The consumer-citizen duality: Ten reasons why citizens prefer safety and drivers desire speed

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Abstract

Cost-benefit analyses for transportation projects usually value impacts on safety and travel time through experiments in which consumers of mobility ('drivers') choose between routes which differ in safety and travel time. This approach has been criticized for failing to consider that private choices may not fully reflect citizens' preferences over public goods and means, a concept known as the *consumer-citizen duality*. Recent empirical evidence has established that individuals do indeed assign comparatively more value to safety in their role as citizens than in their role as drivers. Our study aims to provide explanations for this finding by presenting four stated choice experiments in which respondents were asked to make choices, both as citizens and as drivers, between routes that differed in travel time and safety. Subsequently, respondents were asked to provide reasons for their choices. We identify five cognitive and five normative explanations. The *cognitive explanations* suggest that individuals make diverging choices because their perceptions of accident risk differ between the two roles. Drivers will assign a relatively low value to mitigating accident risk because they believe that: (1) such risks are trivial on an individual level; (2) their personal risk is lower than the average risk; (3) their personal risk is controllable; (4) they would not be able to distinguish relative safety levels in real life; and (5) their choices for others are more risk-averse than choices for themselves and, unlike citizens, they are not explicitly evaluating risky choices for others. The *normative explanations* involve that individuals believe that the government should assign more value to safety compared to individual drivers because: (6) as citizen they are more prone to base their choices on social norms which prescribe risk-averse behaviour in this context; (7) governments have a duty of care concerning the safety of the transportation network; (8) drivers have a relatively high degree of responsibility to reduce their own travel times; (9) governments should account for drivers' tendencies to choose faster routes by building safer ones; and (10) governments should ensure the safety of the road network because this allows drivers to choose the fastest route without being concerned about the impact of their route choice on accident risk.

Keywords: Consumer-citizen duality; accident risk valuation; Cost-Benefit Analysis; Transport appraisal; economic evaluation accident risk

1. Introduction

Cost–benefit analysis (CBA) is used worldwide to support government decision-making on transport projects (e.g. Asplund and Eliasson, 2016; Jones et al., 2014; Thomopoulos et al., 2009). An underlying assumption in standard CBA is that preferences revealed by individuals' willingness to pay in (hypothetical) markets can be used to value the effects of government projects (e.g. Fuguitt and Wilcox, 1999). The postulation that an individual's preferences are restricted by the willingness to pay in (hypothetical) markets is often referred to as 'consumer sovereignty' (e.g. Sugden, 2007). Despite – or perhaps because of – its popularity, various scholars have criticized the use of 'consumer sovereignty' in evaluating public projects. One central theme to their arguments is that the ways in which individuals balance their own after-tax incomes against the attributes of such projects may be a poor proxy for how the same individuals believe that their governments should trade-off public means and effects of public projects (e.g. Ackerman and Heinzerling, 2004; Hauer, 1994; Kelman, 1981; Sagoff, 1988). The general belief that choices made by consumers differ in some way from those made by citizens is also called the 'consumer-citizen duality' (e.g. Alphonce et al., 2014).

The 'consumer-citizen duality' is widely studied in fields such as agricultural economics and food economics (e.g. Alphonce et al. 2014; Blamey et al., 1995; Curtis and McConnell, 2002; Ovaskainen and Kniivila, 2005; Tienhaara et al., 2015). Conversely, it has received relatively little attention in transport economics, with a few exceptions. For instance, Jara-Díaz (2007) argues that a government's decision (not) to finance a project with tax money should be grounded in *society's* willingness to pay to improve its members' mobility, a sum which may differ from the aggregate amount that individuals are willing to pay for the same improvement. He declares that, "*society has its own budget and its own priorities, and clearly total welfare is not necessarily the simple sum of all users' benefits."* (p.106). Mackie, Jara-Díaz and Fowkes (2001) make a similar case, arguing that there is no compelling reason why individual willingness to pay for a shorter commute should be equal to the value that society as a whole assigns to the reallocation of that individual's time savings to other activities. Daniels and Hensher (2000) asked two groups of individuals to evaluate the attributes of a proposed urban road project, the M5 East in Sydney. The first group was asked to evaluate a specific trip and its alternatives from a (self-interested) user/consumer perspective, while the second evaluated

the project as a whole from a citizen/community point of view. A key result is that individuals did not assign significant value to environmental attributes in either setting. One explanation offered for this is that individuals might not be able to accurately process trade-offs between attributes that are close in self-interest proximity (e.g. costs and travel time) with those that are more distant in self-interest proximity (e.g. environmental attributes). Mouter and Chorus (2016) and Mouter, van Cranenburgh and van Wee (2017) define the 'consumer-citizen duality' in a different way by arguing that citizen preferences and consumer preferences involve individual preferences inferred from choices within different budget constraints. Namely, while consumer preferences involve an individual's preferences within his/her personal budget constraint (e.g. after tax income and time), citizen preferences involve an individual's preferences regarding the allocation of the government's budget. Mouter et al. (2017) conducted several experiments in which respondents were asked to choose as consumers between two routes which differed in terms of time savings, safety, and after-tax income. For instance, in one consumer experiment respondents were asked to choose – as 'drivers' – between routes which differed in travel time, accident risk and toll costs. Aside from consumer stated choice experiments, Mouter et al. (2017) also administrated citizen stated choice experiments in which individuals were informed that the government had decided to allocate non-specific taxes (general revenue) to the construction of a new road and wanted the advice of the respondents in choosing between two routes that differed in terms of travel time and accident risk. Through these experiments, they were able to establish that respondents who were asked to provide recommendations as citizens assigned substantially more value to accident risk than travel time, as compared to those who were asked to make route choices as consumers of mobility.

These empirical results could have non-trivial implications for the economic assessment of safety policies; namely, such policies will perform much better in a CBA grounded in citizen preferences than in one which reflects consumer preferences. This raises the question of which approach should be used in evaluating proposed government policies which affect both accident risk and travel time. To answer this, it is first important to understand why people hold different preferences in the first place. Explanations for the consumer-citizen duality in the context of accident risk and travel time could provide empirical building blocks for academics and practitioners who have

to contemplate, discuss or decide about the question whether or not safety policies proposed by the government should be assessed in a CBA based on consumer or citizen preferences.

Despite the fact that the consumer-citizen duality has been studied in a transport context (Daniels and Hensher, 2000; Mouter and Chorus, 2016; Mouter et al., 2017a), to the best of our knowledge, no efforts have been undertaken to *empirically explain* why individuals trade off the impacts of transport projects differently as consumers and citizens. This paper aims to bridge this gap in the literature through the use of an augmented stated choice experimental study. Beyond simply asking respondents to make binary decisions over preferred alternatives, we also elicited and analyzed the lines of reasoning they relied on doing so. In line with the findings of Mouter et al. (2017) of a strong consumer-citizen duality in trading off accident risk and travel time, we opted to make these attributes the focus of the choices presented to participants.

The stated choice experiments conducted in our study each consisted of two parts. The first of these was a consumer setting in which respondents were asked to choose between two routes as drivers; the second was a citizen setting in which respondents were asked to make recommendations to the government on which roads to construct. Respondents were also prompted to elaborate on the reasons underlying their choices; at the end of the stated choice portion of the study, they were each asked whether safety was a more important criterion in their recommendations to the government than in their route choices as a driver. Those that answered affirmatively were then prompted to explain why this was the case. In our study we also investigate whether the motivations provided by the respondents are affected by the magnitude of the risks evaluated or the order in which consumer and citizen choice tasks are performed. For the remainder of this paper, we will use the expressions ‘driver’ and ‘consumer (of mobility)’ interchangeably.

This paper proceeds as follows: Section 2 provides a brief discussion of the literature regarding possible explanations for the consumer-citizen duality in a transport context. Section 3 describes our methodology and the process of data collection. Section 4 presents our results. Section 5 provides a discussion. Section 6 lists the policy implications of our study. Finally, section 7 presents the main conclusions.

2. Literature Review

A key finding of the study by Mouter et al. (2017) was that individuals tend to choose the fastest route as drivers while recommending that the government build the safer route instead. The literature offers several potential explanations for this result. This section surveys these explanations because it allows us to identify the extent to which explanations respondents mention add to the literature. In section 2.1 we discuss four cognitive explanations, which hold that respondents make different trade-offs between travel time and safety because they perceive the associated risks differently as drivers than as citizens. In addition, section 2.2 addresses two normative explanations, according to which the government *should* assign more value to safety than do individual drivers.

2.1 Cognitive explanations

The first cognitive explanation for the discrepancies between the choices of drivers and citizens is that the former entails evaluating tiny impacts on individual mortality risk, while the latter explicitly requires participants to choose the number of traffic deaths on a route. More specifically, if a driver chooses a route with 1 additional traffic death per year, this implies acceptance of an increase of personal mortality risk by 1 in 29,000,000, whereas in the citizen experiments this implies that every year one additional citizen will die in a car accident. Ackerman and Heinzerling (2004) argue that it is likely that people will ignore the 'meaningless figures' in the driver experiments, while in a citizen context they realize that their choice will directly influence how many road users die in a given year. The fact that their decision might contribute to saving a human life can encourage respondents to recommend the safest option. A corresponding explanation follows from prospect theory (Kahneman and Tversky, 1979), which establishes that people are limited in their ability to comprehend and evaluate extreme probabilities. There is a large body of literature which demonstrates that individuals tend to either overweight or discard extremely unlikely events. Furthermore, in a situation where an event is possible but not probable, people's preferences are generally less sensitive to variations of probability than expected utility theory would dictate (e.g. Kahneman and Tversky, 1979; Kahneman, 2011). Hence, prospect theory would predict that individuals will choose for the fastest route in the driver choice tasks because they might (1) discard low probabilities and therefore ignore safety in their

choices, or (2) assign relatively low weight to safety differences between choice options because they are insensitive to risk when making a choice between two events with low probability (drivers may be asked, for instance, to choose between routes with respective mortality rates of 2 in 29,000,000 and 6 in 29,000,000).

The second cognitive explanation is that drivers generally tend to underestimate the risks they personally face because they overestimate their skills relative to those of others (e.g. Greening and Chandler, 1997). There is a large body of literature which establishes that a substantial majority of drivers consider themselves to be more skillful than the average driver (e.g. Delhomme, 1991; Horswill et al., 2004; Svenson, 1981) and, as a result, they estimate their levels of personal risk on the road to be lower than those faced by their peers (e.g. (e.g. Delhomme, 1991; Horswill et al., 2004; Svenson, 1981)). The tendency to believe that one is more skilled and less likely to experience a negative event than one's peers is known as 'comparative optimism' or 'optimism bias' (e.g. Shepperd et al., 2002; Weinstein, 1980, 1984). Although this phenomenon transcends demographic groupings, it is particularly pronounced among young men (e.g. Andersson and Lundborg, 2007; Dejoy, 1992; Gosselin et al., 2010; White et al., 2011; Finn and Bragg, 1986; Harre et al., 2005). The belief that one's driving abilities are better than average might explain why respondents assign relatively low value to accident risk when they are asked to choose between two routes as a driver; they may feel that the stated odds don't apply to them (even while they may desire government intervention to protect their less-gifted peers).

A third, and related, cognitive explanation is that of 'controllability'. The literature establishes that it is more likely that people accept risk they can control when compared to risk that they cannot control (e.g. Dekker et al., 2011; Revesz, 1999; Rowlatt et al., 1998; Slovic, 1987). For instance, individuals' willingness to pay for reductions in mortality risk that is perceived as less controllable (e.g. air pollution) is higher than individuals' willingness to pay for reductions in mortality risk that is perceived as relatively controllable (e.g. road safety). When respondents perceive that the risk in the consumer choices is controllable in the sense that they can influence their risk during their journey, and these individuals at the same time think that the risk they evaluate in the citizen choices is relatively uncontrollable, then it is likely that respondents will assign more weight to safety in the

194 citizen choices than in the consumer choices.

195 The final cognitive explanation stems from a meta-analysis conducted by Atanasov (2015), in
196 which he finds that risky choices made on behalf of others are generally more risk-averse than choices
197 for oneself. Because the choices respondents are asked to make in our citizen choice tasks explicitly
198 impact the safety of other drivers, we can expect that individuals will attach a higher weight to
199 accident risk in the citizen choice tasks than in the driver choice tasks (in which individuals only
200 evaluate their own risks). One potential reason for the tendency of individuals to be more risk-averse
201 when deciding for others involves that people might (implicitly) feel accountable and responsible for
202 the potential risk they impose on others (e.g. Dana and Cain, 2015; Kahneman and Lovallo, 1993).
203 This would amplify one's sense of caution, with more empathetic and blame-sensitive individuals
204 being likely to take others' safety to heart even if they are willing to take certain risks for themselves
205 (Atanasov, 2015). In other words, taking risks on others' behalf can require more backbone than some
206 decision makers possess (Atanasov, 2015).

207

208 2.2 Normative explanations

209 Scientific contributions in the fields of social psychology and political philosophy offer two normative
210 explanations for the consumer-citizen duality investigated in our study. Both of these explanations
211 stem from a belief that one's government *should* assign greater value to safety than individual drivers
212 should be expected to. First, social psychological literature establishes that the power of social norms
213 to drive decision-making is considerably greater when the welfare of others is involved (e.g. Stone and
214 Allgaier, 2008; Roszkowski and Snelbecker, 1990; Teigen et al., 2005). People's decisions in social
215 contexts are based to a large extent on norms of 'correctness' or 'appropriateness', rather than on the
216 costs and benefits of such decisions for other persons (e.g. Stone et al., 2013). Individuals are, for
217 instance, more apt to base decisions involving risk on applicable social norms when deciding for
218 others than when deciding for themselves; the appropriateness of taking risk for others depends,
219 therefore, on the extent to which risk-taking is valued in a particular context (Stone and Allgaier,
220 2008; Stone et al., 2013). Various studies have found that individuals make comparatively risky
221 decisions on others' behalf in situations where risk-taking is valued, such as asking someone out on a

date (e.g. Dana and Cain, 2015; Stone and Allgaier, 2008; Stone et al., 2013). Conversely, in the domain of health and safety, where risk taking is rarely seen as socially desirable, people make more risk-averse decisions for others than for themselves (e.g. Atanasov, 2015; Stone et al., 2013). Social norms in such domains therefore encourage risk-averse decision-making when the effects extend beyond the decision-maker alone. As such, because the choice tasks of our study directly relate to the physical safety of road users, it seems likely that participants will assign a relatively high weight to accident risk in the citizen choice tasks as compared to the driver choice tasks.

The second normative explanation follows from arguments made in political philosophy that providing safety is an activity from which a government derives legitimacy (e.g. Hobbes, 1651/1962). According to Hobbes, for instance, the anarchic 'state of nature' is one where the continual fear of violent death precludes any role for industry or development; as such, the primary imperative for rulers is to move society away from such a state. Even the most radical of modern libertarian political movements – which tend to call for dramatic reductions in the scope of government as a means of maximizing personal freedom – typically agree on the moral justness of continuing to invest in and provide legal backing to their country's police, courts of law and (non-interventionist) national defense (The Libertarian FAQ, 2017). In contrast to this so-called 'night-watchman state', to the best of our knowledge, no political theory or movement exists which has 'promoting travel time savings' as its cornerstone. Since guaranteeing safety has traditionally held such a strong appeal in justifying the existence of governments, we therefore expect that individuals assign more weight to the promotion of (traffic) safety in their roles as citizens than as drivers.

3. Data and Methods

3.1 Research design

The stated choice experiments carried out for this study were both adopted from Mouter et al. (2017); one where respondents took on the role of driver (consumer of mobility), and one in which they took on the role of citizen. We opt for the 'driver' formulation used by Mouter et al. (2017) not only because it is by far the most frequently used approach for consumer experiments in the literature (e.g.

Abrantes and Wardman, 2011; Bahamonde-Birke et al., 2015; Batley et al., in press; Börjesson and Eliasson, 2014; Ehreke et al., 2015; Hensher et al., 2009; Kouwenhoven et al., 2014; Rizzi and Ortúzar, 2003), but this format also shows most resemblance with the citizen experiments. However, the experimental set-up in the present study deviates somewhat from the original design of Mouter et al. (2017) in that respondents completed both driver and citizen choice tasks and were asked to provide verbal motivations for their choices. Hence, we used a within-subject design instead of the between-subject design that was employed in Mouter et al. (2017). Figure 1 presents an example of each of the two components.

Consumer of mobility experiment

Assume the following:

- You drive your car somewhere in the Netherlands and you have to make a choice between two routes
- There are no other persons in the car
- Both routes are 2x2-lane motorways
- Both routes carry 80,000 trips per day, which means around 29 million trips per year
- 80,000 trips per day corresponds with an average 2x2-lane motorway in the Netherlands
- The routes only differ in terms of travel times and number of fatalities on the road per year
- The routes do not differ on other aspects such as costs, environmental effects and non-fatal accidents.

If you have to choose between route A and B, which route would you choose?

	Route A	Route B
Travel time	40 minutes	30 minutes
Number of traffic deaths on the road	2 per year	10 per year

Citizen experiment

The government decided to build a new road.
The government still needs to decide about the route of the new road.
The government asks you whether you would recommend Route A or Route B for the new road that the government will build. Below you will find the characteristics of both routes.

Assume the following:

- Both routes are 2x2-lane motorways
- Both routes will carry 80,000 trips per day, which means around 29 million trips per year
- 80,000 trips per day corresponds with an average 2x2-lane motorway in the Netherlands
- The routes only differ in terms of travel times and number of fatalities on the road per year
- The routes do not differ on other aspects such as costs, environmental effects and non-fatal accidents.
- The government is interested in general preferences of Dutch citizens. Hence, it is not made clear whether or not you would experience any effects (positive and negative) from either of the two routes.

Please select the route which you would recommend to the government.

	Route A	Route B
Travel time	40 minutes	30 minutes
Number of traffic deaths on the road	2 per year	10 per year

FIGURE 1 Design of driver (consumer of mobility) and citizen experiments

To investigate whether the order in which the consumer and citizen questions were presented would have an impact on the answers provided, half of the respondents answered the consumer questions first, while the other half answered the citizen questions first. Moreover, we wanted to test whether participants' stated motivations would differ depending on the levels of risk being evaluated.

Therefore, half of the respondents were asked to make decisions with respect to a provincial road (corresponding with a relatively high accident risk), while the other half did so for a motorway (corresponding with a relatively low accident risk). In the provincial road context, the annualized individual mortality risk levels were 0 in 3,600,000; 1 in 3,600,000; 3 in 3,600,000 and 5 in 3,600,000, while those in the motorway context were 0 in 29,000,000; 2 in 29,000,000; 6 in 29,000,000 and 10 in 29,000,000. In both cases, the attribute levels for travel time on the routes were 30, 34, 38 and 42 minutes. For constructing the experimental design underlying the stated choice experiment we used an efficient design (Bliemer and Rose, 2006).

The questionnaire consisted of four sections, the order of which differed depending on the experiment. For reasons of brevity, we will focus on the case in which consumer choices were made before citizen choices. First, respondents were asked whether they used a car for two or more days per week. Those who answered negatively to this question were excluded from the remainder of the experiment. Second, respondents were asked to make eight choices as drivers, after which they were explicitly asked whether – and why – they generally preferred to take the fastest route or the safest route. Third, respondents were instructed that they would be asked to provide recommendations to the government. In these citizen choice tasks, respondents received eight questions in which they were asked to recommend one of two routes. As before, this was followed by asking whether they generally preferred the fastest or the safest route, and why. Finally, respondents were asked whether safety was a more important criterion in their recommendations to the government than in their route choices as a driver, and, if so, why that was. Based on our objective to study the influence in variations in task order and risk levels, we designed four different experiments. Table 1 shows the characteristics of the four experiments.

TABLE 1 Characteristics of the four experiments

	Experiment 1	**Experiment 2**	**Experiment 3**	**Experiment 4**
Which choice tasks are completed first?	Driver choice tasks	Driver choice tasks	Citizen choice tasks	Citizen choice tasks
Do respondents evaluate high or low accident risk?	Context is a provincial road (high risk)	Context is a motorway (low risk)	Context is a provincial road (high risk)	Context is a motorway (low risk)

3.2 Sampling procedure and data collection

We asked a survey company (Kantar Public) to draw four random samples from the population of Dutch citizens aged 18 years and older. The survey company was not explicitly asked to draw representative samples, but it was important that all segments in terms of gender, age, education and income were represented. 412 of the respondents recruited by the survey company completed the questionnaire. Kantar Public provided us with additional information about the socio-demographic characteristics of each respondent (e.g. income, age, education, gender). Table 2 provides information regarding the socio-demographic characteristics of the respondents who participated in the four experiments.

TABLE 2 Socio-demographics

	Exp 1	Exp 2	Exp 3	Exp 4
Total	105	109	97	101
Gender (percentage)				
Female	42	38	44	44
Male	58	62	56	56
Age (percentage)				
18 to 29 yr.	12	15	19	14
30 to 39 yr.	9	14	18	17
40 to 49 yr.	19	19	16	23
50 to 59 yr.	22	20	20	17
60 to 69 yr.	15	19	15	17
70+ yr.	24	13	12	12
Completed education (percentage)				
Lower education	24	11	11	8
Higher education	41	56	47	46
University education	35	33	41	47
Household gross income (percentage)				
I < 12 900	2	2	4	5
12 900 ≤ I < 27 000	25	16	12	16
27 000 ≤ I < 40 000	10	17	18	14
40 000 ≤ I < 67 000	28	40	37	37
67 000 ≤ I < 79 900	17	12	11	7
I ≥ 79 900	18	13	18	22

3.3 Data analysis

To begin with, we investigated the extent to which choices differed across the four experiments. For this, we estimated Random Utility Maximization (RUM) discrete choice models. These models postulate that decision-makers choose the alternative with the highest total utility among the set of available alternatives. Utility is conceived to be partly observed and partly unobserved, from the side of the analyst, see Equation 1, where U_{in} denotes the total utility of alternative i for decision-maker n; Vin denotes the observed part of utility, and ε_{in} denotes the unobserved part of utility. In this study, all models are estimated in a linear-additive Mulitnomial Logit (MNL) form, as this allows for

315 straightforward interpretation in terms of marginal rates of substitution (MRS) (McFadden, 1974;
316 Train, 2009). That is, we assume that the observed part of utility is linear and additive (see Equation 2,
317 where x_{in}^{D} and x_{in}^{TT} denote respectively the number of Deaths and the Travel Time of alternative i for
318 decision-maker n, and βD and βTT represent the marginal utility for respectively the reduction in the
319 number of deaths and travel time), and the unobserved part ε_{in} is i.i.d. Extreme Value type I
320 distributed – as this leads to the well-known MNL form.
321

$U_{in} = V_{in} + \varepsilon_{in}$	Equation 1

322

$V_{in} = \beta_D x_{in}^{D} + \beta_{TT} x_{in}^{TT}$	Equation 2

323

324 To identify explanations for the consumer-citizen duality in trading off accident risk and travel
325 time, we analyzed the reasons respondents provided for assigning different values in the two decision
326 contexts presented in Figure 1. We began our analysis by coding all statements. The first round of
327 coding sought to establish whether each statement offered any relevant data. Based on this, the 412
328 respondents who completed the questionnaire were classified into three broad groups: (1) the largest
329 group, consisting of 195 respondents, provided coherent reasons to explain their comparatively high
330 valuation of safety in the citizen context; (2) the smallest group, consisting of 66 respondents, argued
331 that safety is more important than travel time in general, but they did not provide any reasons that are
332 helpful in explaining why citizens assign relatively more value to safety when compared to travel time.
333 An example of such a statement is, *"I just think safety is more important than travel time"*; and (3) the
334 final group, consisting of 151 respondents, did not seem to assign a different value to accident risk and
335 travel time in the consumer and citizen choice tasks. To give an example: "*In both contexts, I*
336 *considered travel time and safety in my choices.*" Following this, the statements of the first group were
337 coded for a second time to distinguish between the different lines of reasoning employed.
338

4. Results

Section 4.1 provides comparative results from our MNL estimations across the different experiments. Section 4.2 presents the categories that resulted from coding written responses, along with the frequency with which each was invoked. Section 4.3 provides a more in-depth discussion of these categories, including illustrative responses.

4.1 Multinomial logit results

Table 3 presents the results of the multinomial logit (MNL) models, which include both parameter estimates and MRS between travel time and safety[1]. We find, for instance, that the MRS for the driver choice tasks in experiment 1 is 1.88; in other words, individuals in that group were – on average – indifferent between a reduction of travel time per trip of 1.88 minutes and a reduction of 1 annual traffic death on the road. Furthermore, we see that for experiment 1 and 2 the model fit is quite low (i.e. $\rho^2 < 0.2$). However, this should not be of a particular concern for this study. Among other things it is caused by the rather simple type of discrete choice model that we estimate, which for instance does not account for the panel nature of our data. See Hauser (1978); Mokhtarian (2016) for extensive discussions on the interpretation of the ρ^2.

[1] Given our linear-additive RUM-MNL specification, the marginal rates of substitution are given by the ratios of the parameters. Standard errors are computed using the Delta method (see Daly et al., 2012).

TABLE 3 Estimation results of MNL models, by experiment

	Experiment 1			Experiment 2			Experiment 3			Experiment 4		
Context	Car driver first high risk			Car driver first low risk			Citizen first high risk			Citizen first low risk		
Results car driver choices												
# Observations	792			760			664			760		
Null LL :	-549.0			-526.8			-460.3			-526.8		
Final LL:	-436.9			-452.9			-368.7			-495.2		
ρ^2 :	0.20			0.14			0.20			0.183		
Estimates	Est	SE	t-value	Est	SE	t-value	Est	SE	t-value	Est	SE	t-value
βDeath	-0.346	0.038	-9.12	-0.189	0.020	-9.55	-0.501	0.051	-9.83	-0.251	0.024	-10.67
βTravelTime	-0.184	0.014	-13.22	-0.147	0.013	-11.19	-0.059	0.014	-4.27	-0.071	0.013	-5.47
Marginal rate of substitution												
βDeath/βTravelTime	**1.88**	0.261	7.22	**1.29**	0.191	6.74	**8.49**	2.189	3.88	**3.54**	0.733	4.82
Results citizen choices												
# Observations	792			760			664			760		
Null LL :	-549.0			-526.8			-460.3			-526.8		
Final LL:	-458.6			-460.9			-299.9			-359.0		
ρ^2 :	0.16			0.12			0.35			0.318		
Estimates	Est	SE	t-value	Est	SE	t-value	Est	SE	t-value	Est	SE	t-value
βDeath	-0.520	0.045	-11.46	-0.216	0.021	-10.12	-0.525	0.058	-9.03	-0.297	0.028	-10.61
βTravelTime	-0.110	0.013	-8.46	-0.091	0.013	-7.24	0.003	0.015	0.21	-0.034	0.014	-2.38
Marginal rate of substitution												
βDeath/βTravelTime	**4.73**	0.703	6.73	**2.38**	0.423	5.63	**-161.04**	760.790	-0.21	**8.76**	3.775	2.32

β_{Death} = marginal utility of one additional traffic casualty on a road

$\beta_{TravelTime}$ = marginal utility of one additional minute travel time

SE = standard error

In line with the findings of Mouter et al. (2017), Table 3 illustrates substantial differences in estimates of the MRS between the two choice settings. For experiments 1, 2 and 4 the MRS is higher (indicating a stronger preference for safety) in the citizen choices than in the driver choices. A two-sample t-test shows that, in experiments 1 and 2, the estimates of MRS differ between drivers choices and citizens choices at conventional levels of significance ($\alpha = 0.05$). In experiments 3 and 4, however, these differences are not statistically significant, an outcome that may have resulted from the relatively high standard error seen on estimates of β_{Death} /$\beta_{TravelTime}$ for the citizen choices.

Another observation is that respondents who completed the citizen choices before the driver choices (experiments 3 and 4) assigned significantly more weight to safety in the driver choices than

those who did the opposite (experiments 1 and 2). Finally, respondents in experiment 1 (who had to evaluate high-risk options) displayed a significantly higher MRS as compared to respondents in experiment 2 (who had to evaluate low-risk options). This difference is observable for their choices as both drivers and citizens.

4.2 Summary and coding of written responses

The 195 respondents who mentioned coherent reasons to explain their comparatively high valuation of safety in the citizen context provided 293 relevant statements in total; 236 of these related to the six explanations found in the existing literature (see section 2), while the remaining 57 were clustered into four categories of explanations that we had not yet encountered in the literature. We present the ten clusters in Table 4, with the categories which we had not found in the literature being presented in italics. Table 4 also presents the frequency with which each of the ten explanations is mentioned within each of the experiments.[2]

TABLE 4: Frequency of explanations provided, by experiment

Categories of explanations / Context	Experiment 1 Car driver first high risk	Experiment 2 Car driver first low risk	Experiment 3 Citizen first high risk	Experiment 4 Citizen first low risk	Total
Cognitive explanations					
1 Minuscule versus substantial impact	9	13	4	10	**36**
2 Perceived personal risk is lower than average risk	21	19	11	9	**60**
3 Divergence between controllability of mortality risks	0	2	1	5	**8**
4 Individuals are relatively risk-averse when making choices affecting others	4	3	5	5	**17**
5 Information asymmetry between government and individuals	9	4	6	7	**26**
					147
Normative explanations					
6 Individuals are more prone to base their choices on social norms when choices affect others	9	17	17	24	**67**
7 Government has a duty of care concerning safety	17	20	6	5	**48**
8 Individuals have a high own responsibility to reduce their travel times	3	1	2	4	**10**
9 As individuals choose the fastest route, the government should prioritize safety	3	1	1	4	**9**
10 Role of government in facilitating individual decision-making	2	3	2	5	**12**
					146

Table 4 shows that the total number of 'cognitive' explanations given by respondents is effectively equal to the number of 'normative' ones. The first explanation we did not encounter in the literature

[2] Our sample is not large enough to draw any firm quantitative conclusions from this study like: 'more respondents mentioned explanation A than explanation B, hence explanation A is a more important explanation for the consumer-citizen duality in the context of accident risk and travel time.'

(category 5) was that respondents argued that they make different choices in different roles because, in real life, drivers have at best limited information about the safety of the routes they choose. As a consequence, they simply do not consider accident risk when evaluating alternatives in their role as driver, meaning that they invariably choose the fastest route. Many of the respondents who provided this reasoning argued that the government has access to far better information concerning accident risk, and so it should fall to the government to implement the safest route options. The three remaining 'new' explanations (categories 8, 9 and 10), all of which we classify as normative, are further discussed in section 4.3.

Another observation is that, with a lone exception[3], all ten explanations appeared in each of the four experiments. From this, we can infer that reasons provided by individuals for the fact that they prefer safety as citizen and speed as a driver are not fundamentally affected by either the risk levels they evaluate or the order in which they conduct driver and citizen choice tasks. That being said, participants in low-risk settings offered the 'minuscule versus substantial impact' and 'controllability' explanations (categories 1 and 3, respectively) somewhat more frequently than those facing high-risk choices, which is a plausible result. We also observe that 'social norms' (category 6) was mentioned more frequently by respondents who first received the citizen questions (experiments 3 and 4), whereas 'duty of care' (category 7) was mentioned more often by respondents who first received the consumer questions (experiments 1 and 2). Intuitively, it would make sense that a respondent whose first role is that of a citizen would be primed to take various (unwritten) social norms into account when suggesting public policy, whereas an individual who begins as a driver would see themselves as more distinct from the government and therefore reflect on a special duty of care of the government with respect to securing safety.

[3] Explanation 3 was not provided by any of the participants in experiment 1

4.3 Explanation of categories, with examples

This section provides a more in-depth discussion of the ten categories of explanations presented in section 4.2. We illustrate the explanations through a selection of respondents' statements[4].

1 Minuscule versus substantial impact

Thirty-six respondents indicated that they assigned relatively low values to safety in their route choices as drivers because they saw the differences in accident risk between the options presented as minuscule. Even as these drivers perceived the impact of their route choice on their own safety to be negligible, many recommended in their role as citizen that the government should choose the safest option. According to this line of reasoning, the impact of individual driver choices on traffic safety is marginal, while that of government policy can be substantially greater. Below, we present two examples:

> *I recommend that the government build the safer route, because people will die if they build the faster route instead. As a driver I choose the faster route because the statistical probability that I will die is negligible.*

> *Road safety is the most important criterion when the government builds a new road. Every life counts. However, when I make a route choice as a driver, the probability that something will go wrong is extremely low. Hence, I will choose the fastest route.*

2) Perceived personal risk is lower than average risk

Sixty respondents stated that they assigned relatively low values to safety in their route choices as drivers, arguing that their personal accident risk was less than indicated by the questions due to their above-average driving abilities. As such, they did not feel that their decisions over which route to take

[4] For reasons of consistency and readability, we have made minor cosmetic changes to these statements. For instance, when justifying their preference for the fastest route as a driver, one respondent stated, *"you don't have to judge about other people's lives"*. We have rephrased this as *"As a driver, you don't have to judge about other people's lives"* to clarify the decisional context (driver).

would (substantially) influence their mortality risk. For this reason they assign low value or ignore safety in their choices as a driver. Below, we present two examples of such statements:

> *I overestimate my own driving skills. I think that I am a good driver, while other people make mistakes which lead to accidents… As a citizen, I was prone to recommending the route with the lowest number of deaths because I think that one human life is more valuable than travel time for many people.*

> *I chose the fastest route as a driver because the probability that I will be one of the traffic deaths is very low. I think I am a good and experienced driver, and have not had any accidents or other damage for over 25 years, I am always 100% focused on driving… I recommend the government to choose the safest route. One of the victims could be a relative or a friend.*

3) Divergence between controllability of mortality risks

Eight respondents stated that they assigned relatively low values to safety in the driver choice tasks as opposed to the citizen choice tasks because they saw risk as being more 'controllable' in the former than in the latter context. Below, we provide one example of such a statement:

> *As a driver, you can directly influence your mortality risk. As an individual, you cannot influence the safety of a new road that is being built by the government. For this reason, the government should aim to build roads that are as safe as possible.*

Because only a few respondents mentioned this explanation, it seems that most did not believe that the controllability of the accident risk differed substantially between the driver experiments and the citizen experiments. This notion is supported by the fact that sixteen respondents explicitly argued that the government was to some extent able to control risk ex-post using additional measures after the road's construction.

4) Individuals are relatively risk-averse when making choices affecting others

Seventeen respondents stated that they had recommended the government to build safer routes because not doing so would put other people's lives in danger, whereas as drivers they only had to worry about risks to themselves. This is in line with findings made by Atanasov (2015) that individuals' choices for others are generally more risk-averse than those which only affect the decision-maker themselves. Below, we provide three exemplary statements which illustrate this perspective:

> *As a driver, you don't have to make judgements involving the lives of others. You only have to consider your own risks. I use my car very often and I therefore chose the fastest routes… In the citizen choice questions I tended to select the safest route, because in that case you decide about another person's life.*

> *When the government builds a new road, it should act prudently by prioritizing safety. As a driver, I am responsible for my own safety and not for the safety of a large group of people.*

> *The chance that you will be involved in an accident is really low, so you choose the fastest route as a driver… My recommendations to the government would affect the lives of others, so I chose safer routes.*

5) Information asymmetry between government and individuals

Twenty-six of the respondents who had valued safety more as citizens than as drivers argued that they did so because, in real life, they would not be aware of the extent to which different routes differ in terms of mortality risk. Many of these respondents suggested that they often 'outsourced' their route choices to navigation systems or online route planners, and that it would not be possible to command one of these to weigh safety in its choice of roads to take. As such, they consciously opted not to consider safety in the driver choice tasks so as to better reflect how they would actually make decisions on the road. Below, we present one illustrative statement of a respondent:

I assume that the government conducted a solid study regarding the impact of their decision on traffic casualties. I do not undertake such a study before I decide which route I will take; I follow the route planner. I don't know where I would find information concerning the number of traffic deaths on the routes I consider as a driver.

Interestingly, several respondents remark that if they would possess information concerning safety of the road they would consider this in their route choices. Below, we present an example:

The route planner does not provide any information concerning safety. In reality, I don't know anything about the number of deaths on a road. If I had this information I would definitely consider it in my decisions.

Various respondents predominantly emphasize that the government should choose for the safest route because of the fact that the government is aware of the deadly consequences of choosing the risky option. See for instance the following statement:

It is unacceptable for the government to willingly and knowingly take such a risk… When I plan my own trip I only look at differences in travel time between routes and not at differences in safety.

Based on the responses, it can be concluded that the respondents who were classified in this category did not take the information that was presented in the driver choice tasks at face value. Although they were presented with information concerning the mortality risks of the different alternatives, they ignored it because they did not feel it realistic that they would have such knowledge. At the same time, some respondents stated that if they did have access to safety data in their own lives they would make use of it.

6) Individuals are more prone to base their choices on social norms when choices affect others

It has been established in the literature that social norms play a stronger role in decision-making when the decision-maker is not the only one impacted (e.g. Stone and Allgaier, 2008). In line with this, 67 respondents did indeed invoke such norms when arguing that it is (relatively) unacceptable for the government to trade mortality risk against travel time savings, whereas it is (relatively) acceptable to trade their own mortality risk against their own travel time[5]. Forty-six of this group explicitly stressed their conviction that risk-taking is socially undesirable in the particular context they are asked to evaluate in the citizen choice tasks being a government decision to build a fast and risky route or a slower and safer route. Interestingly, in justifying their greater relative valuation of safety when choosing as citizens, these individuals frequently cited (Dutch) proverbs dissuading either risky behaviour in general or risky behaviour as a means of saving time. These include "Better safe than sorry", "Haste makes waste", "Every life counts", "Safety first" and, a typically Dutch proverb, "It's better to arrive late at your destination than to arrive on time in the hospital/your grave". Apparently, Dutch society possesses a social norm dictating that a government should err on the side of caution when facing a decision offering relatively small per-person benefits in exchange for a higher mortality risk. Indeed, respondents seem to behave more in line with this norm in a public context (citizen choice tasks) than in a private context (driver choice tasks). Below, we provide one example of a statement we clustered in this category:

> *I recommend that the government selects the route with the fewest traffic deaths. It's better to arrive late at your destination than to arrive on time in your grave. What do these few minutes of travel time matter in a human life?*

[5] Note that only statements involving social norms and appropriate government behaviour were clustered in this category. When respondents only stated that they attach more value to accident risk in citizen choice tasks, because these choices affect other people, the statement was clustered in category 4. Although the distinction between these categories is sometimes subtle, the main difference is that category 4 addresses how *preferences can be context-dependent*, while category 6 supports the idea that *individuals have preferences over the actions of public institutions that can differ from those they hold for private individuals.*

7) Government has a duty of care concerning safety

Forty-eight respondents stated that they assigned more value to 'safety' in their recommendations as citizens than in their role as drivers because the government has a special duty of care when it comes to road safety. This sentiment was quite one-sided: we did not find any statements insisting that the government has a special duty (of care) when it comes to reducing travel times. Interestingly, many respondents did not go into substantial detail as to why they held such beliefs, instead seeming to treat the proposition as established fact. Some examples are provided below:

> *The government should always put safety first. After all, it's the government's job to protect its citizens.*

> *The government should promote the public interest. Traffic safety is, by its very nature, in the public interest.*

> *The government has a greater responsibility in terms of taking care of people's safety than reducing travel times.*

Out of the responses which did provide a justification for the duty-of-care argument, we were able to identify several different perspectives. Some respondents stated that the government, as the entity most directly responsible for roads, is responsible for the safety of the road network. See, for instance, the following statement:

> *The government is responsible for the safety of the road, because the government is the entity that builds roads.*

Based on an entirely different line of reasoning, various respondents argued that, since some drivers present unacceptably high risks to others, the government has a (paternalistic) responsibility to reduce this risk. Below, we present two examples:

Many drivers do not seem to care at all about their own safety or the safety of other road users, even with all of the government campaigns and warnings. Since – in my view – these programs haven't worked as well as they were supposed to, it is better to make the roads as safe as possible. It's a pity that so many people are not able to take responsibility for their own actions.

I think it is primarily the responsibility of the individual to drive in a responsible way. However, I generally recommended that the government choose the safest route. Many drivers do not seem to be interested in safety for themselves or other people, so unfortunately the government should take on this role by focusing on safety.

8) Individuals have a high own responsibility to reduce their travel times

Complementing the arguments made under the previous category, ten respondents justified their differing responses in the two settings by claiming that it is not necessarily the government's duty to reduce travel times; rather, it is drivers who have a relatively high own responsibility to do so. For instance, drivers can try to avoid peak hours by starting their trip earlier or later. Moreover, they can relocate their residence or their job when they aspire to get rid of long travel times. To the best of our knowledge, this explanation for why citizens might assign relatively higher values to safety than to travel time is not put forth elsewhere in the literature. Below, we present some illustrative statements:

I think it is important that people can travel in a safe way. If drivers want to arrive on time, then they have to start their trips earlier. The fewer traffic deaths, the better. It is always possible to start your trip a bit earlier.

Travel time is something that lies in your own hands. Traffic deaths need to be prevented as much as possible.

It is always possible to leave your point of departure a bit earlier. Even if you drive safely, you are always vulnerable when other road users make a mistake. We should get rid of all unsafe situations. It is no problem if safety improvements require some investment.

9) As individuals choose the fastest route, the government should prioritize safety

Nine respondents pointed out that drivers will always have a tendency to try to reach their destinations as fast as possible. Because of this, they argued, the government needed to focus its efforts on safety to actively complement such individual choices. To the best of our knowledge, this explanation for why citizens might assign higher value to safety than travel time when compared to drivers is new to the literature. We illustrate this category with the following respondent statements:

A driver will think about travel time. Hence, the government should predominantly focus on safety.

As a driver, I want to travel as fast as possible. Therefore it is important that the government builds the safest route.

I always want to reach a destination as fast as possible. The government should use this knowledge and build safe routes.

It is worth emphasizing that the statements in this category explicitly indicate that some respondents advise the government against interpreting their own consumer behaviour as reflecting their preferences over public policy. These statements clearly support the views of those scholars, mentioned in the introduction, who argue that an individual's consumer behaviour can be a poor proxy for how they, in their role as citizen, believe that their government should trade-off travel time and safety. The respondents' car driver preferences and citizen preferences seem to be communicating vessels. It is precisely because individuals choose speed as drivers that they recommend the government to focus on safety.

643

644 10) Role of government in facilitating individual decision-making

645 Finally, twelve respondents argued that the government should primarily focus on the safety of the
646 road network because doing so allows drivers to focus on travel time when making a route choice.
647 Hence, when the government ensures that all routes have comparable (and low) accident risks, it
648 reduces the cognitive burden on individuals making route choices[6]. To the best of our knowledge, this
649 explanation for why citizens might assign a relatively high value to safety is also new to the literature.
650 We present one statement which exemplifies this category:

651

652 *When the government decides to build the safe route, I do not have to weigh safety in my*
653 *decisions as a driver.*

654

655 **5. Discussion**

656 Probably the most important contribution of our research is an empirical one. We have identified four
657 explanations for the consumer-citizen duality (categories 4, 8, 9 and 10, see above) that, to the best of
658 our knowledge, have not yet been discussed in existing literature. Another contribution of out study is
659 that the identified explanations might serve as a framework for academics who aspire to conduct
660 further research on understanding the consumer-citizen duality, or who aim to develop theoretical
661 underpinnings for it. We recommend these researchers to take a multidisciplinary approach, as our
662 findings establish the relevance of both 'cognitive' and 'normative' factors. This is of particular
663 interest for scholars in accident analysis and prevention and related fields (e.g. transport economics),
664 as hitherto their focus particularly lies on investigating cognitive explanations for the consumer-citizen
665 duality (e.g. Andersson and Lundborg, 2007; Dejoy, 1992; Dekker et al., 2011; Delhomme, 1991;
666 Gosselin et al., 2010). Finally, the range of identified explanations could lend useful context for
667 researchers focusing on one particular explanation. For instance, our research might provide

[6] Note that only statements which refer to the fact that the government can facilitate individual decision-making by minimizing accident risks were clustered in this category. When respondents stated that guarantying safety is a highly important duty of the government (from which it derives legitimacy), the statement was clustered in category 7.

complementary interpretations for the study of comparative optimism (the tendency to believe that one is more skilled and less likely to experience a negative event); this is generally attributed to overestimation of driving skills and perceived controllability (e.g. Dejoy, 1989; Matthew and Moran, 1986), but perhaps a complementary explanation is that individuals are relatively risk-averse when evaluating risks for others (which relates to explanation 5, see above).

From a methodological perspective, we believe that the stated choice experiments conducted for this study are an adequate methodology for eliciting explanations as to why individuals preferred speed as drivers yet desired safety as citizens. Apart from identifying four new explanations respondents were able to provide clarifying statements. However, one clear downside of this methodology was that it was not possible to ask further questions to respondents who had provided useful statements. For instance, it would have potentially been quite illuminating to ask follow-up questions to respondents who stated that the government should actively seek to complement drivers' tendencies to choose the fastest trip by focusing on safety to learn more about their underlying reasons for this statement. Hence, we recommend researchers who aspire to conduct similar exploratory studies to consider making it possible to arrange follow-up interviews with respondents who provided interesting statements.

An interesting avenue for further research involves investigating the relative importance of the ten identified explanations. For instance, one way to study the importance of category 4 (information asymmetry between government and individuals) is to replicate the stated choice experiments of this study, with the sole additional instruction being that participants acting as drivers should imagine they have a route planner in their car which provides immediate information about the safety of different route options. If this replication provides substantially different results than the original study and/or an equivalent control experiment, this may indicate that the explanation actually accounts for at least some of the preference discrepancies (with the significance of the explanation increasing with the magnitude of the difference).

6. Policy implications

The present study confirms the findings by Mouter et al. (2017) that individuals in their role as citizens assign substantially more value to accident risk than travel time, as compared to those who were asked to make route choices as consumers of mobility. This concurrence in results allows us to assert with some confidence that the selection of a particular approach to evaluate transport policies impacting accident risk and/or travel time can substantially affect the results of an appraisal study. This can have non-trivial implications for the economic assessment of safety policies, as our empirical findings indicate that these perform much better in a Cost-Benefit Analysis (CBA) grounded in citizen preferences than one based on consumer preferences.

Whether proposed safety policies should be assessed based on consumer or citizen preferences is an important normative question that results from our findings. Our study does not attempt to give a specific answer. Rather, we aim to provide a useful empirical foundation for practitioners who have to contemplate, discuss or decide upon such matters. For example, a particularly strong argument for basing appraisal on citizen preferences is that various respondents in our study explicitly advised the government against using their own consumer behaviour as a model for public policy. Some argued that the government should respond to drivers' tendency to choose the fastest trip by building safe routes (category 9), while others suggested that authorities should ensure the safety of the road network because this allows drivers to choose the fastest route without being concerned about the impact on their accident risk (category 10). Another argument which supports appraisal based on citizen preferences is that many participants in this study explicitly argued that the government should attach a relatively high weight to accident risk in their decisions, even though individuals themselves ignored risk in their driver choices due to (1) dismissing the 'minuscule' risks they faced on the road, (2) overestimating their driving skills, and (3) lacking useful comparisons of accident risk in real-life route choices.

A conclusion that can be drawn from our study is that individuals perceive their personal choices between risk avoidance and time savings differently from government choices over the same factors. This calls into question the extent to which preferences obtained in a driver context provide useful input for the evaluation of government projects. On the other hand, we think that our research

724 also provides arguments in support of the current practice in which economic evaluations of
725 transportation policy are driven by the choices individuals make as drivers. When one is willing to
726 assume that individuals are the best judges of their own welfare (e.g. Beckerman, 2011; Boadway and
727 Bruce, 1984; Sugden, 2007), then the finding of our study and other literature (e.g. Atanasov, 2015)
728 that individuals' choices for others are generally more risk-averse than choices only affecting
729 themselves should be interpreted as a bias towards conservatism which would distort economic
730 evaluations.

731 It goes without saying that investigating the normative question of which types of choices
732 enable 'better' economic evaluations of transport-related policies is an important direction for future
733 research. Until this question has been answered, we recommend using CBA based on citizen
734 valuations as a useful check on the conventional consumer-based approach. If a proposed safety policy
735 is positively (negatively) evaluated by both approaches, then policy makers can be confident in
736 deciding (not) to implement the proposed policy. Conversely, when two approaches provide
737 conflicting recommendations, then the explanations identified in our study can undergird a debate on
738 the policy's desirability.

739 Finally, we note that several respondents spontaneously stated that they have a desire for
740 navigation systems which could provide information concerning the riskiness of potential routes. The
741 technology to incorporate such information into navigation systems already exists (e.g. Cardno and
742 Mulgan, 2000; Su et al., 2010), but, to our knowledge, information on accident risk is not yet
743 incorporated into conventional navigation systems. Our findings could encourage policy makers to
744 make the necessary data available for navigation systems – in case policy makers have or can get
745 access to the data needed. Furthermore, companies providing these services could be made aware of
746 the potential benefit for their customers if they added such content. This also suggests avenues for
747 future research. Both researchers and public officials, for instance, may be motivated to study how
748 accident information should be presented to drivers: should the navigation system present the number
749 of deaths on the road in the previous year, or should the information be tailored to the driver (such as
750 accounting for higher accident risks among young males)? Perhaps more importantly from a societal

perspective, it would be worth investigating whether (and how) providing such information can result in safer driving behavior.

7. Conclusions

The purpose of this study was to empirically explain why individuals trade-off travel time and accident risk differently as drivers (consumers of mobility) than as citizens. To investigate this, we administered a stated choice experimental study in which each respondent made choices as both a driver and a citizen between routes that differed in terms of travel time and accident risk. Moreover, respondents were asked whether they were more inclined to choose the safest or fastest route in each context, and why that was so. This allows us to empirically substantiate and systematically categorize potential explanations for why citizens might assign a higher value to mitigating accident risk than saving travel time when compared to drivers. We distinguish between cognitive and normative explanations for the consumer-citizen duality investigated in our study. The *cognitive explanations* suggest that individuals make diverging choices because their perceptions of accident risk differ between the two roles. Drivers will assign a relatively low value to mitigating accident risk because they believe that: (1) such risks are trivial on an individual level; (2) their personal risk is lower than the average risk; (3) their personal risk is controllable; (4) they would not be able to distinguish relative levels of accident risk in real life; and (5) their choices for others are more risk-averse than choices for themselves and, unlike citizens, they are not explicitly evaluating risky choices for others. The *normative explanations*, on the other hand, relate to beliefs that the government should assign more value to mitigating accident risk than should individual drivers, because: (6) as citizen, they are more prone to base their choices on social norms which prescribe risk-averse behaviour in this context; (7) governments have a duty of care concerning the safety of the transportation network; (8) drivers have a relatively high degree of responsibility to reduce their own travel times; (9) governments should account for drivers' tendencies to choose faster routes by building safer ones; and (10) governments should ensure the safety of the road network because this allows drivers to choose the fastest route without being concerned about the impact of their route choice on accident risk.

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7. References

Abrantes, P.A.L., Wardman, M. 2011. Meta-analysis of the UK values of time: an update. Transportation Research Part A 45, pp. 1-17.

Ackerman, F., Heinzerling. L., 2004. Priceless: on knowing the price of everything and the value of nothing. New York. The New Press.

Alphonce, R., Alfnes., Sharma, A., 2014. Consumer vs. citizen willingness to pay for restaurant food safety. Food Policy 49, pp. 160–166.

Andersson, H., Lundborg, P., 2007. Perception of own death risk: An analysis of road-traffic and overall mortality risks. Journal of Risk and Uncertainty 34(1), pp. 67–84.

Asplund, D., Eliasson, J., 2016. Does uncertainty make cost-benefit analyses pointless? Transportation Research Part A 92, pp. 195-205.

Atanasov, P.D., 2015. Risk Preferences in Choices for Self and Others. Meta Analysis and Research Directions. Available at SSRN: http:// ssrn.com/abstract=1682569 June 16, 2015.

Bahamonde-Birke, F.J., Kunert, U., Link, H., 2015. The Value of a Statistical Life in a Road Safety Context — A Review of the Current Literature. Transport Reviews, 35(4), pp. 488-511.

Batley, R., Bates, J., Bliemer, M., Börjesson, M., Bourdon, J., Cabral, M.O., Chintakayala, P.K., Choudhury, C., Daly, A., Dekker, T., Drivyla, E, Fowker, T., Hess, S., Heywood, C., Johnson, D., Laird, J., Mackie, P, Parkin, J., Sanders, S., Sheldon, R., Wardman, M, Worsley, T., in press. New appraisal values of travel time savings and reliability in Great Britain. Transportation, pp. 1-39.

Beckerman, W. 2011. Economics as applied ethics. Value judgments in welfare economics. Palgrave Macmillan.

Blamey, R.K., Common, M.S., Quiggin, J.C., 1995. Respondents to contingent valuation surveys:

807 consumers or citizens? Australian Journal of Agricultural and Resource Economics 39, pp. 263–
808 288.
809 Bliemer, M.C.J., Rose, J.M., 2006. Designing stated choice experiments: state-of-the-art. In: 11th
810 IATBR Conference, 2006 Kyoto, Japan.
811 Boadway, R., Bruce., M. 1984. Welfare Economics. Oxford: Basil Blackwell.
812 Börjesson, M., Eliasson, J., 2014. Experiences from the Swedish value of time study. Transportation
813 Research Part A: Policy and Practice 59, pp. 144-158.
814 Cardno, A.J., Mulgan, N.J., 2000. Travel route planner system and method. US Patent. Publication
815 Number US6622084B2.
816 Curtis, J.A., McConnell, K.E., 2002. The citizen versus consumer hypothesis: evidence from a
817 contingent valuation survey. Australian Journal of Agricultural and Resource Economics 46, pp.
818 69–83.
819 Dana, J., Cain, D.M., 2015. Advice versus choice. Current Opinion in Psychology 6, pp. 173-176.
820 Daniels, R.F., Hensher, D.A., 1999. Valuation of Environmental Impacts of Transport Projects. The
821 challenge of self-interest proximity. Journal of Transport Economics and Policy 34 (2), pp. 189-
822 214.
823 Daly, A., Hess, S., de Jong, G., 2012. Calculating errors for measures derived from choice modeling
824 estimates. Transportation Research Part B 46, pp. 333-341.
825 DeJoy, D.M., 1989. The optimism bias and traffic accident risk perception. Accident Analysis and
826 Prevention 21, 333–341.
827 DeJoy, D.M., 1992. An examination of gender differences in traffic accident risk perception. Accident
828 Analysis and Prevention 24 (3), pp. 237-246.
829 Delhomme, P., 1991. Comparing one's driving with others': Assessment of abilities and frequency of
830 offences: Evidence for a superior conformity of self-bias? Accident Analysis and Prevention 23
831 (6), pp. 493-508.
832 Dekker T., Brouwer R., Hofkes M., Moeltner K., 2011. The effect of risk context on the value of a
833 statistical life: A Bayesian meta-model. Environmental and Resource Economics 49, pp. 597–
834 624.

835 Fuguitt, D., Wilcox, S., 1999. Cost-benefit analysis for public sector decision-makers. Quorium
836 Books, London.
837 Greening, L., Chandler, C.C., 1997. Why it Can't Happened to Me: The Base Rate Matters, But
838 Overestimating Skill Leads to Underestimating Risk. Journal of Applied Social Psychology 27
839 (9), pp. 760-780.
840 Ehreke, I., Hess, S., Weis, C., Axhausen, K.W. 2015. Reliability in the German value of time study.
841 Transportation Research Record 2525, pp. 14-22.
842 Finn, P., Bragg, B.W., 1986. Perception of the risk of an accident by young and older drivers.
843 Accident Analysis and Prevention 18 (4), pp. 289-298.
844 Gosselin, D., Gagnon, S., Stinchcombe, A., Joanisse, M., 2010. Comparative optimism among drivers:
845 An intergenerational portrait. Accident Analysis and Prevention 42, pp. 734-740.
846 Hauer, E. 1994. Can one estimate the value of life or, is it better to be dead than stuck in traffic?
847 Transportation Research Part A 28 (2), pp. 109–118.
848 Harré, N., Foster, S., O'Neill, M., 2005. Self-enhancement, crash-risk optimism and the impact of
849 safety advertisements on young drivers. British Journal of Psychology 96 (2), pp. 215-230.
850 Hauser, J. R., 1978. Testing the Accuracy, Usefulness, and Significance of Probabilistic Choice
851 Models: An Information-Theoretic Approach. Operations Research, 26(3), pp. 406-421.
852 Hensher, D. A., Rose, J.M., Ortúzar, J. de. D., Rizzi, L.I., 2009. Estimating the willingness to pay and
853 value of risk reduction for car occupants in the road environment. Transportation Research Part
854 A, 43 (7), pp. 692–707.
855 Hobbes, T., 1651/1962. Leviathan. New York: Collier Books.
856 Horswill, M.S., Waylen, A.E., Tofield, M.I., 2004. Drivers' ratings of different components of their
857 own driving skill: A greater illusion of superiority for skills that relate to accident involvement.
858 Journal of Applied Social Psychology 34 (1), pp. 177-195.
859 Jara-Díaz, S.R, 2007. Transport economic theory. Elsevier Science, Amsterdam.
860 Jones, H., Moura, F., Domingos, T., 2014. Transport infrastructure project evaluation using cost-
861 benefit analysis. Social and behavioural sciences 111, pp. 400-409.
862 Kahneman, D., 2011. Thinking, Fast and Slow (London: Macmillan, 2011).

863 Kahneman, D., Lovallo, D., 1993. Timid choices and bold forecasts: A cognitive perspective on risk
864 taking. Management Science, 39, pp. 17–31.
865 Kahneman, D., Tversky, A. 1979. Prospect Theory: An Analysis of Decision under Risk.
866 Econometrica 47 (2), pp. 263-292.
867 Kelman, S., 1981. Cost-benefit analysis: an ethical critique. In: Donaldson, T., Werhane, P.H.,
868 Cording, M. (eds.) Ethical Issues in Business: A Philosophical Approach, 559–564.
869 Kouwenhoven, M., de Jong, G.C., Koster, P.R., van den Berg, V.A.C., Verhoef, E.T., Bates, J.,
870 Warffemius, P.M.J., 2014. New values of time and reliability in passenger transport in The
871 Netherlands. Research in Transportation Economics 47, pp. 37-49.
872 Mackie, P.J., Jara-Díaz, S.R, Fowkes, A.S., 2001. The value of travel time savings in evaluation.
873 Transportation Research Part E 37, pp. 91-106.
874 Matthews, M.L., Moran, A.R., 1986. Age differences in male drivers' perception of accident risk: The
875 role of perceived driving ability. Accident Analysis and Prevention 18, 299–313.
876 McFadden, D., 1974. Conditional logic analyses of qualitative choice behavior. In Frontiers in
877 econometrics, edited by P. Zatembka, pp. 105-142. New York: Academic Press.
878 Mokhtarian, P. L., 2016. Discrete choice models' ρ2: A reintroduction to an old friend. Journal of
879 Choice Modelling 21, pp. 60-65.
880 Mouter, N., Chorus, C.G., 2016. Value of Time: a citizen perspective. Transportation Research Part A
881 91, pp. 317-329.
882 Mouter, N., van Cranenburgh, S., van Wee, G.P. 2017. Do individuals have different preferences as
883 consumer and citizen? The trade-off between travel time and safety. Transportation Research Part
884 A 106, pp. 333-349.
885 Ovaskainen, V., Kniivilä, M., 2005. Consumer versus citizen preferences in contingent valuation:
886 evidence on the role of question framing. Australian Journal of Agricultural and Resource
887 Economics 49, pp. 379–394.
888 Revesz, R.L., 1999. Environmental regulation, cost benefit analysis, and the discounting of human
889 lives. Columbia Law Review 99 (4), pp. 941–1017.
890 Rizzi, L.I., Ortúzar, J. de. D., 2003. Stated preference in the valuation of interurban road safety.

Accident Analysis and Prevention 35 (1), pp. 9–22.

Roszkowski, M.J., Snelbecker, G.E., 1990. Effects of "framing" on measures of risk tolerance: Financial planners are not immune. The Journal of Behavioral Economics 19, pp. 237–246.

Rowlatt P., Spackman M., Jones S., Jones-Lee M., Loomes, G., 1998. Valuation of deaths from air pollution. National Economic Research Associates, London.

Sagoff, M., 1988. The economy of the earth. Cambridge University press. Cambridge.

Shepperd, J.A., Carroll, P., Grace, J., Terry, M., 2002. Exploring the causes of comparative optimism. Psychologica belgica 42, pp. 65–98.

Slovic, P., 1987. Perception of risk. Science 236 (4799), pp. 280–285.

Su, J.G., Winters, M., Nunes, M., Brauer, M., 2010. Designing a route planner to facilitate and promote cycling in Metro Vancouver, Canada. Transportation Research Part A 44(7), 495-505.

Sugden, R., 2007. Cost-benefit analysis as market simulation: A new approach to the problem of anomalies in environmental evaluation. Resources for the future discussion paper. RFF DP 07-28-REV.

Stone, E.R., Allgaier, L., 2008. A social values analysis of self-other differences in decision making involving risk. Basic and Applied Social Psychology 30, pp. 114–129.

Stone, E.R., Choi, Y.S., Bruine de Bruin, W., Mandel, D.R., 2013. I can take the risk, but you should be safe: Self-other differences in situations involving physical safety. Judgment and Decision Making 8, pp. 250–267.

Svenson, O., 1981. Are we all less risky and more skilful than our fellow drivers? Acta Psychologica 47 (2), pp. 143-148.

The Libertarian FAQ, 2017. http://www.catb.org/esr/faqs/libertarianism.html

Tienhaara, A., Ahtiainen, H., Pouta, E., 2015. Consumer and citizen roles and motives in the valuation of agricultural genetic resources in Finland. Ecological Economics 114, pp. 1–10.

Teigen, K.H., Olsen, M.V.G., Solås, O.E., 2005. Giver-receiver asymmetries in gift preferences. British Journal of Social Psychology 44, pp. 125–144.

Thomopoulos, N., Grant-Muller, S., Tight, M., 2009. Incorporating equality considerations in transport infrastructure evaluation: current practice and a proposed methodology. Eval. Program

919 Plann. 32, pp. 351–359.
920 Train, K., 2009. Discrete choice methods with simulation. Cambridge University Press, 2nd Edition,
921 New York.
922 Weinstein, N.D., 1980. Unrealistic optimism about future life events. Journal of Personality and Social
923 Psychology 39, pp. 806-820.
924 Weinstein, N.D., 1984. Why it won't happen to me: perceptions of risk factors and susceptibility.
925 Health Psychology 3, pp. 431–457.
926 White, M.J., Cunningham, L.C., Titchener, K., 2011. Young drivers' optimism bias for accident risk
927 and driving skill: accountability and insight experience manipulations. Accident Analysis and
928 Prevention 43 (4), pp. 1309–1315.
929