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Determinants of congestion pricing acceptability

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Abstract
We explore what variables influence public attitudes towards congestion charges using a survey carried out in Stockholm, Helsinki and Lyon, three European cities with many similarities but with different experiences and discourses with respect to congestion charging. We find that self-interest matters in the expected way, with lower support in groups with higher expected payments and lower value of travel time savings. However, self-interest variables only contribute 20-50% to total explained variation in attitudes. The rest is explained by differences in respondents' attitudes to environment, trust in public agencies, and views about the fairness of pricing policies in general. What issues are associated to congestion charges are similar in all the cities, but the strength of the associations seems to vary depending on how congestion pricing is framed in the specific local discourse. The most important factor seems to be experience of congestion pricing, which increases support substantially.

Keywords: Congestion charges, transport pricing, acceptability, attitudes.

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1 INTRODUCTION

There is broad support for congestion pricing among transportation economists and traffic planners, and a broad recognition that the benefits in terms of reduced congestion and improved environment can be substantial. When specific schemes are suggested, however, public acceptance usually turns out to be a critical issue, often preventing systems from being implemented. Hence, it is important to understand what factors influence public attitudes to congestion pricing. This question is also of general interest, since public support is usually necessary for introducing any kind of policy, not only in the transport sector.

In this study, we explore and compare which factors influence support for congestion pricing in three European cities with varying degrees of experience from congestion pricing: Stockholm (Sweden), Helsinki (Finland) and Lyon (France). The study is based on a postal survey carried out in all three cities. The survey measured respondents' attitudes to various political issues, such as environment, taxation, social equity and trust in public agencies, and whether respondents considered a number of pricing or allocation principles "reasonable" or "fair". Respondents were also asked about their current travel patterns, and their opinions about various general transport-related issues. Finally, respondents were asked how they would vote in a hypothetical referendum on a congestion pricing system that was described in the survey.

We then test how their stated vote can be explained by various factors using an econometric model. We find that respondents' attitudes to congestion pricing are influenced by self-interest in the expected way: support is higher the less respondents would pay given their current travel pattern, and the higher their value of travel time is. However, self-interest variables only explain 20-50% of the total explained variation in voting patterns. The rest is explained by attitudes to related political issues, such as environment, taxation and social equity, and by views about fairness of pricing in various situations. Pricing principles and motives come in different varieties, such as user pricing, polluter pricing and scarcity pricing. We show that the more respondents find such principles "reasonable" or "fair", the higher is their acceptance of congestion charges.

What factors influence support for congestion charges are broadly similar across all cities, but the strengths of the influences vary somewhat – although less than might perhaps be expected. Depending on how congestion pricing is framed in the local debate, associations to fundamental values and to attitudes to similar issues (what Heberlein (2012) respectively calls attitudes' *vertical structure* and *horizontal structure*) will receive different strength. For example, the local discourse can put more or less emphasis on congestion reduction, local or global environmental benefits, how revenues are used, or on the general argument that scarce resources should be used efficiently. Depending on what weights these different motives or aspects get, charges will become more or less associated with attitudes to issues such as environment, taxation and economic rationality. These associations may hence vary between cities, even if other attitudes and values are similar. They may also change over time, and experience does indeed seem to have a strong effect. Support is much higher in Stockholm, where congestion charges have been in place since 2006, even after controlling for other influencing factors. Before charges were introduced in Stockholm, however, public attitudes to the charges were similar to those in the other cities. Apart from the experience effect, however, results show broadly the same pattern across all three cities.

Section 2 gives some background and describes the data collection. Section 3 presents the results from the econometric model relating stated voting for congestion charges to explanatory factors. Section 4 describes how opinions change if the scheme design changes. Section 5 discusses the results, in particular attitude formation and the apparent experience effect. Secion 6 concludes.

2 DATA

Stockholm, Helsinki and Lyon are medium-sized cities based around a historical city core encircled by more recently populated areas. Traffic has a radial pattern, with the main flow of commuters moving inward in the morning and outward in the evening. The cities have different experiences of congestion charging proposals. Stockholm introduced congestion charges in January 2006. Although initially subject to a fierce debate, the pricing scheme was confirmed in a referendum after seven months of trial operation, and is nowadays rarely a cause of political disputes or media attention. Drivers pay €1 to €2, depending on time of day, per passage across a cordon around the inner city between 6.30 and 18.30. Total charge per day is capped at €6 per car (with 10 SEK to the Euro). The Stockholm experiences are further described in e.g. Eliasson (2008) and Börjesson et. al. (2012).

At the time of the survey, Helsinki went through an extensive debate about implementating a distance based road user charge, with a strong focus on congestion mitigation. A task force had come up with a pre-study, including a detailed scheme design. This design proposition, widely discussed by politicians and in the media, was supposed to employ GPS units in all vehicles, and charge by the kilometre. Different tariffs were to be used depending on how close to the city one travelled, with the outermost priced area lying far outside of Helsinki. Political support for congestion pricing was never widespread, and at the time of this survey, it became clear that there was a decisive majority against its implementation. Presently there are no plans for implementing congestion pricing in Helsinki.

Lyon had a short encounter with congestion pricing, in the form of peak hour pricing of a specific road segment in 1997. The road was a new section of the Boulevard Périphérique, financed partly by local funds and partly by a private concessionaire, who in turn was entitled to regain its investment by charging a toll for those using the new road. The tolls were set to follow the traffic flow, with a discount during off-peak hours. As a measure to ensure that the concessionaire gained sufficient toll revenues, traffic signs and access to parallel roads were rearranged, directing traffic to the new tolled facility. This deliberate reduction of alternative routes did not land well with the public, however. Raux and Souche (2004) summarise: “As a consequence, there was a movement to boycott the new road accompanied by weekly demonstrations at the toll barriers. These prevented users from paying and occasionally even led to the destruction of the barriers.” Eventually the concession was cancelled, the facility taken over by the community and the toll drastically reduced.

2.1 Data collection

The same survey was carried out in all of the three cities during spring 2011, with some minor local variations. In Stockholm and Helsinki, the survey was issued as a mail-out/mail-back survey to a random sample of people 18-65 years of age in each city. The final response rate was 43% (n=1837) in Stockholm and 39% (n=1178) in Helsinki. In Lyon, where a postal survey was ruled out based on previous experiences with very low response rates, a telephone survey was conducted. It was designed to meet

predetermined quotas for, among other things, age and gender, thereby managing the response bias already at the collection stage. In order to ensure a sufficient share of respondents perceiving the survey as relevant, frequent car users and residents within the hypothetical charging zone were oversampled. A total of 10,241 calls were initiated, out of which 53% picked up to answer. Out of those answering, 37% agreed to start answering questions after having been introduced to the purpose of the call. As the interview went along, some calls were terminated either on request by the respondent or when the caller system detected that some answer placed the respondent outside one of the predetermined quotas. When 1,500 complete answers had been obtained and all quotas met, the calling was complete.

When presenting population averages of attitudes and behavior, the data sets have been reweighted to correct for sampling biases. In the subsequent model estimations, the unweighted samples are used.

2.2 Survey content and descriptive results

Respondents were asked for their opinion on a wide range of topics, some related to transport and some more general, such as taxation, environment and social equity. The survey then presented a congestion pricing scheme, and asked respondents how they would vote in a referendum about introducing[1] such a scheme, with the response alternatives *Certainly yes, Probably yes, Probably no, Certainly no* or *No opinion/I don't know.* The presented charging schemes were different in the three cities: in Stockholm, the existing scheme was presented; in Helsinki it was in line with the charging scheme put forward and widely debated in media; in Lyon it was a hypothetical scheme similar to the one in Stockholm. Respondents were also asked about what they thought the effects of the system would be, and how their opinion would change subject to various changes in the system, such as introducing a discount for low-income groups, ensuring complete data privacy, or earmarking the revenues for various purposes.

Respondents were asked to what extent they agreed with a number of statements, using a 7-grade scale with 1 being "completely disagree", 4 "neutral" and 7 "completely agree". Table 3 summarises the answers to some of these questions, along with some descriptive statistics of travel behavior. In this table, the share of people agreeing with a statement is taken to be everyone answering 5-7 on the 7-grade scale (*Neutral/I don't know* responses are included in the base). The support for congestion charges is calculated excluding respondents answering *No opinion/I don't know*.

[1] In Stockholm, several questions had to be rephrased, since congestion charges are already in place. Hence, Stockholm respondents were asked how they would vote in a referendum to *abolish* rather than *introduce* charges; Stockholm respondents were asked what they thought the effects would be if the current system was abolished, while respondents in the other cities were asked about what they thought the effects would be if a system was introduced; and so on.

Table 1. Descriptive statistics of travel behavior and attitudes in Stockholm, Helsinki, and Lyon.

	Stockholm	Helsinki	Lyon
Population, city	851 000	596 000	481 000
Population, metro area	2.1 million	1.1 million	2.1 million
Drive daily	31%	53%	28%
Access to at least one car	75%	79%	81%
Would support congestion pricing in a referendum today (*excl. "don't know"*)	68%	36%	32%
% who agree (≥ 5 on 7-grade scale) with the statements:			
"I am satisfied with the public transport in my city"	52%	64%	78%
"It would be reasonable to build new roads in [city] to reduce road congestion"	61%	44%	56%
"Road congestion is one of [city]'s largest problems"	64%	55%	62%
"Road tolls is a reasonable way to finance new roads"	38%	24%	36%
"Considerably more resources should be used to protect the natural environment."	70%	70%	88%
"Motor vehicle traffic is among the largest threats to the natural environment."	55%	49%	66%
"Taxes are too high in [country]"	54%	61%	67%
"Automatic speed cameras is a reasonable way to save lives in traffic."	71%	79%	54%
"The government should prioritise to reduce the differences between the poor and the rich in the society."	57%	63%	73%
"It is reasonable that airplane tickets cost more for departure during peak hours than during off-peak"	52%	48%	37%
"It would be reasonable if air traffic was subject to a special environmental tax."	47%	75%	65%
"It would be reasonable if the noisiest cars and motorcycles were subject to a special noise tax"	37%	36%	57%

The share of respondents supporting congestion charging is similar in Helsinki and Lyon; about one third of those expressing an opinion state that they would vote in favour of it. Stockholm on the other hand, shows twice as strong support. It is worth noting that before congestion pricing was introduced in Stockholm, support was similar to what is now found in Helsinki and Lyon.

In all the cities, a majority agrees that congestion is a major problem for their city. A majority also agrees with the statement that building more roads is a reasonable way of addressing congestion. Most respondents are satisfied with the public transportation in their city, with Lyon being the most satisfied population. The Lyon respondents are also the keenest on spending more public funds to protect the environment, with close to unanimous support for such a policy. However, Lyon also displays the largest share of respondents agreeing with the statement *Taxes are too high*, with Helsinki second and Stockholm third. Lyon respondents disagree the most with the statement *Automatic speed cameras is a reasonable way to save lives*.

In order to get an indication of respondents' value of travel time savings, they were asked to imagine the following situation:

> *You commute daily by car. On the way, you have to cross a bridge[2] across a river. One day, the bridge closes for repairs for a long time. Another bridge is available further downstream, but the detour takes an additional 20 minutes. During the time it takes to repair the bridge, the road authority has arranged with a ferry that can take cars over the river. What is the highest amount you would be prepared to pay for a one-way ticket for the ferry, to save 20 minutes on your journey to work?*

Figure 1 shows the cumulative value of time distributions implied by the answers. Obviously, a question such as this can only give a crude indication of respondents' actual valuation of travel time savings, but despite this, the distributions are similar to what has been found in proper value of time studies (e.g. Börjesson and Eliasson (2014)). The purpose of the question is only to enable us to explore whether there is a relation between respondents' valuations of travel time savings and their support for congestion charging.

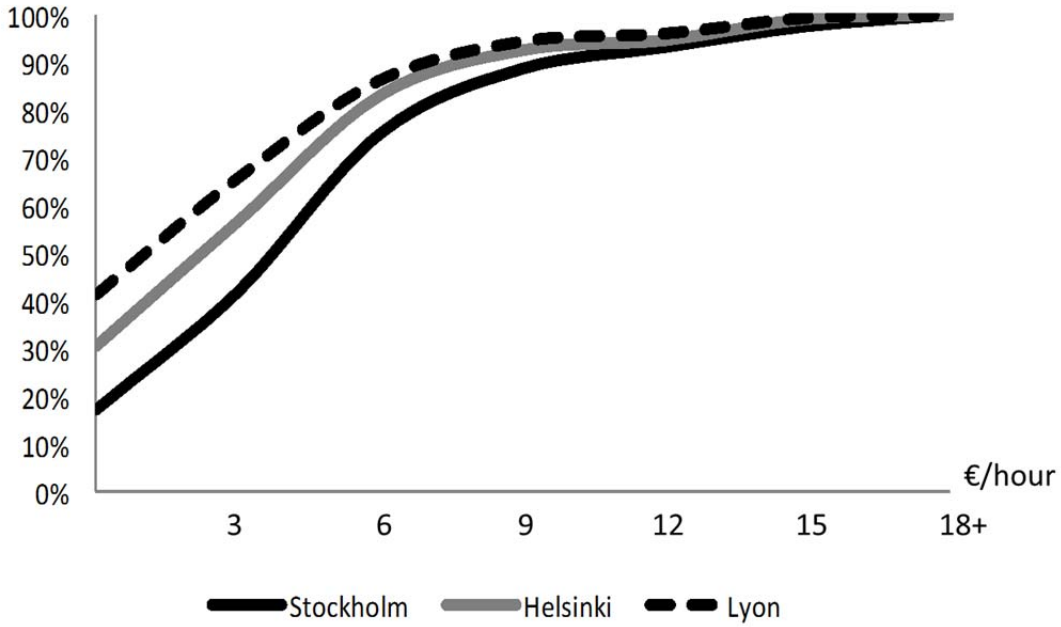

Figure 1. Cumulative value of time distribution from the willingness to pay for ferry tickets.

After this, a question of attitudes to allocation mechanisms followed:

> *Some people complain to the authority that charging for ferry tickets is unfair. When offering the ferry for free, it turns out that all who then want to use it cannot fit on board. The authorities now consider four different methods to choose who may travel with the ferry. To what extent do you consider these alternatives fair?*

- ***Price**: Revert to the original policy of charging those who want to travel for the tickets, and set the price so the ferry is just filled.*
- ***Queue**: Those who arrive first to the jetty and stand first in line get to go with the ferry.*
- ***Authority determines "need":** Those who want to travel with the ferry have to show some evidence to support their need. The authority then provides ferry passes based on their judgement of greatest need.*

[2] In Lyon, the hypothetical situation instead involved a closed tunnel, as this was judged to be closer to reality and easier to imagine.

- ***Lottery****: Tickets are allocated randomly, so that everybody has an equal change of winning.*

Table 2. Share of respondents who perceived allocation strategies as "fair" and "unfair" (≥5 and ≤3 on 7-grade scale)

	Stockholm		Helsinki		Lyon	
	Fair	*Unfair*	*Fair*	*Unfair*	*Fair*	*Unfair*
Price	68%	10%	63%	16%	51%	37%
Queue	59%	18%	79%	7%	23%	68%
Authority determines "need"	25%	43%	13%	68%	17%	73%
Lottery	7%	69%	9%	72%	7%	88%

Price is the most preferred allocation method in Stockholm and Lyon, and the only method viewed as "fair" by more than 50% of all three populations. This is somewhat surprising: earlier studies have shown that it is often viewed as "unfair" to allocate a scarce resource using a price mechanism. In Lyon, contrary to the other cities, pricing is a highly divisive issue: while over 50% views it as fair, nearly 40% view it as unfair. *Queuing* takes the number one spot in Helsinki, with nearly 80% viewing it as fair, while nearly 70% of Lyon respondents view it as unfair. *Authority determines "need"* gets the second weakest support in terms of "fairness", varying from 13% to 25%. *Lottery* is seen as highly unfair, which is consistent with earlier studies. Less than ten per cent view it as "fair". Lyon respondents rate all four allocation methods lower than the other two cities; in fact, pricing is the only strategy which a (narrow) majority view as fair – all the other mechanisms are seen as more or less unfair by a large majority of respondents.

3 FACTORS AFFECTING SUPPORT FOR CHARGES

In order to explore how attitudes to congestion charging relate to various factors, we use ordered logit models. The dependent variable is the answer to the question "*How would you vote in a referendum about congestion charges in [your city]?*". In each survey, a congestion pricing system for the city was described (see section 2.2). Responses were on a five-grade scale: "Most likely yes", "Probably yes", "No opinion/I don't know", "Probably no" and "Most likely no". As explanatory variables, we use a number of variables explained further below. To facilitate the discussion of results, we have grouped variables into five groups: self-interest, equity concerns, environmental concerns, attitude to pricing policies, and trust in government. This division can certainly be discussed, but it simplifies the exposition and discussion of the results.

Most of the attitude variables were recorded as responses on a 7-grade scale from "strongly disagree" to "strongly agree", with 4 being "neutral; neither agree nor disagree". After testing various model specifications, we have chosen to combine levels 1-3 and 5-7, and estimate dummy variables for "neutral" and "agree" compared to "disagree" (which is normalized to zero). Parameter estimates are found in Table 3.

Table 3. Estimation results; explanatory variables of stated votes for congestion charges

Variable [reference level]	**All**	**Sth**	**Lyon**	**Hels**
City [Stockholm]				
Helsinki	-1.06 **			
Lyon	-1.38 **			
Number of cars in household [zero]				
One	-0.36 **	-0.30 *	-0.31 *	-0.62 **

Two	-0.51 **	-0.31 *	-0.41 *	-1.00 **
Three or more	-0.65 **	-0.89 **	-0.22	-1.07 **
Amount of tolls paid [quartile 1]				
quartile 2	-0.26 **	-0.24 *	-0.27	-0.36 *
quartile 3	-0.63 **	-0.51 **	-0.43 **	-1.03 **
quartile 4	-0.70 **	-0.58 **	-0.49 **	-1.10 **
WTP for ferry fare [zero]				
1 Euro	0.22 **	0.30 *	0.23 '	0.19
2 Euro	0.47 **	0.43 **	0.45 **	0.70 **
3 Euro	0.70 **	0.70 **	0.78 **	0.65 **
4 Euro	0.68 **	0.53 *	1.04 **	0.65
5 Euro	0.94 **	1.38 **	0.75 *	0.74 *
> 5 Euro	0.95 **	0.85 *	0.80	1.50 '
Motor vehicle traffic is among the largest threats to the natural environment. [disagree]				
No opinion	0.25 **	0.29 *	-0.13	0.59 **
Agree	0.67 **	0.74 **	0.43 **	0.78 **
"Considerably more resources should be used to protect the natural environment." [disagree]				
No opinion	0.27 *	0.25	0.55 '	0.18
Agree	0.52 **	0.47 **	0.69 *	0.54 *
"The government should prioritise to reduce the differences between rich and poor." [disagree]				
Agree *or* No opinion	0.15 '	0.19	-0.09	0.37 *
"It is reasonable that airplane tickets cost more for departure during peak hours" [disagree]				
No opinion	0.17 *	0.17	0.25	0.32 *
Agree	0.27 **	0.38 **	0.13	0.44 **
"Road tolls is a reasonable way to finance new roads" [disagree]				
No opinion	0.39 **	0.41 **	0.34 *	0.53 **
Agree	0.80 **	1.04 **	0.41 **	1.19 **
"It would be reasonable if the noisiest cars/motorcycles were subject to a special noise tax" [disagree]				
No opinion	0.24 **	0.12	0.43 *	0.20
Agree	0.46 **	0.32 **	0.63 **	0.41 **
"It would be reasonable if air traffic was subject to a special environmental tax." [disagree]				
No opinion	0.21 *	0.25 '	-0.01	0.18
Agree	0.60 **	0.70 **	0.56 **	0.36
Is price a fair way to allocate space on the ferry [Unfair]				
Neutral/no opinion	0.45 **	0.29	0.78 **	-0.06
Fair	0.65 **	0.45 **	0.88 **	0.15
"Taxes are too high" [disagree]				
No opinion	-0.38 **	-0.54 **	-0.34 '	-0.06
Agree	-0.82 **	-1.09 **	-0.71 **	-0.36 *
"An automated speed monitoring system is a reasonable way to save lives in traffic." [disagree]				
No opinion	0.28 **	0.34 '	0.26	0.40
Agree	0.45 **	0.55 **	0.35 **	0.46 *
Is judgment by a public authority a fair way to allocate space on the ferry [Unfair]				
Neutral/no opinion	0.12	-0.02	0.29 '	0.20
Fair	0.27 **	-0.01	0.61 **	0.32 '

Socioeconomics				
Female	-0.17 **	-0.29 **	-0.07	0.08
Master education or higher	0.15 *	0.04	0.38 **	0.01
Children in household	-0.26 **	-0.24 *	-0.29 **	-0.27 *
Income over 45 kEuro/month	-0.19 '	-0.09	-0.61 '	-0.18
Intercepts:				
1|2	-0.00	-0.31	1.51 **	0.92 *
2|3	1.21 **	0.79 **	2.90 **	2.14 **
3|4	1.76 **	1.69 **	2.99 **	2.81 **
4|5	3.46 **	3.31 **	4.80 **	4.79 **
Residual deviance	11582.08	4835.635	3504.993	2840.469
AIC	11676.08	4925.635	3590.993	2928.469
' sign at 90% level				
** sign at 95% level*				
*** sign at 99% level*				

Self-interest: tolls paid, time gains and value of time

Several studies have shown that support for congestion pricing is linked to self-interest. For example, Schade and Schlag (2003) identify expectation of personal outcomes as one of three main explanatory factors of attitudes to congestion pricing in a study of car drivers in four European cities. In the 2005 referendum on congestion pricing in Edinburgh, car drivers were significantly more prone to vote no than non-car drivers (Gaunt, Rye, & Allen, 2007). The same pattern is found by Jaensirisak et. al. (2005). Revealed-preference studies are rare in this field, but Hårsman and Quigley (2010) use the results from the 2006 referendum on the Stockholm congestion pricing to show that voting results per voting district correlated with both average time savings and average toll payments per district.

Respondents were asked to estimate how much they expect to be driving in the charging zone each month. Given the differences in tariff structure presented for each city, this is not immediately comparable between the three cities. Therefore, the expected monthly payment is coded as four levels (low, medium, high and very high). Estimation results show the expected pattern: the more respondents would pay given their current travel pattern, the more negative they are.

The models also include the number of cars available to the household. This is also a significant variable in the estimation. It could be argued that expected payment and number of cars should measure the same phenomenon. Since both variables are highly significant, the overlap in what the two factors represent is not complete. Possibly, owning more than one car adds to a self-image as a car driver, which could influence opinion separately from the amount expected to pay. Alternatively, the ownership of cars makes a person more sympathetic to other drivers, even when oneself does not expect to pay much.

The value of time, as indicated by the stated willingness to pay for a ferry ticket, turns out to be a strong predictor of attitude. The value of time implied by the answer to this question may not be very trustworth, since it lacks realistic context and hence may be subject to e.g. anchoring effects. However, the conclusion that a high value of time is correlated with high support for congestion charges only depends on the relative

distribution being properly captured. Note that this is not merely an income effect – income is already controlled for (various alternative model specifications also confirmed this). Where earlier studies have showed that the amount of time saved increases acceptance, this survey can strengthen that finding by adding that there is also an effect from a higher willingness to pay for such time savings. Interestingly, the explanatory power is almost as strong in Helsinki and Lyon, with no experience of congestion pricing. This indicates that the difference in support before and after introducing congestion pricing is not only due to a failure of foreseeing and valuing the benefits of the time savings. The strong influence by out-of-pocket expenses and value of time indicates implicitly that people actually do understand the general effects of congestion pricing from their individual perspective – you pay some money and gain some time.

Equity concerns

A recurrent argument against congestion charges is the supposedly regressive effects. The literature on equity effects of congestion pricing reach mixed conclusions depending on the travel patterns in the specific city under study. In cities where high-income groups drive substantially more, especially in the areas and time periods which would be subject to pricing, congestion pricing can be expected to be progressive (Eliasson & Mattsson, 2006; Franklin, Eliasson, & Karlström, 2010; Karlström & Franklin, 2009). On the other hand, if there are small differences in driving patterns between low-income and high-income groups, congestion pricing can be expected to be regressive, i.e. low-income groups will pay a higher share of their income in charges (Arnott, de Palma, & Lindsey, 1994; Giuliano, 1992; Small, 1983, 1992). Several authors emphasize that the use of revenue should be taken into account to get a complete picture of equity effects (de Palma & Lindsey, 2004; Eliasson & Mattsson, 2006; Santos & Rojey, 2004; Small, 1983).

If adverse equity effects was seen as an important problem with congestion charges, we would expect to find a correlation between respondents' attitudes to social equity and their attitude to congestion charges, at least once we have controlled for other factors (such as self-interest and other types of attitudes). Respondents were asked to what extent they agreed with the statement "*The government ought to do more to reduce the differences between the rich and the poor in society*". In Stockholm and Helsinki, those agreeing to this statement outnumber those disagreeing by a factor of 3, and in Lyon by a factor of 5. However, agreeing with this statement is *not* associated with a more negative attitude to congestion pricing; in Helsinki, it is actually associated with a more positive attitude. Hence, we find no correlation between concerns for social equity and resistance to congestion pricing. One possible explanation is that respondents may believe that congestion pricing would mainly affect high-income groups, so there would be no substantial adverse equity effects (which is probably a reasonable belief, given the travel patterns of the cities). That equity effects is used as an argument against congestion charges may be because it is seen as a more morally valid argument than mere self-interest. This would be consistent with the finding that a substantial share of respondents in Helsinki and Lyon claim that they would become more positive to the charges if low-income groups got a discount on the charges (see section 4), and that this is more common among drivers than among non-drivers.

Environmental concerns

Although the main welfare benefits from congestion relief typically come from time savings, the environmental improvements associated with it can be even more influential when it comes to acceptance. Eliasson and Jonsson (2011) showed that a green self-image was one of the most influential determinants of attitude towards

congestion pricing in Stockholm, and Jaensirisak et al. (2005) found that an ability to achieve substantial environmental improvements was more important for acceptability than the scheme's perceived ability to deliver congestion relief.

Three of the questions in the survey mention the natural environment or environmental policies, asking respondent to what extent they agree that "considerably more resources should be used to protect the natural environment", "motor traffic is among the largest threats to the environment" and whether it would be "reasonable if air-traffic was subject to a special environmental tax". All three are significant and positive, indicating that people with strong environmental concerns are more prone to support congestion pricing.

Acceptability of pricing policies in general

The survey included five questions related to acceptance of various kinds of pricing. The pricing policies were of three different types. First, a question about whether it was reasonable that a new bridge was financed by user tolls measured the attitude to *user pricing*, i.e. that users of some facility pay the cost for providing this facility. Second, two questions about a noise tax on motor vehicles and an environmental tax on air traffic measured the attitude to *polluter pricing,* i.e. that negative externalities should be priced. Third, two questions about peak pricing for air tickets and about pricing a ferry with limited capacity measure attitudes to *scarcity pricing,* i.e. pricing as a mechanism to allocate a scarce resource. A body of literature exists where respondents are queried for perceived fairness of pricing policies in various situations, e.g. (Frey & Pommerehne, 1993; Kahneman, Knetsch, & Thaler, 1986; Raux, Souche, & Croissant, 2008). They have shown that pricing is often perceived as the least "fair" allocation method compared to e.g. queuing or some measure of "need". User pricing and polluter pricing are often more acceptable types of pricing policies.

Estimation results show strong links between support for congestion pricing and all the various kinds of pricing policies. It is interesting that the answers to the five pricing questions are only mildly correlated, and all become significant in the estimation. Apparently, they measure somewhat different attitudes; for example, the attitude to polluter pricing does not have to be correlated to the attitude to scarcity pricing, and the attitude to scarcity pricing can vary depending on the specific circumstances. Each of these attitudes, however, is associated to the attitude to congestion pricing, which can be interpreted as user pricing, polluter pricing or scarcity pricing depending on the context and how the policy is framed.

Trust in government

Support for congestion charges can be expected to be related to trust in government and support for public interventions in general. Scepticism to congestion pricing can be caused by scepticism to the government's ability to design and manage such a system, or use the revenues efficiently (Dresner, Dunne, Clinch, & Beuermann, 2006; Kallbekken & Sælen, 2011); it can also be associated to a more fundamental dislike of public interventions in general. One may call the former a pragmatic kind of libertarianism and the latter an ideological kind.

The survey included three questions related to such attitudes. Respondents were asked whether they thought that taxes were too high, whether automatic speed enforcement was a good way to prevent traffic accidents, and whether it was fair that a public agency decided which passengers got priority to the ferry based on "need". All of these questions have strong explanatory power for the voting behaviour. The three questions can be interpreted as measures of trust in government, or as indicators of acceptability

of public interventions or regulations. By design, the questions do not make a clear distinction between pragmatic and ideological libertarianism, i.e. between the attitude to the government's ability/efficiency, and the attitude to public interventions in general. The question on taxes could be described as more generic, relating to any kind of government involvement, while the question on speed cameras is specific to the transport sector, and also includes a mentioning of the benefit side (saving lives). The explanatory power of attitude to taxes is much stronger. This may indicate that to the public, congestion pricing is more similar to a general tax increase than to a policy aimed at curbing a specific problem.

Perception of ex ante situation

Congestion is often seen as a big problem in cities. Between 55 and 64% agreed with the statement *Road congestion is one of [city]'s largest problems* (see table 1) in our study. Many authors have found that congestion must be perceived as a big problem for congestion pricing to be acceptable (Jaensirisak et al., 2005; Jones, 1995; Odeck & Bråthen, 1997; Schlag & Schade, 2000; Schlag & Teubel, 1997).

However, there is no evidence for this association in our material: agreeing that congestion is a big problem is not significantly associated to supporting congestion pricing. On the other hand, it turns out that agreeing that congestion is a big problem is a strong predictor of the attitude to increasing road capacity. Hence, there is a link between perception of the problem and desire for the remedy – only that the preferred remedy is increased road capacity, not pricing. Combining this with the findings above, this may indicate that people see congestion charging more as a solution to environmental problems and as a "user pays" policy than as a way to use road space more efficiently.

Expected effects

It is plausible that someone who believes that a policy measure will be effective is more prone to support it. Indeed, a range of studies find a strong connection between belief in effects and support for congestion pricing. Summarising five studies of acceptability of road charging from the period 1979 to 1991, Giuliano (1992) notes that the most frequently cited reason for opposing congestion pricing is scepticism about its effect. This notion is confirmed in several studies (Bartley, 1995; Jones, 2003; Schade & Schlag, 2003; Schlag & Schade, 2000; Schlag & Teubel, 1997; Thorpe, Hills, & Jaensirisak, 2000). When analysing the voting behaviour in Edinburgh, Gaunt et. al. (2007) again found that the low level of expected benefits from congestion pricing was a main reason for the overwhelming *No* in that referendum. Similarly, when Eliasson and Jonsson (2011) analysed explanatory factors behind attitudes in Stockholm, belief in positive effects was one of the two most important factors (followed by environmental concerns).

The survey included four questions on the expected effects, which, as expected, come out as highly significant predictors of attitude to congestion pricing (these estimation results are omitted to save space). But the causality here may be in the reverse direction. If one believes that congestion charges are desirable for some reason other than its ability to reduce congestion, belief in effectiveness is most likely influenced by this. It is a common finding that beliefs tend to be aligned with already formed attitudes. This *affect heuristic* was first described by Slovic et. al. (2000) and later explored by others (summarised by Kahneman (2011), p. 103). For this reason, the factors related to expected effects are not used in the estimation.

Socioeconomic factors

If the model in Table 3 is estimated using only socioeconomic variables, attitudes correlate with several socioeconomic factors. Support increases with age and education, and is higher for respondents living outside the charging zone. In Stockholm and Helsinki, women are more positive to congestion pricing, while in Lyon men are more positive. Those with an income close to average are most positive, i.e. support os lower for both the highest and the lowest income groups.

When controlling for other factors however (as is done in the model presented in Table 3), most socioeconomic variables have little explanatory power. Gender is only significant in Stockholm, but with the opposite sign compared to what the absolute numbers would suggest; education is only significant in Lyon; income is only significant in the highest income group; living inside or outside of the charging zone is not significant. Having children decreases support, perhaps due to scheduling constraints.

3.2 Comparing the cities

The estimation results explain what factors affect support for congestion charges in the three cities. However, relative magnitudes are difficult to compare across cities, since parameters in ordered logit models are not easily interpreted, beyond their sign and level of significance. Instead, we can illustrate factors' relative importance in the three cities by exploring how much groups of variables contribute to the total explanatory power of the models. All explanatory variables are divided into groups, and we then calculate how much each such group contribute to the difference in log-likelihood between a model containing only constants and the complete model with all variables. In this way, the relative importance of each group of variables can be compared between cities, and groups of variables compared to each other.

Figure 2 shows the results. The first group consists of variables related to self-interest (tolls paid, number of cars, value of time). In Lyon and Stockholm, this only contributes with 20% and 29%, respectively, of the models' total explanatory power. In Helsinki, on the other hand, self-interest is by far the most important predictor, contributing 54% to the total explained variation.

Environmental concerns (agree motor traffic is among biggest threats to environment and that much more resources should be spent on protecting the environment) are important predictors of support for the charges in all cities. In Lyon, it explains a bit less than in the other cities. Acceptability of pricing measures in general (find user financing of roads, noise tax and environmental air tax reasonable; view pricing the ferry as a fair allocation method) is also an important predictor in all cities, contributing between 17% and 35% of the model's explanatory power.

The "trust in government" variables (agree taxes are too high, that speed cameras are reasonable, and that it is fair that a public agency allocates ferry space based on need, think) are important determinants in Lyon and Stockholm, but not in Helsinki. Equity concerns and socioeconomic factors (income, gender, number of children, education) have almost no explanatory power in any city. If the models are estimated with socioeconomic factors only, their explanatory power increases, since they are correlated with some of the other variables; but even then, they can only explain 4-8% of the explained variation in the full model.

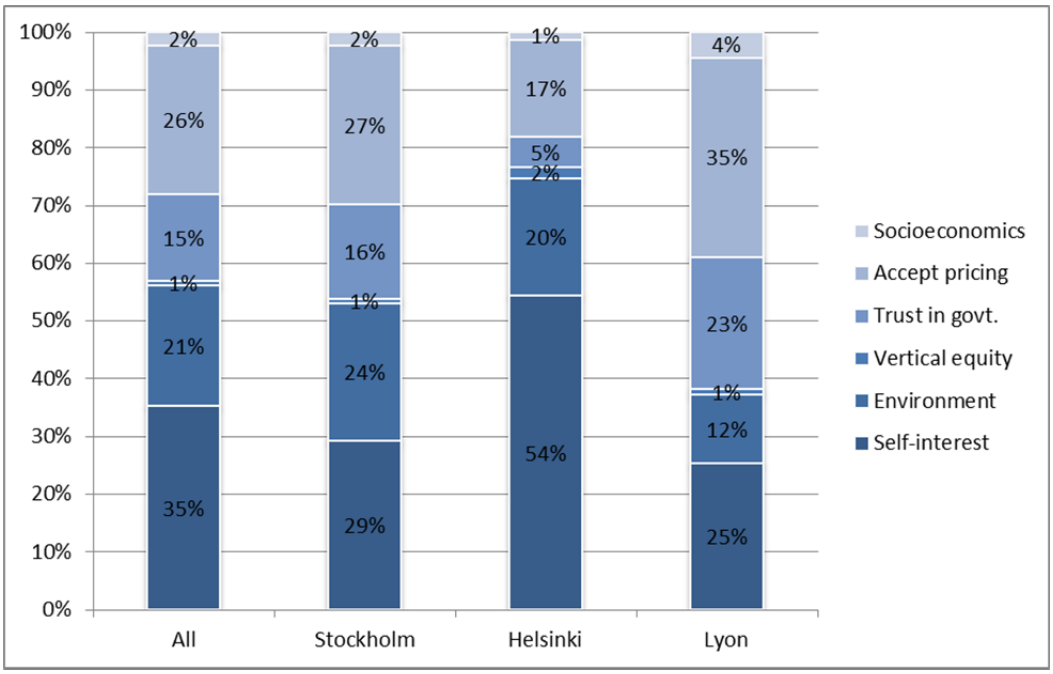

Figure 2. Contribution of variable groups to total improvement of log-likelihood (from constants only to full model).

In a broad sense, results are similar across cities. Self-interest matters, but is far from the only important factor. Environmental concerns and attitudes to pricing mechanisms are important factors in all cities. The main difference is that "trust in government" is not a significant explanatory factor in Helsinki, while self-interest carry much greater weight.

Which factors are most important for explaining attitudes is most likely a function of the local debate. Congestion charges can be associated with different kinds of benefits and drawbacks depending on what arguments are used in the local debate and on the suggested design of the system. The results above should not be interpreted as if Lyon respondents are in general more concerned about equity than those in Stockholm or Helsinki, or as if Helsinki respondents trust the government more; the attitude levels in these and other issues were reported in Table 1. But the links between congestion charges and attitudes and values such as concerns for equity, environment or rationality become stronger or weaker depending on how the issue is framed: what arguments are used for and against charges, and in what context it is placed. Congestion charges can be understood, or "framed" or "branded", in different ways in the sense that the emphasis on different motives can vary. More or less emphasis can be put on congestion reduction, environmental benefits, revenue use, or on the principle that scarce resources should be allocated efficiently. Depending on what weights these different motives or aspects get, charges will become more or less associated with attitudes to issues such as environment, taxation and economic rationality. These associations may vary even between cities where fundamental attitudes are similar (and our three cities are fairly similar in that respect), and obviously even more the more different they are. Heberlein (2012) calls the associations between attitudes to issues that are perceived to be similar the *horizontal structure* of attitudes, while the *vertical structure* refers to how attitudes are anchored in beliefs and fundamental values.

Different arguments also seem to carry different weight at different times of a process. In Helsinki, an extensive system covering a large part of Helsinki was debated at the time the survey was made. The system would affect a large share of all car trips in

Helsinki, and the effects on travel costs was very much in focus in the public debate. Most likely, this explains why self-interest is such a strong variable in Helsinki. In Lyon, the issue was not on the agenda, so respondents had less reason to consider how it would affect them personally; instead, arguments of principle such as allocation fairness carry more weight. In Stockholm, respondents have discovered over the years that only a minor share of their trips are actually affected, and hence, self-interest is a less important determinant, and principles such as attitudes to environment, fairness and taxation matter more.

Next, we turn to the question what explains the differences in attitudes to charges between cities. These differences can depend on two things: differences in variable levels, for example if there are more or less environmentally concerned respondents in a city, or differences in the link from variable levels to attitudes, for example if environmental concerns affect attitudes differently across cities. To explore this, the following illustrative calculation is conducted. First, all variables are set to the same value for respondents in all cities[3]. This gives a baseline value for support, if respondents had been similar in all measurable respects in all cities. Then, variables are changed to their true levels for all respondents, one variable group at a time, and the change in support is noted. Results are shown in Table 4. To make results more readable, they are shown as the share of positive respondents excluding neutral, rather than the underlying five-level responses (from "certainly yes" to "certainly no").

Table 4. Changes in support level from different variable groups.

	Stockholm	Lyon	Helsinki
Only constants	**48%**	**20%**	**27%**
Socioeconomics	*-2%*	*4%*	*3%*
Self-interest	*10%*	*2%*	*5%*
Environment	*8%*	*10%*	*3%*
Support pricing policies	*5%*	*1%*	*3%*
Vertical equity	*-1%*	*0%*	*-1%*
Trust in govt.	*-2%*	*-6%*	*-5%*
Actual support level	**67%**	**31%**	**34%**

When variables are set equal in all cities, there are still big differences, especially between Stockholm and the two cities without experience of congestion charges. With all variables at the chosen default levels, support for the charges is about twice as high in Stockholm compared to Lyon or Helsinki. Setting variables to their actual levels one group at a time, some interesting differences can be seen. Since default variable levels were chosen more or less arbitrary, it is only the relative changes across cities that are interesting. When self-interest variables are set to actual levels, support in Stockholm increases relative to the other cities. This means that less people think they are worse off with the charges, or more people think they are better off, in Stockholm compared with the other cities. This is consistent with the hypothesis that benefits appear larger and losses smaller once congestion charges are in place. Adding environmental variables, the support in Stockholm and especially Lyon increases relative to that in Helsinki. Adding the support for pricing policies in general adds only a small difference, with a slightly larger effect in Stockholm. The equity variable matter very little. The

[3] Default values are male, lower education, children in household, less than 45 kEUR monthly income; one car, toll payment "high", willing to pay 2 Euro for ferry; "no opinion" in the attitude questions.

"trust in government" variables increase the difference in support between Stockholm and the other two cities.

Summing this up, we can conclude that there are several factors contributing to the differences we see between cities, but most of the difference between Stockholm and the others is left unexplained. Self-interest factors and trust in government increase support in Stockholm relative to Lyon and Helsinki. Less environmental concerns in Helsinki decreases support there compared to the other cities. But even after accounting for all observable differences in variables, substantial differences between cities remain. In fact, the single most important factor seems to be what we can denote the "experience effect". This is discussed further in section 5.

4 EFFECTS OF SCHEME DESIGN: REVENUE USE AND DISCOUNTS

4.1 Impact of revenue use on the support

Several studies have shown that acceptability of congestion charging is influenced by how the revenues are used. (Anesi, 2006; Banister, 2003; Sælen & Kallbekken, 2011; Schlag & Schade, 2000; Schlag & Teubel, 1997). Often, people prefer that revenues are earmarked, usually to purposes within the same sector as revenues come from (Deroubaix & Lévèque, 2006; Kallbekken & Aasen, 2010).

Our survey included a number of questions about whether respondents would change their minds regarding congestion charges if the system was changed in various ways. Responses were marked on a 7-grade scale from "would become much more negative" to "would become much more positive". One of these changes concerned earmarking the revenues, either to road improvements or to public transport improvements. Figure 3 breaks down the voting preference in each city by the stated propensity to change opinion given a change to the scheme, and then separately for frequent car drivers and non-frequent car drivers.

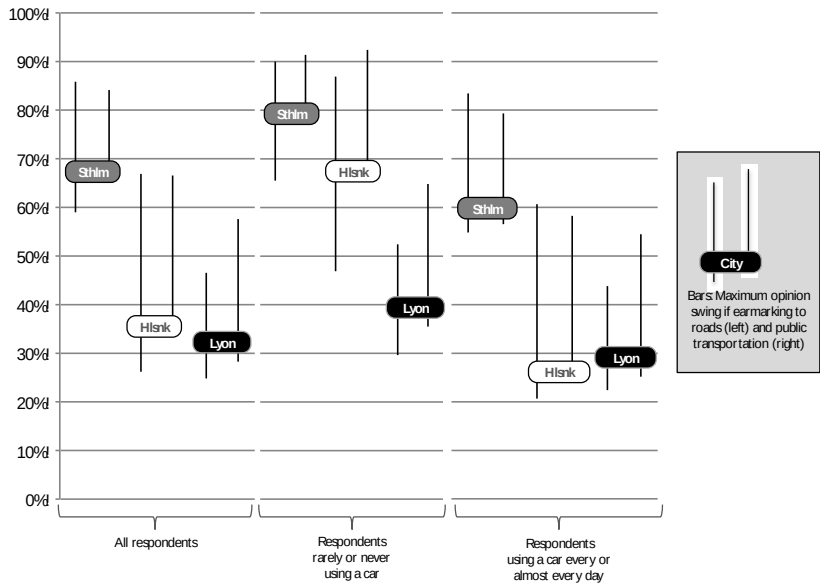

Figure 3. Baseline opinion and maximum swing triggered by earmarking. Left line of each city: effect of earmarking to road improvements. Right line of each city: effect of earmarking to public transport.

The city labels indicate the baseline voting preference, with the leftmost group representing the whole population (same values as shown on line 5 in table 1). The

next two groups of city labels indicate the voting preference for the subsamples of those using car only a few times per month or less (middle section), and those using it a few times per week or more (rightmost section).

From each city label run two bars, indicating the propensity for this share of the population to switch opinion. The left bar represents earmarking to roads and the right earmarking to public transport. The length of the bar is the share of the sample that state that they would become more positive or negative if revenues were earmarked. The upward pointing bar shows how many *No*-voters and undecided would be more likely to vote *Yes*, and the downward bar shows how many *Yes*-voters and undecided would be more likely to vote *No*. Becoming more positive or negative is obviously not the same as actually changing how one would vote; but the length of the bar shows how much the voting shares could potentially change.

It is evident that earmarking generally increases support; the upward bars are almost always taller than those pointing downward. Earmarking to roads leads to both negative and positive reactions in all subsamples, while spending revenue on public transport rarely reduces the support more than a few percentage points. Drivers are in general keener to support spending on public transport than non-drivers are on spending on roads (the left bar stretches further down in the mid section than in the rightmost section for each of the cities).

There is another interesting detail in the difference between how the effect of hypothecation to roads differs from hypothecation to public transport (not visible from the chart). When revenue is dedicated to roads, people who are certain to vote *No* are just as, or almost just as, likely to be influenced by the hypothecation argument as those only *Leaning towards No*. While many of the certain *No*-voters may not be sufficiently influenced to actually switch over to voting *Yes,* the intensity of their disapproval is at least influenced. And if the purpose of hypothecation is not to maximise the number of people just barely choosing to vote *Yes*, but rather to reduce the strength of the opposition, then the data suggests that a hypothecation to roads may be the better bet.

4.2 Discount for low income drivers

Respondents were also asked whether they would become more positive or negative to congestion charges if low-income drivers got a discount. Figure 4 illustrates the potential opinion swing of a low-income discount, in the same format as Figure 3.

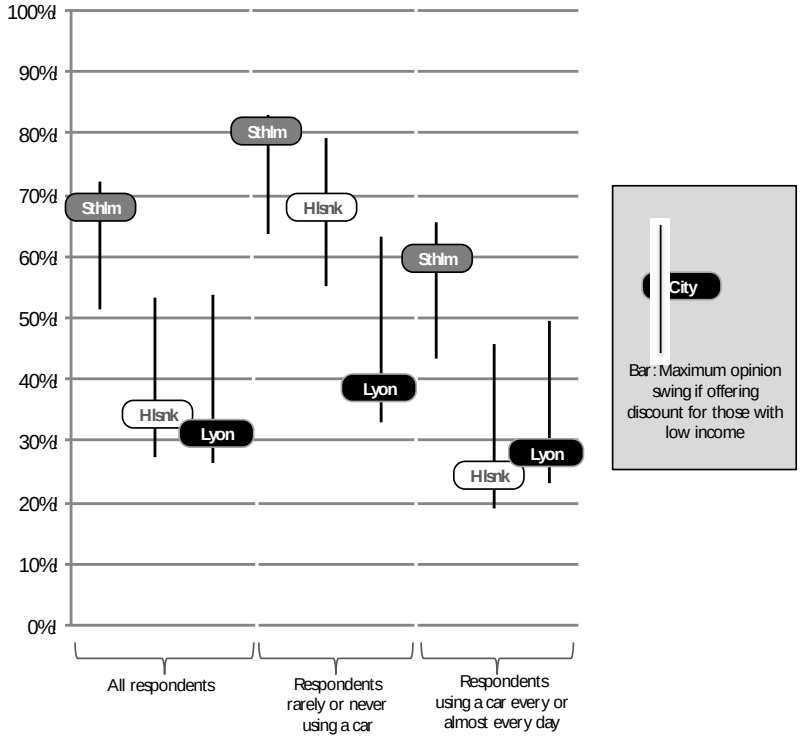

Figure 4. Baseline opinion and maximum swing triggered by discount to low-income drivers.

In Stockholm, both drivers and non-drivers are on average negative to a low-income discount. Apparently, equity is not a strong argument against charges in Stockholm, at least nowadays. Our impression is that it was an important argument when charges were first put on the agenda. But after a number of studies have shown that a majority of rush-hour car drivers in the inner city of Stockholm are in fact relatively affluent, the equity issue seems to have become less important.

In Lyon and Helsinki, substantial shares of negative respondents state that they would become more positive with a low-income discount. In Lyon, this is true both for drivers and non-drivers, while in Helsinki it is mainly drivers who state this. It is difficult to draw any definite conclusion from these statements, especially since no link was found between general equity concerns and resistance to congestion charges. It is possible that the answers to this question is just a "warm-glow" effect; if you oppose congestion charges, it might feel better to motivate this by arguing that it is because it would hurt low-income groups rather than referring to just your own self-interest.

5 ATTITUDE FORMATION AND THE EXPERIENCE EFFECT

Two of our findings beg for a more detailed discussion. First, while objective effects and self-interest influence the support for congestion charges, it is far from the only determinant. Attitudes to other related issues also play a major role, and how these associations are formed would merit further discussion and research. Second, even after controlling for differences in a large number of explanatory factors, a substantial difference in support for congestion charges remains between Stockholm, the only city in our sample with actual experience of congestion pricing, and the other two cities. Based on our survey, we obviously cannot separate differences between cities from differences over time. But it is worth noting that current support levels in Lyon and Helsinki are similar to what it was in Stockholm before charges were introduced. After

controlling for demographical, behavioural, and attitudinal factors, it can be argued that the remaining difference between the cities could be interpreted as an experience effect.

It seems to be a pervasive phenomenon that "familiarity breeds acceptability" of congestion charges. Many cities have reported that the public opinion of congestion charges has become more positive after charges have been introduced (Eliasson, 2014; Odeck & Bråthen, 2002; Odeck & Kjerkreit, 2010; TfL, 2004). An intuitively plausible explanation is that people do not expect the positive effects of congestion pricing to be as big as they turn out to be in reality, and that the surprising realisation of benefits causes the opinion to change (Goodwin, 2006). This is at least partly supported by Schuitema et. al. (2010), who found that people in Stockholm, after having experienced congestion pricing, perceived that congestion, parking problems, and pollution had decreased more than they had expected beforehand. The same authors also found that people's actual out-of-pocket travel expenditures did not increase as much as they had feared. In summary – the benefits turned out to be better than expected, and the worst fears did not materialise.

However, Eliasson (2014), using a longer data series, shows that changed beliefs about the charges' benefits can only explain a minor part of the change in attitudes in Stockholm. Instead, he argues that the political context and framing of the charges played a major role in the drastic shift in opinions in Stockholm. Similar arguments are made by Winslott-Hiselius et. al. (2009) and Brundell-Freij and Jonsson (2009), who suggest a process in which the change is due to a re-evaluation of personal values, so that the same objective effects were evaluated differently.

The "experience effect" can possibly be attributed to a variety of related psychological mechanisms. Schade and Baum (2007) show by an experiment that a scheme does not have to be implemented for acceptance to increase: it is sufficient that a respondent believes that the introduction of the scheme is already decided and unavoidable. The authors suggest that so-called *cognitive dissonance* is the most likely explanation, which in this context means that people tend to accept the unavoidable. Another mechanism that could explain the experience effect is the fact that people tend to overvalue what they have and may lose, and undervalue what they do not have but might gain – a phenomenon referred to as the endowment effect (Thaler, 1980), loss aversion (Kahneman & Tversky, 1984) and status quo bias (Samuelson & Zeckhauser, 1988).

There is a large literature on attitude formation in social psychology (the summary here draws on Heberlein (2012)). Attitudes tend to be more stable the more vertical and horizontal structure they have. Vertical structure refers to how attitudes are anchored in an individual's fundamental values and beliefs (experience and knowledge). Horizontal structure refers to how attitudes in similar issues relate to each other. Attitudes form a network where many interrelated attitudes strengthen each other. When people are faced with a new issue where attitudes are not well developed, new attitudes are often formed by associating the new issue to some familiar one, where the individual already has a well-developed attitude. The new issue then inherits the attitude from the familiar one. Generally speaking, the new question will be linked to an existing issue which is perceived to be similar, in some sense, to the new one. Such new attitudes, which are based on limited experience, knowledge and emotions, tend to be less stable, and may change comparatively easy if they are associated to another issue.

This is similar to what Kahneman (2011) calls the *substitution heuristic.* This refers to the psychological process of the mind replacing a difficult question with a simpler one,

and answering that instead, without reflecting on the change. For example, for a person giving environmental issues top priority, the property of the congestion pricing policy that may pop out as most striking may be its potential for reduction of vehicle kilometres travelled. For her, the policy resembles a measure to reduce the use of cars, to which the reaction is likely to be a positive emotion. Meanwhile, for a person with strong libertarian values, the key characteristics that stand out may be the precision and inexorableness of the intervention itself, i.e. the surveillance cameras, the detailed database of people's whereabouts, and the fact that money will be transferred from individual control to the state. To this person, the answer to the substituted set of questions may be something like "This looks like just another way for the government to expand its scope of control and monitoring, and I don't like it at all."

From this reasoning, a tentative generalisation can be made. Attempting to project the results from this study to another city, one would need to understand the public discourse of that city, and what aspects congestion pricing may be associated with. If for example congestion pricing was suggested in a city where the public places a high value on economic development, and not so much attention to the natural environment, it is likely that some of the explanatory factors would be very different. In this case, one would need to foresee which characteristics of the congestion pricing policy will resonate with an economic development discourse, and then to anticipate whether this characteristic is interpreted as a support or an obstacle given the chosen frame of reference. This way, the attitude is not only shaped by the design of the congestion pricing scheme, but also by the frame of reference and the dominating values common in the population.

6 CONCLUSIONS

The purpose of this paper is to explore what variables affect public support and for congestion charges, comparing and explaining variations between three cities.

First, self-interest variables matter as expected. Respondents are more positive the higher value of time they have, the less they expect to pay, and the fewer cars they own. But self-interest is far from the only explanatory factor: it explains only a third of the total explained variation in Lyon and Stockholm, and around half in Helsinki. Presumably, the difference between the cities in this respect is linked to the cities being in different stages of a process: Helsinki was at the time debating a specific congestion proposal, so increases in travel costs loomed large while any benefits were distant and uncertain. In Lyon, congestion pricing was a purely hypothetical question, and in Stockholm, the charges had already been incorporated in everyday life.

Second, attitudes to congestion charges are strongly linked to various other attitudes. We have identified three broad groups of such attitudes: environmental concerns, attitudes to public interventions, and attitudes to various kinds of pricing policies. Pricing policies can be subdivided into user pricing, polluter pricing and scarcity pricing, and our results indicate that higher acceptability for each of these pricing principles increase acceptability of congestion pricing.

Finally, experience of congestion charges seems to be the single most important factor. This is consistent with the common observation that support increases once congestion pricing has been introduced. This is most likely a combination of status quo bias, larger benefits than expected, and less adverse effects than expected.

What issues are associated to congestion charges are in many respects similar in all the cities, but the strength of the associations varies. The strength of associations seem to depend on how congestion charges are framed: in which specific local discourse it is placed, and how it is "branded" or "marketed". In some contexts, congestion pricing can be associated with environmental policies, in some contexts with fiscal policies, in some contexts with economic efficiency and so on. For a decision maker wanting to promote congestion charges, it would be crucial to try to link congestion charges to the "right" associated attitudes. For example, in a local context where environmental concerns are strong, it might be a successful strategy to link congestion pricing to such issues, whereas in a local context where economic efficiency and rationality are charged with positive emotions, using such arguments might be a successful strategy. It would seem that transport economists tend to prefer the latter strategy, which might not necessarily be the most politically successful one.

7 ACKNOWLEDGEMENTS

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