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Exploring public perceptions of tradable credits for congestion management in urban areas

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ABSTRACT

Congestion is threatening the accessibility and liveability of urban regions. Cities are usually hesitant to consider the effective, yet controversial idea of congestion pricing as a measure to abate the growing economic and environmental problems. In the longstanding search for an effective and acceptable pricing scheme, there has been an increased interest in tradable credits. Compared to charging instruments, this novel concept has the theoretical advantage that it can better address equity issues while effectively reducing congestion. Although one may argue that tradable peak credits (TPC) lead to higher public acceptability, very few empirical studies have researched this. Therefore, this study explores attitudes towards TPC using five focus groups with Dutch citizens. The participants were confronted with a hypothetical city where two instruments were suggested: peak charge (PC) and TPC. Most participants preferred PC and only two participants supported TPC while opposing PC. The advantages as addressed in literature played minor roles in the discussions. Participants revealed a sceptical attitude towards TPC or were more convinced about PC. Contrary to expectations, the attitudes became more negative as the discussions developed. Based on these insights, we propose directions for future research to assist the search for an acceptable congestion pricing instrument.

1. Introduction

Accessibility is essential for strong and vital cities, but is under pressure in many urban areas. Increasing congestion levels have led to a longstanding search for efficient measures to manage car use and to decrease additional emissions. Congestion pricing is widely recognized by transport economists as the best measure, in welfare terms, to abate congestion and optimise traffic flow when the expansion of infrastructure is impossible or unwelcome (e.g. Eliasson & Mattsson, 2006; Kim & Hwang, 2004, Seik, 2000). The effect of congestion pricing on emissions has received less attention but this also has promise (Cavallaro et al., 2018; Kishimoto et al., 2017; Miguel et al., 2017). Despite the strong theoretical arguments, the implementation of congestion charging is currently limited to only a few cities worldwide, including Singapore, Durham, London, Stockholm, and Gothenburg. Congestion charging schemes have proven very difficult to implement, mainly due to their typically low public acceptability (Vonk Noordegraaf et al. (2014) provide an overview of studies). Hence, many researchers have tried to explain why people accept (or reject) road pricing (Gaunt et al., 2007; Grisolía et al., 2015; Jaensirisak et al., 2005; Kim et al., 2013; Schade & Schlag, 2003; Schuitema & Steg, 2008; Ubbels & Verhoef, 2006). These studies have revealed various reasons why people oppose congestion pricing including people's disbelief in the effectiveness and efficiency of the scheme, scepticism towards the government and how they will employ the revenues, the perception that the scheme will treat people unfairly, and the expectation that they will be financially ill-served. With these arguments in mind, transport economists have increasingly shown an interest in the concept of tradable credits[1] as an instrument to manage congestion (e.g. Raux, 2002; Verhoef et al., 1997; Viegas, 2001).

Tradable credits for congestion management can have different designs, but the basic idea is that the government sets a 'cap' on the number of cars passing a certain point, area or stretch of road within a particular time frame and translates this cap into credits. These credits are distributed (via auction/booking or free allocation) among the participants (e.g. all car users or citizens) every week, month of other unit of time. Every time the participant passes that certain point (within a certain time) a credit is redeemed from her/his budget. Once the credits have been distributed, participants can trade the credits within the group of participants and this market of supply and demand determines the price of a credit. We refer to Fan and Jiang (2013), Grant-Muller and Xu (2014), and Dogterom et al. (2017) for reviews on the

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[1] Other studies also refer to credits as permits or rights (Fan & Jiang, 2013)

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concepts of tradable mobility credits. A tradable credit scheme is, theoretically, effective due to the cap since it can reach that predefined cap/goal with the lowest possible social costs because of the use of the market mechanism allocating capacity efficiently, and it can address equity issues by distributing free credits while remaining budget neutral, i.e. there is no revenue flow to the government. In other words, it is expected not to be perceived as 'yet another tax'.

Because of these characteristics, one can argue that this budget-neutral concept can lead to higher acceptability levels than alternative policies such as a congestion charge. This idea is also supported by empirical studies done by environmental scientists that typically find higher acceptability levels for tradable carbon permits compared to alternatives such as a carbon tax (e.g. Bristow et al., 2010; IPPR, 2009; Owen et al., 2008; Wallace et al., 2010). However, no studies have yet been done to see if this also applies to tradable credits applied to congestion management (henceforth: 'tradable peak credits' or 'TPC') (see Section 2). Indeed, TPC is a different policy compared to tradable carbon credits, with different policy aims and a different scheme design, so public opinions may be different.

This study aims to provide a first, in-depth, exploration of public opinion about TPC and systematically compares it with peak charge (PC), a similarly minded but simpler charging based measure. To that effect, this study employs a qualitative approach, making use of focus groups. This method gives participants room for discussion by asking them to share their ideas, views, and experiences of the topic at hand. Participants quiz each other and have to explain their arguments and standpoint to each other. This interaction allows them to build upon one another's arguments, revealing ideas that otherwise may have stayed unheard, and it also allows them to identify and counter each other's extreme views or thinking errors. Hence, focus groups do not only give insights into the ideas and thoughts of the individuals but also into their motivations and behaviour and the extent of agreement and disagreement (Morgan, 1996). Since TPC is a novel and complex concept which the respondents do not have any experience of, and probably do not have fully developed opinions about, using focus groups may help to develop those opinions in a more comprehensive way than an in-depth interview or survey would. The reason is that in the real world people do not develop their opinion about policy ideas in isolation but they can be influenced by the arguments of others, which is what is simulated in focus group discussions (Kitzinger, 1994). Hence, using focus groups may result in a richer, more in-depth and potentially more valid measurement of participants' opinions, compared to in-depth interviews with single participants.

We investigated people's reactions to the introduction of TPC in a hypothetical city. A sample of 36 residents from the Delft region participated in five focus group meetings. The sample was selected to represent diverse perspectives that may exist among the public in general.

Section 2 gives an overview of existing literature on the acceptability of road pricing and personal tradable credits to put the novel concept of TPC in perspective. Section 3 describes the methodology. Section 4 presents the results, which are reflected upon in Section 5. The paper ends with conclusions, a reflection on the method, and recommendations for further study in Section 6.

2. Literature: acceptability of road pricing and personal tradable credit schemes

First, a short overview of factors related to road pricing acceptability is given in Section 2.1. Section 2.2 provides an overview of studies on the acceptability of instruments related to TPC, including personal carbon trading and tradable kilometre credits.

2.1. Acceptability of road pricing

Public acceptability of different road pricing schemes has been studied extensively (Schade & Schlag, 2003). In general, public acceptability of congestion or peak charges is low. A recent survey in the Netherlands found that 32% of the public finds a peak charge acceptable (I&O research, 2019).

Studies have revealed many factors that influence road pricing acceptability. Socio-demographic factors are loosely related to acceptability levels. In most of the studies, acceptability is found to decrease with age (Jaensirisak et al., 2005; Nikitas et al., 2011), to increase with educational level (Börjesson et al., 2015; Ubbels & Verhoef, 2006) and income (Glavic et al., 2017; Golob, 2001), and males are on average more positive about road pricing (Börjesson et al., 2015). Most analysts agree that personal perceptions and norms have a much stronger predictive power than socio-demographic factors (Jaensirisak et al., 2005; Schade & Schlag, 2003). In particular, perceived fairness seems to be strongly related to acceptability. Perceived fairness is ranked higher for road pricing schemes that are believed to protect future generations and the environment (reflecting environmental justice), than for policy outcomes that reflect equality or egoistic concerns (Schuitema et al., 2011). Acceptability levels further correlate with expected effectiveness, perceived infringement of freedom, problem perception, environmental concern, expected personal outcome and social and personal norms (Bamberg & Rolle, 2003; Eliasson & Jonsson, 2011; Jakobsson et al., 2000; Rienstra et al., 1999; Sun et al., 2016). Related to expected personal outcome, non-drivers are more supportive of road pricing than car drivers (Grisolía et al., 2015; Jaensirisak et al., 2005). More recently, trust in the government has also been pointed out as a factor which affects citizens' perceptions towards road pricing (Eliasson, 2016; Glavic et al., 2017; Grisolía et al., 2015; Nikitas et al., 2018). Some people also oppose congestion charging because they fear for privacy issues. However, the causality of these relations is sometimes unclear. Bolderdijk et al. (2013) showed that some people construe privacy concerns when they anticipate that the policy will lead to negative personal outcomes.

Regarding the scheme design, revenue allocation is identified as a key factor (Ubbels & Verhoef, 2006). Several studies found that acceptability is higher when the revenues are allocated to the transport system rather than when revenues are added to general public funds (Schuitema & Steg, 2008). Indeed, a group of people finds congestion charging 'just an excuse to squeeze extra money from the citizens' (Pronello & Rappazzo, 2014, p. 204). Also, scheme complexity seems to play a role, but not all of the existing literature is in agreement. Bonsall et al. (2007) conclude that people strongly prefer simple tariff structures, and in a similar way, Jaensirisak et al. (2005) found that people prefer fixed charges over variable charges, mainly because it is more transparent. Ubbels and Verhoef (2006) did not find a significant relation between complexity and acceptability. Furthermore, Glavic et al. (2017) found that people find charges during weekdays more acceptable than at weekends. In the Netherlands, at least, charge differences during the day are not appreciated; a flat kilometre charge can count on much more support than a peak charge (59% versus 32%) (I&O research, 2019). Furthermore, acceptability is negatively influenced by the amount of the charges (Glavic et al., 2017; Ubbels & Verhoef, 2006).

Besides the influence of socio-demographic characteristics, attitudinal variables and scheme design, it is important to note that acceptability levels are not stable but may change over time. In many cases, acceptability increases once a scheme is implemented (Börjesson et al., 2015; Schuitema et al., 2010). Nilsson, Schuitema, et al. (2016) explain that this increase in acceptability is related to changes in beliefs; more specifically, an increased perceived ease of use of the scheme. They further discuss that opposition is not so much explained by specific expected outcomes of the scheme (e.g. decrease in congestion levels), but rather by emotional and value-related motives. Börjesson et al. (2016) provide several other explanations for this shift in attitude and conclude that the status quo bias, in particular, played a major role in the change of attitude.

2.2. Acceptability of personal tradable credit schemes

Although we are unaware of any studies on the acceptability of tradable credits for congestion management, quite a few studies have been conducted on personal tradable credit schemes in the context of carbon reduction. These studies found that most people prefer personal carbon trading over an equivalent carbon tax (Andersson et al., 2011; Bristow et al., 2010; Wallace et al., 2010) although the concept is still generally acceptable to less than 50% of the population. Tradable credit schemes that primarily aim to manage car use have hardly been studied at all. Kockelman and Kalmanje (2005) introduced a non-tradable, credit-based congestion scheme (CBCP) to a group of respondents. They found that 25% of the respondents supported the measure (which is similar to the acceptability level of a flat toll). They expect this figure to grow when people get more familiar with it and, in turn, they conclude that the measure can be a promising policy. Harwatt et al. (2011) interviewed households about a personal carbon trading scheme for car use and a comparable fuel price increase. The trading scheme was perceived as much fairer, more effective and more efficient. Overall, the trading scheme scored much higher on both personal as well as social acceptability levels. Dogterom, Bao, et al. (2018) conclude from their experiment that 22% of Dutch car users and 67% of Chinese car users support a tradable kilometres credit scheme (Dogterom, Bao, et al., 2018; Dogterom, Ettema, & Dijst, 2018). Van Delden (2009) studied the acceptability of a mobility budget among car drivers using focus groups. The author concludes that most car drivers accept the instrument, but think that the effectiveness would be very low due to the complexity of the scheme. Thus, studies on personal tradable credits show varying acceptability levels but also indicate that many people prefer the tradable scheme over an equivalent tax. Nevertheless, these results have to be interpreted with caution since the policies that were studied have different designs, scopes and policy aims.

3. Methodology

This section presents the design of the focus groups (3.1), the methodology (3.2) and finally the data analysis approach (3.3).

3.1. Design of the focus groups

3.1.1. Scenario

The participants were presented with a hypothetical case study. We presented the tradable credits in a simplified city because we are interested in the perceptions and feelings of citizens towards the general principle of trading for congestion management and we think presenting the scheme in an existing city can lead the discussion, unintentionally, to specific local issues. Also, a peak charge was included to make the comparison between TPC and peak charging possible, as it is likely that a real-world tradable credit scheme would be introduced as an alternative to a peak charge. Indeed, the Dutch public in general know about the idea of peak charges, since several variants have been discussed in the media (Smaal, 2012).

We used animated clips with a voice-over to explain the congestion levels in the city and the two instruments. The animations enabled us to explain the concept in the same clear way to all groups. The city consists of two parts connected by a bridge, where there is a severe bottleneck every morning. The clips explain that most congestion can be solved if the number of peak trips decreases by 15%. Hence, the number of credits matches 85% of the current peak trips. The characteristics of the two concepts are described as neutrally as possible. The clips do not explicitly point out the (dis)advantages of TPC over PC, nor are the negative consequences of the congestion levels (such as travel time uncertainty, and economic or environmental damage). See appendix A for the English translation of the movie scripts.[2]

3.1.2. Pilot

A pilot was conducted using students to test the animated clips and the discussion guide (see Table 1). This pilot provided a few insights that led to a few small changes in the order of the topics and included information about the effects of both instruments at the level of a car driver to make the concept less abstract. Also, we included a few questions whereby the participants were asked to answer simultaneously by using coloured voting cards. This forced them to reveal their initial impression before being influenced by each other's arguments.

3.1.3. Number and composition of the focus groups

Most focus groups consist of 6–10 individuals. The ideal group size depends on the topic (Morgan, 1996), but basically, the groups have to be small enough for everyone to have an opportunity to share insights and large enough to provide a diversity of perceptions (Krueger et al., 2001). The composition of the group is also of importance as discussions may flow more smoothly in groups that are homogeneous rather than mixed (Morgan, 1996). When all members have something in common (e.g. social class), this leads to greater dialogue. However, differences between individuals are also important for a vibrant and 'rich' discussion (Kitzinger, 1994). Regarding the number of focus groups, two to three focus groups are likely to capture at least 80% of all themes if the groups are relatively homogeneous (Guest et al., 2016).

We included a relatively large share of car users since this category of people is usually the most strongly opposed to traditional road pricing schemes and dominate the public debate. We chose educational level as the homogeneous social demographic factor because we expected that mixing people with different levels of debating skills and economic knowledge could lead to less effective discussions. This led to five groups in total: lower educated car users, higher educated car users, lower educated mix in mode users, higher educated mix in mode users, and the pilot. The total of 36 participants is in line with recent studies using focus groups (Ferrer & Ruiz, 2018; Kurniawan et al., 2018; Nikitas et al., 2018). We included the pilot in the data analysis since the setup of the guideline hardly changed.

3.1.4. Sampling and recruitment

Respondents from the region of Delft were recruited through placing an advertisement in a newspaper and using the Facebook page of a local newsroom. Since we are interested in people's first reactions to TPC, the advertisement was kept rather generic. The text invited people for a discussion on mobility and several traffic measures. The participants were paid 40 euros[3] for participating, which we consider to be fair compensation for their time and travel costs. The applicants that fit our classifications and led to the most diverse sample in terms of social demographics and household characteristics were invited to the focus groups. This study aims to find a broad range of attitudes, opinions, and arguments, hence representativeness is not of importance. Rather, we made sure to include participants that can be expected to have a different viewpoint on road pricing (e.g. a mother with young children, a well-paid employee with a lease car, a highly educated bicyclist, a lower educated car user with a fixed working schedule, and a retired person with a lower income).

The sample contains 12 women and 24 men who are rather highly educated: everyone obtained at least a secondary school diploma and 75% obtained a bachelor's degree or higher. The average age is 43, with a relatively high number of participants ($N = 10$) under 30 years old and only 2 participants older than 65. Regarding their main occupation, 16 respondents work fulltime, 4 work part-time, 4 respondents are unemployed, 4 are retired and 8 are studying. Regarding their gross yearly household income, 27% of the participants earn less than 20,000

[2] The animated clips can be found here https://doi.org/10.4121/uuid:ce7e45cc-4711-4382-a2e9-1bbf59ede0ed

[3] A person with an average income receives about 25 euros after taxes

Table 1
Discussion guide.

Minutes	Round	Topics	Questions
10	Intro	**Introduction**, explaining rules, programme consent form and introductory round (ice-breaker)	*1. Please tell us your first name, main occupation and most used mode of transport?*
15	1	**Problem perception**	*2. Is congestion a big problem in the NL? [vote: big problem or not such a big problem]* *3. Should the government invest in measures to reduce congestion, even if this at the expense of other investments, such as healthcare education or traffic safety?* *4. If the government wanted to reduce congestion, what would be the best solution?*
15	2	**Peak Charge**	*5. Do you think this is a good or bad idea? [vote: bad idea, good idea]* *6. What is your opinion about this instrument?* *Can you name advantages / can you name disadvantages?* *7. Do you think this instrument will be effective in reducing congestion?*
15	3	**Tradable credits**	*8. Do you think this is a good or bad idea? [vote: bad idea, good idea]* *9. What is your opinion about this instrument? Can you name advantages / can you name disadvantages?* *10. Do you think this instrument will be effective in reducing congestion?*
15	4	**Comparison**	*11. Which instrument do you favour? [vote: tradable credits, peak charge]* *12. Which instrument do you prefer (and why)?*
15	5	**Tradable credits in more depth & credit distribution**	*13. Do you have any advice on how to adjust this instrument?* *14. Do you think it is a good or a bad idea to implement such an instrument in the Netherlands? [vote: good or bad idea]* *15. Who would be eligible for the credits (and who not)?* *16. How should the credits be distributed over this group?*
10	Ending	**Final remarks and questionnaire**	*17. Can you name the most important aspect that was raised in the discussion about peak charge and tradable credits?*

Euros (mostly the students) 30% between 40,000 and 60,000 Euros, 14% 60,000 Euros or more, and 9 participants did not reveal their income. Regarding household composition, 17% live alone, 67% with a partner and 14% with flatmates. People living with children represent 42% of the sample. One participant did not reveal one's household composition. Although we did not ask for participants' ethnic background, we think the viewpoints of lower-educated people with an immigrant background are not represented in this sample. The same applies to (older) people with reduced mobility. The participants' (replaced) names, main socio-demographic characteristics and travel habits can be found in the first nine columns of Table 2.

3.2. Data collection

The focus groups were conducted in Dutch, lasted around 100 min and took place in the period between November 2018 and February 2019. The second author was the moderator of the focus groups and the first author took notes. The moderator is an experienced moderator and to avoid researcher bias he was not involved with the design of the research until the focus groups actually started. The moderator followed a semi-structured discussion guide which was developed according to the recommendations of Morgan (1996), see Table 1. The focus groups ended with a brief survey.

3.3. Data analysis

All verbal data were transcribed. The participants' votes were also included in the transcriptions. We did not transcribe non-verbatim statements such as nodding one's head since this would have required using a video camera, which could have made participants feel uncomfortable. The reactions were systematically analysed following the principles for content analysis (Elo & Kyngäs, 2008). Content analysis is a method for identifying, analysing and describing categories within data in order to attain a condensed and broad description of the topic at hand. We chose to employ an open-minded, inductive, coding approach in which we analysed the data without any a priori theoretical assumptions because attitudes towards TPC have not been studied before and arguments may come up that are new to the road pricing debate.

4. Results

The results are presented in accordance with the structure set out in the discussion guide: the perceived advantages (4.1), the perceived disadvantages (4.2), expected effectiveness (4.3) and acceptability (4.4). The first two topics are the explorative parts of the discussion, without the researchers prescribing any factors or topics. The latter two topics were more focussed, narrowing it down to acceptability and expected effectiveness. These two factors were also addressed in the survey. Hence, these topics are supplemented with data from the survey. The results are based on participants' arguments, even if these were factually incorrect. Section 5 will reflect on the misperceptions. Furthermore, it is important to note that the results in 4.1, 4.2, and 4.3 are based on the TPC scheme in which the credits are allocated based on historical road use (see appendix A). In Section 4.4, different credit distributions and their influence on acceptability will be addressed. The names of the respondents have been replaced by fictional names for privacy reasons. We refer the reader to Table 2 to see the group structure and the participants' main characteristics.

4.1. Perceived advantages

When asked about advantages, most arguments relate to the potential effects on congestion. Participants argued that TPC makes car users more aware of the problem and their own behaviour, and it makes them think twice before driving in peak hours (Karst; Quint; David; Cato; Brent; Valco; Lucas). In line with this, someone thought that putting the responsibility to alleviate issues that accrue from congestion onto the road users was a positive thing (David). TPC puts road users in charge of the problem. This can give them the feeling that they are responsible for the problem, and also have the possibility to solve it: *'TPC makes the users, the market, responsible for the problem instead of the government. Now, citizens have to solve the problem with each other; it can give them the feeling of having more control'* – David.

Some argued fewer peak trips will decrease congestion. A few participants pointed out that congestion will even be solved, at least in theory (Aron; Anna; David): *'The peak trips will be reduced by 15%. Thus, the problem will always be - kind of - solved' – Anna.* It is also mentioned that a reduction of congestion is beneficial for the environment (Yara). The participants revealed rather generic perceptions regarding the advantages of a decrease in congestion, i.e. only one person (Aron)

Table 2
Main personal characteristics of the participants and their attitude towards TPC before and after the discussion. The names are replaced.

Name	Personal characteristics								TPC support			
	Sex	Age range	Education	Children	Occupation	Main mode	Car use	Peak trips	Start	Post survey		
									Bad/good	Acceptable	Vote	Own allocation
Group 1 (pilot with students)												
Anna	F	20–29	B	N	Student	bicycle	monthly	< 1		1	✗	✗
Aron	M	20–29	B	N	Student	train	monthly	< 1		2	✗	✗
Britt	F	20–29	B	N	Student	bicycle	weekly	< 1		2	?	?
Brent	M	20–29	B	N	Student	bicycle	(almost) never	< 1		2	?	✓
Christiaan	M	20–29	B	N	Student	bicycle	few times a week	< 1		1	✗	?
Cato	F	20–29	M	N	Student	bicycle	monthly	< 1		3	✗	✓
David	M	20–29	B	N	Student	train	(no driver license)			1	✗	✗
Group 2												
Emiel	M	70–79	HSD +1	N	Retired	car	few times a week	2	✗	1	✗	1
Frits	M	30–39	HSD +2/3	Y	Fulltime	car	daily	5	✗	1	✗	3
Gideon	M	–	B	N	Entrepreneur	car	few times a week	< 1	✗	1	✗	1
Hugo	M	30–39	HSD +2/3	N	Fulltime	car	daily	5	✗	1	✗	2
Isaak	M	50–59	HSD	N	Fulltime	car	daily	5	✗	3	?	4
Jaap	M	60–69	HSD	N	Unemployed	car	few times a week	< 1	✗	1	✗	1
Karst	M	70–79	HSD	N	retired	car	few times a week	< 1	✓	4	✓	3
Group 3												
Lucas	M	50–59	M	N	fulltime	car	weekly	< 1	✓	5	✓	4
Lara	F	30–39	B	N	fulltime	car	few times a week	3	✓	5	✓	5
Marc	M	50–59	M	N	retired	car	daily	3	✗	3	✗	3
Maureen	F	50–59	B	Y	unemployed	car	few times a week	2	✗	1	✗	1
Nico	M	30–39	M	N	fulltime	motorcycle	daily	5	✓	5	✓	5
Nadine	F	40–49	B	Y	part-time	car	few times a week	2	✓	4	✓	4
Olive	F	30–39	M	Y	unemployed	car	daily	3	✓	3	✓	3
Group 4												
Peter	M	20–29	M	N	part-time	bicycle	(almost) never		✗	4	?	5
Quint	M	40–49	HSD	Y	fulltime	car	few times a week	5	✗ & ✓	3	?	3
Rene	M	50–59	B	N	fulltime	truck	daily	5	✗	1	✗	1
Rafaela	F	20–29	HSD	N	student	tram/metro	(no driver license)		✓	2	✗	4
Simon	M	50–59	B	N	fulltime	bicycle	weekly	< 1	✗	2	✗	3
Thijs	M	60–69	M	N	unemployed	bicycle	weekly	< 1	✓	1	✗	4
Tirza	F	60–69	B	N	retired	car	few times a week	< 1	✗	2	✗	2
Ulrich	M	50–59	HSD + 2/3	N	fulltime	car	daily	5	✓	3	□	4
Group 5												
Vera	F	60–69	B	N	part-time	bicycle	weekly	1	✓	4	?	4
Valco	M	50–59	B	N	fulltime	car	daily	5	✗ & ✓	3	✓	4
Wende	F	50–59	M	N	part-time	bicycle	few times a week	1	✗	1	✗	1
Willem	M	40–49	M	Y	fulltime	car	few times a week	4	✗	2	✗	4
Xander	M	40–49	PhD	Y	fulltime	bicycle	weekly	< 1	✗	1	✗	1
Yara	F	30–39	M	Y	fulltime	train	(almost) never	< 1	✗	2	?	3
Zach	M	20–29	M	N	fulltime	car	few times a week	2	✗	1	?	4

Education: highest achieved diploma where HSD stands for high school diploma; HSD + X stands for high school diploma + X years; B stands for Bachelor's degree; M stands for Master's degree; PhD.
Children: whether they have a child/children younger than 12 years old in their household (Yes / No).
Main mode: the mode they use to cover the largest distance on an average day (Monday to Friday).
Peak trips: average number of times they use the car in morning peak hours (07,00-09,15) in an average week (Monday to Friday).
TPC bad/good at start: this standpoint was measured right after the explanation of TPC and before the discussion started. It was measured using the coloured cards on the statement 'TPC is a good (✓) or bad (✗) idea'.
TPC acceptable in post survey: this standpoint was measured with the statement 'I find TPC an acceptable instrument' on a five-point Likert scale (1,totally disagree to 5,totally agree).
TPC vote in post survey: this standpoint was measured with the question 'in a referendum setting where TPC is suggested, I would vote…' (✗ stands for against; ✓ stands for in favour; ? stands for I don't know; □ stands for a blank vote).
TPC own allocation in post survey: this standpoint was measured in the post survey with the question 'I find TPC an acceptable instrument if the credits are distributed according to my own preference' on a five-point Likert scale (1,totally disagree to 5,totally agree), or in the case of the pilot: 'in a referendum setting where TPC with my own preferred credit allocation is suggested, I would vote…' (✗ stands for against; ✓ stands for in favour; ? stands for I don't know; □ stands for a blank vote).

pointed out that car users' travel time losses will be reduced.

Others think it is beneficial that the concept is new and trendy (Lara; Aron). Some considered trading as fun (Lara, Nadine).

When compared to the peak charge, six participants considered TPC to be a more positive instrument, since car users are also rewarded instead of only punished (Lucas; Nico; Nadine; Lara; Simon; Cato). Indeed, under peak charge, all car users travelling in peak hours have to pay (Britt; Nadine). A few also considered it to be an advantage that car users could financially benefit from it (Lara, Nadine): '*Personally, I would like this instrument. Indeed, I'm a civil servant and have many vacation days (..) Hence, I can benefit from the instrument – Lara'*.

The characteristic that revenues stay within the system was only mentioned once as an advantage: '*the nice thing about TPC is that the money stays within the system' – Thijs.* One participant argued that TPC has less impact on a frequent car user compared to peak charge and therefore it is preferred: '*In the TPC system, it is feasible to adapt your*

behaviour. Indeed, avoiding the peak with the car once a week is still doable. – Ulrich'.

4.2. Perceived disadvantages

When asked about the disadvantages, the arguments are greater in number, and more diverse.

Most arguments relate to perceived unfairness. Participants argued that TPC is unfair since most people cannot avoid the peak and hence are forced to pay (Gideon; Marc; Christiaan; Tirza; Xander; Hugo). '*You are tied to commitments. I would hope that the government would let us do our work – Gideon'*. Also, people with a lower income will be affected more than people who can easily afford it, which is perceived as unfair (Emiel; Marc; Zach). '*I'm afraid this picks on the little people, who can barely afford this – Marc'*. Some are afraid that the credits will become unaffordable for normal people when rich people or companies buy all the credits (Rene; David; Wende; Xander). *'I fear that companies, only rich companies, would buy up a lot of credits (…) People who have to travel to visit a physician or so, won't be able to buy a credit anymore' – David.* Also, the allocation of credits is seen as unfair. The allocation proposed in the clip distributes the credits according to the historical use of the bridge. Participants found this unfair for people like visitors and tourists (Olive; Valco; Xander; Christiaan), but also for people who do not get any credits in the initial allocation because they have previously been using a bicycle or public transport instead of a car (Peter). Multiple participants argued this allocation has a perverse effect because it favours those who drive a lot and will continue to do so (Olive; Edwin; Zach; Willem; Yara). '*By selling your credit, you reduce your chance on more credits for the next week – Olive'*. Or as a participant summarizes: *'Everyone receives the same number of credits at the start. But some need more credits than others. So do you look at equality of needs, or equality of people? You never get that right' – Zach.* Lastly, some found the trading mechanism unfair because it is disadvantageous to people who do not understand the system very well, while it is advantageous to smart traders. People who are not used to working with digital systems, such as the elderly (Frits; Emiel; Jaap; Quint; Zach), or who are not familiar with this system because they are only visiting the city (Christiaan) are at a disadvantage. This entails the risk of excluding these people from the transport system during peak hours.

The complexity of the trading system is also a frequently mentioned disadvantage. The complexity of the system complicates the feasibility, implementation, and enforcement of it, which were also often mentioned as disadvantages (Hugo; Nico; Olive; Thijs; Rene; Ulrich; Valco; Xander; Aron; Britt David; Anna; Lara; Marc). '*I just can't get the picture. I think too many problems will arise during the implementation – Aron'*. Several participants argued that users can misuse the system (e.g. speculation or fraud) (Isaak; Olive; Tirza; Xander; Marc; Rafaela; Zach) and that trading can even lead to dangerous traffic situations if users are trying to buy a credit while driving the car (Aron; Lara; Quint).

Another main argument is the 'hassle' of the trading system, referring to the time and (mental) effort users have to spend on trading (Aron; Christiaan; Jaap; Frits; Nico; Olive; Simon; Vera; Xander; Cato; David; Brent). *'People already forget to pay for their parking ticket..'- Frits.* Some of them argued that the benefits (reduction of congestion) do not outweigh the costs of the system (including the mental costs) (Valco; Xander; Brent; Christiaan; Aron): '*TPC solves one little problem but spoils it for everyone. Does 15 minutes of waiting in congestion justify TPC? Well, no!' – Xander*.

Lastly, some pointed out the invasion on people's privacy as a disadvantage (Marc; Maureen; Olive).

When comparing the two instruments, several participants argued that TPC has lower feasibility (Christiaan; David). The instrument is more complex and entails risk in implementation and enforcement. '*The peak charge system seems easier to implement, and also easier to explain… and it just seems more practical for everyone' – Christiaan*. Also, participants who were in favour of TPC acknowledged the difficulties regarding implementation: *'I agree that TPC will be difficult to enforce, but I also think that, if it is made feasible… it would be a rather fair system' – Ulrich.*

Furthermore, in a TPC system, the prices are uncertain, whereas with a peak charge system everyone knows the costs (Brent; Wende; Quint; Tirza); '*The price of a credit can already have increased in the time between leaving your house and crossing the bridge' – Wende.* Therefore, PC is also seen as fairer: '*in PC, the prices are the same for everyone. In TPC it might be that your neighbour pays just 70 cents while I have to pay 5 Euros' – Cato.*

Lastly, several respondents argued that a peak charge provides revenues, which are seen as something positive since it is an incentive for the government to improve the transport system (Yara; Rafaela; Simon; Wende): '*Although I acknowledge that a revenue flow to a government that can spend it freely has disadvantages… at least that money can be used to stimulate a pleasant environment' – Wende.*

The fact that TPC is much cheaper for a frequent car user compared to the peak charge does not seem to influence many people: '*the problem is, TPC still hits the lower income groups harder' – Zach.* '*Why should this cost money, again?' – Emiel.*

4.3. Expected effectiveness

The animated clip explained that the total number of credits is based on the capacity of the bridge, which lies 15% lower than the current demand which is causing the congestion (see Appendix A). Nevertheless, only a few respondents argued that, due to this cap, TPC is potentially very effective (Anna; Aron; Peter; Cato). '*In principle, this solves all congestion because all overabundant cars are removed – Cato'*. Many participants had their doubt about the effectiveness, for diverse reasons:

- People will misuse the system (Britt; Aron; Zach; Xander; Tirza; Isaak; Olive; Rafaela; Marc; Simon) and, for example, commit fraud, hoard the credits or hack the system. This strategic trading behaviour can lead to undesired side-effects, such as brokers pushing up the credit price. Participants draw the comparison with the extreme resale prices of concert tickets and the unpredictable volatility of bitcoins: *'Some will make a business case out of this; they buy credits they don't need, to sell them at a different moment. Like what happens with concert tickets' – Xander*.
- TPC will cause new congestion. Because the peak will shift in time (David; Britt) or because the physical toll gates of a TPC system will create new congestion (Marc).[4] '*If no one wants the pay, everyone will use the road at a different time of day which will create a new peak period' – David.*
- It will work only temporarily (Cato; Wende; Rafaela; Hugo; Isaak; Jaap).[5] '*At a certain point, when the demand decreases because more people start to take the bus, the price will also decrease. Consequently, it will become more attractive to take the car again. This way, you maintain the demand for car use' – Cato*.
- People will continue to drive in the peak hour and just accept the 5 Euros fine they receive (Aron; Simon; Willem; Wende).[6] '*It's not fool proof because of that fine of 5 Euros. Will that stop people from using the road? Not me.'- Wende.*

[4] Marc made a wrong assumption regarding the physical toll gates: the animations explained and visually showed that the credits would be redeemed automatically.

[5] It seems that several participants did not understand that TPC is able to attain the given goal for a reduction in peak trips, even if the demand increases, since the number of credits is an absolute constraint.

[6] They misinterpreted the information in the movies. The animations explained that if a car user crosses the bridge without a credit, (s)he will receive a fine and has to pay 5 Euros + *the credit price*.

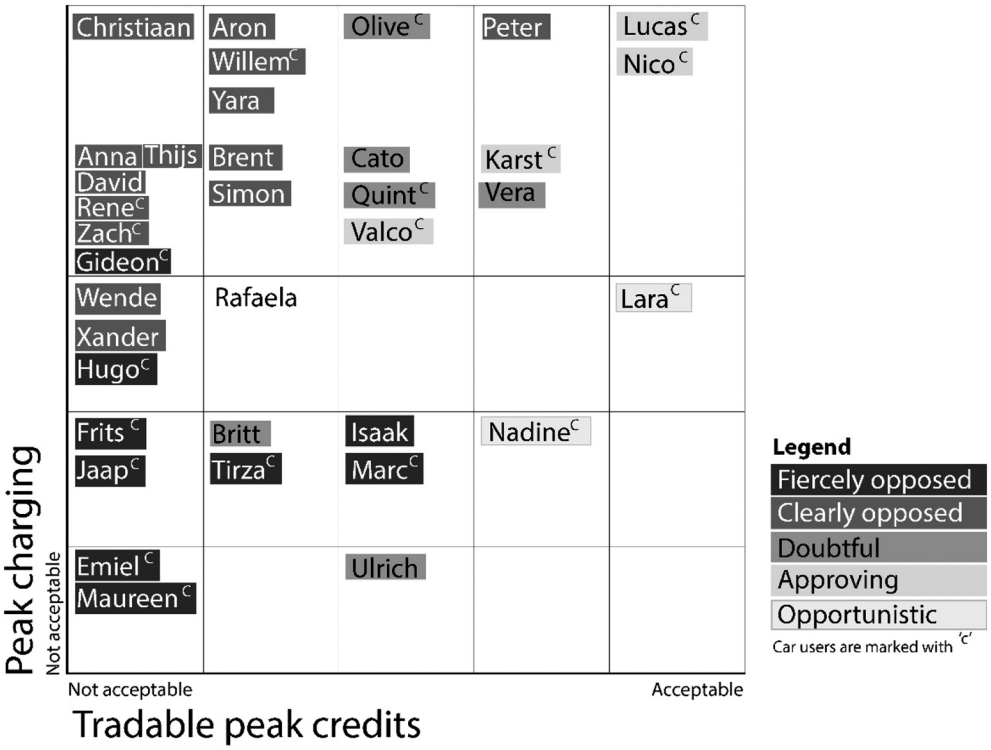

Fig. 1. The participants' acceptability levels. The position of the names represents the respondents' answers to the statements in the post-survey: 'I find tradable peak credits an acceptable system' and 'I find peak charge an acceptable system', using a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. One person (Rafaela) did not provide enough arguments to be able to label her.

Furthermore, it is argued that TPC is not effective because it does not solve the real problem: '*The real problem is the congestion caused by accidents, which lead to very long and unreliable extra travel time' –Tirza.*

In the post-survey, the participants were asked to express their expectations of the effectiveness of both instruments on a 5-point Likert scale. 15 participants (strongly) agreed on the question 'I think TPC reduces the congestion', whereas 10 answered neutral and 11 (strongly) disagreed. Regarding the question: 'I think TPC reduces the impact of the car on the environment', 12 (strongly) agreed and 17 (strongly) disagreed. The expected effectiveness is higher among the people who oppose TPC.

4.4. Acceptability

Section 4.4.1 presents the results based on the arguments provided in round 3 and 4 about the TPC scheme with credit allocation based on historical use. Some participants changed their attitude towards TPC during the discussion which will be discussed in Section 4.4.2. That section also presents the influence of different credit allocations on support.

4.4.1. Five types of supporters and opponents

The reactions towards TPC in terms of support or acceptability were very heterogeneous. First, we distinguished three groups: opposing TPC, supporting TPC and a neither supporting nor opposing group. After clustering the arguments of the people in these groups, we could distinguish two types of opposers, and two types of supporters. We analysed all participants and their arguments again and could place 35 participants within one of the following homogeneous groups that we labelled as: fiercely opposed, clearly opposed, doubtful, approving, and opportunistic.

Nine participants strongly rejected both instruments (Maureen; Emiel; Jaap; Frits; Tirza; Isaak; Marc; Gideon; Hugo). They consider congestion to be a problem which should be solved by the government, without harming car users. TPC is considered as: *'A cheap non-idea. The government is saying; figure it out yourself'– Gideon.* Most of these participants reacted to both of the instruments suggested in an annoyed way and deviated from the discussion by repeatedly providing other ideas to combat congestion, including improving people's driving ability, park & ride facilities and extra lanes. Advantages, such as the lack of revenue for the government, were dismissed with the argument that the government never offers anything for free. Most of these people expressed a critical attitude towards the government. All of the people in this group use the car as their main mode of transport.

Fourteen participants clearly opposed TPC (Christiaan; Willem; Aron; Yara; Thijs; Zach; Anna; Rene; David; Brent; Simon; Wende; Xander; Peter). They showed a good knowledge of the Dutch transport system and other policy ideas. They were convinced that other policies or technologies can offer more effective and efficient solutions. Most of them supported the peak charge concept since they consider it an effective, simple instrument for managing congestion. Also, several people in this group emphasized that a financial instrument should be part of a larger transport policy including soft measures, such as flexible working hours. One of them, however, argued that he would support the implementation of TPC since '*any policy is better than the current system' – Peter.* Only three of them use the car as their main mode of transport. Most people in this group use a bicycle or train as their main mode.

Six participants (Cato; Quint; Olive; Ulrich; Vera; Britt) showed an open attitude towards the concept of TPC but did not take a strong position in either accepting or rejecting it. On the one hand, they see the advantages of the instrument and they reacted positively when the concept was presented. They like the positive approach that TPC has, compared to peak charge, and as Ulrich said, '*it is very hard for many car users to avoid the peak time five days a week, but with TPC you only have to reconsider your peak trip once a week'.* However, they also see many barriers and they became more negative about the implementation and feasibility of the concept during the discussion: '*At first, I found TPC a nice idea. But I believe disadvantages, in particular, will keep on emerging from the discussion' – Quint.* Half of them (3 out of 6) use the car as their main mode of transport.

Four participants supported TPC because they think it is necessary to implement a financial incentive to reduce congestion, regardless of whether the scheme is budget neutral (TPC) or not (PC) (Lucas; Nico;

Karst; Valco). They find congestion a big problem and feel that car users are (partly) responsible for solving it. Their main arguments are related to their belief in the effectiveness of the instruments. They find TPC more 'positive' but also mentioned disadvantages regarding practicability. All of them use the car as their main mode of transport.

Two participants (Nadine, Lara) were positive about TPC while rejecting the peak charge. They stated that TPC would be a fun instrument and both argued that they would probably benefit from such a system since they have flexible workings hours and can easily avoid peak times if they want to. Both use the car as their main mode of transport.

Fig. 1 provides an overview of the respondents' acceptability levels, based on the answers in the post survey. 20% of the participants (strongly) agree with the statement 'I find tradable peak credits an acceptable system' and 56% state this about the peak charge instrument (using a five-point Likert scale). When we only consider the car users ($N = 21$), these numbers are 29% and 43%, respectively.

The acceptability of TPC is comparable what was found in the study done by Dogterom, Bao, et al. (2018) where it was found that 22% of the car users accept tradable kilometre credits, and by Kockelman and Kalmanje who found support levels of 25% for credit based congestion pricing (Kockelman & Kalmanje, 2005). For tradable carbon permits, public acceptability typically lies between 36 and 44% (Andersson et al., 2011; Bristow et al., 2010; Wallace et al., 2010). The acceptability of the peak charge is relatively high in our sample, given that a recent opinion study found that about 32% of the Dutch population supports a congestion charge in the Netherlands (I&O research, 2019).

The answers given by a few participants in the survey seem to deviate from what their positions were during the discussion. Peter was very critical of TPC during the discussion, but in the post survey he agreed with the statement 'I find TPC an acceptable system'. Also, Hugo, Isaak and Marc had a more critical attitude during the discussion than in the survey. Peter explained himself by stating that although he strongly prefers the peak charge, he would still support TPC since '*any policy is better than the current system' – Peter.* The other four participants did not explain their attitude, but a similar explanation may apply to them. Isaak, and Marc may consider TPC the least bad option, and Hugo may consider the peak charge the least bad option.

4.4.2. Shifts in support

Acceptability was also measured right after the explanation of TPC to force participants to reveal their initial response to TPC before they could be influenced by each other. This allows us to identify any shifts in acceptability. Thijs, Ulrich, Olive and Rafaela became more negative towards TPC during the discussion as can be seen in the tenth and eleventh column of Table 2. Peter was the only participant who became more positive about TPC as explained above. The data of the first group are incomplete because the voting cards were not yet introduced. The change in standpoint will be discussed in Section 5.2.

Since the distribution of the credits was expected to have a big impact on acceptability, the participants were also asked about their preferred credit allocation. Participants had rather differing ideas for credit distributions:

- Equal credits for *everyone (Frits; Hugo;)* or for *all inhabitants* (Peter; Yara; Zach), or for *people who use the road* (including cyclists etc.) (Thijs), or for a *combination of regular road users and inhabitants* (Ulrich).
- Equal allocation *for all cars / car owners* (Isaak, Jaap; Tirza; Quint; Simon) *with extra credits for families* (Maureen).
- An allocation based on *historical road use* (Lucas; Willem), that takes into account *(changing) needs* (Lara; Nadine).
- *People who make trips that are more important for the economy receive more credits (Olive; Valco)* or *credits should be distributed among companies (Rafaela).*
- Furthermore, Karst prefers a '*very simple allocation*', and quite a few others refused to answer this question (Gideon, Rene, Wende, Xander).

The last column of Table 2 shows the support for TPC given that the credits are allocated according to people's own preferred allocation. In total, ten participants changed their acceptability level towards a more positive attitude. Thus, about 20% of the participants consider TPC to be acceptable as presented in clip 3 (in which credits are allocated based on historical road use), and this rises to about 40% when the credits are distributed according to people's own preferred allocation.

5. Reflection and discussion

A wide range of perceptions, opinions and arguments were presented in the previous section. This section reflects upon the results, and discusses a few insights.

5.1. Theoretical advantages of TPC

As stated in the introduction, current literature on tradable credits outlines certain benefits of the system. Obviously, the main advantage of TPC (or any road pricing instrument) is that it reduces congestion which can relieve economic and environmental traffic problems, including pollution and health problems, traffic noise, travel delays, travel time uncertainty, and insufficient room for active modes. Nevertheless, the majority of the participants maintained their rather generic standpoint about traffic problems and the potential advantages of TPC/PC, especially about the environmental advantages. When the discussions started with the question 'is congestion a big problem in the Netherlands?', almost everyone agreed that congestion is a big problem and participants gave different arguments related to economic damage or annoyance for road users. Only two participants explicitly mentioned environmental damage/emissions as a current problem and only one participant explicitly mentioned 'less pollution' as a potential advantage of TPC. These participants did not get response from other people in their group so their argument quickly died in the discussion. This lack of arguments related to environmental problems is remarkable since, as Schuitema et al. (2011) showed, for many supporters of road pricing, environmental justice is the main reason to support a road pricing instrument. The link between environmental arguments and supporters was also found by Pronello and Rappazzo (2014) in their focus groups about a road charge that would be in force between 7.00 a.m. and 7 p.m. in Lyon, while in our study, it seems that these environmental arguments did not play a major role for most supporters (or opponents) of TPC or PC. Although peak hour based schemes also lead to positive effects on emissions (Cavallaro et al., 2018), it may be that participants underestimate these effects. It may also be that this lack of environmental arguments was related to the framing in our study in which TPC and PC were both presented as possible solutions to manage car use and reduce congestion, and the participants were not provided with extra information on the potential impact on pollution, for example. In contrast, Pronello and Rappazzo (2014) presented transport policies as instruments to tackle congestion and pollution and most surveys about road pricing acceptability explicitly ask respondents about their environmental attitudes. This underlines that the way in which a policy is presented, can influence the outcomes.

Furthermore, TPC has some unique characteristics compared to traditional congestion charge schemes which may lead to higher acceptability. These include the higher effectiveness due to the cap, the free allocation of credits which can address equity issues and the absence of any increase in (coercive) collective payments. These characteristics, however, were not mentioned at all, or were barely mentioned, as advantages in the discussions. Most participants expect that TPC will decrease congestion, but not as much as a peak charge will. Only a few participants seemed to understand that a cap-and-trade system is theoretically more effective in reaching the predefined goal of

peak trips. Interestingly, almost everyone indicated in the first round that congestion is a big problem and the government should do something about it, but as soon as TPC was introduced, some of them fine-tuned their argumentation and argued, for example, that travel time loss is not the problem, but the high unreliability in travel time caused by accidents is. TPC will not solve that problem. Others argued that the congestion levels are not severe enough to justify the implementation of TPC.

The lack of revenue for the government was not seen as an advantage by the majority of the participants. Some argued that revenue from a peak charge is an advantage since the government can use it to improve alternatives or infrastructure. But also, those who disliked the revenue stream from a peak charge, did not consider the lack of revenue in TPC to be an advantage. They do not believe TPC will be budget neutral and consider it a tax.

With respect to the distribution of costs and benefits, current literature argues that the TPC scheme can address equity issues related to traditional charging schemes by the distribution of free credits: this offers participants the opportunity to avoid any costs or even financially benefit from it, and it provides regulators a flexible tool with which they can control the distributional outcomes. However, only one participant argued that the (free) credit distribution could reduce equity issues, although many considered the allocation to be a difficult or even unsolvable task. The participants were first shown a TPC scheme in which credits are allocated based on historical car use. The fact that car users would be far better off financially through TPC considering this allocation compared to a peak charge scheme seems to be the deciding factor for the two 'opportunistic' participants, and their reason to support TPC. Unsurprisingly, many participants who use public transport or bicycle opposed this allocation and consider the scheme unfair. But also when the discussion started about other potential credit allocations, participants argued that regardless of the allocation it would still hurt certain groups disproportionally (such as people on lower incomes) and therefore it is unfair. Moreover, some found it unfair that TPC can provide the better/smarter traders with advantages.

5.2. Changing opinions

Participants developed their opinion during the discussion and some changed their position regarding the concept. In the post survey, 17 participants stated that they became more negative about the concept during the discussion, whereas 10 participants became more positive. 9 participants did not change their opinion about TPC, either positively or negatively. Self-report has limitations, but the evolving opinions were also noticed during the discussion. Some participants enunciated their strong opinion, without being visibly influenced by other people's arguments. However, most participants reacted to each other's arguments, bringing the discussion to a higher level. A few changed their standpoint about TPC towards a more negative position, namely Thijs, Ulrich, Olive, and Rafaela. At first, they were positive about TPC but became neutral or even negative by the end of the discussion. Arguments about the implementation issues, in particular, seemed to persuade them to move towards a more negative attitude. This observation of opinions becoming more negative may seem to be in contrast with Nikitas et al. (2018) who reported how participants in their focus groups changed their attitudes regarding conventional road pricing in Bristol. In their focus groups, seven participants (out of 30) changed their standpoint, with five becoming more positive. A possible explanation for this difference is that in a discussion on regular road pricing, proponents can convince others about the effectiveness of road pricing using a multitude of evidence and experts opinions. Whereas in a discussion about TPC, evidence and the opinions of experts that advocate the scheme are lacking.

5.3. Misperceptions

Even though the concept was explained by using a simplified case study, and the participants were relatively highly educated, the number of misperceptions about the scheme and its effects was quite high. In the post survey, two-thirds of the participants (fully) agreed with the statement: 'I find tradable peak credits perfectly understandable'. Nevertheless, at least 13 participants interpreted TPC (partly) incorrectly. It was hard for many participants to fully grasp the market mechanism, see Section 4.3. The cap-and-trade principle was hard to fully understand for many people, or, they did not believe the mechanism would work. Participants argued that TPC would not work since car users would simply accept the 5 Euro fine, neglecting the information from the video that explained that the fine would be 5 Euros + the cost of a credit. Others thought the expected increase in future car use would lead to more credits and hence congestion. Market mechanisms and trading are not common practice for most citizens, and they are totally different from current policies concerning citizens. This finding is in line with the results of Owen et al. (2008), who conducted focus group sessions on tradable carbon permits and report that quite a lot of participants had difficulties in grasping the concept of trading. On the other hand, participants did seem to understand the concept of a peak charge. It is unknown whether the misperceptions about TPC are caused by the lack of familiarity with the concept, and/or by the complexity of the scheme. This is relevant for further study since understanding a policy is considered to be a requisite for accepting it (Schlag & Teubel, 1997).

5.4. Opponents acted more fiercely than supporters

Lastly, when we compare the supporters of TPC with the opponents, we notice that many of the opponents had a much fiercer attitude. This is not surprising and has also already been described in congestion charging literature (Pronello & Rappazzo, 2014). It can be explained by prospect theory (Kahneman & Tversky, 1979): losses hurt more than similar gains feel good.

6. Conclusion, policy relevance & next steps

This study is the first exploration into public perceptions of the extremely novel policy concept of personal tradable credits for congestion management (TPC). To that end, 5 focus groups were employed in which 36 Dutch citizens participated. They discussed the (dis)advantages, expected effectiveness and acceptability of a peak charge (PC) and a TPC system.

The participants were heterogeneous in their perceptions and opinions, but we could distinguish five main types of reject/accept positions. The majority of the participants rejects TPC. One homogeneous group fiercely opposes any policy instrument that can disadvantage car users, regardless of the costs for the car user. The other homogeneous group of opponents simply do not see the point of making all the effort and taking all the risks associated with the implementation of TPC while simpler instruments, such as the peak charge, have already been proven to be effective and efficient. Of the minority that supports TPC, two people supported it mainly through self-interest. Four participants liked the positive framing of TPC, but also mentioned the difficulties regarding the feasibility. Lastly, six people initially liked TPC, but changed their mind during the discussion and moved towards a more neutral position.

On average, PC is considered more acceptable than TPC. This outcome contrasts with the studies on tradable carbon permits, which typically find higher support for tradable schemes compared to an equivalent tax as discussed in Section 2.2. A possible explanation is that TPC means that the user is required to do more transactions, while in a tradable carbon scheme, users can trade on a yearly basis. The method employed might also explain (part of) the differences in the results. We

saw that participants developed their opinion about the topic having heard each other's arguments, and some of the people who were initially positive about TPC became more negative. Most of the earlier studies employed methods that did not have this influence, such as interviews or surveys. But the bottom line is that only seven participants (20%) found TPC to be an acceptable instrument. This number doubles when participants may decide their own credit allocation. Thus, even when people may decide the credit distribution and hence influence the welfare redistributions, many people still reject TPC.

There is plenty of overlap between current literature on road pricing and the arguments that emerged during the discussion. Arguments related to fairness/ equity, effectiveness, and trust in government were the main themes, which is similar to discussions on conventional road pricing (Grisolía et al., 2015; Liu et al., 2019; Nikitas et al., 2018; Pronello & Rappazzo, 2014). A few new themes emerged from the discussion that have barely been studied in the light of TPC's acceptability: the 'hassle' (time, effort), the perceived complexity and, related to this, the intelligibility and user friendliness. Respondents, including the supporters, also expressed their concerns about the chance of misuse and the (technical) feasibility of the instrument. Moreover, a new type of perceived unfairness arose in the discussion. Opponents do not only find TPC unfair since it disadvantages lower incomes and people with (fixed) schedules, but also since it disadvantages people who are not the smartest traders or who receive no credits because they did not use the bridge in the past. The only positive new aspects are that some find trading and the expectations of financial gains 'fun' and some argue that TPC will lead to increased awareness and it is a better motivational mechanism. In contrast to previous road pricing literature, this study found that environmental arguments were quite rare in the discussion.

Trading the right to access public property, such as road infrastructure, is a drastically new idea. Some of the objections opponents have, can be solved by the way of communication or by adjustments to the scheme design. This topic needs further study. Indeed, negative media coverage and unsuccessful communication are potential fail factors in road pricing implementation (Ardıç et al., 2018; Vonk Noordegraaf et al., 2014) and tailoring information with respect to people's values can be effective in getting more support for policy measures (Nilsson, Hansla, et al., 2016). The amount of 'hassle' can be decreased by (partly) automating the system and/or distributing the credits over a longer period of time, and exemptions can be made for visitors/tourists. Successful real-world experiments can abate worries about the technical feasibility and undesired effects, such as hoarding, for example, and these experiments can also help users to better understand the system and market mechanism. Acceptability for the policy idea may increase when people see and understand the effects of the temporary system, which was the case in previous road pricing trials (Börjesson et al., 2015; Schuitema et al., 2010). Although the causality of the objections and the acceptability level is unclear. It may be that people rejected TPC regardless of the scheme design and adopted arguments that support their position.

Other objections are more challenging to tackle or even seem insurmountable. A big challenge lies in finding an acceptable distribution of credits. Participants had widely diverging ideas on *who* should get credits in the first place, the discussion did not even go into how credits should be distributed across groups of people. Just like a congestion charge, TPC redistributes income. However, whereas with a congestion charge this remains implicit, since it is based on travellers' willingness to pay, TPC makes this explicit, due to the allocation of credits. Thus, contrary to expectations, the (free) distribution of credits seems to make TPC less acceptable. Furthermore, many people (strongly) supported PC and considered TPC an unnecessarily complex alternative. It is questionable whether they would change their support level since the concept of the peak charge is already permeated in their minds. Hence, TPC may be a more viable alternative in areas or countries where congestion charging schemes are not well-known or cannot count on much support.

Turning to the method employed in this study, the focus groups proved to be useful to get in-depth insights into the richness of arguments, opinions and attitudes, since it helped many of the participants to develop their opinion regarding TPC. All participants were actively engaged in the discussion and everyone indicated in the survey that they felt (very much) at ease during the discussion. The approach also has some limitations. First, the respondents were recruited via an advertisement and received a fee for participating. This might facilitate the self-selection of persons who have a strong (negative or positive) opinion about car use or are solely interested in the allowance. We think the latter did not apply since all participants were actively engaged. Second, we limited the study to one simplified scheme in a hypothetical city. However, the exact scheme design (e.g. credit allocation), the way of explaining and framing the instruments and the underlying problems, and the implementation process within a larger package of transport improvements probably influence the acceptability levels to a large extent (see e.g. Bristow et al., 2010). Third, this is a qualitative study. It should be recognized that the findings are an indication of the views of only a small group of (relatively highly educated) individuals. It may be obvious that these views are not fully representative of the views of all citizens. Nor does this sample account for the possibility that certain subgroups such as older people (Nikitas et al., 2011) and car users, have potentially more influence on political decisions regarding road pricing. Lastly, we emphasize that this is a first study capturing one moment in time, while acceptability of road pricing instruments may change over time, through the influence of new knowledge and experience.

Author statement

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Declaration of competing interest

None.

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Appendix A. Scripts

In total, 4 animated clips were shown to the participants. The first author will share these animations on request. The English transcriptions of these clips are as follows:

Clip 1: introducing the casus

In the up-coming two discussions, we will talk about two traffic measures. First, I will explain the situation that the measures are proposed for. To this end, we will use a fictional city. We made this so-called 'City X' simpler than in the real world, whereby we can focus on the traffic measures and we won't spend too much time on the details of the surroundings.

City X is divided by a river. The shortest route from one side of the

city to the other side is via the only bridge. There are no other bridges or tunnels in the city. Expansion of the infrastructure is impossible. There is, however, a bus and a cycle path crossing the bridge. The number of motorists that uses the bridge has increased over the last few years, which has resulted in severe congestion every week-day morning during peaks hours. Hence, motorists are stuck in traffic for 15 min on average, ranging up to 30 min.

Nowadays about 10,000 cars cross the bridge during this morning peak time, while the bridge can handle about 8500 cars with a good traffic flow. In other words, if you reduce the current number of cars by 15%, you will solve the congestion. Researchers have calculated that in this case most of the congestion will vanish. If there was still some congestion once a week, a car user would have about a 5 min delay.

Clip 2: peak charge

The following plan has been thought of to battle the congestion: peak charge. Several variations already exist in foreign countries. With a peak charge, motorists need to pay an amount to cross the bridge during morning peak hour. The morning peak hour is between 07:00 and 09:15.

The aim of the peak charge is to decrease the congestion by reducing the current number of peak trips by 15%. This is done by increasing the charge until 8500 cars have crossed the bridge. If fewer cars cross the bridge, the price decreases. If more cars cross the bridge, the price increases. The charge will be adjusted on a weekly basis. The revenues of the peak charge go to the municipality who can spend the money. The revenues can be spent on public transport or parking spots, for example, but can also go to the general budget.

In order to avoid waiting lines due to toll gates, people can register their car to make the payment automatically. People who haven't registered their car, can buy an electronic ticket via telephone or computer. Motorists who haven't registered their car and haven't bought an electronic ticket, pay a fine. The fine is the price of a ticket plus 5 Euros. The bridge remains free of charge outside peak hours.

So, let's take a car user who used to drive 5 times a week in the morning peak hour. Due to the peak charge he now avoids the peak once a week on average. He pays the peak charge on the other 4 days. The revenues go to the municipality.

Clip 3: tradable peak credits

Also, another plan has been thought of to battle the congestion: tradable peak credits. This is a new concept and does not exist anywhere in the field of car use. Therefore, we are curious about your thoughts. Each trip in the morning peak time costs a ‘credit’. The morning peak is between 07:00 and 09:15. The total amount of credits is equal to the number of trips the bridge can handle, thus 8500. That's 15% less than the current number of peak trips. So, if this is the number of peak trips, then this is the number of credits [visualisation].

These credits are distributed free of charge on a weekly basis to all car users who used the bridge weekly in the past month. Everyone receives an equal share. Thus, it might be that some car users receive more credits then they need, while others receive less credits then they need. Hence people can trade their credits. People who want to sell their credits to a ‘trade platform’ receive some money. People who want more credits, can buy these. This platform does not make a profit.

The price of the credit is determined by demand and supply. If a lot of people want to buy a credit, the price increases. If a lot of people want to sell them, the price decreases. Trading and managing the credits works via an app or a website. People can register their car and then credits are automatically written off their budget. People who cross the bridge without a credit, pay the current price of a credit at that moment plus a fine of 5 Euros. The bridge remains free of charge outside peak hours.

So, let's take a car user who drives 5 times a week in the morning peak hour. If he avoids the peak once a week he does not make a profit and does not incur costs. If he continues to use the bridge 5 times a week, he must buy a credit. If he drives 3 times or less, he can sell his credit(s) and make a profit.

As explained, tradable credits are a new concept for car use. The concept of tradable credits, or rights, does exist in other fields. Tradable emission rights in the EU. Or tradable milk credits for farmers, for example.

Clip 4: distribution of the credits

Let's go back to the tradable peak credits. We will focus on one aspect: the distribution of the credits. In order to reduce the congestion, the amount of credits has to be lower than the current number of peak trips.

So far, we have assumed that the credits are evenly distributed among all car users who used the bridge on a weekly basis in the last month. But, the credits can of course be distributed in many other ways.

Firstly, it can be determined who are eligible for the credits. This could be the car users, but also all citizens with a driver license, for example, or all households of the city, all adults, you name it.

Secondly, the credits do not necessarily have to be distributed equally. The credits can also be distributed among motorists, but those with a less polluting car get more credits than those with a polluting car, for example. Another example is to distribute the credits among the citizens. And citizens with a job receive more credits than those without a job. Or, the credits are distributed among residents with a driver license and the credits are distributed according to how many people used the bridge in the past. Countless ways to distribute the credits can be thought of (visualizes many ways of distributing).

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