Willingness to pay for private and public improvements of vulnerable road users' safety

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Abstract

A frequent finding in the empirical literature on cost-benefit analysis of traffic safety measures is that valuations of public goods are lower than valuations of private goods, contrary to theory predictions. This study elicits the willingness to pay for publicly and privately provided safety improvement benefiting cyclists and pedestrians, a relatively neglected group in this literature. Our results suggest that there is no significant difference between valuations of a private good and three versions of a public good as long as the good itself is the same, in our case a mobile phone app. The public good versions differ in attributes such as mandatory or voluntary use and private or public provision institutions. . This finding is consistent with the simultaneous presence of both financial altruism and safety altruism, or neither. Public institutions are preferred to private ones in the provision of the public goods, and voluntary participation is preferred to mandated regulation. We also find evidence that attitudes that favor using taxes to fund traffic safety projects, and public responsibility for traffic safety are associated with a higher willingness to pay.

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1. Introduction

Public health, traffic safety, and many other utilities result from various interventions with combinations of attributes such as mandatory vs. voluntary use or tax vs. fee funded. Private good interventions are based on voluntary use, fee funding with exclusive access and provision by private companies, while public good interventions may vary in some of these attributes but provide universal rather than exclusive access. Finding the right balance of such attributes is often a core issue in policy design. For instance, during the Covid-19 pandemic, countries used counter measures that relied in different degrees on governments' regulatory, coordinating and financing powers and on trust in citizens' and markets' own abilities to handle common challenges (Chen et al. 2021). A frequent finding in the empirical literature on cost-benefit analysis that guides policy makers in such situation is that many people seem to value an expected positive impact on health or safety differently depending on whether it is achieved using a private or a public intervention. A surprising frequent finding in the literature on traffic safety is that private goods have been found to be valued higher, sometimes much higher, than public goods (Gyrd-Hansen et al. 2016; Svensson and Vredin Johansson 2010; Andersson and Lindberg 2009; Hultkrantz et al 2006). However, such differences can be caused by differences in what kind of good that is valued (e.g., bicycle helmets or separate lands for cyclists) or various features of public provision, so it is not clear whether, when or why such value differences arise. Our study, therefore, estimates the willingness to pay (WTP) for a traffic safety improvement benefiting vulnerable road-users, such as cyclists and pedestrians, in a contingent valuation survey controlling for various attributes in the public/private dichotomy and for an equal kind of safety-improving service.

We expect preferences over traffic safety measures (or services) to vary with a few of attributes. First, an altruistic individual may prefer that it is provided as a non-exclusive public good instead of as an exclusive private good. Second, people may have preferences regarding the use of coercive taxation. As an example, if a public good is to be paid by mandatory taxes, then the response of an individual to a WTP question may depend not just on her own preferences but also on whether she believes that others will have to pay more, less, or equal to their WTP. With altruistic preferences over financial outcomes WTP responses may be lower if the respondent believes that others are willing to pay less. Third, people may have preferences over the extent to which participation in a scheme or use of a good is mandatory, i.e., whether participation is coercive or not. One possible reason people may prefer private goods is that they can opt out from using them, while some public goods are combined with the government's coercive powers. An example is that people may prefer voluntary in-vehicle speed-control devices instead of external speed cameras. Finally, people may have preferences over whether a good is developed and provided by a private company or a public institution, based on perceptions of effectiveness, perceived transaction costs, fear of big government etc. Viscusi et al. (1988) suggest that attitudes towards public and private provision of risk reducing interventions may mask altruistic values.

Previous studies of the public/private dichotomy in health or traffic safety services have mostly focused on the first two aspects, while our study covers all four. Our study contributes to the earlier literature by examining how participation coercion, framing of the good, and attitudes surrounding traffic safety affect WTP for a traffic-safety enhancing intervention, and particularly how these affect the relative valuation of private vs. public goods. In addition, we focus on cyclists and pedestrians, a group of unprotected travellers that have received little attention in terms of safety.

A main concern in research on traffic safety, including WTP elicitation, has been death from car accidents. In Sweden, programs for reducing fatalities among motorists have been very effective in recent years. As a result of improvements of vehicles and infrastructure (i.e., a mix of private and public goods), road traffic fatalities declined from 524 in year 2003 to 221 in year 2019 (Transportstyrelsen 2021). However, among the 1,244 persons with severe injuries in 2019 caused by road traffic accidents, 32% were cyclists and 39% were pedestrians (Transportstyrelsen 2021). This suggests that the national traffic-safety program under the "Vision Zero" (related to fatalities and severe injuries) launched by the Swedish parliament in 1997 has been less successful when it comes to cyclists and pedestrians.[2] The recent upsurge in urban bicycling, not the least during the Covid-19 pandemic, and the electrification of bicycles and scooters have led to more diverse blends of experienced and non-experienced, and fast and slow users of roads, pavements and sidewalks. This has spurred much concern at national and local government levels for the safety of vulnerable road users (Holmberg and Gustavsson 2020). Remedies considered can be a mix of public and private measures. Examples are conventional methods such as separate lanes and bicycle helmets, and new systems building on information and communication technologies, such as 5G mobile and dedicated short-range communication, magnetic or thermal sensors at street crossings, etc.

[2] Actually, traffic-safety work is much older than the "Vision Zero" program. The number of fatalities from car crashes peaked already in 1970.

We conducted a contingent valuation survey among a sample of 1,026 individuals from a web panel, selected to represent the Swedish adult population with respect gender and age. The respondents were asked about their willingness to pay for a traffic safety intervention that would reduce by half the risk to be in an accident as a pedestrian or cyclist. We used five different scenarios for provision of the safety intervention, varying different aspects that can be attributed to the public/private dichotomy. In the first four scenarios we kept the framing of the intervention as a mobile phone app constant, while varying if it is provided by a government agency or a private company, if it is bought in the market or financed through a tax and if it is voluntary or mandatory to use. In the last scenario we change the intervention to an infrastructure, namely sensors for approaching bicycles or pedestrians. One of the mobile phone app scenarios is a private good while the others are public goods. One of the public mobile phone app scenarios is presented to all respondents, while they all get a second, randomly selected, scenario from the other four. In addition, we ask the respondents about their attitudes towards several aspects that can be connected to the difference between a public and private good.

Our main finding is that valuations of private and public traffic safety interventions measures are not significantly different when we use the same framing of the good, in this case a mobile app. This is consistent with findings reported in the literature on health interventions, where public goods are valued more than private ones (Gyrd-Hansen 2016; Pedersen et al. 2011). Further, and contrary to earlier traffic safety studies, our public good with infrastructure framing generates higher, not lower, valuations than the private mobile phone app. We also find that participation coercion is valued negatively and provision of the good by public institutions is favored over that of private companies.

The outline of the paper is as follows. Section 2 presents empirical background. The survey and data are presented in Section 3, followed by a theoretical discussion in Section 4. Testing hypotheses and descriptive statistics of WTP for a risk reduction are presented in Section 5. Section 6 lays out the econometric framework and results are presented and discussed in Section 7. Section 8 concludes.

2. Empirical background

Most previous studies of traffic safety interventions find a lower valuation for a risk reduction when the intervention is framed as a public measure rather than a private service (i.e., Svensson and Vredin Johansson 2010; Andersson and Lindberg 2009; Hultkrantz et al. 2006). However, the results from studies of health interventions are more mixed and some find instead a higher valuation for a risk reduction provided through a publicly provided intervention (Gyrd-Hansen 2016; Pedersen et al. 2011). One potential explanation to the difference in results depending on context (health or traffic) is that surveys conducted within the health context, contrary to in the traffic context, often use the same specific intervention for both the public and private framing. For example, the WTP for public or private provision of prostate cancer screening (Pedersen et al. 2011) and an ambulance helicopter (Gyrd-Hansen 2016).

For studies conducted in the context of traffic safety, the intervention is instead seldom kept constant or is vaguely defined. For example, the private good can be defined as “a safety device” (e.g., Svensson and Vredin Johansson 2010; Andersson and Lindberg 2009; and Hultkrantz el al. 2006) and the public good as a “road traffic safety programme” (e.g., Hultkrantz et al. 2006), a “public road safety investment” (e.g., Svensson and Vredin Johansson 2010) or a “safety program” (e.g., Andersson et al. 2013). However, since the respondent might have different perceptions about what type of intervention this can be it may potentially influence the respondent’s WTP.

Gyrd-Hansen et al. (2016) are instead more specific about the public measure and state that it could be one of three different alternatives (streetlights, lorry turnings, better marking of walkways and lanes or better signage), which reduces the flexibility of interpretation about the kind of intervention. Although all three alternatives are still different than the private service (that could also be one of three given alternatives of safety equipment such as airbag, special safety belts or better bodywork), they find that the public and private interventions did not generate significantly different valuations.

Other studies (Svensson and Vredin Johansson 2010; Andersson and Lindberg 2009; Hultkrantz et al. 2006) find that the controversial difference in valuation of risk reduction for a traffic accident depending on if it is a public or private intervention is quite large: 80 – 160 percentage points. A disparity of this magnitude can obviously lead to a substantial bias in benefit-cost assessments if benefits are transferred from valuation studies made for another type of intervention than the ones being evaluated. This has therefore spurred research to understand the underlying mechanism. As an example, Svensson and Vredin-Johansson (2010) show that the difference found in their study partly was explained by the individual's attitudes to public or private provision in general (e.g., negative attitude to tax and a negative attitude to interference by the public sector). Another explanation can be the presence of financial altruism, i.e., the respondents state a lower WTP since they believe that others value the good lower than they do and thus should not have to pay as much (Gyrd-Hansen et al. 2016). If financial altruism dominates safety altruism, i.e., the desire to increase others safety, then the net effect on WTP can be negative. In this study, we continue this strand of research by further examining these and other possible explanations.

3. The survey

The data used in this paper comes from a contingent valuation survey conducted among a sample of the Swedish population. The survey was collected in May 2020 using a survey distributed to a sample of the Userneed panel, a web panel with about 110,000 members, aged 18-80. To gather the requested number of responses a total of 7,448 individuals were invited to answer, selected to represent the population by gender, age and geographical region, resulting in 1,022 (14%) fully completed surveys.[3]

The aim of the survey is to collect stated valuations of several traffic safety in[4]terventions for cyclists and pedestrians. A complete set of instructions for the survey is provided in Appendix A online. After a short introduction that presents the aim of our study, the survey collects a few demographic characteristics of the respondents (i.e., age, gender, and geographic location) and their perceived risk of being in a traffic accident as a cyclist or pedestrian. The main research questions collect information about the respondents' willingness to pay for a traffic safety intervention that would reduce by half the risk to be in a traffic accident as a cyclist or pedestrian. We use five different provision scenarios (Table 1), where the first four (A-D) keep constant the intervention, which is a mobile phone app, but vary the provision as private or public, the payment vehicle as market based or tax based and the use of the safety device as mandatory or voluntary. In the last scenario (E), the form of intervention is an infrastructure installation instead of a mobile phone app. Provision scenario A is a standard

[3] Response rates in web panel surveys are usually low. For a discussion on how to judge quality of such surveys see e.g. Survey Society of the Swedish Statistical Association (2015).

[4] Appendix A is available at http://

"private good" that is sold on a market by a private company and scenarios B - E are "public goods" fulfilling the requirements of non-excludability and non-rivalry. Scenario C is similar to A despite it being a public good, but differs from A in that it is financed through uniform taxes. Scenario B differs from C only in that the good is provided by a public institution, and Scenario D differs from B only in that use is mandatory. Finally, Scenario E differs from D only in that it presents an infrastructure intervention.

Table 1 Survey scenarios by attribute

	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E
Good	App	App	App	App	Infrastructure
Provision	Private	Public	Private	Public	Public
Payment	Private	Tax	Tax	Tax	Tax
Coercion	No	No	No	Yes	Yes
No. of resp.	255	1,026	256	259	256

All respondents answered questions about scenario B, i.e., the mobile phone app publicly provided and paid via taxes and with voluntary use. Additionally, each respondent was randomly allocated to answer questions about one of the other four scenarios. Since each respondent gave valuations to two scenarios, we varied the order of when scenario B was presented to control for possible order effects. Since respondents often find it difficult to understand a change in small probabilities (Hammitt and Graham 1999), the survey provides information about how the risk reduction would influence the absolute number of accidents in a small town (with 10,000 inhabitants), i.e., "This means that if all citizens used the app, the number of accidents among unprotected road users in a town with 10,000 inhabitants would decrease from on average 20 to 10 per year." This type of information has been suggested to be a good complement to understanding change in probabilities (Calman and Royston 1997).

Regardless of whether the payment vehicle is a market price or a uniform tax, we present the respondents with five different monthly payment values: SEK 0, 10, 25, 50, and 100 and ask them to indicate which one is the maximum value that they would support; see Box 1 which shows an example from the survey (scenario B).[5] Since answers can be influenced by the duration of payment (Andersson et al. 2013), we also show them the annual equivalent of

[5] During the spring 2020 when the survey was answered, EUR 1 was about SEK 10.5.

each monthly payment value. When the payment vehicle is a tax, it is stated that the cost is going to be equally divided among all taxpayers, i.e., a uniform tax. .

To reduce the problem of hypothetical bias, we remind the respondents about their budget constraints and explain that exaggerations of valuations are common in these types of studies. Furthermore, we also ask the respondents how certain they are that they would buy the good in the private case or vote in favor in the public case. Certainty calibration has been shown to reduce the problem of hypothetical bias (Blumenschein et al. 2008; Ryan et al. 2017) and give more consistent results (Svensson 2009). However, only using the certain respondent can also influence the representativeness of the data (Gyrd-Hansen 2016) and therefore we estimate our models both with and without certainty calibration.

This proposal means that you will have the opportunity to install an app in your mobile phone that is paid for with tax money. The app is provided by the Swedish Transport Administration. It is voluntary to use the app and you, and anyone else who wants to, will be able to download it without additional payment. The cost is shared equally between you and all other taxpayers and is paid through a tax increase. It will not be possible to buy a similar app from private companies.

How much the tax is going to be increased depends on several factors that are still unknown. We currently assume that all levels below are equally likely. Assume that the proposed intervention will be implemented if enough people answer yes to the tax increase that ultimately applies.

Mark the largest tax increase you would vote yes to

- ○ 0 SEK per month (0 SEK per year)
- ○ 10 SEK per month (120 SEK per year)
- ○ 25 SEK per month (300 SEK per year)
- ○ 50 SEK per month (600 SEK per year)
- ○ 100 SEK per month (1200 SEK per year)

Box 1 Willingness to pay question for scenario B

To test for the influence of financial altruism, as proposed by Johansson (1994) and Gyrd-Hansen et al. (2016) to explain the lower valuation of public compared to private goods, we ask about the respondent's perception of others' WTP. Financial altruism would only apply if the respondent believes that others value the good less. In Table 2, which lists all explanatory variables, *WTPother* is a dummy variable that shows that about 20% of the respondents believe that others have a lower WTP than self.

[Table 2 about here]

Furthermore, to test the extent to which respondents appear to be incentivized to truthfully reveal preferences, we ask about beliefs whether the study findings will influence policy (policy consequentiality) and beliefs whether the payment as stated will have to be made if the policy is implemented (payment consequentiality). The importance of such consequentialities has been argued by e.g., Zawojska et al. (2019). To increase the saliency of policy consequentiality, we clearly state that this research is financed by the Swedish Transport Administration, i.e., the government agency responsible for national traffic-safety programs. The variable *Project cons* in Table 2 measures the proportion of respondents who believe that the study findings may affect the implementation of traffic safety interventions. It shows that 15% believe this to be the case. Similarly, only 14% of respondents believe that, if an intervention is implemented, the amount they will have to pay will be influenced by the study, as shown by the variable *Payment cons*. While this is not strong support for consequentiality, we also find that 37% of respondents believe that 50% of people would indeed download and use the app if it were available and free to use.

Following Svensson and Vredin Johansson (2010) that reported that one reason for the difference in public and private WTP can be the respondents' attitudes about the desirability and performance of public and private provision of services, we also ask the respondent about her attitude on several dimensions. Table 2 lists the attitude variables in the second section.

The survey ends with control questions about the respondent's experience of accidents, self risk assessment and socioeconomic and a few additional demographic characteristics. These variables are listed in sections 1 and 3, respectively, of Table 2. We find no significant difference across scenarios in income, age, gender and household size, consistent with a random allocation of scenarios to respondents. The only exception is the gender distribution across scenarios D and A, but the difference is only significant at the 5% level.[6]

4. Theory

4.1 A general utility function

In this study we investigate how peoples' willingness to pay (WTP) for a traffic safety intervention is affected by various circumstances connected to the differences between public and private goods, such as how these interventions will affect other peoples' outcomes, how it is provided and how it is funded. To start with how an individual's WTP is affected by the expected effects on other peoples' outcomes, consider, with a slight abuse of the framework of Jones-Lee (1992), a society with η individuals, each individual i having differentiable utility functions of the following general form:[7]

$$u_i = u_i(\pi_1, w_1, \ldots, \pi_\eta, w_\eta),\ i = 1, \ldots, \eta \tag{1}$$

where π_i and w_i are the one-year ahead probability of being injured in an accident and wealth, respectively, of an individual i, u_i is strictly increasing in $-\pi_i$ and w_i, and non-decreasing in $-\pi_j$ and w_j, where $j = 1\ldots\ \eta$ and $j \neq i$, with partial derivatives denoted as $u_{i\pi_i}$, $u_{i\pi_j}$, u_{iw_i} and u_{iw_j} for all *i, j*.

With this general formulation Jones-Lee defined three polar cases[8] of the utility function of individual *i*:[9]

a. *Pure self-interest,* when:

$$u_{i\pi_j} = u_{iw_j} = 0, \forall j \neq i. \tag{2}$$

b. *Pure altruism,* when:

[6] An earlier version of the survey was first tested on a small focus group ($n = 3$) and later in a pilot study among students ($n = 126$) in November 2019. The pilot only included four different scenarios: A, B, C and E. In the main survey we added scenario D with mandated use. In the pilot study we used an open-ended format for the WTP question, which informed us about the range of probable payment size.

[7] Notice that this formulation is general. It does not specify whether preferences over others' safety and wealth are linked to others' true utility functions, beliefs over others' utility functions or "warm-glow" preferences.

[8] A fourth special case pointed out by Jones-Lee (1992) is pure paternalism, i.e., when an individual has the same safety-wealth marginal rate of substitution for others as for herself.

[9] Notice that these definitions of "pure altruism" relate to marginal utilities. An empirical measurement of the "degree of altruism", or "impure altruism" needs to cope with the issue of disentangling altruism and diminishing marginal utility when wealth endowment is unequal (Gauriot et al. 2020).

$$\frac{u_{i\pi_i}}{u_{iw_i}} = \frac{u_{i\pi_j}}{u_{iw_j}}, \forall j \neq i. \tag{3}$$

c. *Safety-focused altruism*, when:

$$u_{iw_j} = 0 \text{ and } u_{i\pi_i} > 0, \forall j \neq i \,. \tag{4}$$

4.2 A decision model

We now turn to the choice problem that respondents have been presented in this study. For this purpose, we reduce the agents whose safety and wealth are considered in the respondent's utility function to self (s) and others (o). In addition, we amend the arguments with a vector Y of individual-specific variables, such as socio-economic and attitude variables. As described further below, the respondent is asked about her maximum WTP, framed as the compensating variation (τ) for a safety-enhancing intervention in a specific funding and provision context. Assuming that she maximizes her expected utility (Eu), she is asked to express τ in the following equation:

$$Eu([\pi_s - p_s^{\pi}(\tau)d\pi_s], [w_s - p_s^{\tau}(\tau)\tau], [\pi_o - p_o^{\pi}(\tau)d\pi_o], [w_o - p_o^{\tau}(\tau)\tau], Y, p_s(\tau)Z) = u(\pi_s, w_s, \pi_o, w_o, Y) \tag{5}$$

π_s and π_o are the subjective baseline accident probabilities of self and others, respectively, $d\pi_s$ *and* $d\pi_o$ are the given risk reductions from the safety intervention which are given exogenously in the scenario descriptions and are the same for all individuals that participate, Z is a vector of scenario-specific attributes associated with the safety intervention (i.e., an app, an infrastructure device, or nothing) and Y is a vector of individual-specific variables that do not change with the safety intervention.

Except for in the standard private good case (scenario A in Table 1), provision is contingent on that enough other people are willing to accept to pay τ. Therefore, all changes of risk are multiplied by p_s^{π} or p_o^{π}, i.e., the respondent's subjective probability that the measure will be provided for self or others, and all changes of cost are multiplied by p_s^{τ} or p_o^{τ}, i.e., the respondent's subjective probability that self or others will have to pay the cost. These probabilities all depend on τ and may be less than one. In the case of mandated use of public good solutions, i.e., scenarios D and E, equation (5) simplifies by the condition $p_s^{\pi}(\tau) = p_o^{\pi}(\tau)$. For all tax financed alternatives, $p_s^{\tau}(\tau) = p_o^{\tau}(\tau)$.

Thus, the decision model for a representative respondent sets the *Eu* of the proposed safety intervention equal to the utility of the current traffic risk and wealth. Both *Eu* and *u* are functions of the individual-specific variables, *Y*, which do not change with the safety intervention. *Eu* is also a function of *Z*, i.e., the safety intervention attributes that are associated with the specific intervention (i.e., an app, an infrastructure device, or nothing).

An individual who only exhibits safety altruism would have a positive third term in the *Eu* expression in equation (5) and a zero for the fourth term. An individual who exhibits both safety and financial altruism, i.e., pure altruism, would also have a negative fourth term. Thus, for an individual who is a pure altruist, altruism matters less to his decisions than if the individual is only a safety altruist. Bergstrom (2006) demonstrates that the social value, i.e., the value that includes altruism, to a consumer of a public good is the same as the private value under a wide set of assumptions. Gyrd-Hansen et al. (2016) argue that these assumptions are not fulfilled in their data and that the reason private values are higher than public values is due to the financial altruism dominating the safety altruism.

5. Hypotheses and descriptive results

5.1 Hypotheses

The survey scenarios (Table 1) allow us to test for differences in WTP based on the following hypotheses.

H1: Public good versus private good valuation differences

$$WTP_{B,D,E} = WTP_A$$

Scenario A is the only pure private good and is the base scenario for testing H1. Scenario A can be compared to either of scenarios B, D or E. Scenario B is a classic public good where other attributes of the good are the same as for A and therefore directly comparable. Scenario E is also a classic public good and close to previous studies (e.g., Gyrd-Hansen et al. 2016) where the public good offered is not the same as the private good. Scenario D is a public good but where the use of the app is mandated. Theory predicts equality based on the simultaneous presence of both safety altruism (increasing WTP for the public good) and financial altruism (decreasing WTP for the public good) as proposed by Bergstrom (2006).

H2: Framing

$$WTP_E = WTP_D$$

Both scenarios E and D involve public goods. The only difference between scenarios is the safety intervention per se, i.e., a mobile phone app in scenario D versus infrastructure in scenario E, where everything else is kept constant. Scenario E uses a good of a similar type to the public good in Gyrd-Hansen et al. (2016), and scenario D uses a good of a similar type to their private good in that it is not an infrastructure good. In their treatment where they have a uniform tax, like us, they cannot reject this hypothesis. When they use wording that removes the uniformity of the tax, they find that the value of the public good increases, consistent with financial altruism.

H3: Participation coercion

$$WTP_D = WTP_B$$

Scenarios D and B differ in only one aspect, namely that in D the use of the app is mandatory while in B it is voluntary. Thus, a result where $WTP_D > WTP_B$ ($WTP_D < WTP_B$) indicates that respondents are in favor of (dislike) a safety solution that requires participation coercion. Scenario E also requires participation coercion and could therefore alternatively be used in comparison with scenario B, though keeping in mind that the good offered is different in the two scenarios (an infrastructure in E versus an app in B).

H4: Public versus private companies as developers/providers of non-infrastructure good

$$WTP_C = WTP_B$$

Both scenarios B and C offer a tax-financed mobile phone app as safety service, with the only difference that in Scenario B it is developed and provided by a public institution (the Swedish Transport Administration) and in scenario C it is developed and provided by a private company. $WTP_C > WTP_B$ ($WTP_C < WTP_B$) indicates that respondents value a safety service provided by a private company higher (lower) than a same service provided by the public. Such preferences have been proposed by Viscusi et al. (1988).

5.2 Descriptive results

Table 3 shows some descriptive statistics of the stated WTP. The median WTP is SEK 10 for all scenarios, whether or not we include SEK 0 observations. The proportion of responses that are SEK 0 is high, ranging from 30% in scenario E to 50% in scenario C. The mean WTP for the full sample, i.e., including the zero bids, is lowest for scenario C, which is the scenario that uses a privately developed and provided app but financed via uniform taxes. However, even excluding the zero bids generates the lowest WTP for C among the five scenarios. For the full sample, the infrastructure scenario E has the highest WTP, with an average WTP of SEK 15.21 and the lowest proportion of SEK 0 responses, followed by scenario B, with an average WTP of SEK 12.01 and the next lowest proportion of SEK 0 responses.

Table 3 Willingness to pay (WTP) in SEK for reduced risk of accident by provision scenario

	Full sample			Proportion WTP = 0 (in %)	WTP > 0		
	Mean	Std. dev.	Median		Mean	Std. dev.	Median
Scenario A	10.28	16.10	10	44.66	18.57	17.73	10
Scenario B	12.01	18.02	10	40.31	20.12	19.52	10
Scenario C	8.48	13.13	10	49.61	16.84	14.21	10
Scenario D	11.27	17.02	10	46.72	21.16	18.31	10
Scenario E	15.21	18.50	10	30.47	21.88	18.62	10

Note: The proportion of WTP = 0 is reported as share of the number of respondents in that particular scenario. The full sample number of observations in the scenarios are $n_A = 253; n_B = 1{,}022;\ n_C = 254; n_D = 259; n_E = 256$.

Table 4 reports the tests of pairwise comparisons of equality of the full sample distributions based on Wilcoxon rank-sum tests. Columns 2-4 (WTP_A, WTP_C and WTP_D, which are all collected on a between sample basis) show that there is a significant difference in WTP between scenario E and the other three scenarios. The final column shows that scenarios C, D and E are significantly different from scenario B at the 5% level, but A is not.

Table 4 Tests of equality of distributions for WTP in the different scenarios

	WTP_A	WTP_C	WTP_D	WTP_B (sign)
WTP_A				1.687 (0.092)
WTP_C	1.168 (0.243)			3.909 (0.000)
WTP_D	-0.302 (0.763)	-1.431 (0.152)		2.658 (0.008)
WTP_E	-4.030 (0.000)	-5.164 (0.000)	-3.529 (0.000)	-4.973 (0.000)

Note: z-value (p-value) reported. Comparisons between scenarios A, C, D, and E, are conducted using the Wilcoxon rank-sum test with unmatched samples (Mann–Whitney two-sample statistic), while comparisons with scenario B are conducted using the Wilcoxon matched-pairs signed-ranks test.

Based on these unconditional tests in Table 4 we cannot reject H1 for scenario B, the one app scenario closest to a classic public good. We also cannot reject H1 for scenario D where the use of the public good is mandatory. The only exception is scenario E that has a higher WTP than A. However, the comparison between scenarios A and E is confounded by the fact that the two goods are framed differently. We reject H2 since scenario E has a significantly higher WTP than scenario D, so we have a framing effect. We reject H3 since scenario D with mandatory use of the app has a lower WTP than scenario B with voluntary use. Finally, we also reject H4 since scenario C with private development and provision has a lower WTP than scenario B with public development and provision.

6. The econometric framework

6.1 The outcome variable

Our outcome variable is the respondents' willingness to pay for road safety for cyclists and pedestrians. Given our design of the survey, the exact value of the maximum WTP is not directly observable since we present respondents only with a finite number of possible values, i.e., a discrete price list of SEK 0, 10, 25, 50, and 100. Thus, a respondent who states that the most she would pay is SEK 10, could actually have in mind that she would be willing to pay at least 10, but not as much as SEK 25. Thus, the SEK 10 response is censored in the sense that we cannot observe the true maximum, all we know is that the true value belongs to the interval SEK [10 – 24]. Similarly, if the individual responds SEK 25, or SEK 50 we know that the true WTP must lie in the intervals SEK [25 – 49] and SEK [50 – 99], respectively. Responses such as these are therefore interval-censored. A response of SEK 100 at the upper end of the price list is right-censored, since the true, but latent, WTP could be higher than SEK 100. A response of SEK 0 at the lower end of the price list is both left-censored and interval-censored. The upper endpoint for the SEK 0 response is SEK 9, and the lower endpoint is some value below SEK 0 reflecting that latent valuations could be negative.[10]

6.2. Basic setup

The proposed model of the continuous latent outcome variable can be stated as follows

$$WTP_i^* = X_i\beta_X + P_i\beta_P + R_i\beta_R + Q_i\beta_Q + Z_i\beta_Z + \varepsilon_i, \qquad i = 1, 2, \dots, n \tag{6}$$

[10] For instance because some attribute of the public good "bundle" (e.g., compulsory provision or tax funding) is detested.

where X_i is a vector of socio-demographic variables with a corresponding coefficient vector β_X, P_i is a vector of attitude variables with a corresponding coefficient vector β_P, R_i is a vector of variables reflecting risk assessments and accident experiences with a corresponding coefficient vector β_R, Q_i is a vector of variables reflecting consequentiality, usage and WTP of others with a corresponding coefficient vector β_{Q}, and Z_i is a vector of dummy variables representing the scenarios with a corresponding coefficient vector β_Z. Given our design the latent WTP_i^* may fall within a closed interval with two fixed endpoints (interval-censored data)

$$WTP_{Lk} \leq WTP_k^* \leq WTP_{Uk}, \text{ where } k \subseteq i \; are \; interval - censored, \tag{7}$$

where WTP_{Li} is the lower endpoint and WTP_{Ui} is the upper endpoint of the interval. Alternatively, the latent WTP_i^* may fall within an interval that has a fixed upper endpoint and an open (possibly infinite) lower endpoint (left- and interval-censored data)

$$[-\infty, WTP_{Ut}] \text{ where } t \subseteq i \; are \; left - and - interval - censored. \tag{8}$$

Finally, the latent variable WTP_i^* may fall within an interval that has a fixed lower endpoint and an unknown upper endpoint (right-censored data).

$$[WTP_{Lr}, \infty] \text{ where } r \subseteq i \; are \; right - censored. \tag{9}$$

Distributional assumptions

We assume that ε_i are i.i.d. with a normal distribution.[11] The likelihood contribution of each observation is dependent on the conditional probability that WTP_i^* is in an interval defined by one of equations (7), (8), or (9).

Using the short-hand $\Lambda_i\beta_\Lambda = X_i\beta_X + P_i\beta_P + R_i\beta_R + Q_i\beta_Q + Z_i\beta_Z$ the log likelihood is

[11] We use Stata's version 16 xtintreg command that facilitates MLE of interval response data in the case of normally distributed errors. This is the most common assumption in maximum likelihood approaches to this type of data (McDonald et al. 2018).

$$\ln L = \sum_t \log \Phi\left(\frac{WTP_{U_t} - \Lambda_t \beta_\Lambda}{\sigma}\right) + \sum_r \log \Phi\left\{1 - \left(\frac{WTP_{L_r} - \Lambda_r \beta_\Lambda}{\sigma}\right)\right\} + \sum_k \log \Phi\left\{\Phi\left(\frac{WTP_{U_k} - \Lambda_k \beta_\Lambda}{\sigma}\right) - \left(\frac{WTP_{L_k} - \Lambda_k \beta_\Lambda}{\sigma}\right)\right\} \quad (10)$$

7. Results

7.1 Main hypotheses tests

Table 5 presents results from two interval regression specifications all containing dummy variables for the scenarios of the survey, leaving out scenario B as the reference scenario. These are panel models with random effects.[12] In column (1) we control only for scenarios and task order. *Order* is a dummy variable that takes the value 1 if scenario B comes second and does not have a significant direct effect on WTP. Column (2) shows a larger model specification that includes socio-demographics, risk assessment and accident experience as well as the variables reflecting consequentiality, *Usage*, and *WTPother*. While the effect sizes for the dummy variables that capture our scenarios differ somewhat, the significance tests are the same across the two models. Therefore, the results of the hypotheses tests are also the same.

[Table 5 about here]

We start by testing H1, our hypothesis that public and private good valuations are equal. First, we can see that scenario A is not significantly different from scenario B, the public app good with voluntary participation. Wald tests of the equality of the coefficients for scenario A on the one hand and scenarios D and E on the other, show that only E is significantly different from A, but with the sign being the opposite of the effect reported in Svensson and Vredin Johansson (2010), Andersson and Lindberg (2009) and Hultkrantz et al. (2006). Thus, we confirm our inferences from the unconditional tests of H1 (Table 4): only E is significantly different from A, but using E constructs a confounded H1 test because the goods are framed differently.

Our second hypothesis, H2, regards the equality of WTP for our two goods, the mobile phone

[12] An LR-test rejects the hypothesis of no panel-level effects.

app in scenario D and infrastructure in scenario E, both presented as public goods where usage is mandatory. Using a Wald test we reject the hypothesis and therefore find support for framing influencing WTP. Again, our regression result is consistent with our unconditional test: we find a large and strongly significant difference with E valued higher than D.

Our third hypothesis, H3, looks at whether WTP for a public good is the same under voluntary use, scenario B, and mandated use, scenario D. The coefficient on scenario D in Table 5 is significant and shows that mandated use results in a lower WTP, i.e., valuation of participation coercion is negative. Since scenario E also requires participation coercion it can be compared with scenario B as an alternative way to test H3, although this comparison is confounded by the goods being different. The coefficient on scenario E is positive, contrary to the negative coefficient on scenario D. If the coefficient on scenario E is a combination of a negative valuation of participation coercion and a positive valuation of the infrastructure framing, then the latter effect is underestimated by the effect size of the coefficient. Again, our regression results are consistent with our unconditional tests presented in Table 4.

Our fourth and final hypothesis, H4, looks at equality between goods that are developed and provided by private firms, scenario C, vs. public agencies, such as a Department of Transportation, scenario B. Using a Wald test we find a significant difference, again consistent with our unconditional test. Our respondents prefer provision by public agencies.

In summary, we reject three of our hypotheses: H2, H3 and H4, but are unable to reject H1. We do not see a difference between scenarios with a public good and a private good (H1) when we control for framing. This finding is consistent with the presence of both safety and financial altruism in the public goods case, but could alternatively reflect the absence of both. Safety and financial altruism affect the expected utility of the decision maker in opposite directions, and can cancel each other out under commonly valid assumptions, as made clear by Bergstrom (2006).

7.2 Heterogeneity

While our hypotheses tests result in the same inferences for the short model (column 1) and the large model (column 2), the latter also allows us to investigate effects from several explanatory variables. None of the socio-demographic variables result in significant effects at the l% level or higher. Our younger age group, 18-29, indicates a positive effect but only at the 5% significance level. Of the variables reflecting risk assessment and accident experience, only *Expcar* has a significant coefficient, which suggests that respondents that have had experiences with car accidents report higher valuations of traffic safety than those without such experience. Finally, from our fourth grouping of explanatory variables, consequentiality of payments (*Payment cons*) indicates a positive effect but only at the 5% significance level. *Usage* indicates that respondents who believe that more than half of all cyclists and pedestrians would download a voluntary public app report higher valuations. Similarly, those respondents who believe that other individuals hold a lower valuation (*WTPOther*), report higher WTP. This last finding is contrary to suggestions in Johansson (1994) and Gyrd-Hansen et al. (2016) that respondents hold strong pure altruistic preferences which would make them underreport WTP for tax financed goods if they believe others hold lower valuations.

Table 6 shows model specifications that include responses to the attitudinal questions in the survey. These responses can be grouped into five categories: participation coercion (PC), tax coercion (TC), private companies (Priv), financial altruism (FA), and safety altruism (SA).

[Table 6 about here]

Column (1) shows the basic model with the scenario dummies and all the attitudinal variables included. The effects of the scenarios are very similar to those in Table 5, so the inferences are robust to the introduction of attitudinal variables.

Only two attitudinal variables have significant coefficients: *Safety tax* and *Tax attitude*, both positively associated with WTP. Thus, participants who favor tax increases to deal with traffic safety express higher WTP, and participants who do not think taxes are too high already also favor higher WTP.[13] This is consistent with findings in Svensson and Vredin Johansson (2010) that show that negative attitudes to taxes result in lower valuation of public goods, thus offering an explanation to the controversial valuation differences.

[13] Responses of "Don't know" are coded as 0. Appendix B section B.2 reports on robustness tests of our models based on "don't know" responses. The effect of *Tax attitude* proves to be a result of coding "don't know" responses as a zero and is no longer significant in the robustness tests.

The results reported in column (1) are averages across all scenarios and to look at the differential effects across scenarios we estimated scenario specific models, shown in columns (2) – (6). The effect of *Safety tax* is seen in all scenarios, including the private market scenario A. The positive and significant coefficient in the private scenario A suggests that the attitude primarily expresses favoring increased traffic safety rather than a desire for tax financing. In the scenario-specific models the result of *Tax attitude* is shown as arising only in scenario B, the baseline public goods scenario. We do not see a similar significant coefficient in any of the other scenarios (A, C, D, or E), although the coefficients are positive. The only other coefficient that is significant at the 1% level is *Public safety* in scenario E. The positive coefficient shows that those who believe that the government should play a stronger role in ensuring traffic safety express a higher WTP in the infrastructure scenario E compared to those who do not believe in such a role for the government. This is again consistent with the finding in Svensson and Vredin Johansson (2010) that those who have attitudes negative to government intervention value the public intervention less.

The coefficients of two additional variables are significant at the 5% level: *Private safety* in scenario C and *Privatization* in scenario D. The positive effect of *Private safety* in scenario C suggests that those who believe individuals should be responsible for their own safety report a higher WTP for a voluntary app public good provided by private companies. The negative effect of *Privatization* in scenario D indicates that those who believe government activities should be privatized express a lower WTP for the app public good when provided by a public institution with mandatory use.

We performed several robustness tests, reported in online Appendix B[14]. First, in section B.1, we drop respondents who are not certain of their WTP response, resulting in a larger proportion of SEK 0 responses in scenario B. This translates into a negative estimated value in the interval regression model. The marginal effects of the other scenarios are not strongly affected, so that the net result is for all scenarios to have negative values. Thus, certainty calibration does not change the rank ordering of the scenarios, but it does lead to the conclusion that none has a positive estimated WTP value.

[14] Appendix B is available online at http//

Dropping respondents who answered “don’t know” to explanatory variables in online Appendix B section B.2, lowers significance levels. The two variables with significant effects at the 5% level in Table 5 (*Age1829* and *Paymentcons*) have no longer significant coefficients even at the 10% level. Lack of robustness in weakly significant effects like this provides support for our conservative approach to only focus on effects that are significant at the 1% level or better. However, we also find that the coefficient on *Tax attitudes*, that is significant at the 1% level in Table 6, is no longer significant even at the 10% level, both for the full model in column (1) and the model for scenario B. Finally, dropping respondents who completed the entire questionnaire in less than 4 minutes in Appendix B section B.3 (compared to a median duration of 7 minutes and 45 seconds) resulted in only minor changes in the significance of the coefficients, with the main stories still supported.

To summarize, a large portion of our respondents are not willing to pay for the interventions, while at the same time we are somewhat able to categorize the WTP based on their attitudes, accident experiences, and beliefs about others willingness to pay.

8. Conclusions

Based on a web panel survey in Sweden with 1,022 respondents, we suggest that previous studies’ finding that private-good solutions to traffic safety are valued higher than public-good interventions may be due to the different framing of the goods and not to their private vs. public character. If the private and the public goods are otherwise not the same, then valuations may reflect preferences across differential attributes. In this study, we compare valuation differences when both the private and the public good is a mobile phone app, and when the private good is a mobile phone app and the public good is a traffic sensor, i.e., an infrastructure solution. In the former case we cannot reject that valuations are the same, but in the latter case we find significantly higher valuations of the infrastructure solution. Bergstrom (2006) predicts that, in the presence of altruism over the access to the good as well as over the financial costs, the valuations should be similar, consistent with our findings when we use the same mobile phone app. Gyrd-Hansen et al. (2016) suggest that the reason for private valuations being higher than public valuations could be that altruism over financial costs dominate altruism over access. They introduce a treatment that should remove such a dominance of financial altruism over safety altruism and verify that public valuations are higher then. However, like us they do not find that the private valuations are higher than the public ones even without that treatment, and therefore do not provide any additional evidence of the controversial excess of private of public valuations from the earlier literature. Our findings suggest that differences in valuations may arise due to other differences in the framing of the private and public goods offered.

Opinions regarding whether or not interventions should be voluntary or mandatory differ, and can generate strong emotional responses, as the debate over measures to restrict the spread of the corona virus has shown. We therefore find it interesting that in the case of our traffic safety solution for bicyclists and pedestrians 80% of our respondents value the voluntary solution higher than the mandated solution, resulting in a negative value of participation coercion. Thus, there is a great deal of agreement regarding the value of voluntary use among our respondents.

Another interesting finding is that our respondents are in favor of a public institution, such as the Swedish Transport Administration, developing and providing the good, over a private company, when in both cases it is tax financed. This is consistent with current findings on the attitudes of the Swedish population about private provision of tax-financed services. For instance, in a representative sample of the adult population in 2019, 21% were in favor of increasing the share of private provision of healthcare, while 54% were against. While 60% wanted a prevention of dividend payments from private companies producing tax-financed schools, healthcare and caring services, only 24% were against such a ban (Weissenbilder 2020). However, it is unclear whether such sentiments extend to infrastructure and traffic.[15]

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[15] In Sweden, all national tax-funded construction, maintenance & operations of roads are procured. The market shares of the state-owned contractor are 5% and 33% for construction and maintenance & operations, respectively.

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Table 2 Descriptive statistics of variables used in the regression analysis

Variable	Description	Mean (std.dev.)
Socio-economic variables		
Age1829	=1 if respondent is aged 18 to 29	0.185 (0.388)
Age6580	=1 if respondent is aged 65 to 80	0.201 (0.401)
Female	=1 if respondent is female or identifies as other	0.505 (0.500)
IncLow	=1 if respondent's household monthly pre-tax income is <30,000 SEK	0.212 (0.409)
IncHigh	=1 if respondent's household monthly pre-tax income is ≥50,000 SEK	0.412 (0.492)
lnHHSize	Natural logarithm of number of household members (1, 2, 3, 4, 5, >5)	0.728 (0.525)
Children	=1 if respondent's household includes children under the age of 18	0.302 (0.459)
Urban	=1 if respondent lives in urban area	0.721 (0.449)
Attitude variables (PC=participation coercion, TC=tax coercion, Priv=Private companies, FA=financial altruism)		
Public safety (PC)	=1 if strongly agree or agree to "The Swedish government should take a greater responsibility for the security of the citizens."	0.341 (0.474)
Private safety (PC)	=1 if strongly disagree or disagree to "Each citizen should be responsible for her own traffic safety."	0.029 (0.169)
Publ. reg. (PC)	=1 if strongly agree or agree to "To prohibit smoking in public areas outside is a reasonable policy."	0.694 (0.461)
Publ. act.: health (PC)	=1 if strongly agree or agree to "The state should take serious actions to reduce the spread of Covid-19."	0.345 (0.476)
Safety tax (TC)	=1 if strongly agree or agree to "The tax should be raised to increase the level of traffic safety in my city."	0.222 (0.416)
Tax attitude (TC, FA)	=1 if strongly disagree or disagree to "Taxes in Sweden are too high."	0.295 (0.456)
Effectiveness (Priv)	=1 if strongly agree or agree to "Private agents are in general more effective than public."	0.268 (0.443)

Privatization (Priv, PC)	=1 if strongly agree or agree to "More government agencies (activities) should be privatized."	0.156 (0.363)
Distribution (FA)	=1 if strongly agree or agree to "The central government and municipality should prioritize to reduce the difference between rich and poor in society."	0.490 (0.500)
Publ. act.: econ. (FA)	=1 if strongly agree or agree to "The state should take serious actions to reduce the economic consequences of Covid-19."	0.474 (0.499)
Risk assessment and accident experience		
Lowrisk	=1 if respondent perceives own risk as lower than average	0.499 (0.500)
Ownworry	=1 if respondent rates own risk of being injured in a traffic accident as pedestrian or bicyclist >5 on a scale 1 (not worried at all) to 10 (very worried)	0.248 (0.432)
Expcar	=1 if respondent has experience of traffic accident in car, irrespective of how many times	0.175 (0.380)
Expped	=1 if respondent has experience of traffic accident as pedestrian or bicyclist, irrespective of how many times	0.182 (0.386)
Expfamilycar	=1 if a family member or close friend of respondent has been involved in a traffic accident in car with either fatal outcome or serious injury	0.345 (0.476)
Expfamilyped	=1 if a family member or close friend of respondent has been involved in a traffic accident as a bicyclist or pedestrian with either fatal outcome or serious injury	0.232 (0.422)
Consequentiality, usage, and WTP of others		
Project cons	=1 if respondent rates the likelihood >3 (on a scale 1 to 5) that the results of the survey will have any effect on whether any of the suggested interventions will be implemented, and in such case which one	0.149 (0.356)
Payment cons	=1 if the respondent rates the likelihood >3 (on a scale 1 to 5) that the results of the survey will have any effect on how much she will end up paying for the intervention that will potentially be implemented	0.139 (0.346)

Usage	=1 if respondent believes that more than 50 % of all cyclists or pedestrians would download and use the mobile phone app if it were voluntary to use and available free of extra charge (tax financed)	0.308 (0.462)
WTPother	=1 if respondent believes other individuals have a lower WTP than herself	0.208 (0.406)

Note: Attitude variables are ranked on a scale 1-5, where 1=strongly disagree and 5=strongly agree, and respondents were also given the opportunity to give answer "don't know". The attitude variables are hence coded as not sharing the attitude if the respondents answer that they are indifferent, disagree, strongly disagree or don't know, except for in the case of the attitude variables Safety tax and Tax attitude. These two variables are instead coded as not sharing the attitude if the respondents answer that they are indifferent, agree, strongly agrees, or don't know. Thus, the variables are coded to show attitudes in favor of participation coercion. In all questions underlying the variables in the categories Risk assessment and accident experience and Consequentiality, usage, and WTP of others the respondents were also given the opportunity to answer don't know. These answers are coded as zeroes (=0), and thus contained in the reference. The variable Urban is coded as one (=1) if the respondent answered don't know.

Table 5 Panel interval regression with scenario dummies

	(1)	st.e.	(2)	st.e.
Scenario A	-1.660	(1.29)	-0.583	(1.27)
Scenario C	-6.352***	(1.33)	-6.116***	(1.30)
Scenario D	-3.409***	(1.30)	-3.747***	(1.28)
Scenario E	6.038***	(1.26)	5.780***	(1.24)
Order	0.911	(1.75)	1.084	(1.62)
Age1829			4.396**	(2.20)
Age6580			2.647	(2.28)
Female			0.154	(1.65)
IncLow			2.543	(2.36)
IncHigh			-0.141	(1.89)
lnHHsize			3.995	(2.50)
Children			-1.035	(2.63)
Urban			0.608	(1.86)
Lowrisk			-2.658	(1.73)
Ownworry			3.741*	(1.99)
Expcar			6.333***	(2.17)
Expped			3.734*	(2.16)
Expfamilycar			1.725	(1.78)
Expfamilyped			2.412	(2.01)
Project cons.			3.332	(2.57)
Payment cons.			6.048**	(2.59)
Usage			8.812***	(1.77)
WTPother			14.47***	(1.43)
_cons	11.54***	(1.30)	-3.193	(3.20)
sigma_u	24.66***	(0.86)	22.31***	(0.78)
sigma_e	11.96***	(0.26)	11.69***	(0.29)
N	2044		2044	
Log lik.	-2481.3		-2381.9	
rho	0.809		0.784	
LR-test panel	710.7		615.9	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 Interval regression including attitudinal variables. Panel and separate regressions for each scenario

	Panel (1)	Scenario A (2)	Scenario B (3)	Scenario C (4)	Scenario D (5)	Scenario E (6)
Scenario A	-1.907					
	(1.29)					
Scenario C	-5.774***					
	(1.32)					
Scenario D	-3.489***					
	(1.30)					
Scenario E	5.881***					
	(1.26)					
Order	0.854	3.829	-0.109	1.170	-4.542	6.795**
	(1.65)	(3.49)	(1.79)	(3.09)	(3.89)	(3.21)
Public safety, PC	1.307	-3.158	1.722	-0.712	-3.312	10.060***
	(1.93)	(4.01)	(2.08)	(3.66)	(4.32)	(3.81)
Private safety, PC	8.912*	7.044	9.444*	16.459**	-3.411	3.939
	(4.83)	(13.82)	(5.17)	(7.84)	(10.16)	(9.88)
Publ. reg., PC	0.074	-5.335	-0.984	5.022	1.634	0.293
	(1.83)	(3.89)	(1.98)	(3.27)	(4.41)	(3.46)
Publ. act.: health, PC	-0.446	3.347	-1.821	-0.576	4.980	-4.141
	(1.92)	(3.95)	(2.09)	(3.59)	(4.37)	(3.73)
Safety tax, TC	17.393***	12.536***	17.946***	8.959**	24.451***	17.001***
	(2.17)	(4.57)	(2.34)	(4.46)	(4.81)	(4.20)
Tax attitude, TC(FA)	6.031***	7.716*	6.654***	1.533	7.780*	5.011
	(1.99)	(4.20)	(2.14)	(3.79)	(4.57)	(3.76)
Effectiveness, Priv	-0.552	8.344*	-1.404	-6.707*	5.453	-1.838
	(2.17)	(4.79)	(2.35)	(3.89)	(4.83)	(4.32)
Privatization, Priv(PC)	-0.133	7.953	-1.279	5.957	-13.259**	4.357
	(2.66)	(5.79)	(2.89)	(4.98)	(6.17)	(4.91)
Distribution, FA	0.707	-2.703	1.320	-5.014	2.998	2.883
	(1.79)	(3.83)	(1.94)	(3.27)	(3.96)	(3.64)
Publ. act.: econ., FA	2.225	-2.112	3.519*	6.726*	3.508	-0.640
	(1.84)	(3.76)	(1.99)	(3.53)	(4.13)	(3.63)
_cons	4.097*	5.311	4.902**	2.232	-1.502	5.703
	(2.20)	(4.62)	(2.37)	(3.86)	(5.67)	(3.95)
sigma_u	22.921***					
	(0.81)					
sigma_e	11.972***					
	(0.27)					
lnsigma		3.179***	3.253***	3.040***	3.286***	3.135***
		(0.07)	(0.03)	(0.07)	(0.07)	(0.06)
N	2044	253	1022	254	259	256
Log lik.	-2422.0	-327.0	-1399.7	-296.8	-326.1	-352.0
rho	0.786					
LR-test panel	631.5					

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix A: The survey

Background and aim with the survey

Due to safer cars and roads the risk of dying or become serious injured when driving a car has decreased during a long time. However, the trend has not been the same for people who are walking or driving a bike and about two out of three of that gets seriously injured in traffic is walking or biking.

Extensive research and development projects are under way both in Sweden and in other countries to develop automatic systems that can anticipate, warn and prevent accidents among people who are walking or driving a bike. These systems cost money and an important question is therefore how much they are worth for the road users and how they can be financed. We want to ask you what you think about this. The aim of this study is to evaluate how you value interventions for increased road safety for unprotected road users. The study is part of a research project financed by Swedish Transport Administration (Trafikverket) and Örebro University.

Handling of responses

This section is missing and needs to be added to this appendix.

Voluntary to participate

It is totally voluntary to participate and you can end the survey whenever you want to without stating any reason for this.

Principal of Research

This study is done by researchers at Örebro University. Principal of research is Örebro University.

Responsible for the study

Responsible for the study is Elin Vimefall, senior lecturer in Economics. Mail: elin.vimefall@oru.se, phone: 019-303720

○ 1. I have taken part of the information above and agree to participate in the study.

I identify myself as

- ○ 1. Man
- ○ 2. Women
- ○ 3. Other

Year of birth

____

In what community to you reside?

Mark your answer ▼

During one year on average 20 individuals who are walking or driving a bike in a town with 10 000 inhabitants will be in a road accident which leads to a visit to the emergency. Thereby the risk is 2 in one thousand, i.e., 0,2%.

How large do you think that your risk is to, during one year, be in an accident when you are walking or driving a bicycle which leads to a visit to the emergency.

- ○ 1. Less than average
- ○ 2. About the same as average
- ○ 3. Higher than average
- ○ 4. Don't know

How worried are you that you will be hurt in a road accident while walking/driving a bicycle?

Not worried at all — Very worried

1	2	3	4	5	6	7	8	9	10

- ○ Don't know

System proposal

As a pedestrian or cyclist, you can be hit by faster vehicles such as cars, motorcycles, electric bikes, mopeds and electric scooters. With new technology, such vehicles can be equipped with systems that warn and / or brake to prevent accidents. In this study, we assume that all vehicles will have such equipment built-in.

For the technology in the vehicles to detect you in time, your mobile phone or other equipment needs to send an automatically signal to the faster vehicle. Another alternative are fixed sensors at, for example, intersections and transitions with high risk. The technology for this has been developed and tested by researchers and industry but has not yet been used in Sweden. It is always designed so that no one can see or register the identity of individuals. When we in the following talk about app, we mean a mobile app or other equipment.

In the following questions, we ask you to assume that the app halves the risk of accidents for pedestrians or cyclists if they choose to download and use it. This means that if everyone used the app, the number of accidents among pedestrians and cyclists in a city with 10,000 inhabitants would be halved from an average of 20 to 10 per year. Also assume that the introduction of sensors would halve the accident risk for those who move in traffic as pedestrians or cyclists.

The cost of the systems can be paid with a tax that is the same for all taxpayers, or by each person buying the app themselves. We now want to ask you what you are willing to pay for different options. Think about what you really want to pay and can afford. It is easy to exaggerate when answering these types of questions. Keep in mind that there are many other things you would like that also cost money. Assume, that loss of income and medical expenses after an accident are covered in the usual way by social insurance. We now ask you to take a stand on two different proposals for how a system can be financed and provided.

Each respondent gets two proposals, the "Tax-financed alternative provided by the state, voluntary use" and one more. The other proposal is varied among the other 4 scenarios and the order of the proposals are varied.

Fee-financed alternative provided by private companies

This proposal means that you can buy and install the app in your mobile phone if you want to. The app is sold by private companies in the same way as other mobile apps.

Tax-financed alternative provided by the state, voluntary use

This proposal means that you have the option of installing an app in your mobile phone that is paid for with tax money. The app is provided by the Swedish Transport Administration. It is voluntary to use the app and you, and anyone else who wants to, will be able to download it without additional payment. The cost is shared equally between you and all other taxpayers and is paid through a tax increase. It will not be possible to buy a similar app from private companies.

Tax-financed alternative provided by private companies, voluntary use

This proposal means that you have the option of installing an app in your mobile phone that is paid for with tax money. The app is provided by private companies. You, and anyone else who wants to, will be able to download it at no extra charge. The cost is shared equally between you and all other taxpayers and is paid through a tax increase.

Tax-financed alternative under the auspices of the state with a statutory requirement for use

This proposal means that it will be a legal requirement for everyone to install an app in their mobile phone (or use alternative equipment such as a bracelet). The app is provided by the Swedish Transport Administration. You, and everyone else, can download the app for free. The cost is shared equally between you and all other taxpayers and is paid through a tax increase. It will not be possible to buy a similar app from private companies.

Tax-financed alternative, infrastructure

An alternative to the solution with an app is to instead use fixed sensors at crossings, intersections and other places with a high risk of accidents. The sensors cannot identify individuals but only that it is a pedestrian or bicycle user who is approaching. The sensors will sense everyone and there is thus no possibility to refrain from participating. The Swedish Transport Administration will provide the system. The cost is shared equally between you and all other taxpayers and is paid through a tax increase.

If proposal 1 is included: The price / tax increase that will have to be charged depends on several factors that are still unknown. We currently assume that all the levels below are equally likely. Assume that the proposal will be implemented if enough people say yes to the price / tax increase that ultimately applies.

If proposal 1 is not included: Which tax increase will need to be levied depends on several factors that are still unknown. We currently assume that all the levels below are equally likely. Assume that the proposal will be implemented if enough people say yes to the tax increase that ultimately applies.

Mark the largest tax increase you would vote yes to
If proposal 1: Mark the highest price you are willing to pay for the app

- ○ 0 SEK per month (0 SEK per year)
- ○ 10 SEK per month (120 SEK per year)
- ○ 25 SEK per month (300 SEK per year)
- ○ 50 SEK per month (600 SEK per year)
- ○ 100 SEK per month (1200 SEK per year)

How sure are you that you would really vote yes to a proposal to increase the tax by SEK X per year (SEK X per month) to finance the proposal Tax-financed alternative under the auspices of the state?

If alternative 1: How sure are you that you would really buy the app if it was available for SEK X per year (SEK X per month)?

Not at all sure — Completely sure

1	2	3	4	5	6	7	8	9	10

- ○ Don’t know

How large tax increase do you think others are willing to pay compared to you?
If alternative 1: How much do you think others are willing to pay compared to you?

- ○ 1. Less than me
- ○ 2. About the same as me
- ○ 3. More than me
- ○ Don’t know

What percentage of all cyclists / pedestrians do you think would download and use the app if it was voluntary to use and was available at no extra cost (financed through taxes)?

Enter your answer as percentage (0-100)

____

- ○ Don't know

How likely do you think it is that the result of this survey will influence the decision about if any of these proposals, and if so which one, will be introduced in Sweden?

- ○ 1 -Not at all likely
- ○ 2
- ○ 3
- ○ 4
- ○ 5 -Very likely
- ○ Don't know

How likely do you think it is that the results of this study will affect how much you will ultimately have to pay for the proposal that may be implemented?

- ○ 1 - Not at all likely
- ○ 2
- ○ 3
- ○ 4
- ○ 5 -Very likely
- ○ Don't know

Control questions

How often did you travel with any of the following means of transport during a typical week in the past year?

1. Car/motorcykel

- ○ 7 days a week

- 5-6 days a week
- 3-4 days a week
- 1-2 days a week
- Some days a month
- Less
- Not at all
- Don’t know

2. Bicycle / moped / scooter / electric scooter

- 7 days a week
- 5-6 days a week
- 3-4 days a week
- 1-2 days a week
- Some days a month
- Less
- Not at all
- Don’t know

3. By foot

- 7 days a week
- 5-6 days a week
- 3-4 days a week
- 1-2 days a week
- Some days a month
- Less
- Not at all
- Don’t know

How many times during your lifetime have you been in a traffic accident that has meant that you have had to seek medical care?

1. By car
   - ○ 0
   - ○ 1
   - ○ 2
   - ○ More than 2
   - ○ Don't know

2. As a cyclist / pedestrian
   - ○ 0
   - ○ 1
   - ○ 2
   - ○ More than 2
   - ○ Don't know

Has a close relative (friend or relative) of yours died as a result of a traffic accident?

1. By car

   - ○ Yes
   - ○ No
   - ○ Don't know

2. As a cyclist / pedestrian
   - ○ Yes
   - ○ No
   - ○ Don't know

Has a close relative (friend or relative) of yours been seriously injured, but not died, as a result of a traffic accident?

1. By car

   - ○ Yes
   - ○ No
   - ○ Don't know

3. As a cyclist / pedestrian
   - ○ Yes
   - ○ No
   - ○ Don't know

When you cycle, do you use a bicycle helmet?

- ○ Always
- ○ Most often
- ○ Sometimes
- ○ No
- ○ Do not cycle

Mark on a scale [1-5] how much you agree with the following statements

1. The state should take greater responsibility for the security of citizens

do not agree at all | agree completely

1	2	3	4	5

○ Don't know

2. Every resident should take responsibility for their own road safety

1	2	3	4	5

○ Don't know

3. The tax should be raised to be able to finance increased traffic safety in my city

1	2	3	4	5

○ Don't know

4. In general, private actors are more efficient than public actors

1	2	3	4	5

○ Don't know

5. More businesses should be privatized

1	2	3	4	5

○ Don't know

6. Taxes in Sweden are too high

1	2	3	4	5

○ Don't know

7. The state and municipality should prioritize reducing the differences between poor and rich in society

1	2	3	4	5

○ Don't know

8. Introducing a smoking ban in public places outdoors is reasonable

1	2	3	4	5

○ Don't know

9. The state should take stronger measures to prevent the spread of covid-19

1	2	3	4	5

○ Don't know

10. The state should take strong measures to reduce the economic consequences of covid-19.

1	2	3	4	5

○ Don't know

Marital status

○ Single

○ Married / registered partner

○ Cohabitant

○ Widow / widower / surviving partner

○ Divorced]

How many people are included in your household?

○ 1

○ 2

○ 3

○ 4

○ More than 4

If more than 1 in the previous question: Of the members of your household, how many of these are under 18 years of age?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ More than 4

I live

- ◯ In urban area with urban traffic
- ◯ In rural area
- ◯ Don't know

What is your highest completed education?

- ◯ Nine-year compulsory school for children aged 7-16 (Grundskola in Swedish)
- ◯ Seven (eight)-year compulsory school for children aged 7-11 (Folkskola in Swedish)
- ◯ Secondary education that existed 1905-1972 (Realskola in Swedish) or similar
- ◯ 2-year upper secondary education or vocational school
- ◯ 3-year or 4-year upper secondary education
- ◯ University or college education shorter than 3 years
- ◯ University or college education 3 years or longer

What is your current main occupation?

- ◯ Employee
- ◯ Self-employed
- ◯ Pensioner
- ◯ Student
- ◯ Jobseeker
- ◯ Sick leave
- ◯ Other, state what:

Country of birth

- ○ Sweden
- ○ Other European country
- ○ Other country outside Europe
- ○ Does not want to answer

What is the household's approximate total monthly income before tax?

- ○ Less than 10,000 kr.
- ○ 10,000 - 29,999 kr.
- ○ 30,000 - 49,999 kr.
- ○ 50,000 - 69,999 kr.
- ○ 70,000 - 89,999 kr.
- ○ 90,000 - 149,999 kr.
- ○ 150,000 - 300,000 kr.
- ○ Over SEK 300,000.
- ○ Don’t know
- ○ I wish not to answer

How satisfied have you been with your life in the last twelve months?

Extremely dissatisfied — Very satisfied

0	1	2	3	4	5	6	7	8	9	10

- ○ Don’t know

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Thank you for participating!

Your answers will be very helpful!

Appendix B: Robustness Tests

B.1 Robustness with respect to certainty

Our first robustness test is with respect to how certain respondents are with respect to their WTP responses. To test the robustness of our results we estimated our models on the sub-sample of individuals that stated that they are sure that they would pay the stated amount if faced with the opportunity to do so. Champ et al. (1997) and Champ and Bishop (2001) find a good match between hypothetical and real donations for respondents who report that they are certain with value of at least 8 on the 10-point scale. Using the same cutoff point for our robustness test we get a sample of $n = 566$. This is a considerably smaller sample size than in the models in Tables 5 and 6 so we should expect some loss in significance levels. With this subsample we can no longer reject H3 as the coefficient on Scenario D is not significant, so we have no evidence of Participation coercion resulting in a lower WTP for the respondents that are certain of their valuation responses. Table B1.1 and B1.3 show the estimations of the models in Table 5 on the reduced sample. In an alternative full sample specification where we include certainty as an explanatory variable in Table B1.2 we also find that WTP is lower for the certain responders compared to the uncertain ones.

Table B1.1: Robustness dropping uncertain responses

	(1)	
Scenario A	-3.731	(6.95)
Scenario C	-20.261***	(5.51)
Scenario D	-4.207	(4.33)
Scenario E	11.552***	(4.05)
Order	4.717	(6.09)
_cons	-14.439***	(4.93)
sigma_u	45.26***	(3.70)
sigma_e	16.14***	(0.72)
N	566	
Log lik.	-522.7	
rho	0.887	
LR-test panel	156.8	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Comparing Table B1.1 to Table 5 we see that the effect sizes are much larger when only including certain responses, and that the coefficients on the same scenarios are significant. The one difference is that the constant term, which is the valuation in scenario B, is negative and significant here, while it is positive and significant in Table 5. This is consistent with the observation that the proportion of left censored variables here is 67%, a much larger fraction than the 42% in the full sample. Left-censored observations become negative in the interval regression model.

Table B1.2: Full sample including a separate certainty variable

	(1)	
Scenario A	-3.068^{**}	(1.30)
Scenario C	-6.477^{***}	(1.33)
Scenario D	-2.157^{*}	(1.31)
Scenario E	6.193^{***}	(1.26)
Order	0.481	(1.73)
Certain	-13.082^{***}	(1.53)
_cons	15.069^{***}	(1.34)
sigma_u	24.32^{***}	(0.84)
sigma_e	11.85^{***}	(0.35)
N	2044	
Log lik.	-2443.1	
rho	0.808	
LR-test panel	700.0	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In Table B1.2 when instead including a dummy variable for when the respondents are certain of their stated valuations, we confirm that it has a negative effect on valuations.

Table B1.3: Robustness dropping uncertain responses, long model

	(1)	
Scenario A	-3.197	(6.44)
Scenario C	-17.123***	(5.07)
Scenario D	-5.214	(3.98)
Scenario E	10.738***	(3.81)
Female	3.085	(5.62)
Age1829	2.963	(8.41)
Age6580	7.231	(6.83)
IncLow	17.501**	(7.52)
IncHigh	-0.695	(6.37)
Children	-7.766	(8.75)
lnHHsize	9.477	(8.06)
Urban	-0.073	(6.01)
WTPother	34.920***	(5.63)
Expcar	3.083	(7.00)
Expped	15.058**	(7.18)
Expfamilycar	8.823	(5.87)
Expfamilyped	0.471	(6.89)
Lowrisk	-6.278	(5.86)
Ownworry	4.798	(6.48)
Projectcons	4.767	(7.84)
Paymentcons	18.694**	(7.81)
Usage	15.247***	(5.76)
Order	3.234	(5.36)
_cons	-41.796***	(10.60)
sigma_u	37.46***	(3.08)
sigma_e	14.74***	(1.12)
N	566	
Log lik.	-479.1	
rho	0.866	
LR-test panel	119.6	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Comparing Table B1.3 to Table 5 we also find that the marginal effects of the explanatory variables are robust to dropping uncertain responses. The one difference we see is that the coefficient on *IncLow* has a higher significance level and is now weakly significant at 5% level.

B.2 Robustness with respect to "don't know" responses

In the main models of Tables 5 and 6 as well as in the descriptive statistics we coded "don't know" responses as 0. Many of the explanatory variables included an option to respond "don't know", but it was not an option for the WTP questions. To test the robustness of our results to the assumption that these are coded as 0 we also estimated the models on the subsample of responses that did not respond "don't know". Table B2.1 shows the Table 5 model with demographics where we drop observations whenever any of the explanatory variables has a "don't know" response. This leaves us with 1,052 observations.

Table B2.1 Model from Table 5 dropping "don't know" responses

	(1)	
Scenario A	0.427	(1.57)
Scenario C	-5.144***	(1.63)
Scenario D	-3.541**	(1.48)
Scenario E	4.714***	(1.54)
Female	3.382	(2.23)
Age1829	4.945	(3.09)
Age6580	-0.344	(3.08)
IncLow	5.336*	(3.24)
IncHigh	1.661	(2.78)
Children	-2.751	(3.63)
lnHHsize	3.005	(3.49)
Urban	1.775	(2.49)
WTPother	11.237***	(1.69)
Expcar	7.562***	(2.87)
Expped	1.179	(2.85)
Expfamilycar	1.863	(2.40)
Expfamilyped	2.520	(2.69)
Lowrisk	-1.706	(2.36)
Ownworry	7.598***	(2.67)
Projectcons	4.750	(3.20)
Paymentcons	3.739	(3.22)
Usage	6.615***	(2.30)
Order	1.411	(2.19)
_cons	-3.599	(4.39)
sigma_u	22.01***	(1.01)
sigma_e	10.08***	(0.32)
N	1052	
Log lik.	-1228.2	
rho	0.827	
LR-test panel	380.1	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The smaller sample size leads to reductions in significance levels, and we no longer see the effects of *Age1829* and *Paymentcons* significant at the 5% level. However, the coefficients on *Expcar* and *Usage* are still significant at the 1% level.

Table B2.2 shows the model from Table 6 when we drop those observations that have a "don't know" response for any of the attitudinal variables. This leaves us with a sample size of 1,396.

Table B2.2 Model from Table 6 dropping "don't know" responses

	(1)	
Scenario A	-3.277^{**}	(1.57)
Scenario C	-7.094^{***}	(1.62)
Scenario D	-3.064^{*}	(1.62)
Scenario E	6.014^{***}	(1.54)
Order	2.908	(2.02)
Public safety, PC	3.140	(2.30)
Private safety, PC	6.873	(5.16)
Publ. reg., PC	0.757	(2.27)
Publ. act.: health, PC	-1.488	(2.35)
Safety tax, TC	17.376^{***}	(2.55)
Tax attitude, TC (FA)	2.600	(2.48)
Efficiency, Priv	-2.493	(2.49)
Privatization, Priv (PC)	0.583	(2.97)
Distribution, FA	1.765	(2.21)
Publ. act.: econ., FA	1.763	(2.22)
_cons	4.115	(2.84)
sigma_u	23.03^{***}	(0.98)
sigma_e	12.25^{***}	(0.37)
N	1396	
Log lik.	-1677.5	
rho	0.779	
LR-test panel	424.1	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Comparing this model to that presented in Table 6 we see that *Safety tax* still has a significant effect, but *Tax attitude* is not. Since the separate model on scenario B in Table 6 was the only one with a significant effect on *Tax attitude*, we also re-estimate that model on this smaller sample. We confirm what we found in Table B2.2 that the effect of *Tax attitude* is not significant.

Table B2.3 Model of scenario B in Table 6 dropping "don't know" responses

	(1)	
Order	1.349	(2.21)
Public safety, PC	3.812	(2.51)
Private safety, PC	7.364	(5.58)
Publ. reg., PC	-0.385	(2.48)
Publ. act.: health, PC	-3.264	(2.57)
Safety tax, TC	18.299***	(2.79)
Tax attitude, TC (FA)	3.195	(2.70)
Efficiency, Priv	-3.064	(2.72)
Privatization, Priv (PC)	-0.910	(3.25)
Distribution, FA	2.073	(2.41)
Publ. act.: econ., FA	3.652	(2.43)
_cons	5.069	(3.09)
sigma_u	3.63e-08	(811.04)
sigma_e	26.30***	(1.05)
N	698	
Log lik.	-971.7	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B.3 Robustness with respect to fast and slow responses

We also estimate our models excluding the respondents who answered the questionnaire in less than 4 minutes since this indicates that they have not read the questions properly. In one case we also exclude the ones who took more than 30 minutes to answer the questionnaire which reduces the sample. The following three tables (Table B3.1, B3.2, and B3.3) show estimations with different time thresholds for dropping observations, but the results are very similar. The estimates of the same variables are significant: Scen3, Scen4, and Scen5, and with the same signs as in Table 5. Our results are therefore robust to excluding particularly fast or slow respondents.

Table B3.1: Drop 4 min or less and more than 30 min

	(1)	
Scenario A	-2.373^{*}	(1.39)
Scenario C	-7.299^{***}	(1.45)
Scenario D	-3.680^{***}	(1.38)
Scenario E	6.748^{***}	(1.37)
Order	0.525	(1.82)
_cons	11.537^{***}	(1.36)
sigma_u	23.69^{***}	(0.90)
sigma_e	12.03^{***}	(0.26)
N	1766	
Log lik.	-2129.5	
rho	0.795	
LR-test panel	574.6	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B3.2: Drop 4 min or less

	(1)	
Scenario A	-2.111	(1.36)
Scenario C	-7.362^{***}	(1.43)
Scenario D	-3.626^{***}	(1.35)
Scenario E	6.549^{***}	(1.33)
Order	-0.249	(1.79)
_cons	12.073^{***}	(1.34)
sigma_u	23.85^{***}	(0.88)
sigma_e	12.02^{***}	(0.25)
N	1842	
Log lik.	-2231.6	
rho	0.797	
LR-test panel	608.2	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B3.3: Drop 5 min or less

	(1)	
Scenario A	-1.922	(1.47)
Scenario C	-8.165***	(1.54)
Scenario D	-3.799***	(1.45)
Scenario E	6.836***	(1.42)
Order	-0.146	(1.84)
_cons	11.708***	(1.39)
sigma_u	23.17***	(0.92)
sigma_e	12.39***	(0.26)
N	1660	
Log lik.	-2007.6	
rho	0.778	
LR-test panel	502.8	

Note: Standard errors given within parentheses, and * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.