Preferences regarding road transports of hazardous materials using choice experiments - any sign of biases?

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2005

Preferences regarding road transports of hazardous materials using choice experiments – any sign of biases?

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Abstract

This paper uses the choice experiment approach to assess people's preferences regarding road transports of hazardous materials. In a mail survey, carried out in Stockholm, the capital of Sweden, changes in exposure to hazardous materials are used as a proxy for changes in accident risk. The results are analysed in the light of an earlier study on transports of hazardous materials by rail. Special attention is given to biases associated with the choice experiment method. The presence of hypothetical bias is studied by the use of self-reported degree of confidence that the respondent would vote the same way in a real referendum. The presence of a focusing effect is studied by an inclusion of information on other fatal risks. The indication is that there are no major differences in individual preferences for hazmat transported by rail or road. The estimates are also dependent on the confidence of stated choices and interpreting this dependence as a hypothetical bias, suggest that this type of bias tends to push estimated values downwards. The findings show that individual background data regarding transports of hazardous materials affect individuals in expected ways and there is no focusing effect.

Keywords: Biases; Hazardous materials; Risk; Choice experiments.

JEL classification: C25; D61; D81; R41

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1. Introduction

By restrictions and regulations, efforts are made to ensure that transport of hazardous materials (hazmat) is a safe activity. Although the probability of a hazardous material accident is very small, the consequences could be severe for humans and the environment. The level of risk is therefore essential in decisions regarding such transports, and in determining the costs and benefits of various transport configurations. In decisions concerning transports, there is also an interest in the value of a marginal change in the risk of an accident, and this value may be obtained by studying individuals' preferences towards changes in accident risk. However, in discussing the transportation of hazmat we are dealing with very small probabilities that may be hard to understand and relate to other risks. Furthermore, outcomes in the case of an accident involving hazmat may be quite diverse depending on the specific circumstances around the accident. Consequently, it may be an awkward task to estimate people's willingness to pay (WTP) for, or willingness to accept (WTA), a specific change in the risk of an accident.

Since the risk faced by people is closely related to the degree of exposure to hazmat, a more suitable approach may be to investigate preferences with respect to changes in this kind of exposure. With this approach, we may also capture effects that are not directly connected with a leakage of hazardous substances. For instance, people living nearby may be anxious also in cases when there has only been an incident. In this situation, people are often very distressed until information about the outcome is given and, furthermore, they may have to leave their homes during the clearing up. This mental stress and the inconvenience of an evacuation may be seen as negative external effects that ought to be valued, see Adler (2004) on fear assessment.

In Hiselius (forthcoming), exposure is used as a proxy for probabilities and accident outcomes when modelling preferences for changes in the exposure to hazmat transported by rail. The findings indicate that this is a practicable way to describe different transport alternatives.

This paper uses the choice experiment (CE) method in order to analyse and estimate people's preferences towards exposure to road transports of hazmat. The CE method is one out of two main instruments available within the stated preference approach for determining individual preferences. The other one is the contingent valuation method (CV). For long, the CV method has been the standard procedure for eliciting individuals' preferences by normally asking respondents to state their willingness to pay for different goods and scenarios, Mitchell and

Carson (1989). There is an increasing interest in the CE method, though, e.g. Hensher (1994) and Ryan (1999). In this method, subjects are asked to choose between two or more scenarios in a sequence of choice sets. Several attributes and their associated levels describe each scenario. Since the individuals reveal their preferences by their choices, it is possible to estimate the relative weight of each attribute, i.e. the marginal rate of substitution (MRS). Furthermore, given that a cost attribute is included, the marginal willingness to pay or accept, can also be calculated for the selected attributes.

Stated preference methods are sometimes considered to be biased to various degrees. Biases associated with the CV method have been explored in a number of studies but analyses of biases when using the CE method are so far limited in number. One general problem concerns the hypothetical nature of the stated preference approach. Since the whole setting is hypothetical we do not know whether what an individual says she would do match what she will do when actually given the opportunity to do so. There may be cognitive as well as strategically reasons for individuals to misrepresent their true opinions giving rise to a hypothetical bias, Mitchell and Carson (1989). An additional source of a hypothetical bias may be the so-called warm glow effect, Andreoni (1989) and Kahneman and Knetsch (1992). They suggest that people may be purchasing moral satisfaction rather than expressing a value of, for instance, environmental changes and since the cost of acting ethically correct is much lower in a hypothetical situation than in a real, the hypothetical WTP may be overstated.

Economic experiments that compare real and hypothetical WTP by using the CV method suggest that a hypothetical bias problem exists and that it results in overstated WTP estimates, e.g. Johannesson el al. (1998) and Blumenschein et al. (1998) studying public goods, and Champ et al. (1997) studying voluntary donations for an environmental project. There are mixed results when using the CE approach, though. Carlsson and Martinsson (2001) cannot detect any differences in preferences between a hypothetical and an actual choice experiment analysing various environmental programs. Furthermore, Cameron et al. (2002) compare six hypothetical choice formats with actual purchase behaviour and cannot reject the hypothesis of the same indirect utility function across question formats. Telser and Zweifel (2002) compare WTP for hip protectors, derived from a choice experiment with actual choices made by the same respondents later, and show that the predicted WTP corresponds to the actual WTP. On the other hand, Johansson-Stenman and Svedsäter (2003) conducting a similar experiment to Carlsson and Martinsson, suggest that hypothetical WTP exceeds actual WTP in cases which involve an important perceived ethical dimension, and where a high WTP is considered ethically commendable. In addition, Lusk and Schroeder (2003) find that the

hypothetical total WTP for the good exceeds the real WTP but fail to reject the equality of marginal WTPs for changes in the single attributes.

Several studies have attempted to find a method to detect hypothetical biases and to predict the level of real WTP responses. Using the CV method some have shown that the level of real donations to public goods can be predicted from hypothetical responses by the use of a self-reported degree of confidence. In Champ et al. (1997) hypothetical dichotomous choice questions about donating a specified amount are compared to actual donation responses on a 1-10 scale ranging from very uncertain to very certain. They show that hypothetical donations significantly exceed real donations, but that there is no significant difference if only subjects that are very certain of their yes responses (10 on the scale) are counted as real yes responses. Champ and Bishop (2001) and Poe et al. (2002) report similar results. There are also CV studies giving the respondents options when answering WTP questions, ranging from "yes, definitely" to "no, definitely not". Based on the responses a conservative interpretation is used when only "yes, definitely" responses are interpreted as real yes-responses. This calibration method is used in Johannesson et al. (1998) and Blumenschein et al. (1998) when comparing hypothetical WTP responses to real WTP responses. The effect of the calibration differs however. In the study of Blumenschein et al., there is no longer a significant difference between real and hypothetical WTP responses when only "definitely sure" responses are used. When the same approach is used in Johannesson et al., the "definitely sure" responses significantly underestimate the real yes responses and thus provide a lower bound for the real WTP. Eckerlund et al. (1995) and Kartman et al. (1996) use the same method when calibrating hypothetical CV data. In these two studies there are no real WTP responses, though, making comparisons between real and hypothetical responses unfeasible. Using the conservative interpretation, it is simply shown that the mean WTP is significantly reduced.

Calibrating responses for hypothetical bias can be a delicate matter, though. Nape et al. (2003), studying the presence of hypothetical bias in WTA responses, suggest that the hypothetical bias is not a simple scalar that can be used to adjust all hypothetical responses down, but varies with observable socio-demographic characteristics such as race and age. According to Carson et al. (1996), one may also discuss whether the hypothetical setting of the CV and CE method give overstated vales as a rule. In contrast to other findings, Carson et al. suggest that the CV method give smaller estimates on the average than the revealed preference method, which uses observations on actual choices and behaviour.

Instead of calibrating for hypothetical bias, the outcome can be adjusted by using a "cheap talk script". In this method, the respondents are asked to read a script describing the bias problem and they are explicitly asked not to overstate their true willingness to pay. This method has been applied together with various stated preference techniques, e.g. the contingent valuation method in Cummings and Taylor (1999) and the Provision Point Mechanism in Murphy et al. (2003). The cheap talk script has also been used to calibrate for hypothetical biases in CE data. In Carlsson et al. (2004), it is shown that the script has an effect on the result, and according to List (2001), the CE responses are quite similar to choices in the actual treatment when a cheap talk script is used.

Another problem connected with the stated preference approach is that it tends to exaggerate valuations of the intervention that respondents are asked about, relative to interventions not asked about, Saelensminde (1999) and Cookson (2003). This focusing effect is sometimes known as budget constraint bias, since the sums people are willing to pay, for the intervention in question, may be far in excess of what they are willing to pay for the same intervention when other interventions are also assessed. When studying public goods there is also a discrepancy between the maximum WTP for an intervention and the minimum compensation in order to forego the intervention, WTA, Horowitz and McConnell (2002). Besides an income effect, this divergence has been explained both by the degree of substitutability of the good or intervention, Haneman (1991), and by an endowment effect, e.g. Kahneman et al. (1990). Hanemann showed that the WTA/WTP disparity could be large when there were few substitutes for the studied public good. Thus, when a good has few substitutes, a gain may be moderately valuable, but a loss could be irreplaceable, causing a disparity between estimated WTA and WTP. Kahneman et al., on the other hand, propose that preferences are reference-dependent. According to this theory, individuals are shown to display loss aversion for reductions from a reference point, typically status quo, so that losses are weighted more heavily than gains. Once a good becomes part of one's endowment, the value one places on it increases, making WTA greater than WTP. Another effect discussed by Kahneman and Tversky (1979) is the certainty effect or certainty premium. This premium emerges when an outcome is for certain, e.g. when a risk is totally eliminated. There are few studies studying both utilities and disutilities using the CE method, though. One rare example is Adamowicz et al. (1998).

Psychologists have provided extensive evidence indicating that the public's perceptions of, and attitudes to, risk may vary substantially over different hazards and transport modes, e.g. Fischhoff et al. (1978), and Slovic et al. (1980). Transports of hazardous materials by rail and road are, for instance, associated with various characteristics that are likely to affect people's preferences differently. This paper uses the CE approach to assess people's preferences for changes in the exposure to hazmat transported by road. The influence of whether the respondent owns his residence is examined together with various individual background data regarding transports of hazmat. Furthermore, due to the novelty of this method and the complexity of the activity investigated, special attention is given to the validity of the approach. A test of internal consistency is carried out within one block of questionnaires and the estimates are furthermore compared with *a priori* theoretical expectations, giving an indication of the internal validity.

In this paper, special attention is given to hypothetical bias and focusing effect. So far, there have been no clear-cut results of hypothetical biases in CE estimates and "the cheap talk script" is, to the knowledge of this author, the only method that has been applied to adjust for a possible hypothetical bias in CE data. Since the cheap talk method involves additional sections of text, we use a question concerning with which confidence the respondent would vote the same way in a real referendum. This type of self-reported confidence has previously been used in CV studies. Since there is no reference group to compare the obtained estimates with, the result is used as a sensitivity analysis. Observed differences may be interpreted as an indication of hypothetical bias. The presence of a focusing effect is also studied by the inclusion of information on other fatal risks in half of the questionnaires that are used in the study. There are surprisingly few CE analyses of the WTA-WTP disparity, and in order to contribute to the knowledge of this area both WTP and WTA values are assessed and discussed in this paper. The outcome indicates that the CE method can be applied and that the estimates for hazmat transports by road do not differ greatly from those calculated for railway transports, Hiselius (forthcoming). The use of self-reported degree of confidence gives high utility estimates rather than lower bound. Furthermore, no focusing effect is detected.

2. Survey

The survey was conducted as a mail survey in the fall of 2003, in Stockholm, the capital of Sweden. Two thousand individuals were randomly selected from a population of individuals between 18 and 75, who were living next to a transport route for hazardous goods that runs through central parts of Stockholm. The respondents received a reminder card after 2 weeks.

After another 2 weeks, those who did not respond to the questionnaire were sent a new one. A "dropout" questionnaire was finally sent out to those not responding in order to collect information regarding socio-economic status and general attitude towards the transportation of hazmat and the questionnaire itself.

The questionnaire consisted of four parts. The first part contained various attitudinal questions and questions regarding the respondent's socio-economic status. In the second part of the questionnaire, information was given on the likelihood of accidents involving hazmat and the possible consequences. The information also stressed that even if there was no leakage, people could still be affected and evacuated for a couple of days. A short description was also given of the transports of hazmat nearby, together with a city map with the transport route marked out. The third part contained the choice experiment and the fourth part questions regarding costs and consequences considered when stating their answers, questions regarding the certainty of stated choices, and attitudinal questions regarding transports of hazmat.

3. Method

3.1. The choice experiment

The effect of hazmat transports may be seen as a passive use value arising from a change in environmental quality that is not necessarily reflected in any observable behaviour, Adamowicz et al. (1998). In the CE method used in this paper, the respondents are asked to choose one preferred alternative from two hypothetical transport configurations of hazmat and the current transport situation. See Figure 1 for an example of the choice a respondent is asked to make. The respondents are asked to make six such choices and, based on these answers, people's preferences for changes in the exposure to hazmat are analysed.

Figure 1. Example of choice set.

	Alternative 1	**Alternative 2**	**Current situation**
Number of lorries with hazardous materials	No lorries	140 lorries/day	140 lorries/day
Time of transport		Nighttime	Daytime
Classification of hazardous materials		Class 1	Class 2
Altered housing cost per month	40 SEK higher	250 SEK lower	Unaltered
Which alternative would you prefer?	□ **Alternative 1**	□ **Alternative 2**	□ **Current situation**

Attributes and levels

The hypothetical alternative that is preferred by a respondent is assumed to depend on the attributes of the alternatives and the levels of these attributes, Louviere et al. (2000). The first three attributes of this CE study jointly describe exposure to the hazmat being transported, whereas the fourth attribute is a cost variable. Everything else is assumed to be unaltered compared to the present day situation.

Attribute 1: Number of lorries per day transporting hazardous materials. 220, 140 (status quo), 60, and 0 (no transport of hazmat at all). In total 4 levels including the status quo.

Attribute 2: Classification of hazardousness. To facilitate the description of the hazmat being transported, we employ a simplistic representation of its hazardousness. The current mix of hazmat is assumed to be of Class 2, hazardous. Two other levels are defined, Class 1, less hazardous than today's mix, and Class 3, more hazardous than today's mix. With the purpose of minimising the amount of information and its complexity, limited information is given on the hazardousness of the goods. Instead, several follow-up questions are asked in order to control for effects that the respondents may be considering, e.g. damages to personal health and property and the environment. There are thus 3 levels of the hazardousness attribute. In a way, there is also a fourth level; no danger at all. This level appears in those cases where the presented alternative describes a situation with no transport of hazmat at all.

Attribute 3: Time of transport. In the current situation, hazmat is being transported in the daytime only. Two other levels are defined; transports of hazmat in both daytime and nighttime, and nighttime only. Thus, there is a total of 3 levels. However, in the same way as the previous attribute, there is also a fourth level; no transport of hazmat at all.

Attribute 4: Housing cost per month. The text section preceding the choice sets states that the value of houses located near the transport route is assumed to be affected by the transports of hazmat. For instance, a change in the number of lorries transporting hazmat is supposed to affect the market value of the property. This change in the value of the property is in its turn assumed to affect the property taxation, expressed as an increase or decrease in the housing cost per month. The text also states that the housing cost is assumed to be altered for all types of housing.[1] The following 8 levels are used where decreases in housing cost per month are shown as negative values: SEK -250, -130, -50, ±0, 40, 70, 190, 310. (SEK 108 equals EUR 10, November 2004.)

Design of the choice sets

Within each choice set, the respondent is asked to choose one of three alternatives (see Figure 1): two hypothetical transport alternatives (defined by varying levels of the 4 attributes presented in the previous section) and a constant comparator, the current transport situation (defined by current attribute levels). Some alternatives describe a situation where there is no transport of hazmat; see Alternative 1 in Figure 1. In these cases, there is no data on time of transport and classification of the material for obvious reasons. These conditions, together with the use of a constant comparator (the current situation), complicate the task of creating and combining the scenarios without one alternative dominating another. As a result, full orthogonality, i.e. independent variation of all attribute levels, is not achieved. No major imbalances are detected in the scenarios though. Given the complexity of the choices, the choice sets are constructed so that the level of one attribute is always identical for two of the alternatives presented. Each respondent is provided with six choice sets. Thirty-six choice sets are created and separated into six blocks of questionnaires, each consisting of six choice sets.

3.2. Internal consistency and validity

When using the CE method it is of importance to include tests to ascertain whether individuals appear to understand the technique and are taking it seriously. Internal consistency is often tested with a given *a priori* theory on which alternative is best. If an alternative is chosen in one choice set, an even better alternative should be chosen in another choice set. The test for internal consistency is carried out within one of six blocks of questionnaires, since an overall inclusion reduces the efficiency of the choice design. Carried out this way, the test gives an indication of the problem and cannot be used as a tool for sorting out irrational responses.

We use regression techniques to estimate a utility function with presented attributes as explanatory variables. Since there is no secondary data to compare real and stated behaviour, the results of the regression analysis are used to assess the internal validity of this study, i.e. the extent to which the results are consistent with *a priori* theoretical expectations. Assuming diminishing marginal utility of income, we would expect higher income groups to have a lower marginal valuation of cost. The disutility of an increased housing cost is therefore assumed to be lower for higher income groups. Given that reduced exposure is to be preferred, we would expect levels describing less (more) exposure than the current situation to have a positive (negative) sign in the regression analysis. In examining individuals' preferences regarding exposure to transports of hazmat by rail, Hiselius (forthcoming) shows

that residence owners value reduced exposure more than non-owners. One explanation for this may be that householders owning their residences have stronger incentives to accept an increased housing cost in exchange for reduced exposure to hazmat than people renting their housing, since the increase in cost for residence owners is compensated for by an increased price once the property is sold. Segmenting the data on owning one's residence will reveal whether this is a factor of relative importance when studying road transports of hazmat as well. Finally, there are no *a priori* assumptions made about time of transport. At first glance, one may argue that people living close to the transport route only prefer transports of hazmat in the daytime, since they are likely to spend their days at another location further away from the route. Transports of hazmat at nighttime would accordingly increase their exposure. However, one may also argue that traffic is generally less heavy at night, which lowers the risk of an accident involving hazmat. Transportations at nighttime only are then to be preferred.

3.3. Hypothetical bias and focusing effect

When studying the problem of transportation of hazmat (or environmental applications in general), there may be difficulties finding data on actual behaviour in order to make comparisons between hypothetical preferences and actual preferences.[2] Instead, as mentioned in the introduction, different calibration methods have been used. In, e.g. the CV studies of Eckerlund et al. (1995) and Kartman et al. (1996) the respondents are allowed to choose from five alternatives when responding to the suggested bid: yes, definitely; yes, probably; don't know; no, probably not and no, definitely not. Based on the answers, it is analysed whether the estimated result is dependent on how certain the respondents are in their answer. Under the assumption that only the respondents who answer "yes, definitely" and/or "yes, probably" are actually revealing their true preferences, the presence of a hypothetical bias is investigated.

Since there is no control group in this study, we adjust the values based on a self-reported degree of confidence in the stated choices in a similar way as in e.g. Eckerlund et al. and Kartman et al. This is done as a sensitivity analysis interpreting differences as a possible hypothetical bias. The question concerns the certainty with which the respondent would make the same choices in a real local referendum regarding the configuration of the transport of hazmat nearby and with real economic consequences. The follow-up question is phrased as a referendum situation in order to imitate a choice situation of several transport alternatives for which the economical consequences are not out-of-pocket. In a first attempt, a follow-up

question was included after each choice set. Since this design was considered too cognitively demanding, a single follow-up question was therefore included in the last section of the questionnaire of this study. See Appendix for exact wording. Applying the results of previous CV studies of hypothetical bias and with a calibration based on self-reported confidence, one may expect lower bound estimates to be obtained in this CE study as well.

In order to detect the presence of a focusing effect that possibly exaggerates the importance of the activity asked about, relative to other activities/fatal risks not asked about, the subjects are divided into two segments. Half of the population sample received a questionnaire, which solely include information on risks connected with transports of hazmat. The other half received a questionnaire that also reported the risk of dying due to lung cancer, motor vehicle accidents, drowning, electrocution, and lightning. For exact wording, see Appendix. Under the hypothesis that the focusing effect is lowered when other fatal risks are also mentioned, we would expect the estimated preferences for reduced and increased exposure to hazmat to be lower for this segment.

4. Empirical specification

4.1. Theoretical framework

CEs, like many other environmental valuation approaches, share a common theoretical framework in the random utility model, McFadden (1974). The representative individual is assumed to have an indirect utility function of the form:

$$U_{in} = U(Z_{in}, S_n)$$

where, for any individual *n*, a given level of utility will be associated with the choice of any alternative *i*. Alternative *i* will be chosen over some other option *j* if $U_i > U_j$. Utility derived from any option is assumed to depend on the attributes, *Z*, of that option. These attributes may be viewed differently by different agents whose socio-economic characteristics, *S*, will also affect utility. While the individual knows the nature of her utility function, the researchers do not. This introduces the concept of random utility where an error term, ε, is included in the utility function to reflect unobservable factors.

Assume now that the utility function can be partitioned into two parts; one deterministic and in principle observable, and one random and unobservable. The indirect utility function can then be rewritten as:

$$U_{in} = V_{in}(Z_{in}, S_n) + \varepsilon_{in}(Z_{in}, S_n)$$

The probability that individual n will choose option i over option j is given by:

$$\text{Prob}(i \mid C) = \text{Prob}\left\{ V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}, \text{all j in C} \right\}$$

where C is the complete choice set. Depending on the analysis model used, ε can be specified to take into account multiple observations from the same respondent as well as heterogeneity among respondents and correlation between alternatives, see e.g. Hensher and Greene (2003). Assumptions are also made about the distribution of the error term. The usual assumption is that the errors are Gumbel-distributed and independently and identically distributed. This implies that the probability of choosing alternative *i* is given by:

$$\text{Prob}(i) = \frac{\exp^{\mu V_i}}{\sum_{j \in C} \exp^{\mu V_j}}$$

Here, μ is a scale parameter, which is set to be equal to 1 (implying constant error variance).

4.2. Model

The multinomial logit (MNL) model is frequently used to estimate the utility function. There is, however, a debate concerning the use of this model since it assumes that selections from the choice set follow the independence from irrelevant alternatives (IIA) property, i.e. the relative probabilities of two options being selected are unaffected by the introduction or removal of other alternatives. This property follows from the independence of the error terms across different options contained in the choice set. Violations of the IIA hypothesis are often observed, resulting in the need for more complex statistical models. In this study, the data is analysed using both the multinomial logit model and the random parameter logit model (RPL). The RPL model is a less restrictive model and is often used when the MNL model is shown to violate the IIA property. Even if there is no violation of IIA property, there may be arguments for the use of a RPL model since taste-variation among individuals is explicitly treated, as are correlations between parameters and repeated choices from each respondent, Hensher and Greene (2003) and Train (2003).

The following linear and additive utility function is estimated with a common alternative specific intercept α for alternatives 1 and 2 and *k* independent variables, x, (see Table I).

$$U = \alpha + \beta_l x_l + \varepsilon \quad \text{for } l = 1,\ldots, k$$

Table I. Independent variables.

Continuous variable	**Levels**
Altered housing cost/month:	SEK -250; -130; -50; ±0; 40; 70; 190; 310 and segmented by Income L, Income M and Income H
Dummy variables describing	
Attributes	
Number of lorries:	220; 140[a]; 60; 0
Hazardousness:	class 1; class 2[a]; class 3
Time of transport:	daytime and nighttime; daytime[a]; nighttime
Segmentation of respondents, interacting with dummy variables of attributes presented above:	
Model 1	
Residence owning:	not own one's residence[b]; own one's residence
Information on other fatal risks:	not receive information[b]; receive information
Model 2	
How often a reflection is made on hazmat:	daily[b]; occasionally; never
Model 3	
Probability of a fatal accident with hazmat:	high or very high[b]; low or very low
Model 4	
Impact of questionnaire on view of hazmat:	no or don't know[b]; yes
Model 5	
Degree of confidence to vote the same way:	yes, definitely[b]; yes probably; don't know; no, definitely not; no, probably not

[a] Baseline level of attribute = status quo.
[b] Baseline segment.

Altered housing cost/month is treated as a continuous variable for which negative values correspond to decreases in the housing cost. To find out how income affects the cost parameter, separate parameters are estimated for three population segments based on monthly household income per consumption unit.[3] Parameters for number of lorries, classification of hazardousness, and time of transport are dummy coded with the baseline levels equalling the current situation. With the use of dummy variables, the respondents are segmented to assess the way in which individual characteristics affect the preferences for a change in the exposure to hazmat. Due to a lack of observations in some sub-samples, we are not able to analyse the considered individual characteristics jointly. Instead, three types of models are used. [4] In Model 1, dummy variables are used for residence owning and receiving a questionnaire with

information on fatal risks in addition to hazmat risks. In Model 2-4, dummy variables are used for different individual background data regarding towards transports of hazmat. Finally, in Model 5, dummy variables are used for the self-reported degree of confidence that the respondent would vote the same way in a real local referendum. Interacting parameters are thereafter created between the dummy variables for segmentation and each variable for the number of lorries, classification of hazardousness, and time of transport. In addition to the estimated parameters of the baseline segment, these interacting parameters give the effect of the characteristics mentioned. The models do not contain interactions of the number of lorries, the classification of hazardousness and the time of transport, assuming additive parameters.

One common alternative specific intercept term is estimated for alternatives 1 and 2, reflecting the preferences for these alternatives over the current situation when all attributes included in the model are the same. This coefficient can also be regarded as a reflection of an endowment effect or status quo effect, e.g. Samuelsson and Zeckhauser (1988) and Adamowicz et al. (1998). According to this theory, we are most likely to find a negative intercept, which may be interpreted as a disutility of moving away from the current state due to strong preferences for an unaltered situation. Individuals may also choose the current situation when the task of selecting options is considered too complex or when they are uncertain about the tradeoffs they would be willing to make. Choosing the current situation could also be a form of protest response. In some studies, the CE analysis is carried out both on a full sample including respondents constantly choosing one alternative, and a reduced sample excluding these respondents, Adamowicz et al. and McIntosh and Ryan (2002). The analysis of this paper includes all respondents, though, due to uncertainty regarding the underlying motives of respondents constantly choosing the current situation. Important information may be lost if these answers are disregarded. The regression analysis is conducted with Nlogit 3.0.

Once parameter estimates have been obtained, a compensating surplus measure is derived. The monetary value of a marginal change in any attribute is expressed as the ratio between the coefficient of the attribute and the coefficient of the cost parameter. The levels presented in the CE range from above to below the current situation for all attributes, which allows us to examine situations where people are willing to pay for improvements as well as situations where people are willing to accept compensations for deteriorations.

5. Results

The response rate was 47% in the main study, excluding questionnaires undelivered or individuals who were not able to answer.[5] The response rate was 16% in the dropout study. Here the individuals were asked to state the reasons for not responding to the main questionnaire. The most common reasons were that they were too busy, forgot to answer, or just did not want to participate. The dropouts were generally younger and did not own their residences.

The test for internal consistency was carried out within one block to assess whether the respondents understood the questions and answered them consistently. Three out of 136 respondents answered inconsistently.

The analysis is carried out in three parts, which contain the results of Model 1, Model 2-4, and Model 5, respectively. The IIA restriction is not rejected by the Hausman and McFadden statistic when MNL regressions are used, Hausman and McFadden (1984). Nevertheless, the RPL model is also applied in order to take panel structure of the data and heterogeneous preferences among individuals into account. Only the results of the MNL model are presented in this paper, though, since the estimates are not significantly different.

5.1. Results considering residential owning and focusing bias

Model 1 is estimated for the whole sample and a pooled sample of respondents answering that they would respond the same way in a real referendum regarding transports of hazmat nearby. The estimated coefficients of the two samples are not significantly different. The coefficient of cost suggests that respondents with higher incomes have a lower marginal valuation of cost, i.e. a diminishing marginal utility of income. The cost parameter for the high-income group is insignificant in both samples, though, indicating that the respondents are unaffected by the cost attribute given in the choice sets. This is analysed in more detail later on. The majority of the estimated coefficients for the baseline segment are significant at the 5% level, suggesting that the chosen attributes have been taken into account. The coefficients of the number of lorries and classification of hazardousness have the theoretically expected sign, confirming the internal validity of the study. A positive coefficient indicates that an increase in the value of the attribute has a positive effect on utility, whereas a negative coefficient involves a negative effect on utility. In the baseline segment, the estimated coefficients of time of transportation differ from the other coefficients in that they are all insignificant. A change from transportation in the daytime only to either daytime and nighttime or nighttime only is considered as a disutility. The finding is furthermore that the

segment owning their residences, experience a higher utility from decreases in the number of lorries than those not owning their residences. This corresponds to Hiselius (forthcoming) when studying hazmat transports by rail. A related finding of this segment is that residence owners experience a disutility when time of transportation is altered from the current situation.

Table II. MNL estimates of Model 1 with segmentation based on residence owning.

Parameters	**Sample**			
	Yes, definitely or Yes, probably		**Whole sample**	
	Coefficients	P-value	Coefficients	P-value
Intercept	-0.194	0.074	-0.187	0.059
Altered housing cost/(monthx1000)				
Cost (Income L)	-3.992	0.000	-4.122	0.000
Cost (Income M)	-2.301	0.000	-2.562	0.000
Cost (Income H)	-0.667	0.118	-0.714	0.071
Baseline segment[a]				
Number of lorries				
220 lorries/day	-1.391	0.000	-1.357	0.000
60 lorries/day	0.702	0.000	0.665	0.000
0 lorries/day	1.703	0.000	1.591	0.000
Classification				
Class 1	0.379	0.002	0.366	0.001
Class 3	-1.372	0.000	-1.403	0.000
Time of transport				
Daytime and nighttime	-0.065	0.537	-0.070	0.471
Nighttime	0.045	0.655	0.070	0.453
Additional for own residence				
220 lorries/day	0.158	0.352	0.040	0.796
60 lorries/day	0.522	0.000	0.452	0.000
0 lorries/day	0.565	0.000	0.496	0.000
Class 1	0.057	0.639	0.053	0.632
Class 3	-0.096	0.563	-0.101	0.513
Daytime and nighttime	-0.271	0.056	-0.251	0.054
Nighttime	-0.278	0.032	-0.232	0.052
n	4303		5014	
Log likelihood	-3826		-4550	
Likelihood ratio index	0.19		0.17	

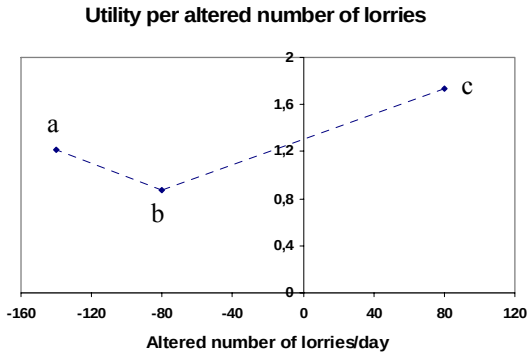
[a] Respondents not owning their residences.

All interacting parameters estimated for the segment of respondents receiving a questionnaire with information on fatal risks in addition to hazmat risks are highly insignificant, indicating that the inclusion of this information has no impact on utility. These

parameters are therefore excluded from the model and hence from Table II. The hypothesis that including information on other fatal risks could lower the focus effect is thus not supported.[6]

Based on the estimated coefficients for number of lorries/day in Table II, we look at differences in the utility associated with different levels of altered number of lorries. The estimated utilities of reducing/increasing the number of lorries are divided by the altered number of lorries that each level implies.[7] The utility ratios, presented in Figure 2, show a varying marginal utility for altered number of lorries. In *point a*, where the number of lorries per day is reduced by 140, the marginal utility of a reduction is higher than in *point b*, where the number of lorries per day is reduced by 80. This difference may be explained by the fact that *point a* represents a total elimination of transports of hazmat, possibly resulting in an added value or an certainty effect for this situation. The result also varies depending on whether an increase or decrease is studied even though the alteration is of the same magnitude. In the figure, it is shown that the marginal utility of a reduction of 80 lorries/day, *point b,* is lower than the marginal disutility of an increase of 80 lorries/day, *point c*. This difference corresponds to the WTP/WTA disparity discussed in the introduction of this paper.

Figure 2. Marginal utility per increased/decreased number of lorries per day. All differences are significant at the 5% level, one tailed.



5.2. Results considering background data on transports of hazmat

In the second part of the analysis, Model 2-4 are estimated in order to study whether individual background data regarding transports of hazmat affect the utility in an expected way. The analysis is based on a pooled sample of respondents answering that they would respond the same way in a real referendum regarding transports of hazmat nearby. The results are presented in Table III. In order to save space, p-values are not presented, but significant estimates (at the 5% level) are marked out. The findings are logical. The results of Model 2 suggest that respondents who never or occasionally reflect on transports of hazmat nearby value a reduced number of lorries and hazardousness less than the respondents that think about hazmat daily. This result is, however, mixed with respect to increased exposure. The outcome is similar for Model 3. Respondents considering the probability of a fatal accident with hazmat occurring within the next 50 years to be low, value a reduction in the number of lorries or the hazardousness less than respondents considering the probability to be high. The lack of significant coefficients in Model 4 suggests that whether the questionnaire has an impact or not on the respondent's view on transports of hazmat has little importance for the preferences being stated.

5.3. Results considering stated degree of certainty in choices

In Model 5, used in the third part of the analysis, the segments are based on stated degree of certainty that the respondent would vote in the same way if a real local referendum concerning transports of hazmat nearby where held. The baseline segment in the model is respondents answering "yes, definitely". Estimated parameters for the segments give the additional effect on individuals choosing any of the other four responses.[8] The results, presented in Table IV, show that the majority of the coefficients estimated for the different segments are significant, indicating an additional effect besides the estimated utility for the baseline segment, i.e. respondents answering that they would definitely vote the same way in a local referendum. The results suggest that respondents who are less sure that they would vote the same way in a real referendum generally value increases and reductions of exposure less than respondents who are definitely sure.

Table III. MNL estimates of Model 2-4 considering various individual factors for the sub-sample of respondents answering "yes, definitely" and "yes, probably".

	Model 2		Model 3		Model 4
Parameters	**Coefficients**		**Coefficients**		**Coefficients**
Intercept	-0.155	Intercept	-0,169	Intercept	-0.173
Alt. housing cost/ (monthx1000)		*Alt. housing cost/ (monthx1000)*		*Alt. housing cost/ (monthx1000)*	
Cost (Income L)	-4.222*	Cost (Income L)	-4,227*	Cost (Income L)	-4.185*
Cost (Income M)	-2.612*	Cost (Income M)	-2,521*	Cost (Income M)	-2.312*
Cost (Income H)	-0.802	Cost (Income H)	-0,488	Cost (Income H)	-0.320
Baseline segment[a]		*Baseline segment*[b]		*Baseline segment*[c]	
220 lorries/day	-1.754*	220 lorries/day	-1,438*	220 lorries/day	-1.268*
60 lorries/day	1.489*	60 lorries/day	1,113*	60 lorries/day	0.871*
0 lorries/day	3.365*	0 lorries/day	2,604*	0 lorries/day	1.951*
Class 1	0.914*	Class 1	0,752*	Class 1	0.392*
Class 3	-1.170*	Class 3	-1,520*	Class 3	-1.283*
Day- and nighttime	0.017	Day- and nighttime	-0,204	Day- and nighttime	-0.126
Nighttime	-0.358*	Nighttime	-0,104	Nighttime	-0.047
Additional for reflect on hazmat occasionally		*Additional for low prob. for fatal acc*		*Additional for impact of questionnaire*	
220 lorries/day	0.308	220 lorries/day	0,124	220 lorries/day	-0.204
60 lorries/day	-0.634*	60 lorries/day	-0,308*	60 lorries/day	0.179
0 lorries/day	-1.552*	0 lorries/day	-1,103*	0 lorries/day	-0.081
Class 1	-0.527*	Class 1	-0,584*	Class 1	0.004
Class 3	0.437*	Class 3	0,161	Class 3	-0.441*
Day- and nighttime	-0.265	Day- and nighttime	0,007	Day- and nighttime	-0.207
Nighttime	0.288	Nighttime	0,017	Nighttime	-0.117
Additional for never reflect on hazmat					
220 lorries/day	1.097*				
60 lorries/day	-1.158*				
0 lorries/day	-2.669*				
Class 1	-1.107*				
Class 3	-0.167				
Day- and nighttime	-0.300				
Nighttime	0.566*				
n	4303		4303		4303
Log likelihood	-3719		-3791		3843
Likelihood ratio index	0.21		0.20		0.18

* Significant at the 5% level

[a] Respondents reflecting on transports of hazmat on a daily basis,.

[b] Respondents considering the probability of a fatal hazmat accident to be high or very high.

[c] Respondents stating that the questionnaire had no impact on his/her view on transports of hazmat or that they don't' know.

Table IV. MNL estimates of Model 5 with segmentation based on stated degree of certainty that the respondent would vote in the same way in a real local referendum.

Parameters	**Coefficients**	**P-value**
Intercept	-0.203	0.042
Altered housing cost/(monthx1000)		
Cost (Income L)	-4.379	0.000
Cost (Income M)	-2.800	0.000
Cost (Income H)	-1.065	0.008
Baseline segment[a]		
Number of lorries		
220 lorries/day	-1.642	0.000
60 lorries/day	1.238	0.000
0 lorries/day	3.131	0.000
Classification		
Class 1	0.802	0.000
Class 3	-1.174	0.000
Time of transport		
Daytime and nighttime	-0.379	0.003
Nighttime	-0.309	0.008
Additional for "yes, probably"		
220 lorries/day	0.381	0.034
60 lorries/day	-0.424	0.000
0 lorries/day	-1.631	0.000
Class 1	-0.523	0.000
Class 3	-0.449	0.009
Daytime and nighttime	0.259	0.080
Nighttime	0.292	0.029
Additional for "don't know"		
220 lorries/day	0.032	0.910
60 lorries/day	-0.756	0.000
0 lorries/day	-2.031	0.000
Class 1	-0.508	0.011
Class 3	-0.472	0.087
Daytime and nighttime	0.284	0.234
Nighttime	0.714	0.000
Additional for "no, definitely not" or " no, probably not"		
220 lorries/day	0.930	0.007
60 lorries/day	-1.024	0.000
0 lorries/day	-2.682	0.000
Class 1	-0.680	0.018
Class 3	-0.101	0.803
Daytime and nighttime	0.466	0.132
Nighttime	0.558	0.104
n	5014	
Log likelihood	-4430	
Likelihood ratio index	0.19	

[a] Respondents answering "yes, definitely".

In order to explore the issue of hypothetical bias further, a model is also estimated for each sub-sample. The same model is also estimated for the whole sample for a comparison. Table V indicates that for the sub-samples of respondents answering "yes, definitely" and "no, probably not" or "no definitely not", some cost parameters are insignificant, suggesting that the respondents with high or medium household incomes are unaffected by the cost attribute given in the choice sets.

Table V. MNL estimates for sub-samples based on stated degree of certainty that the respondent would vote in the same way in a real local referendum.

Parameters	**Sample**				
	Yes, definitely (P-value)	**Yes, probably** (P-value)	**No, probably not or No, definitely not** (P-value)	**Don't know** (P-value)	**Whole sample** (P-value)
Intercept	-0.091 (0.632)	-0.279 (0.037)	-0.880 (0.075)	0.067 (0.823)	-0.182 (0.066)
Altered housing cost/(monthx1000)					
Cost (Income L)	-1.651 (0.047)	-5.052 (0.000)	-5.656 (0.004)	-5.940 (0.000)	-4.370 (0.000)
Cost (Income M)	-0.794 (0.280)	-3.390 (0.000)	-4.432 (0.013)	-3.850 (0.000)	-2.608 (0.000)
Cost (Income H)	-0.347 (0.617)	-1.671 (0.002)	1.076 (0.547)	-2.876 (0.050)	-0.381 (0.331)
Number of lorries					
220 lorries/day	-1.365 (0.000)	-1.328 (0.000)	-0.574 (0.197)	-1.903 (0.000)	-1.337 (0.000)
60 lorries/day	1.037 (0.002)	0.897 (0.000)	0.472 (0.186)	0.468 (0.025)	0.861 (0.000)
0 lorries/day	2.616 (0.000)	1.683 (0.000)	0.989 (0.076)	1.115 (0.001)	1.803 (0.000)
Classification					
Class 1	0.513 (0.001)	0.378 (0.000)	0.487 (0.233)	0.276 (0.259)	0.383 (0.000)
Class 3	-1.083 (0.000)	-1.658 (0.000)	-1.017 (0.062)	-1.992 (0.000)	-1.992 (0.000)
Time of transport					
Daytime and nighttime	-0.211 (0.149)	-0.154 (0.147)	0.284 (0.444)	-0.293 (0.224)	-0.179 (0.021)
Nighttime	-0.086 (0.541)	-0.077 (0.456)	0.374 (0.354)	0.169 (0.459)	-0.029 (0.701)
n	1729	2574	186	525	5014
Log likelihood	-1323	-2422	-182	-488	-4573
Likelihood ratio index	0.30	0.14	0.08	0.14	0.17

Based on the results in Table V, individual estimates for WTP or WTA can be calculated as the ratio between each of the estimated parameters of the number of lorries, classification of hazardousness, and time of transportation, and the cost parameters. Except for those cases where the cost parameters are not significant, the results are presented in Table VI. The differences between the sub-samples are only significant in a few cases, but we can see some general tendencies. The findings suggests that respondents stating that they would vote the same way in a local referendum, as they have done in the choices sets presented, express higher WTA/WTP in the choices than respondents stating that they would not. The sub-sample of respondents answering, "yes, definitely" generally displays the highest WTA/WTP estimates compared to the other sub-samples. For the low-income group, the sub-sample of respondents answering "yes, definitely" shows the highest WTA/WTP estimates. Furthermore, for the same income group, the sub-sample answering “no, definitely not”, and “no, probably not” shows the lowest WTA/WTP estimates. In the same way, the WTA/WTP estimates are generally highest in the sub-sample of respondents answering “yes, probably” and lowest in the sub-sample of respondents answering no for the medium income group. The results for respondents answering “yes, probably” are again generally highest for the high-income group.

Table VI. WTA/WTP values based on estimated coefficients in Table V, SEK per month and household.

Parameters	Yes, definitely			Yes, probably			No, probably not or No, definitely not			Don't know			Whole sample		
	Inc. L	Inc. M	Inc. H	Inc. L	Inc. M	Inc. H	Inc. L	Inc. M	Inc. H	Inc. L	Inc. M	Inc. H	Inc. L	Inc. M	Inc. H
Number of lorries															
220	827	*	*	263	392	795	101	129	*	320	494	662	306	513	*
60	-628	*	*	-178	-265	-537	-83	-106	*	-79	-121	-163	-197	-330	*
0	-1585	*	*	-333	-497	-1008	-175	-223	*	-188	-290	-388	-413	-691	*
Classification		*	*						*						*
Class 1	-311	*	*	-75	-112	-226	-86	-110	*	-47	-72	-96	-88	-147	*
Class 3	656	*	*	328	489	993	180	229	*	335	517	693	329	551	*
Time of transport		*	*						*						*
Day- and nighttime	128	*	*	30	45	92	-50	-64	*	49	76	102	41	69	*
Nighttime	52	*	*	15	23	46	-66	-84	*	-28	-44	-59	7	11	*

* Insignificant cost parameter at 5% level. WTP/WTA calculations are not available.

6. Discussion

This paper suggests that the CE approach can be used to estimate people's preferences for different configurations of transports of hazmat despite the complexity in the activity studied and in the CE method used. The response rate was 47%. A test carried out within one of the six blocks of questionnaires indicated a high degree of internal consistency. Only 3 of 136 respondents answered inconsistently. The application of this method was also supported by the internal validity, i.e. the estimated parameters are of expected sign. For instance, a reduction in the number of wagons with hazmat and a reduction in the degree of hazardousness increase utility, and people are thus willing to pay for these improvements or they demand compensation for changes for the worse. This paper is also generally logical when examining individual attitudes towards transports of hazmat. Respondents reflecting on transports of hazmat on a daily basis, or considering the probability of a fatal accident involving hazmat to be high or very high, value reduced exposure more highly than other respondents. Furthermore, individual preferences do not differ between individuals stating that the questionnaire had an impact on their views regarding transports of hazmat and individuals stating that the questionnaire had no impact.

It is also interesting to discuss the result of this paper on road transport of hazmat in the light of Hiselius (forthcoming) where transport of hazmat by railway is studied. Direct comparisons of estimated values are not possible, though, since the situations analysed differ with respect to the amount and type of hazmat transported. However, we can make some comprehensive comparisons of sign and size of estimated effects. Interestingly, the results of this study do not differ very much from that of Hiselius (forthcoming) even if there are obvious differences between the situations analysed. The estimated parameters are generally of the same sign and of the same magnitude. Furthermore, the individual factor, owning one's residence, influences the individual preferences towards hazmat in the same way. In Hiselius, the estimated WTP is SEK 65 for a reduction in the hazardousness of the materials being transported, while the estimated WTA for an increase in the hazardousness is SEK 292. These values are estimated for the sub-sample from the city of Lund and the segment of respondents with low incomes and not owning their residences. In this paper, the estimated WTP for a similar segment is SEK 89 for a decrease in hazardousness and the estimated WTA is SEK 340 for an increase.

The survey is focused on one problem, transports of hazmat, which may exaggerate the importance of this problem when other hazards are not related. In order to study the focus effect, two types of questionnaires were constructed; one containing information on other

hazards and one excluding this information. According to the result of this study, the inclusion of additional information on other risks had no effect, which can be interpreted in two ways. Firstly, there may have been no focusing effect present and thus no exaggeration of the estimates, and secondly, the information section included may have been too short to attract any attention and to detect the presence of such a bias.

Another potential bias analysed in this study is the presence of a hypothetical bias. This type of bias arises since respondents are faced with hypothetical alternatives, giving rise to stated choices that are hypothetical as well. In Wheeler and Damania (2001), it is argued that the accuracy of responses is improved when respondents are asked to value real-world scenarios. Although the respondents know that they are not actually being asked to pay here and now, the situation should be realistic enough for them to believe that this could happen. In this study, we try to minimize the problem of hypothetical bias by presenting a realistic and familiar payment vehicle and realistic alternatives describing the transports of hazmat. According to Smith (2003), one may also argue that only those who have experienced the problem being studied should be assessed. In this paper, the selected sample consists of people living next to the transport route of hazmat in Stockholm. Since these respondents experience the exposure to hazmat today, there is a reasonable possibility that their preferences are relatively well founded. If there is a hypothetical bias present anyway, the obtained estimates may be overstated. However, studies carried out on differences between actual and hypothetical preferences and using the CE approach differ in that some indicate a difference and others do not, e.g. Carlsson and Martinsson (2001) and Johansson-Stenman and Svedsäter (2003).

In this study, we use a follow-up question concerning the certainty with which the respondent would vote the same way if faced by a real referendum concerning transports of hazmat nearby. Based on this question, it is analysed whether the estimated result is dependent on how certain the respondents are that they would express the same preferences in a real situation. Under the assumption that only the respondents who answer “yes, definitely” or "yes, probably" are actually revealing their true preferences, the presence of a hypothetical bias is sought. Experiences from CV studies indicate that this type of question can detect respondents giving hypothetical, and possibly overstated, answers. Calibrations based on self-reported degree of confidence used in CV studies, suggest that overstated responses are sorted out, since the calibrated estimates correspond to actual preferences or are underestimated, e.g. Blumenschein et al. (1998) and Johannesson et al. (1998). This paper suggests, however, that individuals stating that they would vote the same way in a real referendum express *higher*

values of WTP and WTA than other individuals, i.e. the calibration leads to an increase in WTA/WTP, not a decrease. Even if there are only a few significant differences between the values in Table VI, the general tendency is rather strong. The indication is that there is a difference depending on whether are used or not. Interpreting this difference as a hypothetical bias suggests that this type of bias tend to push estimated values downwards. This result is also in line with the findings of Carson et al. (1996) when comparing revealed preference studies and CV studies. Differences in expressed preferences between confident and not confident respondents may also be seen as an effect of a strategic bias. High WTP/WTA values for people stating that they are confident in their choices can potentially be interpreted as a result of a strategic behaviour as well. The CE approach has been argued to minimise strategic answers, though, since various "packages" of characteristics are used, e.g. Louviere et al. (2000) and Hanley et al. (2001).

The cost parameters are insignificant for some sub-samples and income groups in Table II and V, showing that the respondents are unaffected by the amount being charged rather than estimation problems in the model. This coincides with the findings of Slothuus Skjoldborg and Gyrd-Hansen (2003), Jan et al (2000) and Bryan et al. (1998). Ratcliff (2000) suggests that WTA/WTP may be underestimated if the highest level of cost is set too low. It is then possible that some individuals are willing to pay more than is presented in the choice sets, resulting in understatements and insignificant results. In Slothuus Skjoldborg and Gyrd-Hansen, it is also empirically shown that the levels chosen for the cost attribute influence the payment impact on utility. The insignificance of cost may thus be due to the range of cost specified in the survey. [9] Possibly, there was insufficient variation in the cost attribute to influence the choices of respondents who reported that they would vote the same way in a referendum and had a medium or high household income, see Table V. This result illustrates the problems inherent in conducting a choice experiment. The cost range specified has to be relevant for all sub-groups presented in a selected sample. The fact that cost has no significant impact on utility in the "no, probably not" or "no, definitely not" sub-sample of high-income, may also be explained by lack of degrees of freedom in the model.

The estimated models can also be used to examine the WTA/WTP disparity in the setting of a choice experiment. According to Figure 2, the disutility associated with an increase in the number of lorries is twice as high as the utility of a decrease of the same magnitude. Furthermore, the utility per unit of altered number of lorries is 38 % higher when the number of lorries is totally eliminated, compared to the case when there is no total reduction. The case when the number of lorries transporting hazmat is totally reduced displays the certainty effect.

In this case, the risk and anxiety associated with an accident involving hazmat are eliminated. These results are all according to theory briefly presented in the introduction to this article. Few CE studies include attribute levels that range from above to below the current situation, though. This is surprising since the CE approach may be especially applicable when studying WTA/WTP.

The major result of this paper is that the CE method seems valid in this kind of setting despite several potential difficulties. The estimated parameters are of expected sign and individual background data regarding transport of hazmat influence individual preferences as expected. An increase in an attribute of exposure is considered deterioration, for instance, and individuals reflecting on transports of hazmat on a daily basis, value reductions in exposure more than others do. In the future, results of this and similar studies may provide guidance on different transport configurations (e.g. with hazmat) especially since policy makers may influence the attributes presented here. However, the feasibility of the CE method when studying people's preferences regarding transports of hazmat cannot be fully established until future research is conducted. It is important to test the external validity by incorporating real payments and by conducting consistency and validity tests with larger samples.

7. Appendix

Information included in half of the questionnaires and regarded for segmentation in Model 1:

What is the probability that someone will die in an accident involving hazardous materials compared to other fatal risks?
In the table below the number of fatalities per year are shown for different causes of death. Fatalities due to accidents involving hazardous materials are excluded since no one has died in an accident involving hazardous materials in Sweden in the last 50 years.

Number of fatalities/year	*Cause of death*
3000	Lung cancer
600	Motor vehicle accidents
100	Drowning
4	Electrocution
0.5	Stroke of lightning

Question regarded for segmentation in Model 1:
What is your type of housing?

□ rented (tenancy right) □ cooperative ownership of house/flat □ detached house □ other

Question regarded for segmentation in Model 2:
Have you ever reflected on the fact that hazardous materials are being transported near you?

□ daily □ sometimes □ once in a while □ never

Question regarded for segmentation in Model 3:
As mentioned previously, no one has been killed in an accident involving hazardous materials in Sweden in the last 50 years. What do you think is the probability that an accident resulting in fatalities will occur in the next 50 years?

□ very small □ small □ large □ very large

Question regarded for segmentation in Model 4:
Has this survey influenced your opinion on transports of hazardous materials?

□ yes □ no □ don't know

Question regarded for segmentation in Model 5:
Suppose that the configuration of transports of hazardous materials close to you is to be settled in a local referendum with real consequences for you budget. Would you then vote the same way as you have done in this questionnaire?

□ yes, definitely □ yes, probably □ don't know □ no, probably not □ no, definitely not

Acknowledgement

Financial support from the Swedish National Rail Administration and the Swedish Rescue Services Agency is gratefully acknowledged. I would like to thank Karin Brundell-Freij, Krister Hjalte and Carl Hampus Lyttkens for insightful suggestions. Any errors are my sole responsibility.

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Footnotes

[1] The use of this payment vehicle may be regarded as less appropriate for the pricing of tenancy rights. The essential question is, in our point of view, however, whether the payment vehicle is credible to the respondent. This was established in two pilot studies preceding the main study.

[2] If we could isolate the effect of transports of hazmat on property values, the passive use value might be directly observed. In small countries, like Sweden, this type of data is hardly available in any quantities, though, making this type of study unfeasible.

[3] The consumption units used by Statistics Sweden are applied: single = 1.16, married/cohabitants = 1.92, additional adult = 0.96 and children = 0.66.

[4] See Appendix for exact wording of the questions that the dummy variables are based on.

[5] One hundred and sixty individuals were excluded since they had moved to another location or were unable to participate due to illness, difficulties in understanding the language etc.

[6] The effect of additional information was also tested in Model 3 and 4 by an inclusion of interacting parameters between the dummy variables describing inclusion of additional information and dummy variables describing how often a refection is made on hazmat and the probability of a fatal accident with hazmat. All parameters considering the amount of information were highly insignificant, though, and therefore disregarded in the regressions.

[7] The utility ratios in Figure 2 are based on estimated coefficients from the sub-sample of respondents stating that they would vote the same way in a referendum (multiplied by 100).

[8] The sub-samples of respondents answering “No, probably not” and “No, definitely not” are pooled due to lack of observations.

[9] In hindsight, we ought to have carried out a pilot study in Stockholm in order to define the appropriate range of cost. However, a similar cost range to the one in Hiselius (forthcoming) is used in order to make comparisons between transport modes possible. The range of cost in the present study is 24% higher, though, due to higher income structure and costs of living in Stockholm compared to the two cities previously studied.