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Improving Water Quality in England and Wales: Local Endowments and Willingness to Pay

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ABSTRACT: The Water Framework Directive (WFD) is a far-reaching piece of European Community legislation. Estimates of the benefits of WFD Programs are needed at the present time for two reasons. First, the WFD itself allows for derogations from the general requirement of member states to reach good ecological status in all water bodies by 2015 in cases where the costs of doing so can be shown to be disproportionate. This paper presents a contingent valuation survey for the valuation and desirability of improvements regarding the WFD in England and Wales. According to our behavioral models, positive welfare changes constitute a sound argument in favor of the development of programs developed to increase the water quality. Moreover, the paper tests how the 'departure' endowments influence the willingness to pay for water quality improvements. In this sense, scope test and diminishing marginal value hypothesis are examined. The average willingness to pay appears to be insensitive to the water improvement intensity and a scope bias could be affecting our results. Nevertheless, it is shown a marginal decreasing value for water quality improvements and that the environmental program leads to different wellbeing intensity attending to local endowments.

Key words: Contingent valuation, Dichotomous choice, Diminishing marginal value, Payment card, Scope test

INTRODUCTION

The Water Framework Directive (WFD) is a far-reaching piece of European Community legislation. It covers lakes, rivers, transitional and coastal waters, artificial and heavily modified water bodies, and groundwater. Its first requirement is for member states to protect all water bodies from ecological deterioration. It then requires member states to specify Programs of Measures to improve the ecological status levels of its water bodies over time-limited periods. Measures to improve the status levels of water bodies will potentially be broad ranging, from command and control-type standard setting, to economic instruments and information schemes. Estimates of the benefits of WFD Programs of Measures are needed at the present time for two reasons. First, the WFD itself allows for derogations from the general requirement of member states to reach good ecological status in all water bodies by 2015 in cases where the costs of doing so can be shown to be disproportionate. In such cases, the WFD allows for a longer time frame to achieve good ecological status or for a less stringent environmental objective to be met. In this sense, Stated Preference (SP) methods can be useful to establish a figure for the potential non-market benefit of the WFD impacts as a whole nationally to use in the Regulatory Impact Assessments.

The Contingent Valuation Method (CVM) was broadly applied to the study of water resources. For example, it has been applied to estimate option prices for improved recreation resulting from enhanced river water quality (Desvousges *et al.*, 1987), the economic value for improving the water quality of the rivers and sea (Choe *et al.*, 1996), analyze preferences and willingness-to-pay for volunteer water quality

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monitoring programs (Spencer *et al.*, 1998), marine water quality improvements (Machado and Mourato, 2002), health benefits from safe water and costs of provision of safe supplies (Dasgupta and Dasgupta, 2004), homeowners' preferences for water leasing to maintain stable lake levels at an irrigation reservoir in a residential neighborhood (Loomis *et al.*, 2005), willingness to pay for water service quality (Soto Montes de Oca and Bateman, 2006), , valuation of benefits of urban river water quality (Bateman *et al.*, 2006), economic benefits associated with public investments in wastewater treatments (Bederli Tümay and Brouwer, 2007), valuation of projects for the preservation of water resources (Beluzzo, 2010), accounting for household perceptions before local municipalities rehabilitate existing water infrastructures (Bilgic, 2010), environmental costs of groundwater (Martínez-Paz and Perni, 2011), and others.

This paper presents an analysis of preferences for programs improving the water quality in England and Wales. It is organized as follows. In the next section we give a brief description of the study area. Section 3 presents the contingent valuation method and the valuation scenarios for the empirical analysis. Section 4 presents the results and the willingness to pay estimates using two differentiated elicitation formats: a payment card and a dichotomous choice. The relationship between the local endowments and the willingness to pay estimates is also discussed. Finally, the last section is devoted to main conclusions.

MATERIAL & METHODS

In Contingent Valuation Method (Mitchell and Carson, 1989), the individuals may choose between the current situation, z_0, which would be the situation that would certainly occur in the absence of any intervention; and the change situation (option z_1), an environmental improvement (or deterioration) in exchange for a determined economic cost (or benefit) for individuals. In order to elicit how much having (or avoiding) the change is worth to the individuals, a broad set of elicitation formats has been proposed from the theoretical grounds (Bateman *et al.*, 2002; Champ and Bishop, 2006). In this paper two elicitation formats are used: the payment card (PCCV) and the dichotomous choice format (DCCV).

Following Arrow et al. (1993) recommendations, the CV questionnaire begins with an introductory section, which includes questions on the respondent's use of the water environment. The next section introduces the valuation scenario. It presents the status descriptions and describes the potential benefits of the WFD. The next section introduces the valuation tasks, elicits CV values and asks follow-up questions. The final section asks demographic questions. After the interview is finished, there are a number of debriefing questions for the interviewer to complete. The introduction to the valuation questions sets out the context carefully, mentioning among other things: that under the WFD no site will deteriorate; a base payment may be needed to achieve this; there is no change to access or litter resulting from the WFD; that water bills and household expenses may increase in future for reasons not related to the water environment; that household income may change in future.

In all cases the baseline scenario is for environmental quality to remain as in 2007. For each respondent, the PCCV and DCCV scenarios are identical in terms of environmental improvements offered. For both elicitation questions, a respondent received either a "75% high quality in 8 years" scenario, or a "95% high quality in 8 years" scenario. An equal proportion of the sample received each of these two scenarios and, for each improvement scenario, the proportion of the water environment at high quality to be obtained in 20 years time is 95%. The national-level environmental improvements are the same for all respondents in the sample, except that half are offered the 95% scenario and half are offered the 75% scenario. The local improvements offered vary across respondents according to the current status of their local area, as well as by whether they are offered the 95% or the 75% scenario. The split sample approach (95% and 75%) with respect to environmental improvement scenario offered has sufficient randomised variation to check whether respondents are sensitive to scope. We view this as a test on the validity of the instrument, in line with recommendations by e.g. Arrow et al. (1993), rather than as a precise way of valuing marginal changes in environmental quality.

Finally, the target population for the CVM survey is the set of households in England and Wales. Households were adopted over individuals as the target population due to the fact that budgetary consumption decisions are often made at a household level rather than an individual level and so aggregating individual's decisions could lead to double counting. Also, water and wastewater bills are paid at household level rather than individual level.

RESULTS & DISCUSSION

This section reports the main results from the econometric analysis of the PCCV and DCCV WTP response data. The econometric analysis was conducted as follows: first, we began with a combination of explanatory variables selected from the descriptive results, by picking the seemingly most important variables, and estimated two models using Ordinary Least Squares (OLS) regressions. The first regression was run with *WTP* as the dependent variable; the second with *ln_WTP* as the dependent variable, where *ln_WTP* is the natural log of (1+*WTP*). The choice of log(1+*WTP*) as the dependent variable, rather than log(*WTP*), was due to the fact that there were many zero WTP responses in the sample and log(0) is undefined. Estimation results using log(1+*WTP*) as the dependent variable are interpreted in the same way as those using log(*WTP*), but there are many more observations available for estimation under the adopted approach. Our findings from this analysis showed that the model with *ln_WTP* as the dependent variable fit the data substantially better than the model with WTP as the dependent variable. Subsequent analysis therefore focused on models with *ln_WTP* as the dependent variable. In regard to the explanatory variables, we checked a range of models using OLS for eight explanatory variable groups (Table 1), holding the functional form of all the seven other groups constant.

Table 2 presents the regression models for the PCCV WTP responses for the 75% and 95% high quality scenarios. This allows an examination of the scope sensitivity of our main PCCV results. In the 75% model, *ln_inc*, *income_miss*, *children*, *use*, *pol_control*, *sex*, *int_sex* and *edu_35* enter with coefficients that are statistically significantly different from zero at the 10% level. In the 95% model, only *ln_inc*, *income_miss*, *pol_control*, *edu_35* and *understood* enter with coefficients that are statistically significantly different from zero at the 10% level. The goodness-of-fit for the 75% model is higher than the 95% model (20% vs.15%). The mean PCCV WTP value is about £55 per household per year in both scenarios (75% and 95% high quality in 8 years); and the median PCCV WTP value is £50 and £40 per household per year for the 75% and 95% scenarios respectively. The lower quartile (25^{th} percentile) amount is £20/hh/yr for both scenarios and the upper quartile amount (75^{th} percentile) is £80 and £100 per household per year for the 75% and 95% scenarios respectively. Fig. 1 plots the reverse cumulative distribution of PCCV WTP amounts. The plotted curve is interpreted as showing the proportion of respondents in the analysis sample, stating willing to pay amounts up to and including the amount on the horizontal axis, measured in pounds per household per year. For example, the chart show that 98% and 92% (75% and 95% scenarios respectively) of the sample are willing to pay up to £10 per household per year, and 38% and 23% (75% and 95% scenarios respectively) of the sample are willing to pay up to £100 per household per year.

The lower differences of the WTP for the 75% and 95% scenarios could appoint that PCCV application suffers a scope bias. The reverse cumulative distribution show that 95% scenario respondents have less probability to willingness to pay higher amounts that those that were in the 75% scenario. In Section 5 we discuss if the local endowments could influence those WTP estimates.For the DCCV analysis, the first summary statistics we derive are the proportions of respondents accepting the offered DCCV improvement scenario by the cost amount presented in the scenario. We then derive lower bounds of mean DCCV WTP using the Turnbull non-parametric method. This method involves imposing a monotonicity restriction and then calculating a lower bound on WTP by assuming that the share willing to pay a given amount is the share of the sample that accepted that amount if/when it was offered to them in the DC scenario. Fig. 2 illustrates the calculation of the Turnbull lower bound estimate.

In this figure, the demand for the environmental improvements presented to respondents in the CV scenario is represented as a monotonically decreasing function with respect to the price of the improvements, i.e. a downward sloping line. The area underneath this function is equal to the total willingness to pay of the population for the improvements. This function is unknown. Only the proportions of the sample that accept each of the six bill amounts included in the experimental design are known to the analyst. The Turnbull lower bound estimator of the mean WTP for the population proceeds by summing the shaded area in the figure. So, in this figure, the estimate is equal to:

$$(1/N) \times [n_4 t_4 + (n_3 - n_4) \times t_3 + (n_2 - n_3) \times t_2 + (n_1 - n_2) \times t_1]$$

The advantage of the Turnbull analysis is that it does not impose any restrictions on the distribution of preferences in the sample. However, it is relatively weak, in comparison with parametric regression methods, in identifying the effects of multiple explanatory variables on DCCV WTP.

To contribute to an assessment of the validity of DCCV responses, we first examined some descriptive cross-tabulations of Turnbull lower bound mean DCCV WTP. We then estimated numbers of logit models to investigate the determinants of DCCV choices. The logit analysis is complementary to the Turnbull analysis, in that it is efficient at estimating multivariate influences on DCCV WTP, but at the cost of imposing restrictions on the distribution of preferences in the sample, e.g. that the mean is equal to the median WTP. The logit analysis of DCCV responses was conducted

Table 1. Explanatory variables

	Group	Survival variables: Method	Survival variables: Variable	Description	Mean(s.e.): 75% scenario	Mean(s.e.): 95% scenario
1	Environmental changes (level of high quality / low quality, at the national and local level)	PCCV	*ln_delta_hl*	ln(1+*delta_hl*), where *delta_hl*=variation in the high quality level, local area	0.506(0.044)	0.616(0.042)
		DCCV	-	-	-	-
2	Affordability (income, adjusted for household composition, benefits, etc)	PCCV	*ln_inc*	ln(1+*income*), where *income* = 0 if missing	4.502 (2.699)	4.178(2.763)
			children	= 1 if household contains children	0.274(0.446)	0.285(0.452)
		DCCV	*ln_inc*	ln(1+*income*), where *income* = 0 if missing	4.502(2.699)	4.178(2.763)
			income_miss	= 1 if income not reported, 0 otherwise	0.248(0.432)	0.287(0.453)
3	Use of the environment (contact activities, fishing, etc)	PCCV	*use*	= 1 if contact, fishing or other act	0.841(0.366)	0.861(0.347)
		DCCV	-	-	-	-
4	Attitudes towards the environment (opinion on pollution control, membership to an environmental club, spending priorities, reactions to the maps, most important WFD benefit, etc)	PCCV	*pol_control*	= 1 if wishing to continue improvements for pollution control	0.863(0.344)	0.851(0.357)
		DCCV	*pol_control*	= 1 if wishing to continue improvements for pollution control	0.863(0.344)	0.851(0.357)
			club	= 1 if member of a water related club	0.270(0.444)	0.265(0.442)
5	Other demographics, e.g. sex, age, education, SEC	PCCV	*sex*	= 1 if respondent is a male	0.532(0.499)	0.606(0.489)
			edu_12	= 1 if level of education between primary and O levels	0.383(0.487)	0.404(0.491)
			edu_35	= 1 if level of education above A levels	0.425(0.495)	0.384(0.487)
		DCCV	*sex*	= 1 if respondent is a male	0.532(0.499)	0.606(0.489)
			edu_35	= 1 if level of education above A levels	0.425(0.495)	0.384(0.487)
6	Geography - RBD, country, urban/rural	PCCV	*wales*	= 1 if country is Wales	0.075(0.264)	0.096(0.294)
		DCCV	*wales*	= 1 if country is Wales	0.075(0.264)	0.096(0.294)
7	Survey instrument and interview features: ordering of the questionnaire, water body type example, interviewer gender	PCCV	*int_sex*	= 1 if interviewer is female	0.728(0.445)	0.751(0.433)
		DCCV	*dc_bill*	Cost presented to each respondent for the DCCV scenarios. It was drawn randomly from the range {£5,£10,£20,£30,£50,£100,£200}	53.05(0.609)	53.88(0.632)
			int_sex	= 1 if interviewer is female	0.728(0.445)	0.751(0.433)
8	Comprehension of questionnaire: e.g. understanding, concentration, fatigue	PCCV	*understood*	= 1 if respondent understood "completely" or "a great deal"	0.875(0.331)	0.851(0.357)
		DCCV	*concentration*	= 1 if respondent maintained concentration throughout	0.869(0.338)	0.857(0.351)

Table 2. PCCV Regression Model

Variable	75% high quality in 8 years Coeff. (s.e.)	95% high quality in 8 years Coeff. (s.e.)
ln_delta_hl	2.011	-0.320
	(1.534)	(1.625)
ln_inc	0.403	0.234
	(0.082)***	(0.080)***
income_miss	2.284	1.205
	(0.501)***	(0.479)**
Children	0.224	0.100
	(0.132)*	(0.129)
Use	0.283	0.152
	(0.164)*	(0.168)
pol_control	0.681	0.608
	(0.170)***	(0.161)***
sex	-0.367	-0.125
	(0.116)***	(0.116)
int_sex	-0.308	-0.179
	(0.133)**	(0.133)
edu_12	0.239	0.166
	(0.172)	(0.161)
edu_35	0.566	0.579
	(0.177)***	(0.175)***
wales	-0.109	0.191
	(0.251)	(0.223)
understood	0.217	0.497
	(0.183)	(0.172)***
constant	-0.980	1.105
	(0.896)	(1.096)
Observations	504	502
Adjusted R^2	0.2037	0.1552
Mean WTP (£/hh/yr)	**55.73**	**56.34**
Median WTP (£/hh/yr)	**50**	**40**

Dependent variable = ln_WTP; t-test p-values (two-sided): $p < 0.10$, ** $p < 0.05$ *** $p < 0.01$*

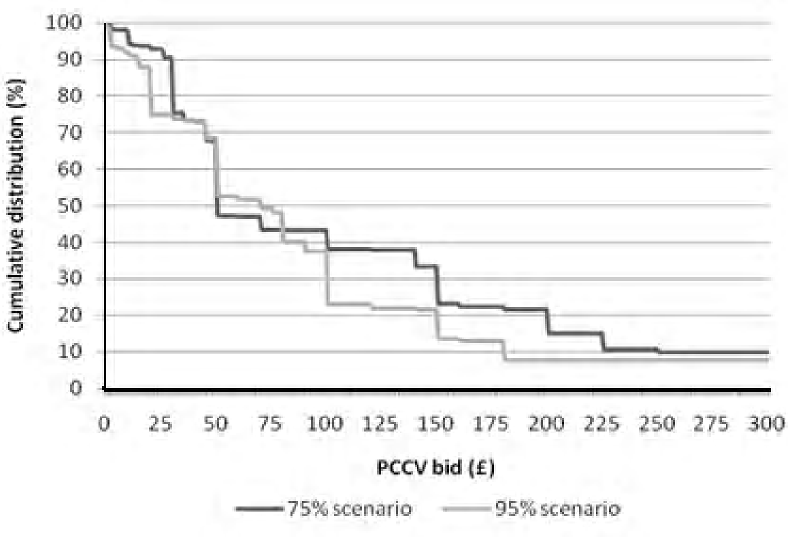

Fig. 1. Reverse cumulative distribution of PCCV WTP

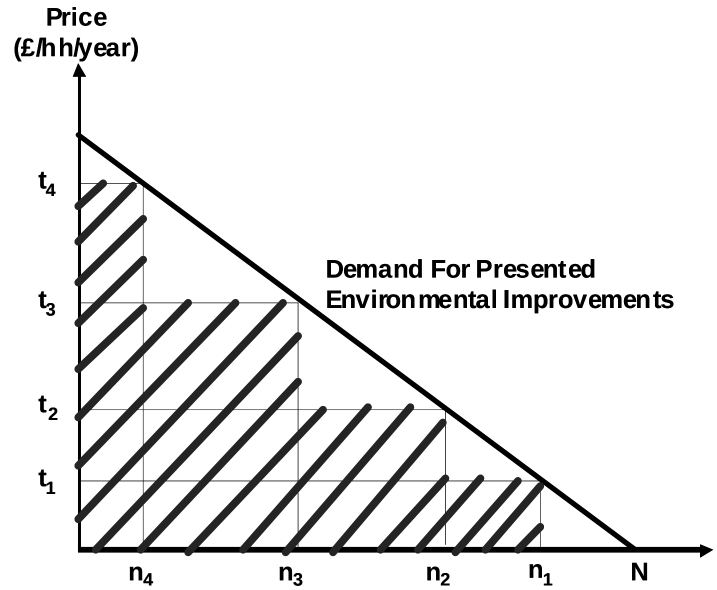

Fig. 2. Illustration of Turnbull Estimator for the Lower Bound on Mean DCCV WTP

in a similar manner to the PCCV analysis. For each of eight variable groups (Table 1), holding the functional form of all the seven other groups constant, we checked a range of plausible logit models to identify the most appropriate functional form. A summary of the findings from this analysis, including a table showing our final DCCV model for aggregation to the population, is reported below.Table 3 shows the proportion of respondents accepting the DCCV improvement scenario by the cost amount presented in the scenario. The cost presented to each respondent for the DCCV scenarios was drawn randomly from the range {£5,£10,£20,£30,£50,£100,£200}, stated to be an annual increment to "water bills and other household payments." This range was derived by open questions in focus groups about the extent of WTP, and adjusted after the pilot to reflect the PCCV pilot answers.

The proportion of respondents accepting the DCCV improvement scenario generally diminishes with the cost of the scenario, as expected. The single exception to monotonic diminishment is the fact that the DCCV acceptance proportion is higher at an offered cost of £10 than an offered cost of £5. A likely explanation for this finding is that the price of £5 might be considered unrealistic.

In order to calculate WTP from the DCCV results, we first use the Turnbull non-parametric approach, following which we estimate logit models to parameterise the distribution and thereby allow for more power to test the effects of covariates in a multivariate context. Table 4 presents the calculation of the Turnbull estimate of the lower bound of mean WTP. In this table, the responses to the £10 case have

Table 3. Proportion of Respondents Accepting DCCV Improvement Scenario

DCCV Cost Amount (£/hh/yr)	75% high quality in 8 years (%)	95% high quality in 8 years (%)
5	90.91	85.11
10	93.67	93.42
20	85.00	74.68
30	66.67	71.43
50	58.11	59.02
100	39.68	36.92
200	6.78	7.81
Sample Size	504	502

Table 4. Turnbull Estimates of Lower Bound Mean DCCV WTP

Sample	DCCV Cost Amount (£/hh/yr)	No. Observations	Accept (%)	Change in Reject Proportion (%)	WTP (£/hh/yr)
	t			*f*(t)*	*t* x f*(t)*
75% high quality in 8 years	5	156	92.31	7.31	0.37
	20	80	85.00	18.33	3.67
	30	72	66.67	8.56	2.57
	50	74	58.11	18.43	9.21
	100	63	39.68	32.90	32.90
	200	59	6.78	6.78	13.56
	Turnbull Lower Bound Estimate of Mean WTP (£/hh/yr)				**62.27**
	Standard error of the estimator				**4.71**
95% high quality in 8 years	5	170	88.82	14.14	0.71
	20	79	74.68	3.25	0.65
	30	63	71.43	12.41	3.72
	50	61	59.02	22.09	11.05
	100	65	36.92	29.11	29.11
	200	64	7.81	7.81	15.63
	Turnbull Lower Bound Estimate of Mean WTP (£/hh/yr)				**60.86**
	Standard error of the estimator				**4.76**

been grouped with the responses to the £5 case in order to achieve monotonicity. The lower bound of £5 is used as the bill amount for this group in order to preserve the status of the estimator as a lower bound. The column entitled "Change in Reject Proportion (%)" captures the width of the blocks (n_i - n_{i+1}). These amounts are multiplied by the DCCV cost amount associated with the bid to calculate the area under that part of the demand curve. The sum of these values is the Turnbull estimate of lower bound mean DCCV WTP. The Turnbull estimator is known to be distributed normally due to the central limit theorem. The standard error of the estimator is equal to:

$$\sqrt{\left(\sum_{j=1}^{6}\frac{F_j^*\left(1-F_j^*\right)}{T_j^*}\left(t_j-t_{j-1}\right)^2\right)}$$

where j indexes the bid amounts, F_j is the proportion rejecting the CV scenario at the j^{th} bid amount (t_j), and T_j is the total number of responses in the sample offered that bid amount. This calculation results in a value of £4.71 / £4.76 (75% / 95% scenarios) for the standard error of the Turnbull lower bound estimate. The Turnbull estimate £62.27 / £60.86 (75% / 95% scenarios) per household per year as a lower bound of the mean DCCV WTP is slightly higher than the mean PCCV WTP estimates (£55.73 and £56.34 respectively). The two elicitation approaches are therefore yielding similar values for the benefits of WFD improvements.

Finally, Table 5 presents our final adopted model from the DCCV responses. Once again, the DCCV results produce a higher willingness to pay value than was found from the PCCV estimate of the same benefits. This reflects the respondents' different answers to the PCCV and DCCV format questions, readily observable in the high proportion of 'yes' responses to the largest bid (£200) presented in the DCCV questions. The unknown high tail of DCCV valuations presents a problem for reliance on models assuming continuity in this range.

Despite its simplicity, a simple model (using only two explanatory variables: *dc_bill* and *constant*), adjusts reliably to the expected WTP and is "compatible with incentives" (Creel, 1998; Soliño *et al.,* 2009). The results from the simple model appoint to a scope test failure. In fact, it is shown a higher WTP for the 75% scenario than the obtained for the 95% scenario. In addition to considering the initial price, it is common to expand this model introducing additional variables to explain the probability of acceptance or rejection. These explanatory variables were described in Table 1. Similar to the simple model,

Table 5. DCCV Logit Model

Model	Variable	*75% high quality in 8 years* Coeff. (s.e.)	*95% high quality in 8 years* Coeff. (s.e.)
Simple model	*dc_bill*(1)	-2.565	-2.317
		(0.268)***	(0.242)***
	constant	2.026	1.802
		(0.169)***	(0.157)***
	Observations	504	502
	pseudo-R^2	0.2679	0.2476
	Mean WTP (£/hh/yr)	**79.01**	**77.77**
Expanded model	*dc_bill*(1)	-3.078	-2.625
		(0.326)***	(0.275)***
	ln_inc	0.761	0.626
		(0.190)***	(0.187)***
	income_miss	4.227	2.973
		(1.123)***	(1.075)***
	pol_control	0.909	0.751
		(0.353)**	(0.320)**
	club	0.414	0.512
		(0.326)	(0.319)
	edu_35	0.773	0.789
		(0.295)***	(0.302)***
	concentration	0.408	0.402
		(0.350)	(0.326)
	int_sex	-0.710	0.008
		(0.308)**	(0.285)
	sex	-0.651	-0.423
		(0.261)**	(0.257)*
	wales	-0.163	-0.169
		(0.477)	(0.419)
	constant	-2.730	-2.512
		(1.066)**	(1.133)**
	Observations	504	502
	pseudo-R^2	0.3887	0.3483
	Mean WTP (£/hh/yr)	**76.99**	**78.32**

Dependent variable = dc_choice (=1 if individual says yes to dc_bill; 0 elsewhere)

t-test p-values (two-sided):* $p < 0.10$, ** $p < 0.05$ *** $p < 0.01$

(1) dc_bill was divided by 100 for inclusion in this model.

results from the expanded model appear to be insensitive to scope. Households are willingness to pay 78 £/yr for the 95% improvement whereas they are willingness to pay 77 £/yr for the 75% scenario.

Carson and Mitchell (1993) affirm that well conducted CV leads to sensitivity to scope. Nevertheless, a large number of CV studies do not pass the scope test. Many causes (warm glow effect, ethical beliefs, uniqueness of the non-marketed goods and services, information, etc.) have been explored in order to understand scope test failures (Ojea and Loureiro, 2009 and 2011). But scope tests may also fail due to diminishing marginal utility effects (Rollins and Lyke, 1998; Lew and Wallmo, 2010). In money-based treatments, Horowitz et al. (2007) found evidence on a decrease in the value as the endowment of the goods increased. Results obtained in previous sections show that the mean WTP is similar for both scenarios (and the median is upper for the lower improvement, i.e., the 75% scenario) in PCCV and DCCV. Moreover, the variation in the high quality level locally (*ln_delta_hl*) was not significant in PCCV (Table 1). These results could appoint to a scope bias, i.e. both scenarios were equally relevant for the interviewed individuals. Nevertheless, our results would also constitute evidence of the assumption of diminishing marginal value (DMV), i.e., that having more of an environmental good will lead an individual to place a lower value on an additional unit of that good.

In this sense, we examine the role of the local endowments (the reference of the marginal utility for the proposed changes) on the ability of respondents to pass the scope test or as evidence of DMV for water quality. These local endowments are measured as the proportion of high quality water in a delimited area. The initial high quality locally for the respondents is similar for the 75% and 95% samples (Fig. 3). More than 50% of the sample shows an initial high quality lower than 10% in both scenarios.

Therefore, the status quo of the interviewees may be very relevant to differentiate between scope bias and DMV of water quality. In our case, it seems that the local endowments may be influencing the WTP estimates. In this sense, the 75% scenario is associated to a lower WTP for relative high levels of water quality (more than 5% in DCCV and more than 10% in PCCV), whereas for lower initial local endowments WTP is higher for the 75% scenario. In definitively, we show that an environmental program could lead to different wellbeing intensity attending to local endowments. Therefore, results argue in favor of modeling the effect of territorial characteristics or local endowments on individuals' preferences.

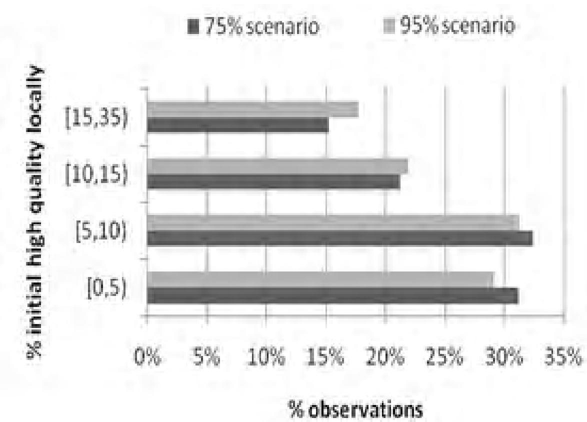

Fig. 3. Initially Local Water Quality Levels

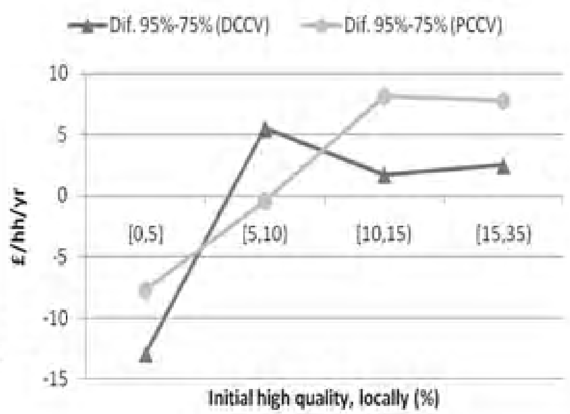

Fig. 4. Differences on scenarios' WTP attending to local endowments

CONCLUSION

The Water Framework Directive is a piece of European Community legislation that sets objectives for member states to avoid further deterioration and to improve the ecological status on inland and coastal water bodies. Measures to improve the water bodies status will potentially be broad, ranging from command and control-type standard setting to economic instruments and information schemes. In England and Wales, the benefits of WFD improvements were estimated through the design and implementation of a contingent valuation survey, calculating the gains in welfare derived from the achievement of good ecological status. For that purpose, two elicitation questions were proposed: payment card and dichotomous question. For both elicitation questions, a respondent received either a "75% high quality in 8 years" scenario, or a "95% high quality in 8 years" scenario. The Turnbull estimate £62.27 / £60.86 (75% / 95% scenarios) per household per year as a lower bound of the mean WTP dichotomous question is slightly higher than the mean WTP estimates (£55.73 and £56.34 respectively) from the payment card. Thus, the two elicitation approaches are yielding similar values for the benefits of WFD improvements. Complementary to the Turnbull analysis, logit models were estimated to investigate the determinants of dichotomous responses. Results from an expanded logit model show that households are willingness to pay 78 £/yr for the 95% improvement whereas they are willingness to pay 77 £/yr for the 75% scenario. In all cases, the average willingness to pay appears to be insensitive to scope. The mean WTP is similar for both improvement scenarios (75% and 95%), appointing to the presence of a scope bias. Nevertheless, our results also suggest that having more of an environmental good will lead an individual to place a lower value on an additional unit of that good, i.e. people states a diminishing marginal value to water quality improvements. In this sense, individuals with "rich" initial local endowments (initial high quality higher than 10%) are more willingness to pay for the 95% scenario, whereas willingness to pay for those individuals with "poor" initial local endowments (initial high quality between 0% and 10%) is higher for the 75% scenario. In summary, the environmental program leads to different wellbeing intensity attending to local endowments and scope bias could be not affecting our results, but more research is necessary to understand the underpinnings of water quality preferences.

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