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2 **Watershed management benefits in a hypothetical, real intention and real willingness to**
3 **pay approach**

4

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14

15 **Abstract**

16

17 Despite growing knowledge of a disparity between stated and actual willingness to engage in

18 pro-environmental behavior, little is known about the cognitive or attitudinal factors

19 explaining the disparity. In the context of water quality improvement in a river basin, we

20 address the disparity issue by applying two approaches: a typical valuation question with a

21 hypothetical option of voluntary payment and a valuation question with a real option of

22 voluntary payment. The latter treatment allows for further analysis of the respondents who

23 committed to a real payment. We show empirical evidence on the psychological factors

24 explaining the disparity between the treatments and its relationship with response uncertainty.

25 The extent of learning from the survey about water management of the watershed increased

26 the likelihood of stating the willingness to contribute, either with certainty or uncertainty. In
27 turn, a previous contribution to the environmental issue, higher income, belief in the scenario,
28 and responding to the hypothetical treatment increased the likelihood of stating certain
29 willingness to contribute. Our findings indicate that the factors influencing the decision on
30 the maximum payment differ between treatments. Cognitive factors, such as perceiving the
31 valuation scenario as plausible, learning from the questionnaire, and in which mailing round
32 the respondent completed the survey, only explained the stated amount for the willingness to
33 pay in the treatment with a hypothetical option for voluntary payment. In the real option
34 treatment, a higher stated willingness to pay was more likely if the respondent actually made
35 the payment and had a higher household income.

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37 **Keywords:** Contingent valuation, freshwater management, hypothetical bias, preference
38 certainty, field study, real donation

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40 **1 Introduction**

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The contingent valuation method (CVM) has been applied in many environmental contexts to estimate the monetary value of changes in non-marketed environmental quality or quantity. The method is based on the theory of utility maximization of consumers (see e.g. Alberini and Kahn 2006; Mitchell and Carson 1993), and allows for the elicitation of willingness to pay (WTP) for a particular environmental change, such as an improvement in the water quality of a watershed. WTP is elicited with the help of a survey and a hypothetical market setting. The hypothetical market refers to

51 the definition of the water quality improvement (a good for
52 sale), the actual measures that would provide the improvement
53 in a specified water basin, and the type of payment. The
54 maximum WTP reflects the benefit derived by the respondent
55 from the environmental improvement (Alberini and Kahn
56 2006).

57 In a stated preferences valuation question,
58 especially in a CVM survey, respondents are not actually bound
59 to paying the amount they state they are willing to pay. This
60 may introduce hypothetical bias if a respondent perceives the
61 valuation scenario to be too hypothetical or unrealistic and acts
62 accordingly (Kling et al. 2012; Moser et al. 2014; Newell and
63 Swallow 2013; Schlapfer and Fischhoff 2012). The validity of
64 hypothetical stated WTPs has been tested for private or public
65 goods in field and laboratory settings by offering one subsample
66 of respondents an option for real payments and another
67 subsample an option for standard hypothetical payments, and
68 then comparing the results (Foster et al. 1997; List and Gallet
69 2001; Little and Berrens 2004; Murphy et al. 2005). As the
70 majority of previous studies have been implemented in
71 laboratory settings and/or focused on a private instead of a
72 public good (e.g. Blumenschein et al. 1997; Frykblom 1997;
73 Neill et al. 1994; Spencer et al. 1998), less information is
74 available on the comparison of real and hypothetical willingness
75 to pay estimates related to a public or quasi-public good,

76 performed under field circumstances. In addition, little research
77 has been conducted on whether this hypothetical bias influences
78 people differently (Bishop and Barber 2014; Murphy and
79 Stevens 2004).

80 Meta-analyses of hypothetical bias (List and Gallet
81 2001; Little and Berrens 2004; Murphy et al. 2005) have
82 reported that respondents overstate their willingness to pay by a
83 factor of 2 to 3 in hypothetical compared to real settings. The
84 underlying reasons for the divergence between real and
85 hypothetical WTP have been investigated since the 1990s. For
86 instance, it has been argued that hypothetical bias may stem
87 from free-riding behavior, where respondents rely on others to
88 pay, even though they positively value the good and would pay
89 something given the knowledge that the good would definitely
90 not be provided without such payment (Brown et al. 1996).
91 Hence, regarding voluntary contributions, for example, an
92 initial “yes” response in a hypothetical survey helps to set up a
93 later opportunity to free ride with respect to the actual
94 contribution (Carson and Groves 2007). In the case of a non-
95 voluntary payment (e.g. tax) in combination with a single
96 dichotomous choice question, hypothetical bias may occur if the
97 respondent thinks that the outcome of the survey will have no
98 influence (inconsequentiality, see e.g. Vossler et al. 2012;
99 Vossler and Watson 2013).

100 Although an extensive body of literature provides
101 clues to some of the factors contributing to hypothetical bias in
102 relation to public goods and field studies (see e.g. Little and
103 Berrens 2004; Murphy et al. 2005), few studies have explored
104 explanatory factors with regression models, simultaneously for
105 actual payment and contingent donation treatments. Champ and
106 Bishop (2001) modeled the factors affecting the decision to
107 hypothetically donate, finding them to be similar to those
108 affecting the decision to make a real donation. Furthermore,
109 they demonstrated the elimination of hypothetical bias when the
110 positive responses of less certain respondents were recoded to
111 negative responses. Brown et al. (1996) observed that WTP for
112 the removal of roads on the North Rim of the Grand Canyon
113 was lower among older people in the hypothetical treatment
114 alone, and was higher among people who had visited the Grand
115 Canyon only in the actual treatment. Loomis et al. (1996)
116 reminded participants to act as if they were in a real market
117 situation with a real budget, and this aided them in behaving
118 more like they would do in an actual cash market.

119 Ways of reducing hypothetical bias have also been
120 examined by different approaches that aim to control preference
121 uncertainty (see e.g. Blomquist et al. 2009; Little and Berrens
122 2004; Ready et al. 2010), since it has been shown that more
123 certain WTP responses are closer to real WTP. Determinants of
124 the sources of respondent uncertainty about their true values

125 have included insufficient interest or the amount of mental
126 effort respondents have put into responding (Hanley et al. 2009;
127 Svedsater 2007), the bid level (Brouwer 2011; Loomis and
128 Ekstrand 1998), prior knowledge or familiarity with the
129 resource (Hanley et al. 2009; Loomis and Ekstrand 1998;
130 Voltaire et al. 2013), believing in the good and/or policy
131 instrument proposed (Akter et al. 2009; Voltaire et al. 2013),
132 and household income (Brouwer 2011; Hanley et al. 2009;
133 Voltaire et al. 2013).

134 Despite growing knowledge of a disparity between
135 stated and actual willingness to engage in pro-environmental
136 behavior, there is a need to understand the cognitive and
137 attitudinal factors explaining this disparity and its relation to
138 response uncertainty. This paper contributes to current
139 knowledge on these factors affecting willingness to contribute
140 and the stated WTP amounts in different survey contexts. The
141 empirical field experiment was designed to derive benefit
142 estimates related to an improvement in the water quality¹ and
143 hydrology of a river basin resulting from the implementation of
144 a river basin management plan according to the European Water
145 Framework Directive (WFD, European Parliament 2000). The
146 empirical data consist of watershed valuation information
147 collected in three ways: through hypothetical donations with
148 either a hypothetical or a real option to pay, and through

¹ With the objective to achieve a good ecological and chemical status to protect human health, the water supply, natural ecosystems, and biodiversity.

149 observable, real donations. This allowed us to analyze the effect
150 of factors specific to the valuation question on the stated WTP
151 amounts and actual payments, and thus to shed more light on
152 the relationship between the real and hypothetical WTP and
153 related uncertainty. Moreover, the actual payments were
154 compared with the stated WTP in hypothetical and real option
155 settings.

156 The following section presents the empirical
157 application and the data collection. The third section presents
158 the results of the models, and the final section discusses our
159 findings and concludes.

160

161 **2 The application**

162

163 **2.1 Study area**

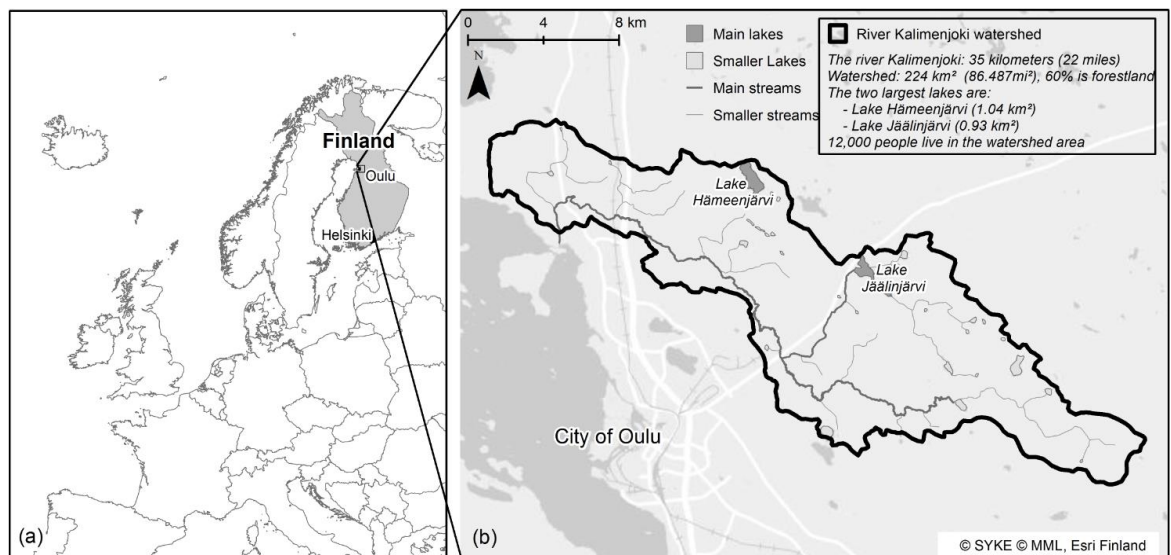
164

165 The study area, the River Kalimenjoki watershed in the region
166 of North Ostrobothnia in Finland, is covered by a national water
167 management plan. The river is 35 kilometers long, originating
168 in the southeastern peat production areas of the region and
169 flowing into the Gulf of Bothnia, the northern part of the Baltic
170 Sea (see Figure 1). Due to the high concentration of phosphorus
171 and occasional acidity, the ecological status of the river is
172 classified as poor. The River Kalimenjoki is defined as a
173 valuable small watercourse mostly located in a peri-urban area

174 and with 12,000 people living in the watershed. Sixty percent of
 175 the watershed area of 224 km² is comprised of forestland. Of
 176 the 27 lakes in the area, the two largest are Hämeenjärvi (1.04
 177 km²) and Jäälinjärvi (0.93 km²).

178

179 [Figure 1 near here]



180

181 **Fig. 1**

182 Map of the study area.

183

184 2.2 Questionnaire and valuation questions

185 The questionnaire included sections describing
 186 major concerns in relation to water management, the current
 187 water state and a description of the proposed restoration option
 188 for the Kalimenjoki river basin in 2021 (valuation scenario),
 189 value elicitation questions, and follow-up and debriefing
 190 questions about the idea of contributing, possible difficulties in
 191 choosing the payments, and belief in the presented scenario.
 192 The final part of the survey contained questions about

193 respondents' socio-demographic and economic household
194 characteristics. Two scenarios for the demand assessment were
195 defined based on the sub-basin management plan and in
196 cooperation with two local water management associations
197 recently established in the river basin area. The survey was
198 pretested in a pilot phase with 13 respondents, resulting in
199 minor changes to the final questionnaire.

200 The valuation research frame involved two
201 treatments. Treatment 1 represented a traditional contingent
202 valuation question that offered the respondents a hypothetical
203 option to make a “voluntary water management payment”. In
204 treatment 2, households had an option to make a real payment.
205 At the beginning of the valuation section, the households were
206 asked whether they would be willing to pay a one-time water
207 management payment to one of the two water management
208 associations with the following question:

209 Q8. Would you be willing to pay a water management donation for the Kellonkylä
210 association OR the Kiiminki–Jääli water management association to implement the
211 formerly presented water improvement plans (i.e. visions)?

- 212 Yes
213 Yes, possibly
 No ► *You may proceed directly to question number 11.*

214 Up to this point, the questionnaires for the two
215 treatments were similar. In the second part of the valuation
216 question, only applying to those respondents who responded
217 ‘Yes’ or ‘Yes, possibly’ to the previous question, the respondents

218 were provided two alternative ways of stating their willingness to
219 pay: a classic single-value open-ended question and, in order to
220 reduce valuation uncertainty and to produce confidence intervals
221 for the willingness to pay, an interval open-ended question (see
222 e.g. Hakansson 2008). The valuation questions were identical,
223 with the exception that in the hypothetical (HYPO) treatment, the
224 recipient was asked “**if** your household had the possibility to
225 make a one-time donation...”, while in the REAL OPTION
226 treatment, the question was framed as “**now** your household has
227 the possibility to make a one-time donation...” Moreover, in the
228 REAL OPTION treatment, the respondents were given practical
229 instructions on how to make the donation (see Appendix A).

230 The treatments were designed to have as many
231 similar settings as possible, for instance the time periods for the
232 behavioral intent (the HYPO subsample) and for the actual
233 behavior (the REAL OPTION subsample and those who
234 actually paid). Donation has been proposed as a practical
235 payment vehicle, as it offers a plausible means of providing
236 small-scale public goods (Byrnes et al. 1999) and makes
237 validation against actual behavior relatively easier (Champ and
238 Bishop 2001). However, its incentive compatibility has been
239 questioned (Carson and Groves 2007). As a consequence of
240 free-riding, i.e. when the respondent perceives that the cost will
241 be covered by other donations, the actual cash donations will
242 underestimate Hicksian measures of WTP (Macmillan et al.

243 1999). The one-time payment vehicle was chosen because of
244 practicality: it was seen as the most realistic and policy-relevant
245 means for comparing the hypothetical and real WTP for the two
246 water management associations².

247 Although the open-ended (OE) WTP question
248 format is not preferred over dichotomous choice (DC) or other
249 formats³, it has been shown to provide a more accurate
250 prediction of actual behavior than the DC question format
251 (Hakansson 2008; Poe and Vossler 2002). Hence, both the
252 single-value and interval OE question formats were chosen as
253 the methods for eliciting WTP. As we applied the same
254 question format to elicit the hypothetical and real WTP, the
255 difference in WTP should be due to the hypothetical nature of
256 the contingent valuation method.

257 The mail survey was sent by post out to 1,632 randomly
258 selected households across the Kalimenjoki river basin in
259 October 2012. Both treatments included 816 households. The
260 survey practice followed Dillman's (2007) "total design method",
261 involving a booklet questionnaire and four contacts, including
262 the first mailing of the questionnaire, a postcard reminder, a
263 second mailing of the questionnaire, and an additional follow-up
264 questionnaire to those respondents in the REAL OPTION
265 treatment who stated that they were willing to contribute, but did

² Several studies have investigated donation payment mechanisms (see e.g. Brown et al. 1996; Byrnes et al. 1999; Duffield and Patterson 1992; Navrud 1992).

³ See, for example, the opinion of the famous blue-ribbon panel - assembled by NOAA- who assessed the reliability of CV methods (Arrow et al. 1993).

266 not actually do so. The sampling was carried out by the Finnish
267 Environment Institute and the Finnish Population Register Centre
268 based on Finnish Census data from 2011.

269

270 **3 Results**

271 The final response rate was similar in both treatments, 31%, as
272 the data collection ended with 505 complete responses: 253 in
273 the HYPO subsample and 252 in the REAL OPTION subsample.
274 Hence, and interestingly, giving the respondents a real option to
275 pay did not have a decreasing effect on the response rate.
276 Although response rates were moderate, they were very close to
277 our prior expectation: the desired number of responses ($N = 263$
278 per treatment) was calculated using a confidence level of 95%, a
279 margin of error 5%, and population of 12,000.

280

281 3.1 Descriptive statistics for the data

282 Table 1 presents descriptive statistics for the data
283 with regard to socio-demographic information, experience, and
284 answering of the valuation questions, and a comparison of
285 respondents in the treatments with the independent samples t-
286 tests and nonparametric tests. The proportion of females, average
287 age of the respondents, household income, and the average
288 distance of the respondents' homes from the nearest lake or river
289 did not differ statistically significantly between the HYPO and
290 REAL OPTION treatments. Regarding the experience of water

291 resources or their management and the socio-demographic
292 characteristics, the data sets were similar. The majority of
293 respondents (53% and 52% in hypothetical and real intention
294 treatments, respectively) learnt from the questionnaire about
295 freshwater management in the area (*LEARN*). Almost half of the
296 respondents (46/43%) had visited a lake or riverside for
297 recreational purposes (*USER*). A clear minority (9%/8%) had
298 participated in voluntary water management work (*VOLUN*)
299 and/or paid a subscription fee to the water management
300 association (11%/11%) (*SUBSCRIPT*). In conclusion, the
301 respondents were fairly familiar with the public good being
302 valued, and the similarity between the data sets in socio-
303 demographic terms was sufficient to allow a comparison of the
304 WTP results between treatments.

305 Some statistically significant differences were
306 found in relation to the answers to valuation questions. Although
307 the share of respondents who responded in the first mailing
308 round was similar (68% and 71% in hypothetical and real
309 intention treatments, respectively), stating the maximum
310 donation was perceived as easier (*EASE*) in the REAL OPTION
311 treatment (60%) than in the HYPO treatment (48%). A larger
312 share of respondents in the hypothetical treatment (51%) than in
313 the real option treatment (41%) perceived the scenario to be
314 plausible (*TRUST*). Moreover, a larger share of respondents in
315 the HYPO treatment (33%) than in the REAL OPTION treatment

316 (29%) expressed uncertainty over whether to contribute to the
 317 program (*UNCERT*), but this difference was not statistically
 318 significant.

319 As only a fraction of REAL OPTION participants
 320 actually paid, statistical comparisons based on the descriptive
 321 statistics should be interpreted with caution. However, the results
 322 indicated several statistically significant differences in relation to
 323 the third subsample, i.e. actual donors (Table 1).

324

325 **Table 1**
 326 Descriptive statistics of subsamples

Variable		HYPOTHETICAL N=253	REAL OPTION N=252	REAL DONORS N=19
<u>SOCIO-DEMOGRAPHICS</u>				
<i>FEMALE</i>	Proportion of females	45%	43%	42%
<i>AGE</i>	Average age	50	52	54
<i>SHORE</i>	Living near the shore of a lake or river	42%	42%	47%
<i>INCOME</i>	Ten classes: 1=<€1,000;...; 10=>€7,800	5.9	5.8	6.7
<u>EXPERIENCE</u>				
<i>HEARD</i>	Had already heard about management projects in the area: 1=yes; 2=no	1.8	1.8	1.8
<i>USER</i>	Recreational user	46%	43%	58%
<i>VOLUN</i>	Has taken part in voluntary work	9%	8%	11%
<i>SUBSCRIPT</i>	Pays a subscription fee for to management association and is willing to donate a one-time payment	11%	11%	21%
<u>ANSWERING</u>				
<i>FIRSTROUND</i>	Responded in the first mailing round	68%	71%	84%
<i>EASE</i>	Ease of defining the sum of WTP	48%	60%	31%
<i>LEARN</i>	Learnt from the questionnaire	53%	52%	65%
<i>UNCERT</i>	Stated being "possibly" willing to contribute (Q8)	33%	29%	42%
<i>TRUST</i>	Perceived the scenario as plausible	51%	41%	28%

327

328

329 3.2 Willingness to contribute in hypothetical and real intention
 330 settings

331 In the pooled data set for the two treatments, the
332 majority of the respondents (55%) refused to pay ($n_{\text{yes}} = 60$, $n_{\text{yes,}}$
333 $n_{\text{possibly}} = 151$, $n_{\text{no}} = 259$). Table 2 presents the proportions of
334 respondents who were willing to contribute to the association
335 (Question 8 in the questionnaire), those who stated their WTP
336 in euros (Question 9 in the questionnaire, see Appendix A), and
337 the share of actual payments in the REAL OPTION treatment.
338 The number of respondents stating willingness to contribute
339 was higher in the HYPO (15%) than in the REAL OPTION
340 treatment (9%). In addition, 33% and 29% of respondents in the
341 HYPO and REAL OPTION treatments, respectively, stated that
342 they were possibly willing to contribute. Almost two-fifths
343 (38%) of the respondents in the HYPO sample and one-fifth
344 (21%) in the REAL OPTION treatment stated their WTP in
345 euros. Only 8% of the respondents in the REAL OPTION
346 treatment actually donated the payment through a bank transfer.
347 Although these respondents had quite evenly answered “yes”
348 (YES) or “yes, possibly” (PYES) to question 8, this proportion
349 was close to the share of those respondents who were without a
350 doubt ready to contribute (9%). The decision to state a positive
351 payment varied among “yes, possibly” contributors in the two
352 treatments: 71% and 40% of these respondents in the HYPO
353 and REAL OPTION treatments, respectively, stated a positive
354 payment.

355 **Table 2**

356
357
358

The proportions of respondents willing to contribute and stating a positive payment out of all respondents in the HYPO and REAL OPTION treatments and in the pooled data set

Treatment	Willingness to contribute (Q8)		Out of the "contributors" (Q8) who chose to pay (Q9)	Real payment
	YES ¹	PYES ¹	Stated a payment	Made the payment
HYPO (n=253)	15 %	33%	38%	n.a.
REAL OPTION (n=252)	9%	29%	21%	8%
REAL (n=19)	58%	42%	100%	100 %
POOLED (n=505)	12 %	31%	30%	n.a.

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360
361

¹) Being a respondent who expressed willingness to contribute (yes/yes, possibly) a one-time donation to the Kellonkylä association and/or Kiiminki–Jääli water management association.

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3.3 Factors associated with willingness to contribute and related response uncertainty

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Two logit models (see e.g. Gujarati 2004) for a detailed description of the model) were constructed with the aim to reveal the factors associated with the stated willingness to contribute and related response uncertainty. The dependent variables referred to whether the respondent was willing (YES) or possibly willing (UNCERT) to make a non-zero payment. In the first model, the dependent variables take the value of one when the respondent is definitely willing to contribute ("yes, possibly" and "no" respondents counted as not willing to pay), and in the second model when the respondent is uncertain, i.e. only possibly willing to contribute ("yes" and "no" respondents

375 counted as not having uncertainty in the decision to pay). Table
376 3 presents the results estimated using the statistical software
377 NLOGIT5.

378 The results of the first logit model show that
379 definite willingness to contribute significantly correlated with
380 six variables: already paying a subscription fee for a water
381 management association (*SUBSCRIPTION*), a higher household
382 income (*HHINCOME*), learning from the questionnaire
383 (*LEARN*), not responding in the REAL OPTION treatment
384 (*REAL OPTION*), perceiving the scenario to be plausible
385 (*TRUST*), and having difficulty in defining the maximum sum
386 of WTP (*EASE*).

387 The results of the second logit model for factors
388 influencing uncertainty related in the decision to make a
389 positive payment are also reported in Table 3. Notably, higher
390 uncertainty was significantly correlated with the stated
391 difficulty in revealing the household's WTP (*EASE*) indicating
392 an increasing amount of mental effort put into responding.
393 Responding in the first mailing round (*FIRSTROUND*), and
394 learning from the questionnaire (*LEARN*) also increased the
395 uncertainty of respondents. However, the household's income
396 and whether the respondent answered in either the HYPO or
397 REAL OPTION treatment, or being a member of a water
398 management association, did not influence the respondent's
399 uncertainty (*HHINCOME*, *REAL OPTION*, *SUBSCRIPTION*).

400 These results partly contradict those of Hanley et al. (2009),
 401 who showed that experience of the good, a higher income, and
 402 an increasing amount of mental effort put into responding may
 403 explain increased uncertainty over the value people place on
 404 public goods.

405

406 **Table 3**

407 Estimated coefficients for two logit models of i) the definite certainty
 408 of a respondent in being willing to make a one-time donation to the
 409 water management association and ii) related response uncertainty
 410

Variable descriptions		YES (0-1)	UNCERT (0-1)
		Coefficient (Std. Error)	Coefficient (Std. Error)
Constant		-2.24 (1.47)	-1.14 (1.01)
<i>GENDER</i>	Female (1); male (2)	-0.09 (0.01)	0.10 (0.25)
<i>AGE</i>	18-75 yrs	-0.01 (0.01)	-0.01 (0.01)
<i>USEVALUE</i>	Uses waters for recreation (1); otherwise (0)	0.56 (0.40)	0.33 (0.26)
<i>HHINCOME</i>	Household's average monthly income, ten classes	0.17(0.08)**	-0.01 (0.01)
<i>KNOWLEDGE</i>	Had already heard about the river basin management plan (1); otherwise (0)	-0.37 (0.46)	0.18 (0.32)
<i>SUBSCRIPTION</i>	Pays a subscription fee to a water management association (1); otherwise (0)	1.12(0.44)**	-0.48 (0.37)
<i>ATTITUDE</i>	Restoration of small waters: very important (1),...,very unimportant (5)	-0.37 (0.46)	0.04 (0.22)
<i>INTEREST</i>	Detached the first page (information about the water management associations) of the survey to her/himself (1); otherwise (0)	-0.01 (0.37)	0.05 (0.26)
<i>REAL OPTION</i>	Responded in the REAL OPTION treatment (1); in the HYPO treatment (0)	- 0.81(0.38)**	0.16 (0.25)
<i>FIRSTROUND</i>	Responded in the first mailing round (1); otherwise (0)	0.02 (0.41)	0.65(0.28)**
<i>TRUST</i>	Perceived the scenario to be plausible (1); otherwise (0)	0.78(0.39)**	0.16 (0.26)
<i>LEARN</i>	Learnt from the questionnaire (1); otherwise (0)	0.91(0.42)**	0.57(0.27)**
<i>EASE</i>	Ease of defining the sum of WTP (1); otherwise (0)	-0.68 (0.39)*	-1.38(0.26)***
N		337	337
Chi squared [13 d.f.]		60.50***	52.49***
McFadden pseudo R ²		0.22	0.12

411 Note: *** p < 0.001, ** p < 0.05, * p < 0.1

412

413 3.4 Factors associated with higher WTP

414 Another regression analysis was carried out to
 415 investigate the factors that influence the size of the payment
 416 stated by the respondent. The majority (72%) of the respondents
 417 who reported willingness to contribute stated their payment with
 418 a single-value open-ended (OE) valuation question, while the rest
 419 chose the alternative type, i.e. an interval OE valuation question.
 420 Examining this issue from the actual payment viewpoint, the
 421 majority of respondents who actually made the payment in the
 422 REAL OPTION treatment had stated their maximum WTP with
 423 the single-value OE question, and those who stated their payment
 424 with the interval open-ended question paid along their upper
 425 bound payment. Therefore, the mean WTPs were calculated
 426 using the payments stated with the single-value OE answers and
 427 the upper bound payments of an interval OE question.

428 The effect of socio-economic and attitudinal factors on
 429 the stated WTP was analyzed with a linear OLS regression
 430 model. The type of valuation question and motivational factors
 431 were accounted for in the fourth model (POOLED, WTP > 0).

432 The results of the models are presented in Table 4.

433

434 **Table 4**

435 Linear OLS regression analysis of the factors affecting single-value
 436 and interval OE statements for WTP. Dependent variable: [ln
 437 (WTP+1)]

Variable	Model			
	HYPO	REAL OPTION	REAL	POOLED, WTP > 0

	t	t	t	t
Constant	2.55**	1.47	0.64	3.28***
<i>GENDER</i>	0.18	-0.98	-	0.21
<i>AGE</i>	-2.24	-0.63	-0.22	0.20
<i>USEVALUE</i>	0.77	0.78	-0.64	1.16
<i>HHINCOME</i>	1.27	2.22**	-0.15	1.68*
<i>KNOWLEDGE</i>	-0.46	0.00	-0.64	0.56
<i>SUBSCRIPTION</i>	2.16**	2.28**	4.09***	1.40
<i>ATTITUDE</i>	-1.58	0.10	-0.64	-1.52
<i>INTEREST</i>	0.93	-0.93	-1.11	1.80*
<i>REAL OPTION</i>	-	-	-	-1.77*
<i>FIRSTROUND</i>	1.91*	1.60	0.77	0.47
<i>TRUST</i>	2.68***	1.45	-1.23	1.16
<i>LEARN</i>	2.32**	-0.05	1.36	-0.35
-	-	-	-	-
<i>EASE</i>	4.47***	-6.23***	3.32**	-0.92
<i>PAID</i>	-	6.59***	-	-
<i>INTERVAL</i>	-	-	-0.32	2.31***
<i>WATERQUALITY</i>	-	-	-0.57	-1.04
<i>IMPORTANCE</i>	-	-	-0.58	2.25**
N	164	120	19	124
R ²	0.43	0.62	0.98	0.32

Note: ***p < 0.001, **p < 0.01, *p < 0.05

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Two statistically significant variables associated with a

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higher willingness to pay statement are common between the

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HYPO and REAL OPTION treatments. First, the negative

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coefficient of the variable *EASE* indicated that respondents who

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perceived the maximum sum of WTP as being difficult to

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define were more likely willing to pay a higher sum than those

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who perceived this to be easy. This factor was also significant

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for the likelihood of being willing to contribute. Second, the

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positive sign of the variable *SUBSCRIPTION* indicated that

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those respondents who were already members of either river

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management association were more willing to pay a higher sum

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than non-members.

477 treatment, including the respondents who stated zero WTP. Thus,
 478 the hypothetical to real intention ratio is 1.9. Before the analysis,
 479 two outliers, identified as having paid amounts that exceeded
 480 €999, were removed. There was statistical evidence of an overall
 481 difference in the mean donations between the HYPO and REAL
 482 OPTION treatments (independent-samples t-test: $t = 3.229$,
 483 $p = 0.001$; $t = 2.435$, $p = 0.015$). Out of 252 respondents for the
 484 REAL OPTION treatment, 51 stated some positive payment in
 485 the survey. Of these, 19 (37%) actually made a donation. Next,
 486 we compared the stated amounts of WTP in the REAL OPTION
 487 treatment with those payments actually made to the associations.
 488 The REAL OPTION:REAL ratio was 2.8, whereas the
 489 HYPO:REAL ratio was 5.5. Table 5 reports the mean WTPs for
 490 the two treatments and the average of the actually paid donations
 491 for those who responded in the REAL OPTION treatment.

492

493

Table 5

494

The mean willingness to pay estimates (EUR per household in October 2012) for the HYPO and REAL OPTION treatments and the average of the actually paid donations in the REAL treatment (and standard deviations of the mean WTPs in parentheses)

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497

Treatment	Stated willingness to pay		Actual payment	
	Per contributor	Per respondent	Per contributor	Per respondent
HYPO	€75 (106.9)	€33 (80.0)	n.a.	n.a.
REAL OPTION	€60 (77.8)	€17 (49.4)	€80 (115.5)	€6 (27.3)

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An aggregate benefit estimate was calculated by

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multiplying the pooled average household WTP estimate by the

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number of households in the municipality of the study area, i.e.

503 5,600. When determining the sample mean WTP, the mean WTP
504 values of non-respondents were assumed to be 49% of the values
505 for respondents. This was due to the difference in the data, as the
506 mean WTP differed between respondents replying to the first and
507 second mailing (64%/36%, the variable *FIRSTROUND*), being
508 €31.7 and €12.5, respectively. Thus, households of the region
509 would be willing to pay a one-time water management payment
510 of EUR 93,000 in total to the water associations of Kellonkylä or
511 Kiiminki-Jääli.

512

513

514 3.6 Inconsequentiality

515 To investigate the reasons underlying the
516 hypothetical bias and whether inconsequentiality had played any
517 role in it, the motivations for not paying are investigated with a
518 follow-up questionnaire including seven alternative options
519 explaining the difference in the stated willingness to pay and the
520 actual payment. The follow-up questionnaire (see Appendix B)
521 was sent to the 34 respondents in the REAL OPTION treatment
522 who had not actually paid. Based on 13 (38%) completed and
523 returned questionnaires, the following reasons were identified:
524 some respondents had paid the annual subscription to the local
525 association, other respondents first wanted to be sure that the
526 other residents would also pay, and one respondent had changed
527 his mind because he thought that polluters should pay all the
528 costs of water management. Furthermore, two respondents paid
529 the donation later. Based on this analysis, we cannot identify a
530 lack of belief in the influence of the survey on policy makers
531 among the majority of respondents.
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534 **4 Discussion**

535 Offering respondents a possibility for real payment
536 makes a valuation scenario more realistic, as it allows
537 respondents to contribute in real monetary terms. Moreover, a
538 more careful consideration of whether to state a positive

539 willingness to pay could be expected, with a consequent
540 reduction in hypothetical bias. The analysis in this paper
541 confirmed this expectation, reflected by a lower proportion of
542 stated contributions among respondents in the REAL OPTION
543 treatment (9–21%) in comparison to the HYPO treatment (15–
544 38%). Using the proportion of YES responses out of all
545 responses (including possible YES responses and NO
546 responses) to the question concerning willingness to contribute
547 (Q8) offered a simple way to estimate the minimum number of
548 welfare gainers, since only 8% of the respondents actually
549 donated a water management payment⁴ in the REAL OPTION
550 treatment.

551 This paper provides new empirical evidence on the
552 explanatory factors of the willingness to contribute and the
553 related response certainty. The extent of learning about water
554 management from the survey increased the likelihood of stating
555 a willingness to contribute, either with certainty or uncertainty.
556 In turn, responding immediately to the survey (during the first
557 mailing round) and the perceived difficulty in stating the WTP
558 amount (implying the difficulty of the task for the respondent)
559 increased the likelihood of stating an uncertain willingness to
560 contribute. In turn, previous contribution to the environmental
561 issue, a higher income, belief in the scenario, and responding to

⁴ However, not every *yes* response revealed actual payment, and there were also actual payers among the “*yes, possibly*” responses.

562 the HYPO treatment increased the likelihood of stating a certain
563 willingness to contribute.

564 Earlier studies have indicated a clear divergence
565 between hypothetical willingness to pay and actual payments in
566 stated preference valuation in both laboratory studies and field
567 circumstances (e.g. Foster et al. 1997; List and Gallet 2001).
568 Based on a meta-analysis, Murphy et al. (2005) argued that the
569 calibration factor varies between two and three. The calibration
570 factor calculated from this study, 1.9 in the hypothetical and
571 real intention payment treatments, is close to their findings.
572 When only including the actual payers of our sample in
573 comparisons, the calibration factor between the average WTP in
574 the HYPO treatment and the actual payment was 5.5. These
575 results are in line with earlier studies and closest to the results
576 presented by Brown et al. (1996).

577 Consistent with the outcome obtained by Duffield
578 and Patterson (1992), the mean WTPs of the respondents with a
579 positive WTP were rather similar across hypothetical (€75) and
580 real (€60) treatments. Interestingly, the mean WTP estimate of
581 actual contributors in the REAL OPTION treatment (€80)
582 exceeded the mean WTP in the REAL OPTION treatment
583 (€60). This result suggests that the respondents having a
584 positive WTP had a true incentive to state their maximum WTP.
585 It is also notable that a large share of all actual contributors

586 stated that they were “possibly” willing to contribute some
587 positive payment.

588 However, to obtain “real” sample WTP estimates
589 closer to the Hicksian value (see e.g. Newell and Swallow
590 2013), methods adding realism in the “water management
591 market” should be considered. Furthermore, the usefulness of
592 adding questions on self-reported implementation intentions,
593 i.e. planning when and where to pay, could be considered to
594 define the number of “true” contributors. According to
595 Gollwitzer (1993), individual intentions are more likely to be
596 translated into action when an individual develops a clear
597 scenario of the circumstances under which the pursued action is
598 to be performed.

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601 **5 Conclusions**

602 This paper provides estimates of the benefits from the
603 improvement of water quality according to the European Union
604 WFD using two treatments: a typical hypothetical contingent
605 valuation question (HYPO) and a contingent valuation question
606 with a real payment intention (REAL OPTION). Our paper
607 compares real and hypothetical WTP estimates and dependent
608 factors related to the improvement of freshwater quality, performed
609 under field circumstances. The novelty of this paper is in probing
610 the cognitive and attitudinal factors that might explain this disparity

611 between stated and actual willingness to engage in pro-
612 environmental behaviors. The results demonstrated a difference
613 between the hypothetical and real intention WTP: the subtle
614 wording changes and some instructions about paying via an
615 Internet or local bank may move the individuals one step closer to a
616 commitment to pay when they say they will pay.

617 In the water management context, further studies comparing
618 real with hypothetical payments involving a reasonable sample size
619 to enable statistical analyses within the real treatment would be
620 desirable. In addition, there appears to be a common interest among
621 cognitive psychologists and environmental economists in exploring
622 the effect of the wording of valuation questions.

623 Our study, while revealing the divergences in results
624 gathered from real intention and hypothetical treatments, did not
625 challenge the feasibility of the contingent valuation method in
626 valuing environmental amenities as such. However, the results
627 highlight the need for a more thorough assessment of which
628 respondent-related factors are associated with hypothetical bias.
629 Although challenging to implement, further split sample and real
630 world case studies on this subject with sufficient sample sizes are
631 encouraged.

632 When provided an option to make a real payment, survey
633 respondents stated their valuation realistically compared to their
634 average actual donation, adding more realism to the valuation
635 scenario. The divergence between the hypothetical and real

636 willingness to pay evidenced in this study does not indicate
637 whether the WTP is overstated in the hypothetical or understated in
638 the real option treatment. Acknowledging the difference in WTP
639 estimates in these two treatments provides an opportunity to use
640 either estimate of the aggregate WTP as a useful measure of the
641 actual behavioral intentions of individuals or the environmental
642 benefits derived from water quality improvement when estimating
643 society's demand for water quality improvements.

644

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646

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778 Appendix A. Valuation question in the two separate questions
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Treatment I: Hypothetical WTP	Treatment II: Real WTP
<p>Q9. If your household had the possibility to make a one-time donation to the Kellonkylä association and/or Kiiminki–Jääli water management association, what is the highest payment you would be willing to make?</p> <p>Funds would be gathered through bank transfer to the bank account of the association and the funds would be used for planning and as widely as possible for the implementation of a water vision.</p> <p><input type="checkbox"/> My household would be ready to donate _____ euros at most as a water management lump sum to the Kellonkylä association* in order to implement the water vision of Kello.</p> <p>OR</p> <p><input type="checkbox"/> My household would be ready to donate _____ - _____ euros as a water management lump sum to the Kellonkylä association* in order to implement the water vision of Kello.</p>	<p>Q9. Now your household has the possibility to make a one-time donation to the Kellonkylä association and/or Kiiminki–Jääli water management association: how large a payment are you willing to make?</p> <p>Funds will be gathered through bank transfer to the bank account of the association and the funds will be used for planning and the widest possible implementation of a water vision. You can pay via Internet bank or at your bank with the following information.</p> <p><input type="checkbox"/> My household is ready to donate _____ euros at most as a water management lump sum to the Kellonkylä association* in order to implement the water vision of Kello.</p> <p>OR</p> <p><input type="checkbox"/> My household is ready to donate _____ - _____ euros as a water management lump sum to the Kellonkylä association* in order to implement the water vision of Kello.</p>

*) The same questions were also used for the Kiiminki–Jääli water management association. The respondent could choose to donate to one or both of the associations.

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785 Appendix B. Questionnaire to those who expressed willingness to pay, but who did not pay
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787 **1. I didn't pay because**

788 *(Choose the most suitable alternative and mark it with 1, and the second best alternative with 2):*

789

790 [] I changed my mind about paying.

791 [] I couldn't afford to pay.

792 [] I forgot.

793 [] I wanted to consider the matter further.

794 [] I felt that I didn't support this project enough to pay for it.

795 [] I preferred voluntary work to donation.

796 [] Some other reason, what? _____

797