Journal of Agricultural and Resource Economics 34(3):450–463

The Payment Vehicle Used in CV Studies of Environmental Goods Does Matter

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This paper examines the effect of the payment vehicle on the valuation of an environmental good with the contingent valuation method (CVM). Results from three CV studies comparing different payment vehicles by using split samples when valuing environmental encroachment caused by roads in Sweden are presented and compared to results from other such split-sample studies of payment vehicle effects. The results are consistent and show that the payment vehicle affects the valuation, but not always the way expected when considering incentives to behave strategically.

Key words: CVM, payment vehicle, split-sample tests, valuation

Introduction

Stated preference (SP) studies, which aim to make respondents state their preferences as accurately as possible, are often conducted to find the valuation of environmental goods [see Freeman, 2003, for a thorough description of different SP methods]. Carson and Groves (2007) note two conditions that must be met in order to interpret answers to SP questions with economic theory. First, the respondent must believe that his or her response could potentially influence decision making. Second, the respondent must care about the outcome of the decision making.[1] Such consequential questions might not be incentive compatible; i.e., the respondent might not have an incentive to tell the truth. Referring to the results independently derived by Gibbard (1973) and Satterthwaite (1975), Carson and Groves (2007) argue that the response format with just one binary choice can be incentive compatible. The contingent valuation (CV) variant dichotomous choice (DC), where each respondent is asked about one specific bid for the change (first used by Bishop and Heberlein, 1979), is such a method.

In economics, strategic behavior is just utility-maximizing behavior (Carson, Flores, and Meade, 2001). A thorough discussion about strategic behavior is found in Mitchell and Carson (1989), where a division is made between two different kinds of bias due to strategic behavior. One is an incentive to exaggerate willingness to pay (WTP) when payment is not compulsory, and the other is an incentive to state a too low WTP when payment is individual and compulsory.

As pointed out by Carson and Groves (2007), the payment vehicle used when valuing a public good must be compulsory to be incentive compatible. When answering a DC CV question using a compulsory payment vehicle, it is only when the bid differs from the expected cost *and* the respondent's WTP is between the bid and the expected cost that strategic

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Review coordinated by Douglas M. Larson.

[1] Carson et al. (2004) performed experiments which supported the assumption that as long as the probability of influencing a decision is not zero, the size of the probability does not matter.

behavior would result in an inaccurate response (see Ivehammar, 2006). When the payment vehicle is voluntary (made as a donation), respondents have an incentive to exaggerate their WTP (if they want the good at all) and then free-ride when payment is collected.

Apart from some payment vehicles giving incentives to answer strategically, the payment vehicle could be important for WTP per se. People's WTP may vary depending on their opinions about which payment vehicle is preferable in a specific situation or which group of people should pay, for example, because of political or moral views.

If the amount of the public good is not precisely defined, WTP should be higher with a compulsory payment vehicle than under a voluntary one (if there is no bias), and the more general the payment vehicle is, the higher WTP should be. This is because the greater the number of people paying for the public good, the greater will be the collective benefit.

The importance of the payment vehicle has been discussed since the beginning of the use of CVM. Cummings, Brookshire, and Schulze (1986) state that the choice of payment vehicle should be influenced by what payment vehicle is reasonable in a specific case, i.e., how the case in question would be financed if it were implemented. Mitchell and Carson (1989) propose realism and neutrality as two criteria for the choice of payment vehicle. Carson, Flores, and Meade (2001) emphasize that the payment vehicle used must be regarded as credible by the respondents in order for them to believe they might have to pay for the good in that manner.

Different payment vehicles are used in various studies. It is important to be aware of how the choice of each payment vehicle affects the estimated WTP—both as an aid in determining the proper payment vehicle in a specific planned study and when using values from existing studies. According to Boyle and Bergstrom (1999), payment vehicles are often assigned to each case without the selection of payment vehicles being proven. They caution that there ought to be more research about the effect of the payment vehicle used. Bjornstad and Kahn (1996) concur. The Organization for Economic Cooperation and Development (OECD, 1989) proposes to compare mean WTP when using different payment vehicles. This can be accomplished by using different payment vehicles in different random samples within the same study.

The results of split-sample studies comparing different payment vehicles, performed as part of three Swedish studies on environmental encroachment caused by roads and their traffic, are examined here. (The author of the current study was a principal investigator in each of these three earlier studies.) In the Swedish studies, the incentive-compatible SP variant DC CVM was used with the hope of minimizing biases due to incentive compatibility. The results pertaining to payment vehicle are also interesting when using other SP methods such as stated choice or multi-bounded CVM. The results are compared with findings of other split-sample studies on the effect of the payment vehicles used in CV investigations of environmental goods. The primary objective is to make a contribution to the literature regarding this important issue of payment vehicle effects that can be used as guidance in future stated preference studies of different kinds.

Three Swedish Split-Sample Studies Comparing Different Payment Vehicles

The three Swedish studies about environmental encroachment caused by roads and the traffic on them are discussed in Ivehammar (2006). Roads are meant for flexible transportation to fulfill different useful purposes. Unfortunately, roads at the same time cause negative environmental effects. These externalities may be termed *environmental encroachment*. The

motor vehicles driving on the roads create emissions and noise, and the road and its traffic together can cause a number of other negative effects, both when the area being encroached upon is a nature and/or recreational area, and when it is a built-up area where people live and work. A splendid view might be spoiled and the road may cause a barrier to (or in) an attractive area. The land where the road is placed cannot be used for anything else, and the area around it can suffer a lower value due to the encroachment.

The effect of using different payment vehicles was examined within each of the three studies of environmental encroachment (with the main aim to estimate the decreased environmental value due to the encroachment) by using versions of questionnaires in split samples, differing only in which payment vehicles were used. The payment vehicle in the main version of all three studies is an increase in local taxes each year for 10 years. The form of raised local taxes was chosen because it is compulsory, i.e., no one who pays taxes would be able to avoid payment if the investment is financed in that manner. Even though these taxes are paid as a percentage of work income in Sweden, the bids were presented in monetary terms. This main payment vehicle is compared to three alternative payment vehicles: (*a*) redistribution of a given local tax revenue, (*b*) voluntary contributions to a fund for financing the investment (a donation), and (*c*) an obligatory earmarked charge—all per year for 10 years.

Redistribution within a particular item of expenditure (transport investments) was tested because this is often the way specific road investments are financed. Payment by donations was chosen because this payment vehicle has been fairly common in CV studies (see, e.g., Ready, Whitehead, and Blomquist, 1995; Berrens et al., 2002). Finally, an obligatory earmarked local charge was tested because it could differ from raised local taxes due to political views about taxes, or because an obligatory earmarked local charge would be paid equally by everyone while the amount of local tax is paid in proportion to income.

Description of the Studies

The first of the three CV studies considered the scenario of placing *Centralbron* (the Central Bridge), with six lanes and a metro bridge in the city of Stockholm, in an underground tunnel.[2] This scenario represents an improvement of the scenic view in this unique Swedish area, and was illustrated in the questionnaire with a picture of the current view and a picture (montage) of how it would look with the change. A total of 3,600 postal questionnaires were sent to a random sample of adults living in the Stockholm area. This mailing was followed by two reminders. The final response rate was 69%. The study pertaining to replacement of the Central Bridge by a tunnel in Stockholm used a main version and seven alternative versions of the questionnaire. The main version of the postal questionnaire was sent to 800 randomly chosen inhabitants of Stockholm who were 18 years of age or older. The seven alternative questionnaire versions were sent to samples of 400 persons each. In two versions, the payment vehicles of redistribution of local tax money and donations were assumed instead of increased local taxes.[3]

The scenario for the second study was one in which a specific stretch of 1,200 meters of European Route 4 passing Huskvarna, situated between a housing area and Lake Vättern, is

[2] The study was carried out by the author in 1997. The questionnaire was pretested using focus groups.

[3] The other five versions had a different change of the object, less information about the change, a positive instead of neutral description of the change, and two respective alternative payment periods.

located in a tunnel.[4] The scenic view would be improved, and a photo with the road as well as a depiction (montage) of the stretch of the road in a tunnel were provided in the questionnaire. Under this scenario, the noise in the area would decrease and the accessibility to the lake would improve. Two different samples were developed. A random sample of 460 persons, i.e., one-third of the persons aged between 18 and 75 years living in the immediate area surrounding the stretch of the road, were mailed a questionnaire. This sample was not used in the analysis of payment vehicle effects. A random sample of 2,800 persons in the rest of the municipality also received different versions of a postal questionnaire. In two versions, compulsory local fees or donations were the payment vehicles instead of increased local taxes. Two reminders were sent as follow-ups to all questionnaire mailings. The response rate was 78% in the immediate surrounding area, and 65% in the rest of the municipality.

The third study consisted of the scenario in which a specific 1,300-meter stretch of County Road 100 passing Höllviken between a housing area and the sea is placed in an underground tunnel.[5] All 230 persons 18 to 75 years old living in the area immediately surrounding the stretch were sent a postal questionnaire. This sample was not used in the analysis of payment vehicle effects. A random sample of 1,200 persons in the rest of the town of Höllviken were also part of the study. Half of these individuals were sent the main questionnaire version with raised local taxes and the other half were sent the version with the compulsory local fee as the alternative payment vehicle. Two follow-up reminders were mailed. The response rate was 70% in the immediate surrounding area and 73% in the rest of the town.

In all three studies, the response rate is defined as the share of the people in the sample answering the CV question. A tunnel scenario was used in each of the three studies, with the stated intent that the only benefit in the scenario is the improved environment, and the only cost is the payment of the project by the payment vehicle, while travel distance and travel time, etc., are the same. The improved environment in each scenario was described in narrative and with pictures. All respondents were familiar with the area and thus knew what the environmental encroachment meant. What they were asked to imagine was the absence of the environmental encroachment.

Econometric Models and Tests

The possible differences when using alternative payment vehicles are tested in two ways. One is with the help of a nonparametric model. The Turnbull estimator uses only the information from the responses—i.e., the share of respondents answering "no" to a certain bid—to estimate the distribution of willingness to pay. The lower-bound mean willingness to pay is estimated as:

$$E_{LB}(WTP) = \sum_{j=0}^{m^*} Bid_j (F^*_{j+1} - F^*_j), \tag{1}$$

where $F^*_j = F_w(Bid_j)$. $E_{LB}(WTP)$ is normally distributed and the variance of the expected lower bound is given by:

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[4] The study was conducted by the author together with Stefan Grudemo and Jessica Sandström at the Swedish National Road and Transport Research Institute (VTI) in 1999. The questionnaire was pretested with a pilot study as well as through the use of focus groups.

[5] The study was performed by the author in collaboration with Stefan Grudemo and Jessica Sandström at VTI in 2000. The questionnaire was pretested using focus groups.

$$V\left(E_{LB}(WTP)\right) = \sum_{j=1}^{m^*} \frac{F_j^*(1-F_j^*)}{T_j^*}(Bid_j - Bid_{j-1})^2. \tag{2}$$

A detailed description of lower bound is found in Haab and McConnell (2003). The hypothesis that using the scenario with an alternative payment vehicle results in the same estimated lower-bound WTP ($E_{LB}WTP$) as when using the main scenario with raised local taxes (i.e., $E_{LB}WTP_{Alternative\ Payment\ Vehicle} = E_{LB}WTP_{Main\ Payment\ Vehicle}$) is tested as follows:

$$t\text{-Statistic} = \frac{E_{LB}WTP_{Main} - E_{LB}WTP_{Alternative}}{\sqrt{V_{Main} + V_{Alternative}}}, \tag{3}$$

where V denotes variance.

An alternative test is to pool data from two different split samples with different payment vehicles and analyze them with an estimated logit model [see, e.g., Louviere, Hensher, and Swait (2006) for a description of the logit model]. Data for the main questionnaire version and the alternative version are pooled, and a logit model with dummy variables for differences in intercept and/or effect of the bid between the main version and the alternative version is estimated as:

$$P_k \text{ answers "yes"} = \frac{e^{(\alpha+\beta_{Bid}*Bid_k+\Sigma\chi_i X_{ik}+\Sigma\delta_j*Y_{jk}+\beta_{DummyVersion}*DummyVersion+\beta_{BidDummyVersion}*BidDummyVersion)}}{1+e^{(\alpha+\beta_{Bid}*Bid_k+\Sigma\chi_i X_{ik}+\Sigma\delta_j*Y_{jk}+\beta_{DummyVersion}*DummyVersion+\beta_{BidDummyVersion}*BidDummyVersion)}}, \tag{4}$$

where α is a constant; Bid_k is the bid to which respondent k reacts; X_{ik} are variables describing the exposure of the transport infrastructure placed in a tunnel and its traffic for respondent k; Y_{jk} are socioeconomic variables for respondent k; *DummyVersion* is a dummy variable equal to 1 for the version with an alternative payment vehicle and 0 for the main version; and *BidDummyVersion* is a dummy variable which is the bid for the alternative version and 0 for the main version. If no difference due to payment vehicle exists, neither the intercept dummy nor the bid dummy should be significant.

One explanatory variable that can be expected to affect WTP in all three cases studied is the number of visits to the encroachment area by the respondent. Another possible explanatory variable in all cases is age of the respondent, since a number of Swedish valuation studies have shown that the valuation of environmental amenities decreases with age.[6] A model with a constant, the frequency of visits, age, the bid, and the two dummy variables for the alternative version is estimated with pooled data from the main questionnaire version and the alternative version.

[6] See Ivehammar (2006). In all samples in all three studies, data were collected concerning visits and age. However, the respondents were not asked any questions about income in the study pertaining to the Central Bridge because it was feared such questions would prompt lower response rates. That study was complemented with an assessment of whether including an income question affected the response rate. Findings revealed no impact on the response rate. Thus, an income question was included in the other two studies.

Table 1. Answers in the Stockholm Central Bridge Study, Different Payment Vehicles

	Raised Local Taxes		Redistribution of Local Tax Money		Donations	
Bid (SEK)	*n*	"Yes" Share	*n*	"Yes" Share	*n*	"Yes" Share
10	67	0.716	38	0.579	34	0.794
50	73	0.493	35	0.600	34	0.588
100	68	0.426	34	0.588	30	0.367
300	64	0.344	32	0.531	31	0.258
600	68	0.162	36	0.444	36	0.194
1,000	69	0.130	36	0.500	33	0.121
2,000	63	0.127	34	0.324	34	0.118
5,000	66	0.045	33	0.364	37	0.081
Per Year	$E(WTP)$ = 480 SEK		$E(WTP)$ = 788 SEK		$E(WTP)$ = 569 SEK	

Tests of Payment Vehicle Effects in the Stockholm Central Bridge Study

Table 1 shows the "yes" share on respective bids and the estimated lower-bound WTP (SEK[7] per person per year for 10 years) for the scenario with the Central Bridge in a tunnel among people living in Stockholm, in the different split samples.

In the version with redistribution, the share of "yes" answers does not monotonically decrease with the size of the bid as in the two other versions. When calculating lower-bound WTP for the version with redistribution, adjustments for increases of "yes" answers at a higher bid are addressed by computing a pooled share for both bids using only the lower bid. In this case, this means the bid of 5,000 SEK will be removed and it will be assumed that no one has WTP higher than 2,000 SEK, even though 36.4% of the respondents answered "yes" to the 5,000 SEK bid. Following this strict lower-bound estimate, the intervals for the main version are adjusted accordingly by using 2,000 SEK as the upper border to assure comparability of the estimated WTP.[8] Estimating lower-bound WTP for the main version, using 2,000 SEK as the upper border, results in an estimated WTP of 345 SEK. The lower-bound WTP in the version with redistribution is 788. The hypothesis that the version with raised local taxes results in the same estimated lower-bound WTP as the version with redistribution of tax money from similar areas (i.e., $E_{LB}WTP_1 = E_{LB}WTP_0$) is tested and yields a *t*-statistic of 3.48. The null hypothesis can be rejected at the 1% significance level. Table 2 shows the estimated model with pooled data from the version using the payment vehicle of redistribution of local taxes and the main version with the payment vehicle of raised local taxes.

The dummy variable for the bid for the version with redistribution is significant and has a positive sign. A higher bid affects the probability of a "yes" answer less negatively when the payment vehicle is redistribution of local taxes than when the payment vehicle is raised local taxes. This finding corroborates the results from the nonparametric model.

[7] SEK is the Swedish currency unit, where $1 US is equal to approximately 7 SEK.

[8] Restricting in only one of the samples would appear biased.

Table 2. Logit Model, Redistribution and Raised Local Taxes, the Stockholm Central Bridge Study

Variable	Coefficient	Std. Error	*t*-Statistic	$P[\,\lvert Z\rvert\,] > z$
Intercept	0.13330	0.27550	0.484	0.6284
Bid	−0.00102	0.00018	−5.813	0.0000
Visits	0.02830	0.01030	2.745	0.0060
Age	−0.01060	0.00475	−2.221	0.0264
Dummy Redistribution	0.30270	0.19500	1.552	0.1206
Bid Dummy Redistribution	0.00084	0.00019	4.297	0.0000

$n = 811$
Pseudo-$R^2 = 0.12$
Percent Correctly Predicted = 68%

Table 3. Logit Model, Donations and Raised Local Taxes, the Stockholm Central Bridge Study

Variable	Coefficient	Std. Error	*t*-Statistic	$P[\,\lvert Z\rvert\,] > z$
Intercept	0.09820	0.29110	0.337	0.7358
Bid	−0.00102	0.00018	−5.809	0.0000
Visits	0.02960	0.01100	2.677	0.0074
Age	−0.01000	0.00510	−1.980	0.0477
Dummy Donations	−0.04170	0.21290	−0.196	0.8448
Bid Dummy Donations	0.00027	0.00026	1.052	0.2930

$n = 801$
Pseudo-$R^2 = 0.13$
Percent Correctly Predicted = 72%

Using the payment vehicle of donations to a fund, the calculated mean lower-bound WTP is 569 SEK per person per year for 10 years. The hypothesis that the version with donations to a fund results in the same estimated lower-bound WTP as the version with raised local taxes (i.e., $E_{LB}WTP_1 = E_{LB}WTP_0$) is tested and yields a *t*-statistic of 0.51. The hypothesis cannot be rejected at the 10% significance level. Table 3 shows the estimated model with pooled data to test if any of the dummy variables are significant when pooling data for the version with the payment vehicle of donations to a fund and the main version with the payment vehicle of raised local taxes in the Stockholm Central Bridge study.

Neither of the two dummy variables is significant. According to the results of the tests of the responses in the study about the Central Bridge, the hypothesis of no significant difference between using raised local taxes and using donations to a fund as a payment vehicle cannot be rejected.

Tests of Payment Vehicle Effects in the Huskvarna Study

A version with donations to a fund was also tested in the case involving placing a specific stretch of European Route 4 passing Huskvarna in a tunnel, as well as the compulsory fee payment vehicle. Table 4 reports the share of "yes" answers on respective bids and lower-bound

Table 4. Answers in the Huskvarna Study, Different Payment Vehicles

	Raised Local Taxes		Compulsory Fee		Donations	
Bid (SEK)	*n*	"Yes" Share	*n*	"Yes" Share	*n*	"Yes" Share
10	84	0.529	45	0.600	45	0.533
25	83	0.518	43	0.488	39	0.513
70	78	0.436	42	0.476	38	0.368
120	86	0.430	43	0.326	44	0.182
300	84	0.298	46	0.261	51	0.176
600	84	0.202	48	0.250	43	0.186
1,200	88	0.159	43	0.163	48	0.021
Per Year	$E(WTP)$ = 264 SEK		$E(WTP)$ = 271 SEK		$E(WTP)$ = 90 SEK	

Table 5. Logit Model, Voluntary Contributions and Raised Local Taxes, Rest of Huskvarna

Variable	Coefficient	Std. Error	*t*-Statistic	$P[\,\lvert Z\rvert\,] > z$
Intercept	0.64180	0.24610	2.607	0.0091
Bid	−0.00163	0.00028	−5.881	0.0000
Visits	0.03570	0.01130	3.166	0.0015
Age	−0.01890	0.00490	−3.818	0.0001
Dummy Donations	−0.11260	0.20790	−0.541	0.5882
Bid Dummy Donations	−0.00145	0.00068	−2.127	0.0334

n = 808
Pseudo-R^2 = 0.11
Percent Correctly Predicted = 67%

WTP for the scenario in Huskvarna for those living in the rest of the municipality of Jönköping in the different split samples with alternative payment vehicles.

The calculated mean lower-bound WTP to have the stretch of road in a tunnel is 264 SEK per person per year for 10 years compared to 90 SEK per person per year for 10 years when the payment vehicle is donations. The hypothesis that the version with donations to a fund results in the same estimated lower-bound WTP as the version with raised taxes (i.e., $E_{LB}WTP_1 = E_{LB}WTP_0$) is tested and yields a *t*-statistic of 4.97. Thus, the hypothesis can be rejected at the 1% significance level. Table 5 shows the parameters in a logit model with pooled data from the version with the donations payment vehicle and the main version with the payment vehicle of raised local taxes for the rest of Jönköping municipality.

The dummy variable for the bid for the version with donations is significant. A higher bid negatively affects the probability of a "yes" answer more when donations are used than when raised local taxes is the payment vehicle. This finding is in agreement with the nonparametric result. The a priori hypothesis considering incentives to behave strategically is instead that individuals making donations should give higher payments because payment is not compulsory and, when collected, respondents can avoid paying. Since the public good was exactly defined, this could not be the explanation for our finding (refer to discussion in the introduction section). This topic is further discussed below.

Table 6. Logit Model, Compulsory Fee and Raised Local Taxes, Rest of Huskvarna

Variable	Coefficient	Std. Error	*t*-Statistic	$P[\,\lvert Z\rvert\,] > z$
Intercept	0.58270	0.24390	2.389	0.0169
Bid	−0.00163	0.00028	−5.887	0.0000
Visits	0.03740	0.01110	3.376	0.0007
Age	−0.01760	0.00490	−3.603	0.0003
Dummy Compulsory Fee	0.01620	0.19460	0.083	0.9337
Bid Dummy Compulsory Fee	−0.00004	0.00047	−0.079	0.9370

$n = 879$
Pseudo-$R^2 = 0.08$
Percent Correctly Predicted = 65%

Table 7. Answers in the Höllviken Study, Different Payment Vehicles

	Raised Local Taxes		**Compulsory Fee**	
Bid (SEK)	*n*	"Yes" Share	*n*	"Yes" Share
20	86	0.500	89	0.449
100	91	0.308	80	0.263
300	81	0.235	92	0.261
500	88	0.227	84	0.107
1,500	95	0.063	88	0.091
Per Year	$E(WTP)$ = 190 SEK		$E(WTP)$ = 195 SEK	

The calculated mean lower-bound WTP is 271 SEK when using a compulsory fee as the payment vehicle. The hypothesis that the version with a compulsory fee to a fund results in the same estimated lower-bound WTP as the version with raised taxes (i.e., $E_{LB}WTP_1 = E_{LB}WTP_0$) is tested, resulting in a *t*-statistic of 0.19. Hence, the hypothesis cannot be rejected at the 10% significance level. Table 6 gives the coefficients in the estimated logit model with pooled data from the two versions. The model does not have any significant dummy variable. This finding is consistent with the nonparametric test.

Tests of Payment Vehicle Effects in the Höllviken Study

A version with a compulsory fee to a fund was also used in the study about placing a specific stretch of County Road 100 in Höllviken in a tunnel. Table 7 reports the share of "yes" answers on respective bids and distribution-free estimation of WTP for the scenario in Höllviken for those living in the rest of the town[9] when using raised local taxes compared to when using a compulsory fee as the payment vehicle.

The calculated lower-bound mean WTP per person per year for 10 years to place the stretch of road in a tunnel is 190 SEK when raised local taxes is the payment vehicle and 195 SEK when a compulsory fee is the payment vehicle. The hypothesis that the version with a

[9] A sample comprised of the people living in the immediate surrounding area to the stretch of the road was developed as well as a larger sample from the whole town of Höllviken.

Table 8. Logit Model, Compulsory Fee and Raised Local Taxes, Rest of Höllviken

Variable	Coefficient	Std. Error	*t*-Statistic	$P[\,\lvert Z\rvert\,] > z$
Intercept	1.8464	0.4407	4.190	0.0000
Bid	−0.0018	0.0003	−5.479	0.0000
Visits	0.0323	0.0127	2.537	0.0112
Age	−0.0463	0.0083	−5.580	0.0000
Dummy Compulsory Fee	−0.2322	0.2160	−1.075	0.2823
Bid Dummy Compulsory Fee	0.0003	0.0005	0.636	0.5248

$n = 844$
Pseudo-$R^2 = 0.11$
Percent Correctly Predicted = 76%

Table 9. Comparison Between WTP with Raised Local Taxes and an Alternative Payment Vehicle

Payment Vehicle and Study	Result
Redistribution of Local Taxes:	
■ The Central Bridge in Stockholm	WTP higher
Donations to a Fund:	
■ The Central Bridge in Stockholm	No difference
■ Route E4 passing Huskvarna	WTP lower
Obligatory Earmarked Local Fee:	
■ Route E4 passing Huskvarna	No difference
■ County Road 100 in Höllviken	No difference

compulsory fee to a fund results in the same estimated lower-bound WTP as the version with raised taxes (i.e., $E_{LB}WTP_1 = E_{LB}WTP_0$) is tested and results in a *t*-statistic of 0.11. As with the two previous studies, the hypothesis that a compulsory fee to a fund and raised local taxes results in the same estimated lower-bound WTP cannot be rejected at the 10% significance level here. Table 8 shows the parameters in a pooled parametric model for raised local taxes and a compulsory fee to a fund for the respondents in the rest of the town of Höllviken. Neither the bid nor the intercept dummy is significant, in agreement with the nonparametric analysis.

Summary of Results from the Tests of Payment Vehicle Effects in the Three Studies

Table 9 summarizes the results of all tests of payment vehicle effects in the three studies, as to whether the alternative payment vehicles significantly differ from raised local taxes.

The comparison between raised local taxes and donations gave different results in the two different studies where they were compared. In one of the studies, donations to a fund did not result in any significant difference, but in the other, WTP by donations was significantly lower than WTP by raised local taxes.

Redistribution of local tax money resulted in higher WTP than raised local taxes in the study concerning the Central Bridge in Stockholm. One possible explanation is that redistribution of tax money is not fully interpreted as a cost by respondents, as suggested by the nonmonotonicity for redistribution between "yes" shares on different bids. Respondents might believe that the reallocation would be made from what they think is least valuable. To describe in detail from what source the redistribution would come, however, is only an alternative when the aim is to make a decision in a particular case knowing exactly what that source would be, since WTP depends on how the respondents value this usage. It would be interesting to study this payment vehicle with some SP method in connection to a real case. An obligatory earmarked fee gave no statistically significant different results in either of the two comparisons in the Huskvarna and the Höllviken studies.

Comparison with Results from Other Studies

There have been other split-sample studies comparing donations with raised taxes, and their results are consistent with our findings. Jakobsson and Dragun (1996) compared increased annual state taxes with annual donations to a fund when valuing the Leadbeater's possum in a DC CV study. Approximately 600 questionnaires with each payment vehicle were sent, yielding a response rate of 32%. WTP was significantly higher when the payment vehicle was increased taxes compared to when it was donations. Bateman et al. (1995) tested unspecified donations, donations to a specific fund, and direct taxation as payment vehicles in a pilot study preceding a study about WTP for a project to protect the Norfolk Broads wetland against flooding from the North Sea. The pilot study used open-ended CVM in interviews with 433 persons in a three-split sample. A large difference was observed among zero WTP bids. With unspecified donations, 46% of respondents gave a zero bid; with donations to a fund, 23% gave zero bids; but only 12% gave zero bids with the tax payment vehicle. Champ et al. (2002) compared donations to a fund, the same with a provision point with money-back guarantee, and a one-time tax increase for Boulder County, Colorado, residents when valuing open space land in a CV study. Questionnaires were mailed to 4,200 Boulder County residents—i.e., 1,400 questionnaires were mailed per payment vehicle. A response rate of 49% was achieved. WTP was significantly higher with raised taxes as the payment vehicle compared to the other two payment vehicles. Milon (1989) compared WTP by voluntary contributions and WTP by a special one-year charge on fuel for boaters to be applied to a fund to build an artificial reef. The sample consisted of 3,600 boat owners, and the response rate was 45%. Milon found no significant difference in WTP.

A problem with donations is that respondents cannot be forced to pay, and consequently there is no cost for their answer in the study. This means they have an incentive to exaggerate their WTP (if they want the good at all), because they can then free-ride when donations are actually collected. This choice could be assumed to potentially result in too high a valuation. Moreover, there are eventual effects due to personal views about payment vehicles and the fact that real donations instead give incentives to free-ride. One possible explanation for the result in the studies of payment vehicle effects associated with donations is a finding reported by Champ and Bishop (2001) in the pre-test focus groups prior to a mail survey where donations was used as the payment vehicle. One reason participants gave for answering "no" was their belief that all customers should jointly share the expense. Another possible explanation is that participants respond by considering what they would actually donate.

Wiser (2007) presents the results from a study comparing a voluntary with a collective payment vehicle and a private with a government provision. The DC CV study examined WTP in dollars per month for three years for renewable energy. A total of 4,056 questionnaires were mailed, generating a response rate of 45%. The sample was split into four segments, which differed according to collective/voluntary payment and private/government provision. The collective payment was in the form of a compulsory increase in the electricity bill for everyone, and the voluntary payment was in the form of a voluntary increase in the electricity bill. The collected funds would be spent either by the government or by electricity suppliers on renewable energy projects. WTP was higher with collective payment than with voluntary payment in both split samples, but the difference was significant only when provision was private.

Redistribution of tax money and raised taxes has also been compared by others, yielding results consistent with ours. Bergstrom, Boyle, and Yabe (2004) compared redistribution of tax money and raised taxes when valuing a groundwater protection program. The valuation question was asked in a form which elicited a "yes" or "no" response to a referendum on the issue. The payment vehicle was either a special tax in dollars per year for 10 years or reallocation of tax money from other public services. Roads and bridges, schools, parks, police protection, and health care were given as examples of public services. A total of 787 households in Georgia and 920 households in Maine were mailed questionnaires with a dichotomous choice or an open-ended question, where special tax or tax reallocation was the payment vehicle. The response rate was 53%. WTP was significantly higher when using tax reallocation than when using a special tax. The differences were huge. With DC, estimated WTP was 18 times higher when using tax reallocation as the payment vehicle than when using a special tax.

An increase in taxes was compared with a fee by Morrison, Blamey, and Bennett (2000). Their study estimated WTP for constructing a pipe to transport drained groundwater away from a unique wetland in Australia using either a "one-time levy" on the water bill or on income tax. Questionnaires were mailed to a split sample of 1,648 households in New South Wales and South Australia and generated a response rate of 48%. WTP using the two different payment vehicles was not significantly different, consistent with the results in our studies.

Some other payment vehicles have also been compared with split-sample studies. In a couple of studies conducted at the end of the 1970s and the beginning of the 1980s, as referenced by Cummings, Brookshire, and Schulze (1986), a general sales tax as a payment vehicle resulted in higher valuation than using a special fee. Kontoleon, Yabe, and Darby (2005) report the results from a study assessing the valuation of labeling whether food is genetically modified, using two different payment vehicles. Redistribution of tax money from other public services was compared with increased food prices as the payment vehicle. Questionnaires were sent to 2,000 UK households, resulting in 533 usable responses. It was not possible to reject the hypothesis of no difference in estimated WTP using the two different payment vehicles.

Campos, Caparrós, and Oviedo (2007) value a visit for one day in two different protected Spanish forests using two different payment vehicles. An entrance fee is compared with increased expenditures for visiting the forest in the form of increased gasoline price. Visitors were interviewed. In one application the different payment vehicles were used on different occasions (and only half as many respondents were asked about the entrance fee), while in the other the respondents randomly received either of the payment vehicles. Approximately 500

interviews per variant (250 in one) were carried out. One of the applications asked about three different amounts, and the other used one DC question followed by an open-ended valuation question. Estimated WTP was significantly higher (2–3 times higher) when using increased gasoline price than when using the entrance fee as the payment vehicle in both studies, even though the effect of the increased gasoline price on all other trips was not counted.

Concluding Remarks

When a payment vehicle is compulsory, it is nearly impossible to avoid payment. All of the payment vehicles used in the split samples are more or less compulsory except for donations. With some payment vehicles, all members have to pay, while with others, only the users of the good pay. When a charge or tax is connected to buying or using specific goods, it is possible to escape payment by no longer using the goods, while a general obligatory tax increase, obligatory general charge, or redistribution within the budget expenses cannot be avoided. The effect of increasing the price of goods depends on the price elasticity of demand, which depends on the substitution possibilities. The degree to which a fee on the valued good is compulsory depends on the price elasticity of the good.

There are some general results that are consistent across our studies as well as other investigations. One is that redistribution of already collected tax money can give higher WTP than raised taxes or a new fee, while donations as a vehicle payment results in lower (or the same) WTP. General payment vehicles seem to result in higher WTP per person than payment vehicles where only the users of the good pay, although the extent of the good received is defined.

It is important to carefully consider which payment vehicle should be used in a planned study, and to consider the payment vehicle when using values from earlier studies, since it has been clearly proven that the payment vehicle does matter. Something important to point out is that it is not evident that what is assumed from incentives to behave strategically will be found in empirical studies (as for donations).

More research is needed about the effect of the payment vehicle used.[10] Although it has been pointed out in several earlier studies using stated preference applications that the payment vehicle should be studied, to date this topic has not been adequately addressed in the literature.

[*Received September 2008; final revision received October 2009.*]

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[10] A possibility in some transport infrastructure projects might be to use the willingness to substitute actual travel time for not having environmental encroachment, avoiding an ordinary payment vehicle (see Ivehammar, 2008).

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