Acceptability of road pricing and revenue use in the Netherlands

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Draft version

Barry Ubbels Erik Verhoef[1]

Department of Regional Economics
Free University
De Boelelaan 1105
1081 HV Amsterdam
The Netherlands
Email: bubbels@feweb.vu.nl

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Samenvatting

Acceptatie van prijsbeleid (inclusief gebruik van opbrengsten) in het autoverkeer in Nederland

Nieuwe vormen van prijsbeleid voor het wegverkeer worden over het algemeen niet acceptabel gevonden door het publiek waardoor veel voorstellen stranden in de planfase. Toch blijkt uit eerdere studies dat de mate van acceptatie wel degelijk beïnvloed kan worden. Met name de wijze van gebruik van opbrengsten die deze prijsmaatregelen opleveren blijkt belangrijk te zijn. Dit paper presenteert de resultaten van een onderzoek naar (de mate van) acceptatie onder Nederlandse weggebruikers. Het blijkt dat acceptatie over het algemeen niet hoog is, maar veel hangt af van de vormgeving van de maatregel en dan met name de wijze waarop de opbrengsten worden gebruikt. Een lage kilometerheffing met afschaffing van de huidige wegenbelastingen blijkt redelijk acceptabel te zijn. Belangrijke karakteristieken van de respondent die de mate van acceptatie verklaren zijn onder andere de opleiding, de ‘value of time’, financiële tegemoetkoming van de werkgever en het aantal kilometers dat jaarlijks wordt afgelegd.

Summary

Acceptability of road pricing and revenue use in the Netherlands

It is generally acknowledged that road pricing measures meet public resistance and that acceptability is nowadays one of the major barriers to successful implementation of new and more efficient pricing measures. Previous studies also suggest that the level of acceptance strongly depends on the way revenues are distributed. This paper presents the results of a survey asking for the opinion of Dutch commuters on acceptance of road pricing measures including revenue use. The results confirm previous findings that road pricing is in general not very acceptable and that revenue use is very important for the explanation of the level of acceptance. Road pricing is more acceptable when revenues are used for abolishment of existing car taxation or lower fuel taxes, indeed those targets that are in the direct interest of the respondent. For all types of measures it was found that education, the VOT of the respondents, financial compensation (partly or full) by the employer and the number of driven kilometers are important explanatory variables. Higher educated people, as well as respondents with a higher VOT, seem to find road pricing measures more acceptable than other people. The same holds for people that receive financial support for their commuting costs and for respondents driving many kilometers in a year.

1. Introduction

Road transport is known to generate considerable external costs, in particular in the form of congestion, accidents and noise. Governments use different types of measures to deal with these problems, pricing being one of them. Most countries rely on pricing mechanisms such as fuel duties, registration fees and parking charges. This current charging regime however, is not very efficient. Economists have advocated the use of more appropriate pricing tools for a long time by demonstrating the welfare gains. Nevertheless, these more efficient road pricing measures have up till now only seldom been implemented in practice. The low level of implementation is nowadays not so much caused by technical or administrative problems. It is generally acknowledged that pricing measures meet public resistance and that acceptability is nowadays one of the major barriers to successful implementation of new and more efficient pricing measures (MC-ICAM, 2003).

Transport pricing schemes have the double consequence of discouraging transport use, at least at certain times on certain parts of the network, and of transferring cash from private persons to other (often public) funds. The fact that road pricing – at least before recycling of revenues – involves such a transfer of cash from private travelers to public institutions, is likely to be a major impediment to its public acceptability. The implementation of efficient road pricing policies typically affects equity in a way that policy makers and/or the general population are likely to disapprove of. Therefore, to render pricing schemes politically and publicly acceptable, it seems desirable to 'recycle' the revenues generated in such a way that most population subgroups at least equally well off. The destination and distribution of these revenues may be used to gain public and political acceptance. However, acceptability objectives of revenue recycling may conflict with efficiency goals (Mayeres and Proost (2001) suggest for instance that using revenues for public transport investments may decrease the welfare benefits obtained by the pricing measure alone).

The Netherlands has a long experience in developing new road pricing proposals to reduce the increasing levels of congestion. None of these plans has ever been implemented mainly due to low levels of public acceptance. It is therefore interesting to investigate the issue of acceptance of road pricing and use of revenues in this country. This paper reports on the acceptability of new road pricing measures among Dutch commuters facing congestion on a regular basis.

This paper is organised as follows. Section 2 discusses previous literature results on the acceptance of road pricing and the role of revenue use. Many public concerns can be identified which policy makers should take into account when thinking about implementation of road pricing. Acceptance is influenced by the way in which revenues are used, various possibilities exist, all with different consequences. Section 3 outlines the empirical survey conducted in the Netherlands and presents some first results from the data analysis. We try to identify important explanatory variables for the level of acceptance for different types of road pricing measures and find the preferred destination of the revenues. Section 4 concludes.

2. Acceptability and Revenue Use in Literature

In modern societies private cars play a very important role in satisfying existing mobility demands. But current car traffic also causes serious problems like congestion, pollution, noise and accidents. Theory of transport economics detects the problems as one of negative externalities: since marginal social costs exceed the marginal private costs, demand is too high. The standard theoretical economic solution is to internalise these external costs by raising the price of usage of the externality. It is therefore remarkable surprising that such pricing instruments are applied so seldom, because efficiency means that everyone is potentially better off and that the winners are able to compensate the losers. When we focus on congestion pricing, various explanations can be given for the fact that the measure is only rarely implemented in practice. The regulator may face different types of constraints ranging from practical (and technical) ones to institutional and acceptability constraints. However, we have now reached the situation where the major barriers to the successful implementation of transport pricing strategies relate largely to lack of stakeholder and political acceptability, rather than to technical or administrative problems. Since raising prices is generally disliked by the respective user group, the acceptance of pricing policies is often low. But pricing also generates revenues, which one can use for many purposes, including influencing the public acceptability of pricing. In this section we focus on revenue use and acceptance of road pricing, and not so much on the welfare consequences. We refer to Mayeres and Proost (1997 and 2001) and Parry and Bento (2001) for analyses of welfare effects of road pricing and redistribution of revenues in a general equilibrium framework.

2.1 Acceptability and the Implementation of Transport Pricing Measures

Many attempts have been undertaken to introduce urban road pricing around the world over the last 40 years, and many of them have failed. Examples of schemes that have never been implemented include Stockholm, Hong Kong and the Netherlands. In most cases extensive studies had demonstrated the technical feasibility and economic benefits of introducing the scheme, but the problem was public and political acceptability. This aspect has apparently received inadequate attention in the belief that a scheme which showed strong social and economic benefits would sell itself.

It is vital for the design of any transport pricing measure that, in addition to devising a technically robust system, an understanding of the reason for implementation among the public and politicians has to be realised.

Despite the fact that politicians and the public regard traffic problems in cities as a very important and urgent issue, people may have several concerns about road pricing. Besides the views and intentions of the persons affected by the measure, also responsible political agencies as another key group have to be taken into account. Politicians may have the feeling that transport problems have to be solved by using some form of pricing measure. They are often initiators of the measure, which may be adapted to specific local circumstances. Therefore the opinions and the acceptability on the local political level is of great importance for the implementation of specific measures. The TransPrice project concludes that the lack of political willingness to implement charging measures stems from a perceived low acceptability of the electorate for such measures (TransPrice, 1999). Despite the fact that political acceptability is necessary, we will focus on public concerns to pricing measures. The policy maker should consider these before implementing pricing measures of any kind. The public concerns often mentioned include (Jones, 1998):

- It is difficult for drivers to accept the notion that they should pay for congestion, it seems irrational and inappropriate;
- Car users feel that urban road pricing is not needed, it is a publicly provided good that is free at the point of use;
- Pricing will not lessen congestion, it is an ineffective measure because drivers will be inelastic to road charges;

- The measure will result in unacceptable privacy issues. This issue played an important role in the discussion on kilometer charging in the Netherlands;
- Road pricing will face implementation problems such as unreliable technology and boundary issues;
- Road pricing is considered to be unfair.

In order to meet these concerns and to obtain some level of acceptability and make a transport pricing measure more likely, policy makers should consider some general rules. Research, for instance, suggests that the use of revenues is important. Verhoef (1996) asked morning peak road users about their opinion on road pricing. An overwhelming majority (83%) stated that his or her opinion depends on the allocation of revenues. The opinion of businesses on the other hand seem to depend very much on the perceived effectiveness with regard to time savings. An analysis of the economic effects of road pricing in Utrecht (the Netherlands) indicates that companies are positive as long as time savings are expected to compensate for road pricing costs (see PATS, 1999). However, these businesses do have their doubts whether road pricing would be really effective and decrease the level of congestion.

A number of guidelines to a more successful implementation can, taking these research issues into account, be suggested (CUPID, 2000):

- Pricing strategies should be perceived as very effective solutions. The effectiveness of road pricing may be high but this is not guaranteed and depends on the definition of objectives. These objectives must be highly valued by the public. Moreover, people must also believe that their change in behavior will contribute to reach these objectives;
- Revenues should be clearly hypothecated and alternatives have to be provided. People want to get something for their money.
- Fairness issues have to be considered, the system must be perceived as fair in terms of personal benefits and costs. The use of revenues together with the charging structure is important to influence the distributional impacts in the desired direction. Governments could use the revenues to reduce taxation, or they could target particular disadvantaged groups or locations, as is done in Switzerland (Banister, 1994). However, the question still remains whether the public can be persuaded that equity concerns have been accommodated. Guiliano (1993) argues that, no matter how the revenues are distributed, some individuals may still be worse off, since congestion tolls do not lead to strict Pareto improvements.

These issues reveal that it is necessary to develop an intelligent communication strategy. Clearly describing the problem (the presence of externalities in the case of road pricing) and the solutions to this problem with the objectives seems appropriate.

2.2 Acceptability and the Use of Revenues

Various studies have paid attention to the awareness, perceived effectiveness and acceptance of transport policy measures including pricing. Bartley (1995) for instance finds that road and congestion pricing are generally not regarded as acceptable. Improvement of public transport is the most acceptable policy according to his findings, followed by measures which restrict driving possibilities. In another study Jones (1998) finds that road pricing is not publicly acceptable unless the money raised is hypothecated for local transport and environmental projects. Some studies report on the acceptance levels of practical experiences with road pricing. The Norwegian experience with the implementation of the toll ring indicates that attitudes may differ before and after opening. The majority of the population was negative towards the proposal (around 70%), whereas this picture changed after opening (PROSAM, 2000). When the system had been operative for one year, the opposition reduced to 64%. The share being positive to the toll system has steadily increased over time, from 30% before opening to 46% in 1998.

After an analysis of empirical studies Rienstra and others (1999) draw the general conclusion that the opinion of respondents on price measures strongly depends on the way revenues are distributed. This is in line with the previous mentioned findings of Verhoef (1996). He asked for the public opinion on a number of possible allocations of revenue spending on a five point scale, varying from a very bad allocation of revenues to a very good allocation. The allocation objectives that are in the direct interest of the road users received most support, as may be expected. Road investments, together with lower fuel and vehicle taxes (variabilisation) received the highest average score. General purposes, such as general tax reductions and the government budget in general, obtained least support from morning peak road users in the Netherlands. The AFFORD study reported similar findings from an empirical survey on public acceptability of different pricing strategies in the four European cities of Athens, Como, Dresden and Oslo (Schade and Schlag, 2000). It was found that common purposes of money use like e.g. traffic flow and public transport improvements are favoured by a vast majority of respondents. Lowering vehicle taxes is supported by the people, whereas lower income taxes is not acceptable as revenue spending target. This study has also analysed the factors influencing the degree of acceptability of pricing measures. It appears that revenue use is not a very important factor. In particular, variables such as ‘social norm’, ‘perceived effectiveness’ and ‘approval of societal important aims’ are positively connected with the acceptability of pricing strategies.

2.3 This survey

This paper analyses the acceptance of road pricing measures and the distribution revenue use by Dutch commuters that face congestion. It not only focuses on average acceptance scores (as is done in the previous mentioned studies), we also try to explain this level of support. It is for instance likely that the support for measures is influenced by personal features of the respondent (age, income, education, etc.).High income earners may be less opposed to price measures in order to reduce congestion than people with lower incomes, because their value of time is higher. Since we have asked for the value of time (see also section 3) and many other variables that may have explanatory power, it is possible to analyse the impact of these different variables on the support for policy measures. Rienstra and others (1999) have done a similar type of study, however, this study analysed the support (together with effectiveness and problem perception) for transport policy measures in general and not in particular for road pricing. They find that several personal features and the perceived effectiveness have a significant impact on the respondent’s support for policy measures in transport. High levels of support are found with persons who are older, highly educated, now owing a car or having a driver’s license, or are members of higher income groups. Our approach is different since we focus specifically on road pricing measures and the sample consists of car drivers facing congestion.

3. Acceptance and Revenue Use in the Netherlands

3.1 Data collection

The data used in this paper have been obtained by conducting an (interactive)internet survey among Dutch commuters. The questionnaire can roughly be divided into three parts. First, we asked for some socio-economic characteristics of the respondent (such as education and income). In order to analyse the behavioural responses to road pricing we developed a stated choice experiment, which is the second part of the survey. And finally we asked for the opinion of the respondents on several carefully explained road pricing measures. The first and the second part was answered by 1164 respondents, whereas the latter sample (opinion questions) consisted of 564 respondents. This paper will present some outcomes of the analysis of this latter part of the survey. Although we have also posed questions on the fairness and the effectiveness of the measures, we will here focus on acceptability of road pricing and revenue use.
The data collection was executed by a specialised firm (NIPO), who have an internet panel of over 50.000 respondents. Since the survey was aimed at respondents that use a car for their home to work journey and also face congestion on a regular basis, we selected working respondents, which drive to work by car two or more times per week, and who face congestion of 10 or more minutes for at least two times a week. This resulted in a total of about 6800 possible respondents. An initial analysis revealed that a random sample would result in a relatively low number of women and lower income groups. Because the behaviour of lower income people is important to analyse, it was decided to 'over sample' the lower income groups and create an equal number of respondents over the various income classes. The data were collected during three weeks in June 2004.

3.2 Survey

As previously explained, the survey started with some general questions asking for important explanatory variables of the respondent. These variables may help explain the differences in acceptance levels. Most variables are explained in Table 1, except for the value of time of the respondents (VOT). This value was derived from a question posed in the stated choice experiment. The respondents were asked to make a choice between four different alternatives, differing in tolls, travel time and departure time (constant arrival times were used, equal to the respondents' preferred arrival time). Because the question allowed the respondent to distribute 10 trips over 4 alternatives, a rather precise point estimate of an individual's value of time can be made once additional assumptions are made concerning the average value of time implied by the choice for one of the 4 alternatives (for a more detailed derivation we refer to appendix 2).

Table 1: Explanation and population share of explanatory variables of data set (N=564)

Variable	**Type**	**Levels**
Gender	Dummy	Men (75,2%); Woman (24,8%)
Age	Dummy	Age1: 18-25 (7,3%), Age2: 26-35 (39,7%), Age3: 36-45 (28,2%), Age4: 46-55 (18,1%), Age5: 56+ (6,7%)
Education	Dummy	Edu1: primary (15,6%), Edu2: junior general secondary (MAVO) (6,0%), edu3: intermediate vocational (MBO) (24,8%), edu4: senior general secondary (HAVO/VWO) (9,4%), edu5: Bachelor (31,9%), edu6: Master (12,2%)
Income (gross yearly)	Continuous	
Place of residence (region)	Dummy	Loc1: 3 large cities (17,9%), loc2: rest west (33,9), loc3: north (3,7%), loc4: east (23,9), loc5: south (20,6%)
Family size	Dummy	Fam1: 1 person (23%), fam2: 2 (31,6%), fam3: 3 (18,3%), fam4: 4 (18,3%), fam5: 5 (7,6%), fam6: 6 (1,2%)
Number of children younger than 11	Dummy	Childno: 0 (72,5%), childyes: 1 or more (27,5%)
Type of measure	Dummy	Measure 1A to 1D, 2A to 2G, 3A to I (see app. 1)
VOT	Continuous	
Weight of the car	Dummy	Weight1: low weight (22,7%), weight2: middle class (67,2%), weight3: heavy (10,1%)
Yearly number of kilometers driven	Continuous	
Compensation of costs by employer	Dummy	Comp1: none (11,9%), comp2: partly (43,8%), comp3: completely (44,3)
Travel time with congestion/free flow travel time	Continuous	

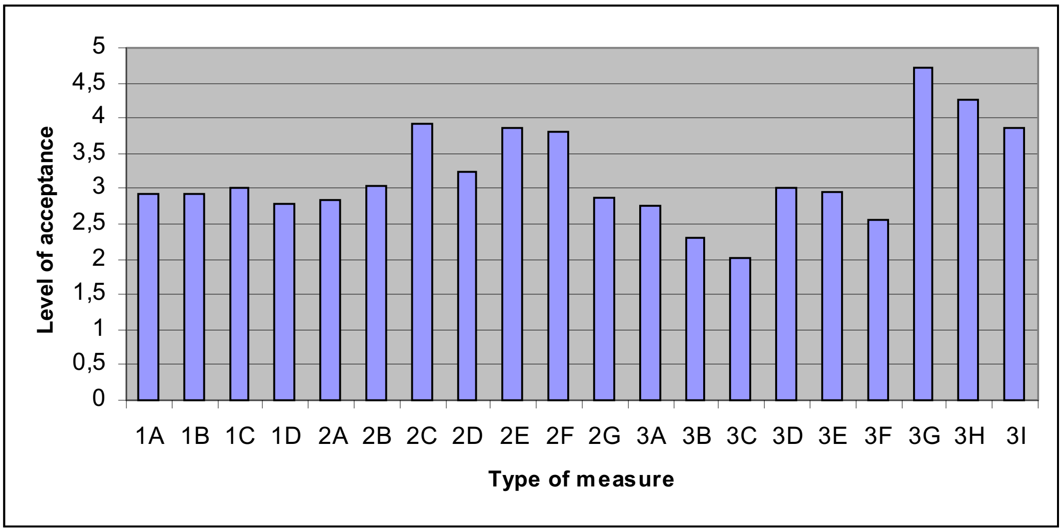
The respondent was confronted with three different types of road pricing measures. After a concise description of each measure, the respondents' opinion on various issues was asked including the level of acceptance ranging from very unacceptable to very acceptable (on a scale from 1 to 7). Not each respondent had to evaluate the same type of measure. Within each type of measure, we have developed various alternatives differing on type of charge (measure 1), type of revenue use (measure 2) and level of charge plus revenue use (measure 3). This resulted in 4 different alternatives for measure 1, 7 different alternatives for measure 2, and 9 different descriptions of type 3 measure (a detailed description can be found in appendix 1). All alternatives have been randomly divided over the respondents. This means that we obtained about 140 observations for each type of measure 1, 80 for measure 2, and 60 for measure 3. A short introduction preceded the explanation of the measures. This was to explain that one should imagine the implementation of the measures in the Netherlands. It was also to be assumed that the privacy of car users is guaranteed, electronic equipment registers the toll and the driver can choose freely the payment method (e.g. credit card, bank transfer etc.).
In addition, we have asked the respondents to evaluate the acceptance of different revenue uses separately (without mentioning the road pricing measure).Six different revenue use options were presented to the respondent: the treasury of the government (and hence be used for other options than transport), new roads, improvement of public transport (e.g. increase of frequencies), a removal of existing car ownership

taxes, a decrease in fuel taxation and a decrease of income taxes. Again, for each option, a 7-point acceptability scale was used.

3.3 Methodology and results

Before explaining the level of acceptance (and the method applied) we start with a presentation of the acceptance levels for each single measure. Figure 1 shows the mean acceptance outcomes. Measure 1 (congestion charge with revenues for new roads) is for all alternatives not very acceptable. The level of acceptance differs significantly between the various alternatives of measure 2 (kilometer charge based on weight of vehicle with different revenue use destinations). Especially measures 2C (new roads and less car taxation), 2E (abandoning of road taxation) and 2F (lower fuel taxes) have higher acceptance levels. But, a score of 4 still means that the respondents are indifferent. Measure 3 has 9 alternatives, combinations of three different levels of the kilometer charge with three different revenue use options. This explains the pattern that is shown in Figure 1. Apparently the respondents prefer revenues to be used for abolishment of car taxation over that of new road and an unclear destination. A charge of 2,5 €cent is more acceptable than higher charges of 5 and 7,5 €cent, as may be expected. Measure 3G has the highest mean (4,71) which comes close to an average score of 5 ('slightly acceptable').

Figure 1: Mean acceptance scores on each single measure (level 1 = very unacceptable; level 7 = very acceptable)



Methodology

Various econometric techniques are available that can be used to investigate the relation between various variables. The methodology to be applied depends to a large extent on the structure of the data. Here, the aim is first to explain the level of acceptance for the various measures, where the dependent variable consists of a choice out of an ordered set of acceptance alternatives. Given this framework, the ordered probit (OP) technique seems to be most appropriate (see for an explanation of OP Maddala (1983)). Ordinary Least Squares (OLS) is less appropriate but has the advantage that the coefficients are more easily interpretable. Hence, the results of OP estimations will be presented here, for a comparison with OLS outcomes we refer to the appendices.

What explains the differences in levels of acceptance? In order to analyse the responses we have estimated an ordered probit model for each type of measure. The underlying response model is of the form (see Maddala, 1983):

$$ACC^* = \beta' X_i + \varepsilon.$$

The underlying continuous response variable ACC* is unobserved, X is the set of explanatory variables, and ε is the residual. The observed discrete response variable ACC is related to ACC* as follows:

$$\begin{array}{ll} ACC = 1 & \text{if } ACC^* \leq 0, \\ ACC = 2 & \text{if } 0 < ACC^* \leq \mu_1, \\ ACC = 3 & \text{if } \mu_1 < ACC^* \leq \mu_2, \\ \vdots & \\ ACC = 7 & \text{if } \mu_6 \leq ACC^*. \end{array}$$

The μ's (threshold values in the model output) are unknown parameters to be estimated with β, and the model assumes that ε is normally distributed across observations. The constants μ therefore divide the domain of ACC* into 7 segments, which corresponds with observations of the discrete response variable. The model estimates probability intervals for the seven possible answers:

$$\Pr ob(Z_{ij} = 1) = \Phi(\mu_j - \beta' X_i) - \Phi(\mu_{j-1} - \beta' X_i)$$

where Φ is the cumulative standard normal. The interpretation of the estimated coefficients is not straightforward. The estimated coefficients for the included explanatory variables can be interpreted as indications of shifting the distribution to the left or the right depending on the sign of the β's. Assuming that β is positive, this means that that the probability of the leftmost category (in this case ACC=1) must decline. At the same time we are shifting some probability into the rightmost cell (ACC=7). But what happens to the middle cells is ambiguous and is dependent on the densities. Hence, we must be very careful in interpreting the coefficients in this model (see Greene, 1993). The values of the coefficients can only be interpreted relatively, a larger value denotes a large impact.

Measure 1: Electronic toll on daily bottlenecks with fixed revenue use (new roads)

After having tried various specifications of the model for measure 1 (by including variables that may be expected to have some explanatory power), Table 2 presents the best result. The first row presents the estimates for the thresholds values allowing the model to determine the probability intervals. The second row presents all explanatory variables that have been included in the estimation. It appears that the individual's value of time (VOT), higher levels of education, number of kilometers driven by the respondent and compensation of costs by the employer have a significant impact on acceptance. Most signs of the coefficients are as expected, for example, respondents with higher value of time tend to have higher acceptance levels of an electronic toll on daily bottlenecks. In addition, commuters that have to pay the toll from their own expenses tend to find the measure less acceptable than drivers receiving full compensation. Income is not significant, one explanation may be that VOT and education (both correlated with income) take up this effect. On the other hand, the type of measure, living in one of the three larger cities (loc 1) and the weight of the car seems not have an important effect. The different types of bottleneck charging measures have no significant effect on acceptance of the respondent. It makes no difference whether it is a charge at all times (m1A), a peak time charge (m1B) or a differentiated peak charge (m1C).

Table 2: Results of ordered probit analysis with the acceptance of measure 1 as dependent variable

Variable	Probit ACC measure 1	Sign.
Threshold (µ's as explained)		
ACC=1	-.168 (.435)	
ACC=2	.828 (.436)	*
ACC=3	1.207 (.437)	***
ACC=4	1.498 (.438)	***
ACC=5	2.255 (.443)	***
ACC=6	3.632 (.508)	***
Gross yearly income	9.561E-03 (.020)	
VOT	4,828E-04 (.000)	***
Gender	.237 (.176)	
Edu2	-6.655E-02 (.220)	
Edu3	8.734E-02 (.149)	
Edu4	.321 (.189)	*
Edu5	.389 (.147)	***
Edu6	.675 (.183)	***
Loc1	-6.626E-02 (.118)	
Childyes	2.575E-02 (.109)	
Age1	-.300 (.244)	
Age2	-.346 (.196)	*
Age3	-.258 (.204)	
Age4	-.392 (.205)	*
Travel time in congestion/free flow tt	8.167E-02 (.073)	
M1A (charge of € 1)	8.320E-02 (.132)	
M1B (charge of € 2during peak)	.108 (.124)	
M1C (peak time charge)	8.329E-02 (.130)	
Yearly driven number of kilometers	-3.978E-06 (.000)	**
Comp1	-.398 (.157)	**
Comp2	-.131 (.103)	
Weight1	.144 (.177)	
Weight2	.221 (.154)	
N	564	
Log-likelihood	-917.171	***
Pseudo R-square	Cox and Snell	.110
	Nagelkerke	.114
	McFadden	.035

Notes: The standard errors are shown in brackets. *, **and *** denote significance at the 10, 5 and 1% level, respectively, (two-sided *t*-test).

Measure 2: Kilometre charge differing on vehicle weight with different revenue use

Table 3 shows the estimation results for the second measure. We have included the same explanatory variables as in measure 1. Again we see the importance of the VOT, education, compensation of costs by the employer and the driven number of kilometers. A striking difference with the previous estimation is the explaining impact of the type of measure. Measure C, E and F obtain significantly more support than measure G, but also when we compare it with the other alternatives of this measure (looking at the size of the coefficients). This suggests that when revenues from the charge will be used to lower or abandon existing car taxation (m2B and m2E) or fuel taxes (m2F), more public support is obtained. Age seems to be more important in this estimation. Older people tend to find this measure relatively more acceptable than younger drivers (although not for the youngest group). The weight of the car does not have a significant impact despite the fact that this measure differs on this characteristic.

Table 3: Results of ordered probit analysis with the acceptance of measure 2 as dependent variable

Variable	**Probit ACC measure 1**	**Sign.**
Threshold (μ's as explained)		
ACC=1	-.894 (.437)	**
ACC=2	-.138 (.436)	
ACC=3	.159 (.436)	
ACC=4	.459 (.436)	
ACC=5	1.059 (.438)	**
ACC=6	2.187 (.450)	***
Gross yearly income	-1.594E-02 (.02)	
VOT	3.588E-04 (.00)	***
Gender	.257 (.175)	
Edu2	-.171 (.219)	
Edu3	.116 (.148)	
Edu4	.180 (.188)	
Edu5	.254 (.146)	*
Edu6	.488 (.181)	***
Loc1	-7.056E-03 (.117)	
Childyes	-6.692E-02 (.108)	
Age1	-.259 (.242)	
Age2	-.516 (.196)	***
Age3	-.398 (.204)	*
Age4	-.487 (.204)	**
Travel time in congestion/free flow tt	4.752E-02 (.073)	
M2A (revenues to general budget)	-8.251E-02 (.169)	
M2B (traffic system in general)	7.161E-02 (.172)	
M2C (lower car taxes and new roads)	.555 (.172)	***
M2D (public transport)	.197 (.167)	
M2E (abandon existing ownership tax)	.557 (.173)	***
M2F (lower existing fuel taxes)	.539 (.173)	***
Yearly driven number of kilometers	-3.611E-06 (.00)	**
Comp1	-.357 (.157)	**
Comp2	-.184 (.102)	*
Weight1	.133 (.177)	
Weight2	.120 (.153)	
N	564	
Log-likelihood	-986.11	***
Pseudo R-square	Cox and Snell	.129
	Nagelkerke	.132
	McFadden	.038

Notes: The standard errors are shown in brackets. *, **and *** denote significance at the 10, 5 and 1% level, respectively, (two-sided *t*-test).

Measure 3: Kilometre charge with different charges and revenue use

The third measure that we have analysed is in fact a combination of three types of revenue use with three types of a kilometer charge (resulting in 9 alternatives). Therefore we have included two new dummy variables instead of one for the type of measure as before. One dummy has been created for the type of revenue use and one for the level of the charge. Table 4 shows the results for this estimation. It is interesting to see that the level of acceptance very much depends on the way revenues are redistributed and the level of the charge (as may be expected). Higher charges are relatively less acceptable, and abolishment of existing car taxes is far more acceptable than an unclear revenue use (note the high coefficient) and somewhat more than the construction of new roads. This suggests that measure 3G (combination of low charge and abandoning of existing car taxes) is relatively most acceptable. This finding is confirmed by the results shown in Figure 1. It is remarkable that the weight of the vehicle does have an explanatory impact.

Table 4: Results of ordered probit analysis with the acceptance of measure 3 as dependent variable

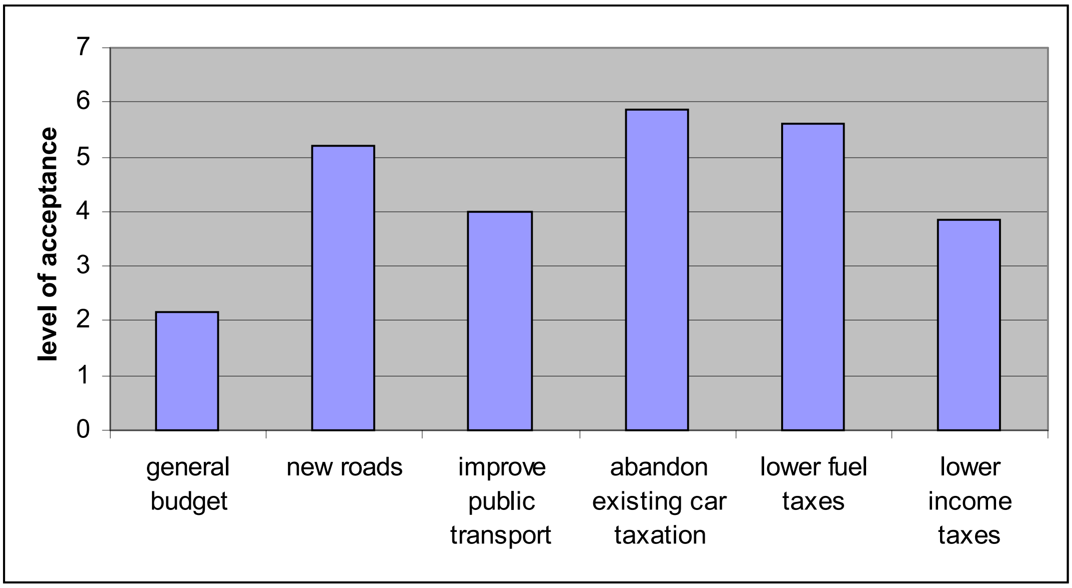
Variable	Probit ACC measure 1	Sign.
Threshold (µ's as explained)		
ACC=1	-.841 (.432)	*
ACC=2	-7.506E-03 (.432)	
ACC=3	.323 (.432)	
ACC=4	.687 (.432)	
ACC=5	1.241 (.434)	***
ACC=6	2.263 (.444)	***
Gross yearly income	6.973E-03 (.02)	
VOT	3.380E-04 (.00)	***
Gender	-5.580E-03 (.179)	
Edu2	-.305 (.224)	
Edu3	9.621E-02 (.149)	
Edu4	.179 (.190)	
Edu5	.250 (.147)	*
Edu6	.304 (.182)	*
Loc1	-2.778E-02 (.118)	
Childyes	-.111 (.109)	
Age1	-.245 (.244)	
Age2	-.332 (.197)	*
Age3	-.181 (.205)	
Age4	-.406 (.206)	**
Travel time in congestion/free flow tt	6.945E-02 (.073)	
Charge=5 €cent (dummy)	-.222 (.111)	**
Charge=7,5 €cent (dummy)	-.441 (.112)	***
Revenue use is new roads (dummy)	.318 (.114)	***
Revenue use is abandon car taxes (dummy)	1.175 (.118)	***
Yearly driven number of kilometers	-3.743E-06 (.00)	**
Comp1	-.393 (.158)	**
Comp2	-.190 (.103)	*
Weight1	-.493 (.178)	***
Weight2	-.296 (.153)	*
N	564	
Log-likelihood	-936.95	***
Pseudo R-square	Cox and Snell	.258
	Nagelkerke	.265
	McFadden	.082

Notes: The standard errors are shown in brackets. *, **and *** denote significance at the 10, 5 and 1% level, respectively, (two-sided *t*-test).

Revenue use only

Finally we have asked the respondents for their opinion on allocation categories of the revenues alone. Six different possibilities have been scored on acceptance by the respondents (general budget, new roads, improve public transport, abandon existing car taxation, lower fuel taxes and lower income taxes). The findings presented in Figure 2 are in line with the previous findings of revenue use as part of a road pricing measure. An abolishment of existing car taxes is most preferred (a mean score of 5.85, a 6 is 'acceptable'), whereas the general budget is 'unacceptable'.

Figure 2: Mean acceptance scores on each type of revenue use (level 1 = very unacceptable; level 7 = very acceptable)



4 Concluding Remarks

Economists have advocated the use of more appropriate pricing tools for a long time by demonstrating the welfare gains. Nevertheless, road pricing measures have up till now only seldom been implemented in practice. The low level of implementation is nowadays not so much caused by technical or administrative problems. It is generally acknowledged that pricing measures meet public resistance and that acceptability is nowadays one of the major barriers to successful implementation of new and more efficient pricing measures.

Despite the fact that politicians and the public regard transport problems as very urgent and important, people do have concerns about road pricing, resulting in low acceptance levels. Previous studies suggest that this is mainly related to the perceived (low level of) effectiveness of the measure, the feeling that roads are free to use and the fact that it is an unfair measure. An intelligent communication strategy can help to reach some level of acceptance, but literature also suggests that there is an important role for the destination of revenues of the pricing measure. Spending targets that are in the direct interest of the road users seem to receive most support.

The outcomes from a survey among Dutch commuters analysed in this paper confirm these findings. The first measure that has been evaluated by the respondents (electronic toll differing according to time and place without changing revenue use) is in general (for all alternatives) not perceived as very acceptable, irrespective of the type (or alternative) of measure. The acceptance of second measure (akilometre charge depending on vehicle weight combined with different allocation of revenues) does depend on the type of measure. This indicates that the respondents' opinions on road pricing are very sensitive to the way tax revenues are allocated. The measure is more acceptable when revenues are used for a decrease in fuel taxes, an abolishment of existing car taxation or to lower existing car ownership taxes together with the construction of new roads, indeed those targets that are in the direct interest of the respondent. These findings correspond with results from the third measure. It is also found that higher charges are less acceptable.

For all types of measures it was found that education, the VOT of the respondents, financial compensation (partly or full) by the employer and the number of driven

kilometers are important explanatory variables. Higher educated people, as well as respondents with a higher VOT, seem to find road pricing measures more acceptable than other people. The same holds for people that receive financial support for their commuting costs and for respondents driving many kilometers in a year.
The above findings on revenue use targets are confirmed when we do not present the type measure, but only ask for the acceptance of various ways to redistribute the revenues. Dutch car commuters find it almost acceptable when policy makers decide to use the revenues to compensate the car drivers by abandoning current car taxation. This option outperforms all other destinations in terms of acceptance. Lower fuel taxes and new roads are slightly less acceptable. By far the least attractive option is the public treasury.

References

Banister, D., 1994, *Equity and Acceptability Question in Internalising the Social Costs of Transport*, in OECD/ECMT, Internalising the Social Costs of Transport, Paris.

Bartley, B., 1995, Traffic demand management options in Europe: the MIRO project, *Traffic Engineering and Control*, 95, pp. 596-603.

CUPID, 2000, State of the Art – Frequently Asked Questions, Deliverable 3, Project funded by the European Commission under the Growth Programme, Brussels.

Greene, W.H., 1993, *Econometric Analysis*, 2nd edition, Macmillan Publishing Company, New York.

Guiliano, G., 1993, *An Assessment of the Political Acceptability of Congestion Pricing*, Transportation, 19 (4), pp. 385-358.

Jones, P., 1998, *Urban Road Pricing: Public Acceptability and Barriers to Implementation*, in: Road pricing, traffic congestion and the environment: Issues of efficiency and social feasibility, K.J. Button and E.T. Verhoef (eds.), pp. 263-284, Edward Elgar, Cheltenham.

Maddala, G.S., 1983, *Limited-Dependent and Qualitative Variables in Econometrics*, Cambridge University Press, New York.

Mayeres, I., and S. Proost, 1997, Optimal tax and investment rules for congestion type of externalities, *Scandinavian Journal of Economics*, 99 (2), pp. 261-279.

Mayeres, I., and S. Proost, 2001, Marginal tax reform, externalities and income distribution, *Journal of Public Economics*, 79, pp. 343-363.

MC-ICAM, 2003, *Pricing of Urban and Interurban Road Transport: Barriers, Constraints and Implementation Paths*, Deliverable 4 of the MC-ICAM project funded by the European Commission, Leeds.

Parry, I.W.H. and A. Bento, 2001, Revenue Recycling and the Welfare Effects of Road Pricing, *Scandinavian Journal of Economics*, 103 (4), pp. 645-671.

PATS, 1999, *State of the Art Synthesis on Price Acceptability*, Deliverable 1, Project Funded by the European Commission under the Transport RTD Programme of the 4th Framework Programme, Brussels.

PROSAM, 2000, *The Toll Cordon – Public Attitudes 1989 – 1999*, Report 67, Public Roads Authorities, Oslo.

Rienstra, S.A., P. Rietveld, and E.T. Verhoef, 1999, The social support for policy measures in passenger transport. A statistical analysis for the Netherlands, *Transportation Research D*, Vol. 4, pp. 181-200.

Schade, J. and B. Schlag, 2000, *Acceptability of Urban Transport Pricing (AFFORD publication)*, VATT research report 72, Helsinki

TransPrice, 1999, *Public acceptability*, TransPrice Deliverable 6, Helsinki, Dresden, London.

Verhoef, E.T., 1996, *Economic Efficiency and Social Feasibility in the Regulation of Road Transport Externalities*, Thesis Publishers, Amsterdam.

Appendix 1: Description of measures

Measure	Alternatives
1. Electronic toll on daily bottlenecks (independent of bad weather); revenues hypothecated to construct new roads and improve existing roads	A) charge of € 1,00 at all times B) charge of € 2,00 on working days, during peak hours: 7.00-9.00 and 17.00-19.00, no charge on other times C) peak time charge: 6:00- 7:00 € 0,50, 7:00-7:30 € 1,00, 7:30-8:00 € 1,75, 8:00-8:30 € 2,50, 8:30-9:00 € 1,75, 9:00-9:30 € 1,00, 9:30-10:00 € 0,50. The same structure for the evening peak (16.00-20.00) D) charge depends on traffic density, more congestion means a higher charge with a maximum of € 5,00
2. Kilometer charge depending on weight of the car (heavy cars are less environmental friendly). Light cars pay 4 €cent per kilometer; middle weight cars pay 5 €cent per kilometer; heavy cars pay 6 €cent per kilometer. Monthly (extra) costs for the various types of cars based on average kilometrage were presented to respondent.	A) Revenues hypothecated to general budget of the government B) Revenues hypothecated to the traffic system in general, this may include new roads or improvement of public transport C) Revenues used to lower existing car taxes and improve or construct new roads D) Revenues hypothecated to public transport E) Revenues used to abolish existing car ownership taxes F) Revenues used to lower existing fuel taxes G) Revenues used to improve roads and construct new road infrastructure
3. Kilometer charge	A) charge of 2,5 €cent per kilometer; revenue use unclear B) charge of 5 €cent per kilometer; revenue use unclear C) charge of 7,5 €cent per kilometer; revenue use unclear D) charge of 2,5 €cent per kilometer; revenues used for new and better roads E) charge of 5 €cent per kilometer; revenues used for new and better roads F) charge of 7,5 €cent per kilometer; revenues used for new and better roads G) charge of 2,5 €cent per kilometer; revenues used to abolish existing car taxes (ownership and purchase) H) charge of 5 €cent per kilometer; revenues used to abolish existing car taxes (ownership and purchase) I) charge of 7,5 €cent per kilometer; revenues used to abolish existing car taxes (ownership and purchase)

Appendix 2: Calculation of VOT point estimate

The average VOT according to previous (Dutch) studies is about € 7.5 (per hour). We We have identified the following intervals:

1. € 0 – 4
2. € 4 – 8
3. € 8 – 12
4. > € 12

In order to allocate respondents to one of the above categories we have developed four different scenarios.

	A (group 4)	B (group 3)	C (group 2)	D (group 1)
Departure time	T_D	T_D – 15 min.	T_D – 30 min.	T_D – 45 min.
Travel time	T_f	T_f + 15 min.	T_f + 30 min.	T_f + 45 min.
Arrival time	T_A	T_A	T_A	T_A
Toll	€ 6	€ 3	€ 1	€ 0

The respondent then allocates ten (commuting) trips over these scenarios. We now need clear values for the calculation of the point estimates. For interval 2 and 3 we have chosen the average value (6 and 10). We assume that category has a skewed distribution towards the right, therefore a VOT of 3 has been taken as the average. The maximum VOT value of interval 4 has been set at 16. These values, together with the allocation made by the respondent allows us to calculate the point estimates. For instance, when the respondent allocates 5 trips to B and 5 trips to C a point estimate of 10 results ((5*6+5*10)/10).