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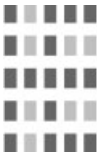

Warm glow, free-riding and vehicle neutrality in a health-related contingent valuation study

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Summary

Criticism of contingent valuation (CV) stresses warm glow and free-riding as possible causes for biased willingness to pay figures. We present an empirical framework to study the existence of warm glow and free-riding in hypothetical WTP answers based on a CV survey for the measurement of health-related Red Cross services. Both in conventional double-bounded and spike models we do not find indication of warm glow phenomena and free-riding behaviour. The results are very robust and insensitive to the applied payment vehicles. Theoretical objections against CV do not find sufficient empirical support. Copyright © 2004 John Wiley & Sons, Ltd.

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Introduction

In connection with the embedding phenomenon there is an ongoing debate on the occurrence of warm glow in CV studies. It is argued that stated willingness to pay (WTP) may be insensitive to variations in scope because respondents do not report real economic preferences but rather derive moral satisfaction (warm glow) from the act of giving per se [1]. Therefore, the WTP request may simply be treated as a donation to charity instead of a serious attempt to value individual welfare. This has led several critics to state that CV answers should not be used in cost benefit analysis [2]. According to the NOAA (National Oceanic and Atmospheric Administration) Panel, CV results only reflect approval for the environmental program in question under the existence of warm glow but cannot be interpreted as a reliable estimate of true WTP [3]. The existence of warm glow effects in CV welfare measures can be attributed to different reasons. One reason may be found in different attitudes of individuals in gaining moral satisfaction, prestige or social approbation from actual donations or stated WTP. Nunes and Schokkaert [4] address this type of warm glow. They identify inter-individual differences in warm glow motivation measured through a factor analysis. Thereby, they found a robust influence of warm glow effects on WTP answers. Although still disputed (see [2,3]), one can argue that this utility component gained from moral satisfaction should be part of the utility from the public good in question: 'it is utility whatever its source that matters for total value. Motives are essentially irrelevant from the perspective of economic theory ...' (see [5, p. 177]). However, warm glow can also be produced by the CV setting. Carson

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et al. tested warm glow in connection with the occurrence of interviewer bias (quoted in [5]): Depending on whether the announcement of individuals' WTP is given to the interviewer or written down on a sheet of paper sealed in an envelope, so that the interviewer did not know the answer, they found no significant difference in the WTP estimates. Another type of warm glow that fits into this category can be generated by the payment vehicle, a phenomenon that we analyse in this paper. In contrast to the first type of 'moral satisfaction' the second type is more erratic and therefore, affected by the argumentation of Hausman and the NOAA Panel. Significant warm glow effects generated by the CV setting would question the CV method seriously. As an example this type of warm glow is held responsible for the occurrence of embedding effects. For a comprehensive description of the relation between warm glow and embedding effects in health care, see [6].

Another set of problems that plague non-market evaluation studies is the respondents' opportunity of strategic behaviour. As early as 1954 Samuelson [7] states that 'it is in the selfish interest of each person to give false signals, to pretend to have less interest in a given collective activity than he really has'. In CV studies this free-riding effect may occur in two directions. Respondents would underbid if they believe that they have actually to pay the amount they reveal. On the other hand we expect respondents to overbid if they believe they have actually not to pay their willingness to pay but hope to influence the provision of the good in question. This issue has been extensively discussed in the literature since the occurrence of CV. Carson *et al.* [5] present a survey on controversies and evidence in CV including a summary of the literature on strategic behaviour. They state that WTP figures will vary with different elicitation formats. Empirical evidence on strategic behaviour is in accord with theoretical predictions, however, in many cases the differences are not as extreme as theory predicts [5]. Most of the discussion about strategic behaviour is focused on the appropriate question format (closed-ended versus open-ended questions, ...) but there is little evidence on the influence of the payment vehicle (taxes, contributions to a fund, insurance premium, ...).

It is important to notice that the donation literature brings in another dimension of free-riding which is of relevance in CV studies. Besides the fact that individuals announce higher or lower figures than their true WTP either to avoid payment or to increase the probability for the change of the public good in question a respondent's belief in other people's free-ride may lead her to expect a lower provision level of the public good in question. Therefore, individuals may state a lower WTP. In this paper we address both aspects of free-riding in a CV setting.

Champ *et al*. [8] and Chilton and Hutchinson [9] present a theoretical framework for the joint analysis of warm glow and free-riding in a donation context. Chilton and Hutchinson [10] extend this framework for the classification of CV answers with respect to warm glow and altruistic motives. Whereas these contributions emphasise the theoretical background they do not provide empirical evidence on the importance of warm glow and free-riding in a CV context.

In this paper we empirically investigate the occurrence of free-riding behaviour and warm glow effects in CV studies depending on different payment vehicles. For this purpose we analyse the results of a CV survey on heath-related Red Cross Services in Austria conducted in the summer of 2001.

There is a considerable body of recent literature on the application of CV in health care context. Diener *et al*. [11] present a comprehensive classification of 48 CV studies published between 1984 and 1996 and conclude that appraisal of the literature is difficult because methodological documentation and the method's relationship with the conceptual framework of Cost Benefit Analysis is poor. In a comparable survey Olsen and Smith [12] investigate the superiority of WTP over Quality Adjusted Life Years (QALYs) as a measure of benefit of health care. For this purpose they review 71 WTP health care studies conducted during the period 1985–1998. The survey ends with a critical assessment due to the '... huge mismatch between the theoretical glory of WTP and the usefulness for public health policy of the majority of surveys ...' (see [12, p. 47]). Smith [13] similarly argues that many CV studies in health care are not 'best practice' studies and guidelines such those proposed by NOAA have had almost no impact on the quality of health care related CV applications. The author argues for the development of 'benchmarks' for such CV studies in health care and for a health-specific adoption of NOAA guidelines originally developed for environmental issues. Furthermore, he claims a systematic re-

search agenda to assess the importance of hypothetical bias, and the impact that methodological issues have on final values. All these surveys have in common the strong request for 'state of the art' applications of the CV method in health economics. The survey presented in our paper is a 'best practice' health care application of CV in accordance with the NOAA guidelines. The Red Cross services to be analysed in this paper include three major components: Emergency treatment for injury before regular medical aid is available, transportation services for the sick to and from hospitals, and both national and international disaster relief. Moreover, we provide a methodological discussion of free-riding and warm glow issues in the CV framework in compliance with Smith's claim for the development of a research agenda.

The paper is organised as follows: We develop a simple welfare economic framework which enables us to derive empirically testable hypotheses on warm glow and free-riding. Next we describe the operationalisation of warm glow and free-riding incentives into different questionnaire versions and discuss the CV study. Then follows an overview of the estimation procedure, and next empirical evidence is presented. Finally we summarise and conclude the paper.

Warm glow and free-riding in a welfare economic framework

The purpose of this section is the development of a simple theoretical framework in order to derive hypotheses about the existence of warm glow and free-riding effects in CV studies. We assume a simple two goods world with individual i solving the following utility maximisation problem:

$$\max_{x_i} U_i(x_i, q; w) \tag{1}$$

subject to the budget constraint

$$px_i = y_i \tag{2}$$

where x_i represents a private good and q a public one. The binary variable w indicates the occurrence of warm glow. If $w = 1$ the individual is characterised by egoistic preferences under which the announcement of a positive WTP in the CV survey generates private warm glow benefits beyond the direct provision of the public good in question. On the other hand, $w = 0$ indicates that the individual derives utility only from the availability of the public good and warm glow benefits are not existent. This specification represents a simple discrete version of the Andreoni notion (see [14]) that warm glow increases with actual contributions in a donation context. The variables p and y_i represent the price for the private good and personal income, respectively. For this maximisation problem the indirect utility function V_i reads as $V_i(p, y_i, q, w)$. In this framework we distinguish three different provision levels of the public good q: q_0 represents the original amount of the public good. q_2 is a considerably higher provision level of the public good in question the economic value of which to be evaluated in the CV study. q_1 is some provision level between q_0 and q_2 indicating that in case of the respondent's belief in substantial free-riding by others the high level q_2 of the public good cannot be realised but just a lower one. Our interest in the following theoretical section is on the consequences of this belief in others' free-ride on the respondent's own WTP. Implications of the fact that an individual herself may over- or underbid either to avoid payment or to increase the probability for the provision of the public good in question (respondent's own strategic free-riding behaviour) will be discussed next.

Three different versions in connection with free-riding and warm glow can be formulated:

Version 1: consider first a situation under warm glow without free-riding. Then the consumer's compensating surplus for the higher level of the public good q_2 compared to a reference point with no warm glow and the original level of the public good q_0 is given by CS_i^1, defined by

$$V_i(p, y_i - \mathrm{CS}_i^1, q_2; 1) = V_i(p, y_i, q_0; 0) \tag{3}$$

Version 2: suppose warm glow still exists, and the focus is on the implications of others' free-riding on the respondent's welfare measure. First, one could think of a situation in which the individual beliefs that other people's free-riding behaviour will not have any consequences on the provision of the public good. This assumption is equivalent to a supposition that others do not take the opportunity of free-riding and the public good level q_2 in its entirety may still be available. Under this situation the individual's consumer surplus can be expressed by

$$V_i(p, y_i - \mathrm{CS}_i^{21}, q_2; 1) = V_i(p, y_i, q_0; 0) \tag{4}$$

In comparison of this scenario with Version 1 we get identical values for the true WTP (in a CV setting CS_i^{21} should be equal to CS_i^1). A second and probably more realistic situation is the individual belief that others' free-riding opportunity will lead to a lower provision of the public good in question. Therefore, the individual is assumed to have the public good level q_1 in mind, and the indirect utility formulation determining the consumer surplus CS_i^{22} changes to

$$V_i(p, y_i - CS_i^{22}, q_1; 1) = V_i(p, y_i, q_0; 0) \quad (5)$$

Version 3: the third version neither assumes free-riding nor warm glow feelings. Hence, the consumer surplus CS_i^3 for the intended public good level q_2 is given by

$$V_i(p, y_i - CS_i^3, q_2, 0) = V_i(p, y_i, q_0, 0) \quad (6)$$

Based on these three versions the following hypotheses can be formulated: In comparison of Version 1 with Version 2 we get identical consumer surpluses if individuals believe others would not free-ride ($CS_i^{21} = CS_i^1$). For the assumption of more farsighted consumers, who think that other persons' free-riding would reduce the overall public good level, we expect a lower consumer surplus in Version 2 as compared to Version 1 ($CS_i^{22} < CS_i^1$). Therefore, we hypothesise mean and median WTP of stated WTP figures in CV studies being smaller in Version 2 as compared to Version 1 due to the belief in a reduced level of the public good through free-riding of other persons ($CS^2 < CS^1$).

A comparison of the welfare measures in Version 1 and Version 3 allows the formulation of a hypothesis on warm glow. As can be seen from the indirect utility functions the consumer surplus in Version 1 has to be higher than the respective value in Version 3. Given identical public good levels the reason for the expected difference lies in the occurrence of warm glow benefits in the first version. Based on a CV setting with the elicitation of average WTP we therefore formulate hypothesis 2 that the consumer surplus in Version 3 should be smaller than in Version 1 ($CS^3 < CS^1$).

It remains ambiguous whether the empirically estimated surplus measure in Version 2 is higher or lower as compared to Version 3 (hence $CS_i^2 \lesseqgtr CS_i^3$) since it is *a priori* unclear which of the two effects (warm glow or free-riding) dominates quantitatively. We expect $CS_i^3 > CS_i^2$ if the belief in free-riding of other persons is stronger than the warm glow effect. On the contrary, if $CS_i^3 < CS_i^2$ the warm glow component dominates the free-riding.

As will be argued next our hypotheses would become even more plausible if we also consider the strategic incentive for the respondents in the CV framework to announce higher or lower than their true WTP either to avoid payment or to increase the probability for the provision of the public good in question.

Data and the study design

This section provides a description of the census survey and presents different formulations of the questionnaire.

Operationalisation of warm glow and free-riding

In order to operationalise different warm glow and free-riding incentives various payment vehicles were applied in the CV study. For the three different versions we used the following wording (presented to the respondents in German):

Version 1: "The Red Cross organisation is planning the privatisation of financing the emergency treatment for injury, the transportation services for the sick, and the disaster relief. Each private household is invited to make voluntary donations in the future since all public funds for the Red Cross up to the present will be cancelled.

Only those can benefit from Red Cross services who have donated. A person who would not donate must organise an alternative solution in case of needed assistance."

Version 2: "The Red Cross organisation is planning the privatisation of financing the emergency treatment for injury, the transportation services for the sick, and the disaster relief. Each private household is invited to make voluntary donations in the future since all public funds for the Red Cross up to the present will be cancelled.

For humanitarian reasons – as before – all people can benefit from Red Cross services irrespective as to whether a person has donated or not."

Version 3: "The Red Cross organisation is planning the privatisation of financing the emergency treatment for injury, the transportation

services for the sick, and the disaster relief. The necessary resources shall be provided by private households through insurance premiums since all public funds for the Red Cross up to the present will be cancelled.

Only those can benefit from Red Cross services who have paid the insurance premium. A person who would not pay must organise an alternative solution in case of needed assistance.''

The wording of these descriptions makes clear that Versions 1 and 2 generate warm glow incentives. Since these two versions use donations as payment vehicles respondents are assumed to include a moral satisfaction component in their WTP answer. In contrast, Version 3 uses an insurance premium as vehicle which theoretically does not generate a comparable warm glow effect. As regards the respondents' inducement to over- or understate their WTP our versions differ in their incentives to answer strategically (= the respondent's own free-riding). At first glance the formulation in Version 2 – in contrast to Versions 1 and 3 – invites respondents to strategically understate their true willingness to pay since respondents are informed that they would still be eligible to Red Cross services even though they have not donated. Thinking of the possibilities to positively influence the provision of Red Cross services by overstating the true WTP we have no a priori presumption that our versions would differ in this respect. Hence, we do not expect a systematic influence on our hypothesis due to overstating WTP.

The implications of both warm glow and free-riding by others have been covered in the theoretical framework in the previous section ($CS^2 < CS^1$ and $CS^3 < CS^1$). The additional consideration of the respondent's own free-ride would have the following implications on our hypotheses: We expect an empirically measured consumer surplus in Version 2 being even smaller than CS^2 because the wording of the second payment vehicle invites people to use Red Cross Services even though they have not contributed. Therefore, the strategic incentive to understate true WTP strengthens the plausibility of our hypothesis 1.

The census survey in Upper Austria

The following empirical analysis is based on survey data of the Upper Austrian census conducted in summer 2001. In supplement to the regular census program a sub-sample of 2536 households was confronted with questions about financial aspects of first aid. In each household one person between 20 and 65 years old was interviewed at her place of residence.

The questionnaire was split into four parts: The focus of the survey was the elicitation of willingness to pay figures for the provision of (health-related) Red Cross services. Moreover, we asked people's knowledge about the Austrian Red Cross, respondents' volunteering activities in non profit organisations and a list of questions on socio-economic variables and motives for volunteering and not volunteering.

The respondents were presented a one page list containing a description of Red Cross services. (Emergency treatment for injury, transportation services for the sick, disaster relief.) Subsequently the respondents were asked their willingness to pay as a maximum donation or a maximum insurance premium. A double-bounded closed-ended question format was used with bid values ranging from €1.80 to €40 per household and month.

The Austrian Red Cross is representing one of the most important non-profit organisations with more than 41 000 voluntary part time employees and 4000 persons in regular occupation. An Upper Austrian household makes use of the Red Cross organisation every 3 years on average and in 42% of households at least one person holds a Red Cross membership. Daily Red Cross services in Upper Austria comprise 1100 carriages of sick and injured people, 1300 services for elderly care and sick-nursing at home, and 1300 meals provided by mobile meal services. The 14 000 employees in the study region (Upper Austria) provide 7000 voluntary hours per day, and the services are predominantly financed by public funds.

Estimation procedure

The empirical estimation of closed-ended welfare measures requires a stochastic interpretation of the indirect utility function V as discussed before [15,16].

$$\Phi(p, y, q, w; s) = V(p, y, q, w; s) + \varepsilon_q \tag{7}$$

with s representing a vector of socio-economic variables. The stochastic term ε_q is assumed to be i.i.d. The probability P_y that offer B to be paid for the provision of Red Cross services will be

accepted is given as

$$P_y = \Pr\{V(p, y - B, q_2, w; s) - V(p, y, q_0, w; s) > \varepsilon_{q0} - \varepsilon_{q2}\} \quad (8)$$

A stochastic variable η is defined as the difference between ε_{q_0} and ε_{q_2}. With $F'_\eta(\bullet)$ the cumulated distribution function of η the probability that offer B to be paid for the Red Cross services will be accepted can be written as:

$$P_y = F'_\eta(-\Delta V) = F_\eta(B; \theta) \quad (9)$$

with the utility difference $\Delta V = V(p, y - B, q_2, w; s) - V(p, y, q_0, w; s)$ and $F'_\eta(-\Delta V)$ usually assumed as logistic or cumulated standard normal.

By maximising the following log-likelihood function the parameters θ of the cumulated density function can be estimated for the *conventional closed-ended double-bounded model*:

$$\ln L^C(\theta) = \sum_{i=1}^{N} \left\{ \begin{array}{c} d_i^{yy} \ln[F_\eta(B_i^h; \theta)] \\ + d_i^{nn} \ln[1 - F_\eta(B_i^l; \theta)] \\ + d_i^{yn} \ln[F_\eta(B_i^i; \theta) - F_\eta(B_i^h; \theta)] \\ + d_i^{ny} \ln[F_\eta(B_i^l; \theta) - F_\eta(B_i^i; \theta)] \end{array} \right\} \quad (10)$$

The individual i is confronted with the initial bid B_i^i. If this amount is accepted the respondent will be asked whether she would also be willing to pay the higher bid B_i^h for the provision of the good. However, the follow-up bid is some lower amount B_i^l if the respondent did not accept to pay the initial bid. If the individual answers positively to both WTP questions the dummy variable d_i^{yy} (yes, yes) is equal to one. Depending on individual answers to questions one and two the dummy variables d_i^{yn} (yes, no), d_i^{ny} (no, yes) and d_i^{nn} (no, no) are coded in an analogous way. N is the number of respondents.

Different functional forms can be specified for the utility difference ΔV. In our specification the following variables explaining the preferences for health services provided by the Red Cross organisation are used:

$$\begin{aligned} \Delta V = \; & a_0 + a_1\, bid + a_2\, urban + a_3\, persh + a_4 \\ & age + a_5\, sex + a_6\, alone + \\ & a_7\, school + a_8\, orgnumb + a_9\, volunt + \\ & a_{10}\, volpart + a_{11}\, volparent + \\ & a_{12}\, youthact + a_{13}\, relig + a_{14}\, worship \\ & + a_{15}\, member + \\ & a_{16}\, donation + a_{17}\, availment + \\ & a_{18}\, children + a_{19}\, job \end{aligned}$$

with

bid	Willingness to pay offer (in €)
urban	Dummy for urban place of residence (Linz, Wels, Steyr = 1)
persh	Number of persons living in household
age	Age of respondent
sex	Person's sex
alone	Dummy for people living alone (single, divorced, widowed = 1)
school	Last grade of formal education [no primary and lower secondary school (0); primary/lower secondary school (1); apprenticeship (2); intermediate vocational school (3); high school (4); higher vocational school (5); higher vocational college (6); university of applied sciences (7); university (8)]
orgnumb	Number of organisations at which respondent volunteers
volunt	Dummy for voluntary activities (volunteering = 1)
volpart	Dummy for partner volunteering (partner volunteering = 1)
volparent	Dummy for parents volunteering (father or mother volunteering = 1)
youthact	Dummy for youth club membership (club activity in youth period = 1)
relig	Dummy for religiousness (Would you designate yourself religious? yes = 1)
worship	Do you attend worships? [regularly (1); sometimes (2); almost never (3)]
member	Dummy for Red Cross club membership (membership = 1)
donation	Dummy for donations to the Red Cross (Has any member of your household donated to the Red Cross organisation last year? yes = 1)
availment	Dummy variable for the availment of Red Cross services (Have you or has any member of your household benefitted from Red Cross services in the last three years? yes = 1)
children	Number of unprovided children per household
job	Dummy variable for employment (Are you employed? yes = 1)

As an alternative to the conventional double-bounded model a *spike model* (see [17] or [18]) with the following WTP distribution $H(B; \theta)$ has been

estimated

$$H(B;\theta)=\begin{cases}1 & \text{if } B<0\\ p & \text{if } B=0\\ F_\eta(B;\theta) & \text{if } B>0\end{cases} \tag{11}$$

where $F_\eta(B;\theta)$ is the cumulated distribution function from the conventional double bounded version and $p\in(0,1)$ is a constant reflecting the probability of zero WTP. We assume respondents to have zero WTP if they have answered 'no' to both WTP questions and have explicitly stated that they are not prepared to pay any positive amount. The parameters θ of $H(B;\theta)$ can be estimated with the following log-likelihood function using the same variables for ΔV as in the conventional model. S_i is equal to one if the respondent announced a positive WTP and zero otherwise:

$$\ln L^S(\theta)=\sum_{i=1}^{N}\left\{\begin{array}{l}S_i d_i^{nn}\ln[F_\eta(0;\theta)\\ \quad -F_\eta(B_i^l;\theta)]\\ \quad +S_i d_i^{yn}\ln[F_\eta(B_i^i;\theta)\\ \quad -F_\eta(B_i^h;\theta)]\\ \quad +S_i d_i^{ny}\ln[F_\eta(B_i^l;\theta)\\ \quad -F_\eta(B_i^i;\theta)]\\ \quad +(1-S_i)\ln[1-F_\eta(0;\theta)]\\ \quad +S_i d_i^{yy}\ln[F_\eta(B_i^h;\theta)]\end{array}\right\} \tag{12}$$

A typical pattern in empirical CV studies is the significant number of respondents who are decidedly not prepared to pay any positive amount. In our questionnaire all respondents who did not accept the lowest bid amount were asked a follow up question as to whether their WTP was actually zero or not. Among the group of 1449 respondents who were not prepared to pay the lowest bid amount 1223 persons explicitly stated a zero willingness to pay. Since the spike model takes these zero answers into account a better approximation of the WTP-distribution function can be achieved (see [19]).

It is typical for CV results that empirical welfare measures vary with the assumptions of the underlying model specification. Therefore, it is state of the art to present the potential range in a sensitivity analysis. Hence, the following empirical section includes various different statistical models to show the order of magnitude of free-riding and warm-glow effects depending not only on the choice between the conventional double-bounded and the spike model. Following this idea we vary the form of the distribution function (Logit or Probit), the truncation value at which the distribution function is cut off, and the welfare measure itself (mean or median).

Empirical result

Tables 1 and 2 provide the coefficients of the maximum likelihood estimation for both the conventional and the spike model. The results show for both models the expected negative sign for the bid variable *bid* in all specifications indicating that the probability for the acceptance diminishes with the offered WTP amount. The *constant* is highly significant in the conventional model whereas the coefficients remain not significant in the spike specifications. As expected the influence of the education variable *school* on the acceptance of a given bid is significantly positive. Another positive sign results for the respondents' club membership during their youth years. The dummy variable *youthact* is significant at least at the 95% level in all but one versions. The significance level of 95% is not attained in the spike model specification of Version 2.

Ambiguous estimation results provide the age of respondents *age* and the number of people living in a household *persh*. Whereas the number of people per household influences the probability for the acceptance of a given bid significantly negative in Version 1 (donation with no incentive for free-riding) the same variable shows a positive sign under Version 3 (insurance premium with no incentive for free-riding). The influence is not significant in Version 2. A priori we do not have a clear theoretical expectation on the sign of *persh* for the following reasons: An argument for the negative sign is that per capita income diminishes with household size. On the other hand likewise plausible is a positive sign showing an increasing household's willingness to pay with the number of persons who may benefit from Red Cross services. We observe this positive sign in the insurance version indicating that the number of insured household members determines the overall insurance premium to be paid. Similar arguments apply to the number of unprovided children per household *children*. This variable influences the probability for accepting the bid significantly positive in Version 1 and significantly negative in Version

Table 1. Estimated coefficients for the closed-ended double-bounded model (CEDB) and the spike model (SPIKE) using a logistic distribution function (LOGIT)

	Version 1				Version 2				Version 3			
LOGIT	CEDB		SPIKE		CEDB		SPIKE		CEDB		SPIKE	
variables	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value
Bid	−1.27	−19.8**	−0.33	−21.2**	−1.42	−20.5**	−0.358	−22.4**	−1.33	−21.8**	−0.334	−22.4**
Urban	−0.05	−0.29	0.13	0.77	−0.04	−0.18	−0.175	−0.97	−0.17	−0.95	−0.117	−0.74
Persh	−0.24	−2.25*	−0.17	−1.80*	0.06	0.76	−0.012	−0.16	0.15	1.61	0.146	1.73*
Age	−0.001	−0.08	−0.002	−0.27	−0.01	−0.91	−0.009	−1.23	−0.02	−2.56**	−0.017	−2.36*
Sex	0.05	0.34	0.09	0.64	0.12	0.75	0.152	1.06	0.09	0.59	0.146	1.05
Alone	−0.12	−0.59	−0.04	−0.20	0.22	1.16	0.205	1.22	0.10	0.52	0.119	0.70
School	0.12	3.05**	0.10	2.65**	0.10	2.38*	0.086	2.20*	0.13	3.25**	0.066	1.73*
Orgnumb	0.16	0.68	0.09	0.38	0.32	1.80*	0.241	1.51	0.34	1.59	0.246	1.20
Volunt	−0.19	−0.53	−0.29	−0.84	−0.64	−2.13*	−0.311	−1.17	−0.50	−1.50	−0.502	−1.60
Volpart	0.04	0.16	0.004	0.02	0.14	0.61	−0.013	−0.06	−0.16	−0.77	−0.142	−0.74
Volparent	−0.28	−1.36	−0.26	−1.39	−0.20	−1.05	−0.383	−2.24*	0.28	1.55	0.340	2.01*
Youthact	0.45	2.85**	0.44	3.05**	0.31	1.85*	0.212	1.42	0.56	3.55**	0.413	2.88**
Relig	0.02	0.12	0.12	0.79	0.11	0.66	0.039	0.27	−0.13	−0.81	0.027	0.19
Worship	0.14	0.63	0.08	0.40	−0.05	−0.23	−0.010	−0.05	−0.05	−0.23	−0.023	−0.12
Member	0.28	1.69	0.33	2.14*	0.49	2.94**	0.622	4.15**	0.10	0.59	−0.085	−0.57
Donation	0.80	4.00**	0.84	4.75**	0.12	0.68	0.301	1.84*	0.42	2.35*	0.616	3.78**
Availment	0.39	2.46**	0.15	1.04	0.21	1.36	0.145	1.03	0.43	2.87**	0.300	2.19*
Children	0.29	2.33*	0.26	2.30*	−0.03	−0.27	−0.024	−0.24	−0.28	−2.41*	−0.215	−2.04*
Job	0.16	0.90	0.07	0.44	0.32	1.72*	0.119	0.74	−0.21	−1.16	−0.100	−0.60
Constant	3.88	5.94**	−0.81	−1.50	4.69	7.30**	−0.177	−0.35	4.92	7.87**	−0.145	−0.28
N	839		839		834		834		861		861	

*Significance at 5% level.
**Significance at 1% level.

Table 2. Estimated coefficients for the closed-ended double-bounded model (CEDB) and the spike model (SPIKE) using a cumulated standard normal distribution function (PROBIT)

	Version 1				Version 2				Version 3			
PROBIT	CEDB		SPIKE		CEDB		SPIKE		CEDB		SPIKE	
variables	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value	Coeff.	*t*-value
Bid	−0.75	−21.7**	−0.205	−21.5**	−0.84	−22.2**	−0.222	−23.3**	−0.79	−23.2**	−0.209	−22.8**
Urban	−0.03	−0.33	0.068	0.7	−0.03	−0.24	−0.108	−1.02	−0.10	−0.99	−0.061	−0.66
Persh	−0.13	−2.03*	−0.092	−1.65	0.03	0.71	−0.007	−0.17	0.09	1.65	0.081	1.62
Age	−0.001	−0.21	−0.002	−0.35	−0.004	−0.87	−0.005	−1.12	−0.01	−2.52**	−0.010	−2.27*
Sex	0.03	0.37	0.053	0.62	0.08	0.86	0.086	1.01	0.03	0.39	0.073	0.89
Alone	−0.05	−0.43	−0.022	−0.21	0.13	1.19	0.123	1.23	0.06	0.54	0.066	0.66
School	0.07	3.26**	0.060	2.75**	0.06	2.42*	0.051	2.16*	0.09	3.50**	0.042	1.84*
Orgnumb	0.08	0.55	0.046	0.33	0.19	1.86*	0.158	1.62	0.18	1.41	0.132	1.04
Volunt	−0.09	−0.42	−0.145	−0.71	−0.36	−2.07*	−0.207	−1.28	−0.28	−1.44	−0.270	−1.43
Volpart	0.01	0.06	−0.020	−0.15	0.10	0.76	0.008	0.07	−0.10	−0.79	−0.097	−0.84
Volparent	−0.18	−1.46	−0.147	−1.33	−0.12	−1.11	−0.215	−2.13*	0.16	1.47	0.200	1.96*
Youthact	0.27	2.85**	0.257	3.02**	0.17	1.72*	0.117	1.33	0.32	3.50**	0.242	2.86**
Relig	0.03	0.35	0.082	0.90	0.07	0.73	0.026	0.30	−0.07	−0.71	0.014	0.16
Worship	0.05	0.43	0.031	0.26	−0.03	−0.24	−0.011	−0.10	−0.04	−0.32	−0.024	−0.21
Member	0.16	1.67	0.189	2.06*	0.28	2.92**	0.357	4.02**	0.07	0.74	−0.034	−0.38
Donation	0.46	4.03**	0.470	4.57**	0.06	0.61	0.159	1.67	0.22	2.18*	0.339	3.55**
Availment	0.22	2.33*	0.087	1.02	0.14	1.51	0.086	1.03	0.23	2.69**	0.170	2.09*
Children	0.15	2.16*	0.142	2.17*	−0.01	−0.23	−0.009	−0.15	−0.15	−2.33*	−0.118	−1.90*
Job	0.12	1.17	0.049	0.51	0.21	1.95*	0.085	0.88	−0.12	−1.12	−0.055	−0.56
Constant	2.25	5.88**	−0.487	−1.51	2.73	7.35**	−0.131	−0.43	2.90	8.04**	−0.096	−0.31
N	839		839		834		834		861		861	

*Significance at 5% level.
**Significance at 1% level.

3. In Version 2 the influence does not remain significant.

The respondent's age is not significant under both donation scenarios (Version 1 and Version 2) but determines WTP acceptance significantly negative in Version 3. Moreover, the results show a positive sign for the Red Cross club membership *member* with a significant influence in the donation Versions 1 and 2. This expresses a stronger preference of members in favour of Red Cross services.

The dummy variable whether the respondent or any member of her household have benefitted from Red Cross services in the past three years *availment* shows the expected positive sign at the 95% level in Versions 1 and 3 for the conventional model and only in Version 3 for the spike variant. The influence disappears in the free-riding Version 2 indicating that the experience of past Red Cross assistance increases – if any – the willingness to pay for own precaution but does definitely not influence willingness to pay components that would allow the co-provision of services for others. Different from that the variables *orgnumb* and *volunt* are significant in Version 2 for the conventional model with the probability for accepting the bid being lower for those who stated to volunteer in their leisure time. One reason for this negative relationship might lie in the strong aversion of volunteers against social free-riding. Both variables *orgnumb* and *volunt* remain not significant in the spike specification. However, the probability for the acceptance increases with the number of organisations at which respondents volunteer.

The probability for accepting the bid increases ceteris paribus for those who have already donated to the Red Cross. However, the variable *donation* is statistically significant only in Versions 1 and 3. Whether a person is employed shows the expected positive influence only under Version 2 with the variable *job* being significant at the 95% level, however, only in the conventional double-bounded model.

The remaining variables are not significant in any of the three versions. This is true for the sex of respondents *sex*, for the marital status *alone*, for an urban place of residence *urban*, and for the two variables indicating volunteering activities of relatives *volpart* and *volparent*. However, with *t*-values of -2.24 (Logit) and -2.13 (Probit) the variable *volpart* is significant in Version 2 of the spike model. The influence of both religiousness variables *relig*, *worship* remains likewise not significant. Income is not included as explaining variable. The reason is the high denial rate with respect to the household income question in the survey. Including the income variable would mean a reduction of the sample size by one half. Moreover, all estimations with household income resulted in not significant coefficients for this variable indicating quasi-linear preferences.

Welfare measures: Table 3 shows the welfare measures based on the above mentioned estimations. Mean values result from the numeric integration of the willingness to pay function over the range of the offer bids up to a certain truncation limit (we use multiples of the highest bid of €40 as truncation limits). Results vary with the estimated model, the survey version, the chosen probability distribution and different truncation limits. In general, the figures show that the means are (considerably) higher than medians in all cases. This is the result of few people with high WTPs and a high number of persons with low WTP. Moreover, truncation limits play an important role with WTP figures varying substantially with integration borders due to flat tails in the WTP functions. Comparing spike with conventional closed-ended welfare measures we found higher means and substantially lower medians in the spike variants. This follows from the different treatment of no/no answers resulting in different WTP distribution functions (see Figure 1). The presented results are conservative insofar as all 'do not know' answers are being interpreted as not accepting the offered bid amount. If we calculate an optimistic scenario by eliminating all 'do not know' answers means and medians are higher by 5.3% and 5.2% on average, respectively.

Analysing the two methodological questions of free-riding and the occurrence of warm-glow behaviour we found the following results: Independent of truncation limits, the conventional closed-ended and spike estimations provide the highest mean WTP for Version 3. The comparison between Versions 1 and 2 shows an ambiguous picture: With one exception (mean of conventional model with a truncation limit of €3*40) the means of Version 2 are higher as compared to Version 1 with the difference in the conventional model with a truncation limit of €2*40 not being statistically significant. In general the medians show the same pattern, however, their order of magnitude is evidently lower since almost half of the sample rejected a positive WTP.

Table 3. Mean and Median WTP per household and month for different models in € (95% confidence interval in parentheses)

		Mean		Median	
		Logit	Probit	Logit	Probit
Truncation at 3 * 40€					
Conventional closed-ended double-bounded	Version 1	8.56 [7.33–9.43]	7.72 [6.65–8.51]	3.32 [2.89–3.77]	3.27 [2.85–3.73]
	Version 2	8.43 [7.34–9.15]	7.60 [6.66–8.27]	3.84 [3.39–4.30]	3.79 [3.35–4.23]
	Version 3	9.10 [8.00–9.86]	8.05 [7.11–8.73]	3.79 [3.36–4.29]	3.71 [3.29–4.19]
Spike	Version 1	15.67 [13.32–16.95]	14.01 [11.90–15.32]	0.13 [0.08–0.20]	0.12 [0.07–0.18]
	Version 2	16.10 [13.97–17.36]	14.13 [12.30–15.41]	0.21 [0.13–0.31]	0.19 [0.12–0.28]
	Version 3	17.06 [14.38–18.24]	14.97 [12.98–16.19]	0.18 [0.11–0.28]	0.16 [0.09–0.24]
Conventional closed-ended double-bounded	Version 1	8.04[a] [6.97–8.76]	7.50[b] [6.53–8.21]	3.32 [2.89–3.77]	3.27 [2.85–3.73]
	Version 2	8.04[a] [7.09–8.68]	7.47[b] [6.60–8.10]	3.84 [3.39–4.30]	3.79 [3.35–4.23]
	Version 3	8.58 [7.64–9.26]	7.86 [6.99–8.51]	3.79 [3.36–4.29]	3.71 [3.29–4.19]
Spike	Version 1	11.70 [10.08–12.63]	10.67 [9.14–11.62]	0.13 [0.08–0.20]	0.12 [0.07–0.18]
	Version 2	12.12 [10.59–13.01]	10.87 [9.56–11.82]	0.21 [0.13–0.31]	0.19 [0.12–0.28]
	Version 3	12.73 [11.12–13.64]	11.40 [9.98–12.31]	0.18 [0.11–0.28]	0.16 [0.09–0.24]
Truncation at 40€					
Conventional closed-ended double-bounded	Version 1	7.01 [6.23–7.55]	6.85 [6.11–7.41]	3.32 [2.89–3.77]	3.27 [2.85–3.73]
	Version 2	7.20 [6.48–7.71]	7.01 [6.31–7.51]	3.84 [3.39–4.30]	3.79 [3.35–4.23]
	Version 3	7.52 [6.81–8.04]	7.24 [6.55–7.77]	3.79 [3.36–4.29]	3.71 [3.29–4.19]
Spike	Version 1	7.07 [6.16–7.60]	6.62 [5.78–7.16]	0.13 [0.08–0.20]	0.12 [0.07–0.18]
	Version 2	7.41 [6.57–7.92]	6.85 [6.12–7.39]	0.21 [0.13–0.31]	0.19 [0.12–0.28]
	Version 3	7.67 [6.78–8.24]	7.06 [6.26–7.62]	0.18 [0.11–0.28]	0.16 [0.09–0.24]

[a,b] Differences are statistically not significant at the 95% level. All other differences are statistically significant. 'Welch's approximate *t*-test' was employed to check significance.

Therefore, the comparison of Version 1 and Version 2 does not support the occurrence of free-riding behaviour generated by different payment vehicles. Obviously, on average the respondents do not take the opportunity of free-riding and state lower willingness to pay values. Since a provoking

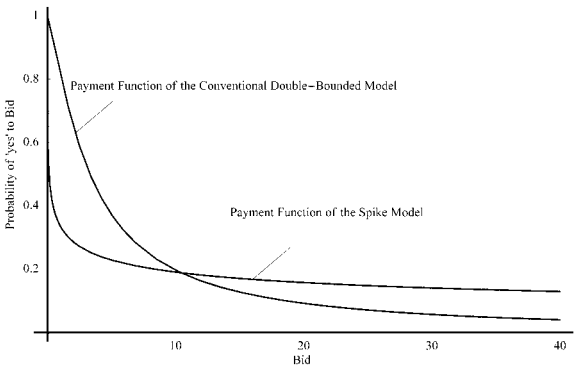

Figure 1. Payment Functions for different estimation models – Version 1.

incentive structure towards free-riding was presented to the respondents this result is surprising. From a theoretical perspective the WTP in Version 2 should have generated a welfare measure close to zero. From that we follow that respondents do not either understate their WTP to avoid own payments nor do they belief in a lower provision of the good in question triggered by free-riding of others. Since WTP in Version 2 is higher than WTP in Version 1 we can exclude any kind of free-riding behaviour generated by different payment vehicles.

However, some indication for free-riding can be found if the whole sample is split into one group including lower educated persons (1799 persons with apprenticeship or below) and another of higher education (735 persons with intermediate vocational school or higher). Whereas the lower educated group does not show free-riding behaviour, the mean WTP in Version 2 for well-educated people is lower as compared to Version 1 (€10.62 versus €9.65 for the conventional logit model and a realistic truncation level of €3*40). A reasonable interpretation for this result is that higher educated people better understand the different strategic incentives and therefore take the opportunity of free-riding. Nevertheless, we do not find this evidence for the medians.

With regard to the second question of interest we do not either find empirical evidence that would support the occurrence of warm glow generated by different payment vehicles. In a warm glow scenario WTP in Version 1 (donation and no free-ride incentive) should be higher than the figures in Version 3 (insurance premium and no free-ride incentive). As was mentioned before, we observe the opposite result ($WTP_3 > WTP_1$). Therefore, we do neither confirm free-riding nor do we support the warm glow hypothesis.

In connection with the elicitation of monetary welfare measures for health services general criticism is raised from different perspectives. The existence of altruistic motives is one example for these objections. However, altruistic motives in their original form (= health care consumption of individual *A* appears in the utility function of individual *B*) defined by [20] do not have an impact on our empirical conclusions since we assume a given preference structure whatever the goods that matter for utility. However, several authors conclude that a paradigm shift has occurred interpreting altruistic behaviour as part of human nature irrespective of personal satisfaction derived from a bundle of consumption goods. For a more comprehensive discussion on this issue see Shiell and Seymour [21] who interpret altruistic preferences as a predilection for public over private health insurance. Given this form of altruistic motives – which is beyond the traditional neoclassic framework – the consequences on our warm glow and free-riding hypotheses cannot be assessed.

Another more fundamental caveat against CV is raised by a comprehensive body of psychological Literature (see [22–24]): In contrast to the 'purchase model' of neoclassical theory it is argued that CV responses are better described as expressions of attitudes than as indications of economic value. This refers to the notion of constructed preferences with a focus emphasise on the lability of preferences and their susceptibility to framing effects and to variations of context and elicitation procedure ('contribution model'). As a result WTP answers are interpreted as expressions of attitudes rather than preferences, and a general scepticism towards monetary values is stressed. However, [23, p. 5] narrow their fundamental criticism to the application of CV to passive use values. 'When applied to use values of goods from which the respondents derive consumption benefits, the contingent valuation method presumably shares the strengths and weaknesses of familiar market research techniques.' The empirical analysis presented in this paper provides consumption values for Red Cross Services, and therefore, the application of the 'purchase model' seems justifiable.

Conclusions

This paper discusses warm glow and free-riding behaviour in connection with different payment vehicles in a Contingent Valuation study. These payment vehicles comprise two donation settings with and without free-riding incentives as well as an insurance premium version. The analysis differs from previous work by

- *An explicit consideration of two types of free-riding*: The first component covers that respondents may over- or understate their true WTP either to avoid payment or to increase the probability for the provision of the public good in question. Different from that the second component attributes to the possibility of reduced stated WTP if respondents believe that other individuals' opportunities of free-riding will reduce the provided level of the public good in question.
- *The presentation of empirical evidence on warm glow in connection with payment vehicles*: Existing work on warm glow uses a behavioural framework, thereby focussing on respondents' motives and beliefs behind their WTP answers. In contrast to this branch of literature our interest is the particular influence of different payment vehicles (donations versus insurance premiums) on the purchase of moral satisfaction.
- *The evaluation of both free-riding and warm glow behaviour under various statistical model specifications*: The paper aims at showing how the order of magnitude of free-riding and warm glow may change in different model specifications. These different specifications comprise conventional closed-ended versus spike models, the payment vehicle, the type of the underlying cumulative density function (Probit or Logit) and variations in truncation limits.

The empirical analysis is based on a CV study for Red Cross services among 2536 households in Upper Austria conducted in 2001. Given the evidence of this study we summarise our results on warm glow and free-riding as follows:

We did not find evidence that would support the incidence of warm glow in a donation setting in comparison to an insurance premium vehicle. As compared to donations with real payments warm glow might play a minor role in a CV context due to its hypothetical nature. We suppose that real actual donation payments make the heart more glow than the hypothetical answers in a WTP questionnaire. From that we conclude that warm glow generated by payment vehicles should not be given a too high priority in connection with Contingent Valuation studies. First, we have no evidence that the selection of CV payment vehicles would generate warm glow effects. Second, even though it cannot be excluded that certain goods to be evaluated provoke different degrees of warm glow feelings, in line with Carson *et al.* (see [5]) we argue that such utility components are part of the total economic value and should be reflected in cost benefit analysis. Warm glow generated by different attitudes of individuals as treated by Nunes and Schokkaert (see [4]) is not addressed in this paper.

In contrast to theoretical expectations but in line with other field studies we only found a few cases that would point at free-riding behaviour. For example well-educated people tend to state lower mean WTP for strategic free-riding reasons. However, the majority of welfare measures did not support the occurrence of strategic behaviour of respondents.

Hence, we draw a positive picture from the application of the CV method in our Red Cross setting. Empirical results are very robust. Although we got statistically significant differences between the WTP figures for the various payment vehicles their order of magnitude is very similar. Based on our results we conclude that theoretical objections against CV such as strategic behaviour and warm glow do not find sufficient empirical support.

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