of a gasoline-powered passenger car seems to overpay in the Netherlands: the sum of fixed and variable charges amounts to 6.85 € cents per passenger-km, compared with estimated total social costs of 5 € cents per passenger-km, excluding congestion costs. However, the total costs of all other means of transportation of passengers and goods (train, van, aircraft, etc.) exceed the existing charges (Bruinsma et al., 2000; CE, 1999).

'Variabilisation'

This motive is aimed at reducing car use by shifting from fixed charges to variable charges. The resulting price per kilometre is determined by the current level of fixed costs. In the Dutch situation, 'variabilisation' of fixed costs for the passenger car on gasoline would imply an increase of the variable charges from 3 € cents per passenger-km to 6.85 € cents per passenger-km (Bruinsma et al., 2000; CE, 1999).

NVVP's motives

NVVP's motives for pricing seem to be a mixture of total cost recovery (apparently for reasons of fairness) and 'variabilisation.' In the sections of the plan in which the effects of road pricing are analysed, existing fixed charges have been partly substituted by a variable 'kilometre charge' (corresponding with the principle of 'variabilisation'). Table 1 shows how the charges resulting from NVVP 'variabil-

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Table 1 Kilometre charges based on variabilisation and on optimal allocation

	NVVP variabilisation	Optimal allocation ^a
	€ cents per vehicle-kilometre	
gasoline	2.5	1.8
diesel	6.1	4.3
LPG	6.5	5.6
total ^b	3.7	2.7

^a Marginal social costs minus existing variable charges based on CE (1999) and Bruinsma et al. (2000).

^b Weighted with annual car kilometres 1998.

Source: CPB, 2000 forthcoming

isation' are higher than those resulting from the optimal allocation motive. However, for specific types of cars the charge resulting from optimal allocation can be higher compared with the charge from variabilisation, depending on the valuation of the external environmental effects.

Effects of road pricing

NVVP aims at a kilometre charge and a congestion tax as parts of a general road pricing system that could, for instance, be based on a positioning system (for example GPS) – where the charge is dependent on the place and

time the vehicle is used. For analytical reasons, this note examines separately the effects of a kilometre charge and the congestion tax.

The full introduction of road pricing is slated for after 2010. Note that a number of technical and other problems remain to be solved before 'real' road pricing (as opposed to tolls) can be introduced. Also, the system costs (of devices, monitoring, etc) are as yet unknown. These uncertainties give road pricing a somewhat 'pie in the sky' character.

Kilometre charge

In the actual Dutch situation, not a single category of goods or passenger vehicle covers its variable external costs through payment of variable user charges. Thus, compared to fixed charges, the kilometre charge as proposed in NVVP ('variabilisation' of the Vehicle Circulation Tax and a part of the Passenger Car and Motorcycle Purchase Tax) could, in principle, increase welfare. However, the charge proposed is only differentiated with respect to vehicle weight and kind of fuel use. If the variable costs are meant to reflect the marginal social costs, further differentiation would be needed – for example, using environmental characteristics. Moreover, marginal rates should not be based on a fixed level of (present) revenues, but rather on the marginal social costs.

Table 2 Welfare effects of a kilometre charge and a congestion tax

	costs	revenues	net revenues before recycling	recycling	net revenues after recycling
	1	2	(3) = (2) - (1)	4	(5) = (3) + (4)
<i>billions of euros (constant 1997 prices) per year in 2020</i>					
Kilometre charge					
road users, incl. congestion	5.5 ^a	2.3 ^b	-3.2	4.1 ^c	0.9
government		3.5 ^d	3.5	-4.1 ^c	-0.6
external effects, excl. congestion		1	1		1
TOTAL	5.5	6.8	1.2	0	1.2
Congestion tax					
road users, incl. congestion	0.3 ^a	0.9	0.6	0.2	0.8
government		0.2	0.2	-0.2	
TOTAL	0.3	1.1	0.8	0	0.8
Total, incl. system costs					
road users, incl. congestion	5.8 ^a	3.1 ^b	-2.6	4.3	1.6
government		3.7	3.7 - SC ^f	-4.3	-0.6 - SC
external effects, excl. congestion		1	1	1	
TOTAL	5.8 + SC	7.8	2.0 - SC	0	2.0 - SC

^a Taxes paid and loss of welfare caused by the transport foregone.

^b Including benefits of less congestion.

^c Under the assumption that (ex-post) revenues of the kilometre charge are fully recycled through lowering other taxes paid by motorists.

^d Including the negative effect of the loss of existing government charges caused by the transport foregone.

^e Under the assumption that part of the kilometre charge is replaced by a congestion tax.

^f System costs (SC) of road pricing; not available.

Source: CPB, 2000 forthcoming.

Costs and benefits of a kilometre charge

The costs and benefits of the proposed charge per kilometre in the Dutch situation are illustrated in Table 2. Without recycling of revenues, motorists would suffer a welfare loss in 2020 of about 0.5% of GDP. But the 'variabilisation' of NVVP provides for a full recycling of revenues by lowering the fixed costs of motorists, resulting, on balance, in a welfare gain for motorists of about 0.1% of GDP. In this result, the reduction of congestion plays a major role. The reduction of external costs (less environmental damage and traffic accidents) is estimated to be almost 0.2% of GDP. Overall, the total welfare effect of the kilometre charge amounts to an annual welfare gain of about 0.2% of GDP. However, this result takes no account of the system costs of car use registration.

Congestion tax

NVVP proposes a congestion tax to be introduced from 2010 at all places and times of capacity problems. The introduction of such a tax can – together with a kilometre charge – lead to fully charging the marginal social costs. According to calculations presented in NVVP, the effects of a congestion tax on congestion are significant: in 2020, a reduction of 35% under the optimistic assumption of full ex ante information about times and places with capacity problems.

Table 2 summarises the welfare effects of the congestion tax. Under the assumption of full recycling of revenues (i.e. replacement of a part of the kilometre charge by the congestion tax), the annual welfare gain for motorists amounts to 0.1% of GDP. The effects are positive for different categories of road use (commuter, business, private, freight). The overall annual welfare gain of the congestion tax also amounts to 0.1% of GDP; this result, however, has to be reduced by the system costs. It should be noted that the welfare effects are concentrated in the regions suffering the most congestion.

Total effects

In total, road pricing as proposed in NVVP would yield a positive welfare effect of about 0.3% of GDP in 2020, to be reduced by (as yet) unknown system costs. This implies that the welfare effects, on balance, will be positive – if system costs are lower than about € 150 per car per year.

Conclusions

The road pricing plans of the new NVVP seem to increase welfare, although they are not actually inspired by a welfare motive but by other aims such as total cost recovery and keeping present tax revenues constant. NVVP's road pricing plans after 2010 (kilometre charge and congestion tax) lead to a welfare gain of up to € 2 billion per year (about 0.3% of Dutch GDP) in 2020. The welfare gains can be increased by gearing the price of road use more to the external effects caused. Full recycling of tax rev-

enues can ensure that motorists also enjoy benefits from road pricing.

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Notes

- ¹ Throughout this note existing charges are excluding VAT.
- ² It has been shown that the optimal allocation principle can lead to full cost recovery if certain rather restrictive conditions are met, such as optimal investment decisions by the owner of the road(s) (Hau, 1998). In the real world, however, these conditions are clearly not met. Therefore, the total cost principle has different implications for price levels than the optimal allocation principle.