Distance decay and WTP for water quality improvements – differences between users and non-users

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1. Introduction

The Water Framework Directive (WFD) requires economic analyses and assessments of the associated environmental and resource costs and benefits. As the population who benefits from water quality improvements in a water-body may be spread across a wide geographical area, one of the key parameters when aggregating benefits of improved water quality is the spatial distribution of these benefits. The spatial distribution of benefits can, in turn be used to qualify the boundaries of the aggregation of benefits for cost-benefit analyses (CBA), and is therefore essential e.g. when determining whether the water quality of a certain water body should be improved or exempted from the objectives (EU Commission 2009).

When performing CBA an important task is to identify the population affected by the improvement. The population consist of both users and non-users of the public good, and when the welfare measure is compensating surplus, i.e. an improvement in the environmental quality is valued, we have an a priori expectation that users will exhibit distance decay in their WTP (Bateman et al 2006), i.e. WTP is expected to be a decreasing function of the distance from respondents' place of residence to the resource. The background for this expectation being, that peoples' opportunities for taking advantage of improvements in the level of use values offered by a given resource are greater the closer they live by the resource; as an example the costs (e.g. time and transportation costs) associated with using the resource are inversely proportional to the distance between respondents' residence and the resource. However, benefits can be high also for users living remote from the resource, especially if the site is unique (e.g., a users' utility of the Rocky Mountains), but it can be expected that there will be some distance decay in the value of these benefits because of an increase in the availability of substitutes with increased distance from the site. Turning to non-users, expectations regarding distance decay in WTP are less clear. It does not seem unreasonable that a person living 100 km from a river or a lake may care just as much for the water quality as someone living 20 km from the water resource, given that neither actually visits the resource and do not have any intentions to do so in the future even when the quality increases (Hanley et al 2003; Bateman et al 2006). Hence, this suggests that non-users' WTP should not display distance decay. However, it cannot be rejected that people – independent of actual use – may prefer environmental improvements to occur in their local area rather than in more distant areas. Also, it may be the case that the considered improvements may in fact induce non-users to become users. With these observations in mind, the relevance of distance decay effects in relation to non-users cannot be rejected. However, it seems fair to conclude that non-users WTP are unlikely to be affected by distance decay to the same extent as users' WTP are.

Just as differences in distance decay are expected between users and non-users, differences in distance decay may also be found between different types of users and non-users. Hence, the way that one chooses to categorise respondents as either users or non-users may have an important impact on the outcome of the analysis. Focusing on the differences between users and non-users, an important element of the analysis is therefore related to choosing an appropriate definition of users and non-users, respectively. Prior to the present study, analyses related to the consequences related to applying different definitions of users/non-users were conducted, and the results of these analyses showed, that the choice of definition has an impacts on results. In the present paper, however, the results will only be presented for one definition of users vs. non-users. The categorisation of respondents as either users or non-users in the present study is based on respondents' answers to a question regarding their previous use of the environmental good being valued. As the considered improvements may imply that respondents' future use will differ from their previous it could be argued that the categorisation of respondents into users and non-users should also take into account respondents' intentions regarding potential future use. As such information was not collected in the questionnaire, it has however not been possible to incorporate these aspects in the approach adopted in the present study.

There is a general recognition that in assessments of Total Environmental Value (TEV), e.g. for the use in Cost Benefit Analyses (CBA), both use and non-use values should be included (Pearce et al 2006). In relation to the aggregation of both types of values, an important task is to identify the relevant populations to aggregate across; i.e. the relevant population of users (who can hold both use and non-use related values) and the relevant population of non-users (who primarily are expected to hold non-use related values, but also may display some values related to potential future use (option and bequest value)). Although it may not be easy and unproblematic to identify the relevant population of users, it is – in relative terms - likely to be fairly straight forward to identify the spatial boundaries of the population of users compared to identifying the spatial boundaries of the population of non-users. Hence, in principle, anyone can attach a value to the good in question, and therefore – at least theoretically – should be included in the analysis. As the inclusion or exclusion of non-use values can have significant impacts on the results of the CBA (Hanley et al 2003), it is important to make sure not only that they are properly assessed but also that they are aggregated across the relevant population the analysis. An important factor in relation to the estimation and aggregation values, and in relation to identifying the spatial boundaries of the relevant populations, is distance decay effects, and the potential differences in distance decay between users and non-users. Hence, if there are significant differences between users and non-users in terms of distance decay, then failure to take these differences explicitly into account in the estimation and aggregation processes may lead to biased results.

Apart from the fact that users and non-users are likely to differ in relation to distance decay, they may also differ in terms of their relative susceptibility to different biases associated with the use of stated preference methods. More specifically, non-users are expected to be more prone to biases than users – the reason being that non-users due to their lack of experience with using the good cannot be expected to have as stable and well-defined preferences for the goods/services as users can.

It is not – within the context of the present study – possible to make an all-encompassing analysis of the user/non-user issue. In this paper we focus on the relationship between use/non-use and distance decay, and we do this by testing the extent to which distance dependency effects are conditional on the applied definition of the concept 'user'/'non-user'. Subsequently, we investigate the extent to which TEV estimates are sensitive to whether or not different preference structures of users/non-users are accounted for in the process of estimating the WTP's which serve as the base for calculating TEV. This is accomplished by comparing TEV estimates derived by two different approaches; one where users and non-users are modelled jointly, and one where users and non-users are modelled separately. Finally, it is investigated, if there are differences in users and non-users susceptibility to ordering bias. The analyses are conducted in the context of a contingent valuation (CV) study focussing on assessment of WTP for improvements of the water quality in a specific river in Denmark (Hasler et al 2009).

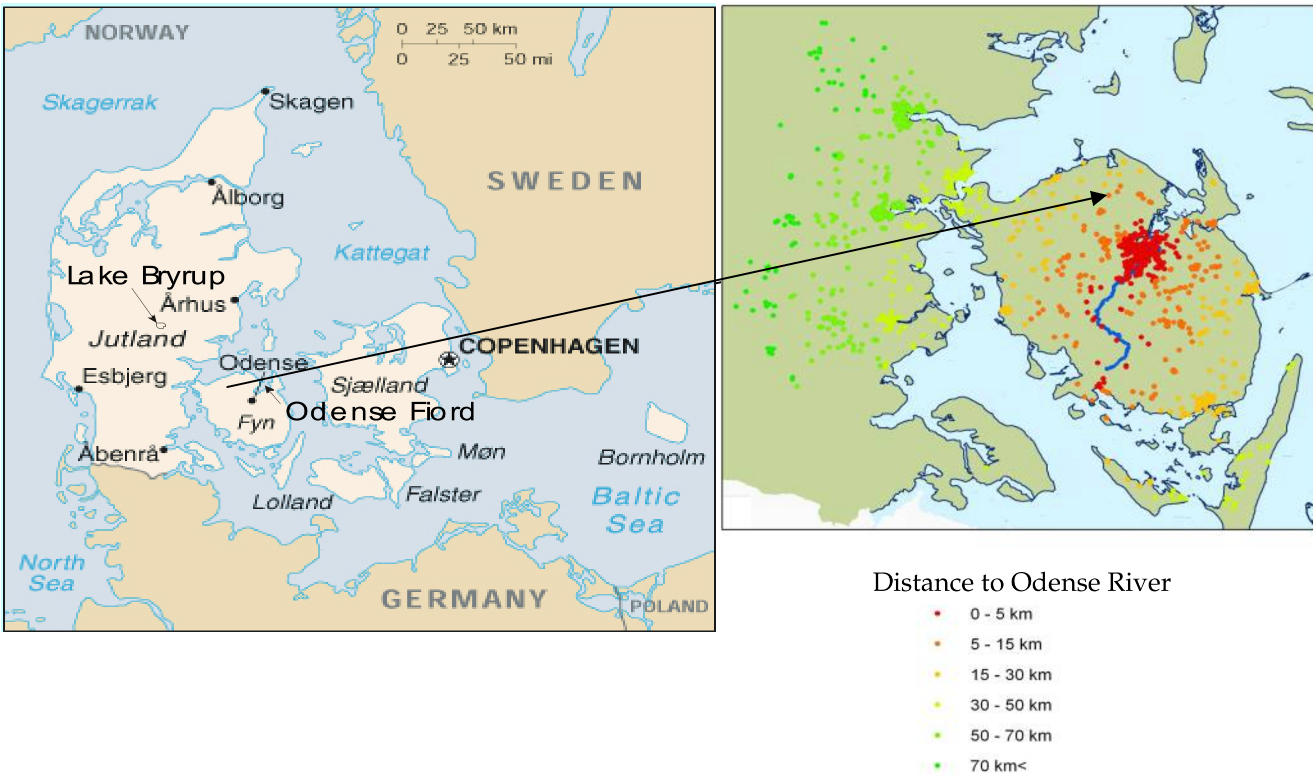
In the following section we describe the existing literature focussing on differences between users and non-users in relation to stated preference studies, and in section 3 the data used for the empirical analysis is described. In section 4 we present the results of the empirical analysis and finally section 5 concludes and discusses the results of this paper.

2. Existing literature

A number of studies have examined distance decay relations for users and non-users, respectively. Bateman et al (2006) find that distance decay is stronger for non-users than users, and Hanley et al (2003) find that while distance decay is significant for both users and non-users, users of a water body show stronger distance decay than non-users.

Several papers have looked at other aspects of the use/non-user issue. Kniivilä (2006) investigate the impact of respondents' previous and expected future use of an area on the probability that the respondent supports conservation of the area. She finds that while previous use of a good have no significant effect on the probability of supporting conservation, then intentions regarding future use do have a significant effect on the probability of supporting conservation. She also finds no support of the hypothesis that non-users' responses are less valid than users' responses. Also focusing on disparities between stated preferences of users and non-users, but focussing more on respondents' susceptibility to biases than on differences in preferences as such, Dupont (2003) finds that respondents who are relatively unfamiliar with the good being valued are more sensitive to ordering bias compared to respondents who are more familiar with the good. One potential explanation for this may be that the degree of familiarity is correlated with the extent to which respondents have, and are able to express, well-defined preferences for the given good. Hence, non-users may – due to unfamiliarity with the good – be more prone to several of the biases normally associated with stated preference methods. In relation to ordering bias, Dupont (2003) finds that non-users are more likely to attach a substantially higher value to a good when it appears in the beginning of a sequence than when it appears last. In a Choice Experiment, Ladenburg (2010) finds that respondents with no experience, or experience from the far past, are more sensitive to anchoring bias, compared to respondents with experience from a less distant past. Paradiso and Trisorio (2001) test the difference between indirect (derived from a description) and direct (from physical inspection) knowledge of a good in an experiment valuing an antique art print. The hypothesis of the study being that if a CV study does not yield valid WTP estimates for a private (priced) good, it is unlikely that it will provide valid WTP estimates for a public (unprized) good. They find that lack of direct knowledge can be a source of the disparities between hypothetical and real WTP. This indicates that it is not enough to have heard about something; in order to be able to state a valid hypothetical WTP for a good, one has to have direct knowledge. Although the mentioned studies have investigated different aspects related to the user/non-user issue, they all seem to support the notions that not only do differences in preference structures between user and non-users exist, but also that the preferences of users and non-users diverge in relation to how susceptible they are to different biases.

Several definitions of users have been used in the literature to distinguish users from non-users, ranging from the very loose definition according to which a user is defined as a person who has knowledge of the good, to the quite strict definition according to which frequent use is a prerequisite for being defined as a user. As an example, Hanley et al. (2003) and Kniivilä (2006) define *users* quite loosely as respondents who have visited the water body (a river in their study) at some point in the past for recreational purposes (fishing, walking beside the river etc.). Whitehead et al (1995) follow a different approach where they divide respondents into 3 groups; 1) on-site users (i.e. direct use), 2) off-site users who have read, seen a program etc. about the area (i.e. indirect users), and 3) non-users who have never seen or heard about the area. They test for validity and reliability of WTP and find that validity increase with increasing familiarity of the good. Johnston et al. (2004) restrict the focus to non-users, and they define three different groups of non-users; non-recreational users (who does not participate in any recreational use of the area), non-proximate user (who does not live within sight, drive by or otherwise view the sight), and a combination of the two (respondents who neither see nor use the good). The study does not look specifically at the distance decay issue, but on how the choices of different definitions of non-users affect the resulting WTP estimates. They find that the definition of non-users most likely will influence the estimates of user and non-users' WTP.



Map 1 Denmark

Map 2 Main Survey sampling area

Figure 1. Overview of Denmark and the survey sample area on Funen (Fyn).

As should be evident from the review of the literature, discrepancies between the preferences held by non-users and users seem to be relevant in relation to several aspects related to estimation of WTP by the use of stated preference methods.

3. Data description

The analysis is based on data from a Contingent Valuation (CV) study on Odense River (Hasler et al 2009), which was conducted as part of the Danish case study in the AQUAMONEY project. In this project, a common valuation design was applied simultaneously in several countries, and focus was on assessment of WTP for the water quality improvements brought about by the implementation of the European Water Framework Directive (WFD).

In order to increase the probability that the sample encompass respondents with a broad range of different user/non-user-profiles, a quite large sample area including Funen, the small islands around

Funen and southern Jutland was chosen. On Map 1 in figure 1 the geographical location of Funen (Fyn) is seen, while Map 2 in figure 1 displays the sample area. On the sample area map, the blue represents the course of Odense River and the coloured dots specify the location of the individual respondents' residence[1]. The colour of the dots indicates the distance to the river going from red (closest) to green (farthest). In terms of the approach used to measure distance, then distance is measured as the Euclidian distance between respondents' residence and the nearest point on the river.

The data was collected via an internet questionnaire distributed to a sample selected from an internet panel administered by the GALLUP institute during spring 2009. The questionnaire was sent to 2001 respondents of which 754 responded. After cleaning the sample for protest bids[2] the resulting effective sample consisted of 644 respondents, which is equivalent to a response rate of 32%. For detailed information about the data and survey see Hasler et al (2009).

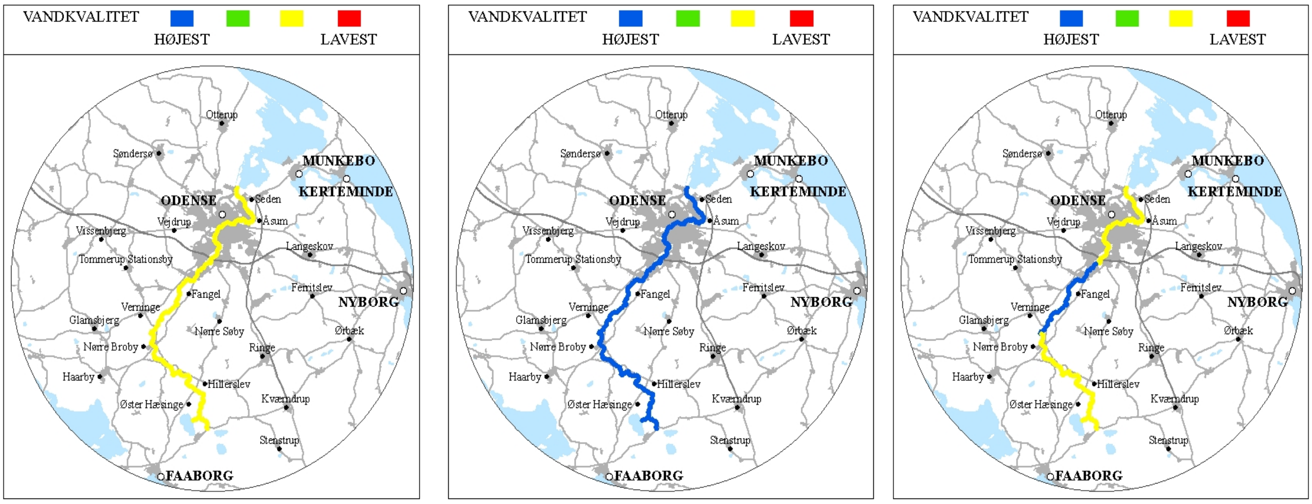


Figure 2. Current water quality (yellow = moderate) in Odense River and the improvement scenarios for the whole and a part of OR (blue = very good)

The study estimates WTP for improving water quality from moderate water quality to very good water quality. In the questionnaire, two different CV scenarios were used, thereby creating the

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1 The distance is based on a combination of the respondents address and those who did not state an address a plot on a map is used. An analysis has shown that the error distance between the two methods is around 1 km.

2 In accordance with the AQUAMONEY definition.

opportunity to conduct an internal test for scope sensitivity. In terms of the scenarios used, then one represents a large improvement while the other represents a small improvement. The more specific scenarios we defined as follows:

- Water quality improvements in the whole Odense River (60 km), as seen in the map in the middle in figure 2.

- Water quality improvement only in part of Odense River (stretch of 15 km), as seen in the map to the right in figure 2.

In order to facilitate testing for ordering effects, a split sample approach was used. Hence, while one split was first asked to state their preferences for the CV scenario where the entire river is improved and subsequently for the scenario describing the shorter stretch improvements, the order of scenarios was reversed for the other split.

An increase in the annual water bill was used as the payment vehicle for improved water quality in Odense River. The payment card in which the respondents were asked to indicate their WTP is shown in table 1. The water quality in Odense River is currently characterized as moderate. As already mentioned, the valuation scenarios proposed to the respondents are that the water quality in the river (or part of the river) will be improved from a yellow (moderate) to a blue (very good) state. The current quality and the two improvement scenarios are seen in the maps in figure 2, which are identical to the maps used in the survey.

So - how should a user be defined? Does a person have to visit the area on a daily/regular basis in order to be a user? Or is it sufficient that a person drives by once in a while, or maybe just have visited the area once in the past? Or is it perhaps a sufficient requirement that a person knows about the existence of the area? Evidently, many different options exist in terms of how to define a user (and thereby also non-users) – or perhaps, how to define different categories of users/non-users.

Introductory questions and follow-up questions can be used to reveal respondents relations to the good in question, and thereby provide input to the process of identifying criteria for categorising users or non-users. To identify different user types, the respondents in our survey were asked about their previous use of Odense River. The possible answers to this question were : 1) I have never heard of Odense River, 2) I have heard of the river but never been there, 3) I have been there but not within the last year, 4) I have been there one or two times during the last year, and 5) I use the river frequently. In the analysis the definition of users versus non-users is based on respondents' answers to this question. More specifically, respondents answering either 1 or 2 have been categorised as non-users, while those answering 3, 4 or 5 have been categorised as users. In relation to the applied definition of users vs. non-users it should be noted that it solely is based on information regarding previous use, implying that it does not reflect respondents' intentions regarding potential future use.

0 kr	❑	560 kr	❑	1200 kr	❑	4880 kr	❑
20 kr	❑	600 kr	❑	1280 kr	❑	5250 kr	❑
40 kr	❑	640 kr	❑	1350 kr	❑	5630 kr	❑
80 kr	❑	680 kr	❑	1430 kr	❑	6000 kr	❑
110 kr	❑	710 kr	❑	1500 kr	❑	6380 kr	❑
150 kr	❑	750 kr	❑	1690 kr	❑	6750 kr	❑
190 kr	❑	790 kr	❑	1880 kr	❑	7130 kr	❑
220 kr	❑	820 kr	❑	2060 kr	❑	7500 kr	❑
260 kr	❑	860 kr	❑	2250 kr	❑	7880 kr	❑
300 kr	❑	900 kr	❑	2440 kr	❑	8250 kr	❑
340 kr	❑	940 kr	❑	2630 kr	❑	8630 kr	❑
380 kr	❑	970 kr	❑	3000 kr	❑	9000 kr	❑
410 kr	❑	1010 kr	❑	3380 kr	❑	>9000 kr	❑
450 kr	❑	1050 kr	❑	3750 kr	❑	Other, note:	
490 kr	❑	1090 kr	❑	4130 kr	❑	Do not know	❑
520 kr	❑	1130 kr	❑	4500 kr	❑		

Table 1. The payment card.

4. Results

In table 2 the distribution of respondents' answer to the question regarding previous use is seen. The table reveals that there is a significant connection[3] between the use of the river and how far from the river the respondents live. Hence, while the mean distance between Odense River and respondents' residence is around 30 km for the whole sample, the mean distance between the river and respondents' residence is less than 5 km for frequent users (5) and for respondents who have no knowledge of the river (1) the mean distance is more than 58 km. From the last two rows of table 2 it also appears that the mean distance for users and non-users (as defined in the present study) is 24 kilometres for users and 52 kilometres for non-users.

Answer to previous use question	**N**	**Mean dist. to river (km)**
1. Have never heard of the river	20	59
2. Have heard of the river, but never used it	117	29
3. Have used the river at some point in time	242	24
4. Have visited the river at least one within the last year	175	14
5. Frequently use the river	91	5
All respondents	644	30
Users (3, 4 and 5)	*508*	*24*
Non-users (1 and 2)	*136*	*52*

Table 2. Respondents' answers to previous use question.

In order to analyse the differences between users and non-users in relation to distance decay and ordering effects, the Tobit regression used in Hasler et al. (2009) is run separately for the two groups, for both the short and the long stretch improvement of the river. The models used to estimate WTP include the following variables: distance to the river/stretch of river, distance to a

[3] Significant – the calculations are however not shown here.

substitute coastline, how long the respondent have lived at the current address (>or < than 5 years), respondent's prior experience with water pollution, if the respondent strolls along the river, whether or not the respondent finds the improvement possible, the extent to which the respondent use the river, household income, if the respondent is retired or not and the age of the respondent. Furthermore, to account for the ordering effect, a dummy - indicating which order the respondent was asked the two CV questions – was included. The results of the 4 separate regressions are seen in table 3. As Tobit-regression coefficients cannot be interpreted directly, the marginal effects are presented beside them and in parenthesis under the coefficients the standard error is presented. The *'s indicate the significance of the estimated coefficients/marginal effects.

Table 3 shows the results of the 4 different regressions; that is, separate regressions for users and non-users pertaining to WTP for the scenario where water quality is improved in the entire Odense river, and likewise for the scenario where water quality improvements only occur in the 15 km stretch of the river. Comparing the 4 models it is seen that a common characteristic of all models is, that the variables "residency_dum(>5yrs)", "exp. with water pollution", "retired" and "age" turn out to insignificant. For the remaining variables, however, the level of significance varies across models. In the following focus will be on the "distance" and "scope_small" variables.

	Entire river						Small stretch of the river					
	User (N=507)			Non-User (N=136)			User (508)			Non-User (N=136)		
	Coef.	Marg. effect		Coef.	Marg.effect		Coef.	Marg. effect		Coef.	Marg.effect	
Distance[a]	-3.358	-1.585	**	-18.555	-6.959	***	-2.028	-0.875		-9.643	-3.728	**
	(1.546)			(7.110)			(1.275)			(3.869)		
Scope_small[b]	228.117	108.049	***	18.170	6.810		175.450	75.951	***	-64.795	-25.140	
	(67.469)			(221.026)			(55.216)			(126.159)		
Distance to coast	5.650	2.667		35.169	13.190	**	3.002	1.295		20.374	7.876	**
	(6.210)			(17.658)			(5.130)			(10.157)		
Residency_dum(> 5 years)	-1.908	-0.901		55.611	20.789		-85.213	-37.326		-64.610	-25.146	
	(82.478)			(251.264)			(68.806)			(141.193)		
Exp. with water pollution	39.840	18.860		220.048	84.137		25.141	10.873		71.001	27.747	
	(67.467)			(230.456)			(56.387)			(133.185)		
Strolls along the river	87.385	40.703		354.195	130.091		108.427	45.850	*	125.095	47.719	
	(72.255)			(240.607)			(60.677)			(134.927)		
Finds improvement possible	224.551	104.281	***	111.349	41.601		181.438	76.718	***	161.426	61.625	
	(69.230)			(219.979)			(58.4719			(128.444)		
Household income	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	*
	(0.000)			(0.000)			(0.000)			(0.000)		
Retired	-152.656	-69.288		-113.109	-41.571		-113.482	-47.235		-140.157	-51.854	
	(14.019)			(414.799)			(94.326)			(233.064)		
Gender	-157.891	-74.524	**	-221.447	-83.049		-105.091	-45.344	*	-127.199	-49.171	
	(68.374)			(218.842)			(57.096)			(123.750)		
Age	-0.959	-0.453		-3.812	-1.430		0.916	0.395		3.397	1.313	
	(3.092)			(9.959)			(2.590)			(5.588)		
Constant	378.809		**	965.906		*	134.944			566.851		*
	(190.981)			(579.026)			(160.457)			(334.949)		
Sigma	711.389			1125.270			587.644			635.523		
Log Likelihood	-3196.76			-759.890			-2960.82			-689.989		
Prob > chi2	0.002			0.413			0.001			0.253		

***,**and * indicates statistical significance at respectively 1, 5 and 10 % level. [a] The variable controls for the distance from the residence of the respondents to the short stretch and the entire river. [b] Dummy variable = 1 if the respondent is first asked to state the preference for the short stretch, else = 0.

Table 3. Regression results.

With reference to table 3 it is seen that the sign of the distance coefficient, as expected, is negative for all 4 regressions. This implies that the longer the respondent lives from the river, the lower is the stated willingness to pay for improvements in the quality of the river. This initially suggests that distance decay applies to the preferences of users as well as non-users. However, it also appears from table 3 that the distance decay effect is not uniformly significant across users and non-users. More specifically and quite surprisingly, the distance decay estimate for users when evaluating the short stretch is in fact found to be insignificant at the 10% level of statistical significance; when valuing the large improvement, however, users do display significant distance decay effects. Accordingly, it seems that distance decay effects among users might be sensitive towards the scope of the environmental improvement. For non-users, on the other hand, distance decay appear to be present independent of scope; hence, the distance decay coefficient is found to be significant in both of the regressions pertaining to non-users. In terms of the estimated marginal distance decay effect, then for users it lies between a reduction in willingness to pay of -0.875 DKK (small improvement) to - 1.585 DKK (large improvement) for each km the respondent lives from the river, while for non-users, the reduction in willingness to pay lies between -3.728 DKK (small improvement) and -6.959 DKK (large improvement) for each km. Hence, in the present study non-users are found to display stronger distance decay effects than users do.

In table 4 total economic valuation (TEV) estimates pertaining to the two different scenarios for water quality improvements in the Odense River are presented for users, non-users and the whole sample. TEV is calculated by first calculating the mean expected WTP, which is the expected WTP (E(wtp|wtp>0)), given that it is larger than zero, times the probability that the WTP is larger than zero (Pr(wtp>0))[4]. This is then multiplied by the share of population that the definition covers. The number of households in the study area is 464,614. Referring to table 4, the numbers show that the probability of stating a positive WTP is higher for users than for non-users. In terms of the expected WTP, given that WTP is positive, it is seen that this is greater for non-users than for users when dealing with the large improvement, while it's the other way around for the small improvement; the differences, however, are not very large. Looking at the mean WTP estimates, it is seen that these for both scenarios are greater for users than for non-users. In order to assess the extent to which the

[4] Mean WTP = $p_{>0}$* $WTP_{>0}$ + $p_{=0}$ * $WTP_{=0}$, where $p_{>0}$ is the probability for WTP > 0, $WTP_{>0}$ is the mean WTP given that WTP >0, $p_{=0}$ is the probability for WTP = 0, $WTP_{=0}$ is the mean WTP given that WTP =0 which means that $WTP_{=0}$ = 0. This means that Mean WTP = $p_{>0}$* $WTP_{>0}$.

calculation of TEV is affected by whether or not differences in distance decay between users and non-users are explicitly taken into account in the estimation and aggregation process, TEV is calculated both separately for users and non-users and jointly for the entire sample without distinguishing between users and non-users. The results for the TEV based on addition of separate estimates for users and non-user, all lies within a close range of the TEV calculated without separation into use and non-use (see table 4). Hence, while the results of the study indicate that there are indeed important preferences differences between users and non-users, then the analysis nevertheless suggest that it does not have a significant impact, whether or not these preference differences are explicitly accounted for in the WTP estimates used for the calculation of the TEV of the considered improvements in water quality.

	E(wtpl|wtpl>0)	Pr(wtpl>0)	mean WTP	TEV
Entire Odense River				
User	699.91	0.67	470.79	172,470,366
Non-User	764.58	0.61	467.79	45,970,091
Total TEV				218,440,457
All (users and non-users jointly)	753.99	0.63	476.85	221,551,295
Short stretch of Odense River				
User	536.56	0.61	329.59	120,792,277
Non-User	530.54	0.58	309.98	30,462,158
Total TEV				151,254,435
All (users and non-users jointly)	538.40	0.60	322.39	149,786,109

Table 4. Total Economic Value.

As mentioned previously the survey design facilitated the testing of whether or not users and non-users differ in relation to their susceptibility to ordering bias. In tables 3, the potential presence of ordering bias is captured by the dummy variable “Scope_small”, which assumes the value 1 if the respondent first was asked to state his preference for only a part of the river and subsequently for the entire river, and 0 if the order was reversed. If the variable is significant it suggests that respondents’ preferences have been affected by an ordering effect. Looking at the non-user models in table 3 it appears that non-users are not affected by ordering bias; hence, the “scope_small” variable is insignificant in both regressions pertaining to non-users. Moving on to the users, the opposite seems to be the case. Hence, in both the regressions pertaining to users, the coefficient of the “scope_small” variable is significantly positive, implying that the respondents who have first stated their preferences for the short stretch and secondly for the entire river state significantly higher levels of willingness to pay compared to the respondents who initially stated their preferences for the entire river and then the short stretch. Hence, the results quite surprisingly suggest that users are more susceptible to ordering bias than non-users.

5. Discussion

Several of the results presented in the previous section do not correspond to our a priori expectations regarding differences between users and non-users in relation to distance decay and ordering bias. In relation to non-users and distance decay, there were no clear prior expectations; hence, the fact that the study finds non-users to display significant distance decay effects independent of the scope of the considered improvement does not seem unreasonable. In stead it supports the hypothesis that people, independent of any actual use, may prefer environmental improvements to occur in their local area rather than in more distant areas. However, the fact that the distance decay effects found in the present study are stronger and more significant for non-users than for users does not seem to be reasonable in general, and one should probably be careful not to use this result as the base for drawing any more general conclusions. In terms of potential factors contributing to the somewhat counterintuitive nature of the results, at least two factors have been identified. The first of these is that the applied definition of users versus non-users implies that the group of users spans a very wide spectrum of different use-profiles in terms of frequency of visits. Hence, it seems likely that this very broad definition may have contributed to blurring the results, and one might expect that more clear results could be obtained if it had been possible to apply more strict (and limited) definitions of users versus non-users. However, this would have required larger sample sizes. The other factor relates to the approach used to measure distance. Hence, the Euclidian distance between respondents' residence and the nearest point on the river, which is used in the modelling, may at least in two respects misrepresent the distance as perceived by the respondent. For one, it seems likely that distance by road may be longer than distance measured by a straight line, and secondly, there is no guarantee that the nearest point on the river coincide with the place that the respondent uses.

In relation to aggregation of WTP estimates into TEV estimates, results indicate that it is not crucial to explicitly take distance decay differences between users and non-users into account in the estimation and aggregation process. In terms of the more general applicability of this result, it is relevant to note that the results of the present study are likely to be affected by the fact that both users and non-users display distance decay. Hence, results should probably not be extended to contexts where this does not apply.

6. Conclusions

Using data from a Contingent Valuation study of users and non-users WTP for two different scenarios related to water quality improvements in Odense River the study investigate differences between users and non-users in terms of distance decay and susceptibility to ordering bias. In relation to distance decay, results show that distance decay is present for non-users independent of the scope of the considered improvement, whereas for users distance decay effects only are found to be significant for the scenario dealing with a large improvement. Hence, the results indicate that distance decay effects in fact are stronger for non-users than for users. These findings do not correspond to our prior expectations, and in this connection it is important to note that these somewhat counterintuitive results may partly be due to the shortcomings related to the applied definition of users versus non-users and the more specific approach used to measure distance. Hence, the results should probably not be extended to different contexts.

In relation to the aggregation of WTP estimates, the findings of the study suggests that even though there are differences in the preferences held by non-users and users in relation to distance decay, then it has little or no impact on the results whether or not these differences are explicitly accounted for in the estimation and aggregation of WTP to obtain Total Economic Value (TEV) estimates, e.g. for use in Cost Benefit Analyses.

In terms of ordering effect, the results show, that some respondents are indeed sensitive to the ordering of WTP questions, and more specifically that users display significant ordering effects, whereas non-users do not. This is not in line with out prior expectations, and this finding should probably not be accepted at its face value. However, it may nevertheless be taken as an indication that the relative susceptibility of non-users to ordering bias – and perhaps other biases as well – may not be as pronounced as often suggested.

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