Collaborative Research Programme

On River Basin Management Planning Economics

Report on The Benefits of Water Framework Directive Programmes of Measures in England & Wales APPENDICES M - O

Nera & Accent

25 October 2007

JEP

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The Benefits of Water Framework Directive Programmes of Measures in England & Wales

APPENDICES M - O

A Final Report to DEFRA re CRP Project 4b/c

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Appendix M. Supplementary Analyses Tables

M.1. Payment Card Contingent Valuation Supplementary Tables

This section presents supplementary analysis of the PC CV responses. It includes tables showing sample mean and median PC CV willingness-to-pay responses by a range of variables in the dataset and a summary of the results from supplementary econometric analyses.

M.1.1. Descriptive Analysis of PC CV WTP Amounts

M.1.1.1. Sensitivity of PC CV WTP to Sample Formation

Table M.1 presents descriptive statistics on the WTP distribution for the four samples defined in the main report to examine the influence of alternative exclusion approaches.

Table M.1
Comparison of Summary Statistics on PC CV WTP Across Analysis Samples

Sample Name	N	Payment Card CV Willingness To Pay Statistics (£/hh/yr)						
		mean	sd	min	p25	p50	p75	max
pref	1389	49.50	52.99	0	15	30	60	300
trim1	1462	51.50	64.93	0	10	30	60	500
trim3	1299	48.68	45.96	0	20	30	60	200

Source: NERA

Table M.1 shows that the PC CV WTP mean is around £50 and the median is £30 for each sample.

M.1.1.2. Sensitivity of Payment Card CV WTP to Disposable Income Determinants

Table M.2 presents PC CV WTP amounts by income group.

Table M.2
Payment Card CV WTP by Total Weekly Household Income

Total Weekly Household Income	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Low (<£300)	38.6	20	419
Medium	58.6	50	463
High (>£1,000)	72.3	50	127
Missing Income Data	42.7	25.5	380

Source: NERA

As expected, payment card CV WTP increases with total weekly household income.

Table M.3
Payment Card CV WTP by Household Composition

Household Composition	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Adults without children			
One adult	46.7	25.0	365
Two adults	48.0	30.0	498
Three or more	53.5	40.0	150
Adults with children			
One adult			
One child	38.9	20.0	38
Two children	33.2	20.0	22
Three or more	62.0	20.0	9
Two adults			
One child	52.2	45.0	107
Two children	60.1	40.0	84
Three or more	40.7	40.0	41
Three or more adults			
One child	68.7	50.0	45
Two children	39.9	27.5	16
Three or more	72.7	30.0	11
N			1,386

Source: NERA

Table M.4
Payment Card CV WTP by Presence of Children in Household

Children	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Households without children	48.4	30	1013
Households with children	52.5	30	376

Source: NERA

Table M.5
Payment Card CV WTP for Single Parents and Others

Single Parents	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
No	50.0	30	1320
Yes	40.1	20	69

Source: NERA

Payment card CV WTP is approximately equal for those with children as for those without children on average in the sample. Single parent households have a lower amount than others, but the sample sizes are quite small for this group.

Table M.6
Payment Card CV WTP by Receipt of State Financial Support

Any Member of Household Receiving State Financial Support?	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
No	57.4	50	547
Yes	44.4	25	842

Source: NERA

Households receiving state financial support of some kind have s significantly lower payment card CV WTP on average, in comparison with all other households.

Table M.7
Payment Card CV WTP by Respondent's Employment Status
(Full Version)

Employment Status	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Working full-time (31+ hours)	58.2	45	442
Working part-time (1-30 hours)	47.9	30	205
Self employed	61.3	50	60
Working and full time student	65.8	35	12
Not working - seeking work	36.9	25	63
Not working - full time student	71.4	55	14
Not working - retired	44.5	25	387
Not working - looking after home/children	43.7	30	90
Not working - permanently sick/disabled	37.7	20	64
Not working - other	36.9	20	50
Don't know	5.0	5	1
Refused	0.0	0	1

Source: NERA

Table M.8
Payment Card CV WTP by Respondent's Employment Status
(Abbreviated Version)

Employment Status	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Working	55.5	40.0	707
Not working	42.4	25.0	654
Students	68.8	45.0	26
Other	2.5	2.5	2

Source: NERA

As expected, respondents that are working have a higher payment card CV WTP on average than those that are not working. Students have a higher still payment card CV WTP on average, but the sample size is small for this group.

Table M.9
Payment Card CV WTP by Respondent's Socio Economic Classification

Socio Economic Class	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Large Emp - Manag.	44.9	30.0	22
Higher professional occup.	63.1	50.0	128
Lower manag.	64.2	50.0	245
Intermediate occup.	53.8	37.5	170
Small employers - own account	47.6	37.5	90
Low supervisory / technical	46.5	30.0	138
Semi-routine	43.9	30.0	122
Routine occup.	43.9	25.0	200
Never worked / LT unemp.	32.1	20.0	129
Not classified	40.3	20.0	145

Source: NERA

The higher socio-economic classes tend to have higher payment card CV WTP amounts on average.

M.1.1.3. Sensitivity of CV WTP to Use of the Water Environment

Table M.10
Payment Card CV WTP by Household's Use of the Water Environment

Any Household use	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Contact activities			
Non user	42.6	25	772
User	58.2	50	617
Fishing			
Non user	48.2	30	1160
User	56.2	35	229
Other activities			
Non user	39.4	20	264
User	51.9	30	1125
Any use (Contact, fishing or other)			
Non user	36.3	20	215
User	51.9	30	1,174

Source: NERA

As expected, users of the water environment, whether for contact activities, fishing, or other activities, all tend to have a higher payment card CV WTP on average than non-users.

M.1.1.4. Sensitivity of Payment Card CV WTP to Environmental Attitudes

Table M.11 to Table M.13 present descriptive results on PC CV WTP by the environmental attitude measures from the survey questionnaire.

Table M.11
Payment Card CV WTP by Membership to an Environmental Organisation

Anyone in Household Member of an Environmental Organisation?	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
No	44.7	26	1,015
Yes	62.5	50	374

Source: NERA

Table M.12
Payment Card CV WTP by Opinion on National Spending on Water Pollution Control

	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Continue improvements regardless of cost	53.1	35	641
Continue improvements if not excessive cost	50.0	30	547
Already paying the right amount	33.4	20	95
Concentrate on holding down costs	47.6	20	59
Already paying too much	28.7	20	41
Don't Know	32.5	30	6

Source: NERA

Table M.13
Payment Card CV WTP by Opinion on Water Company Spending on Pollution Control

	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Too much	16.8	20	25
About right	47.1	30	455
Too little	52.5	30	732
Don't Know	47.9	30	177

Source: NERA

Environmental attitudes appear to work well as predictors of payment card CV WTP for all question types. Those that are members of environmental organisations, consider that environmental improvements should continue regardless of cost or if the cost is not excessive, or, believe that water company spending on pollution control is too little, have higher WTP on average than other respondents.

M.1.1.5. Variation in Payment Card CV WTP Amounts by Geographic Area

Table M.14
Payment Card CV WTP by RBD

RBD	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Anglian	55.8	50	100
Dee	61.3	30	69
Humber	38.1	25	286
North West	46.1	30	143
Northumbria	56.8	30	50
Severn	62.7	50	136
Solway Tweed	45.6	20	54
South East	45.9	30	75
South West	58.6	40	59
Thames	50.8	30	363
Western Wales	42.4	25	54

Source: NERA

Respondents in the Humber RBD provided the lowest payment card CV WTP amounts on average; those in the Severn and Dee RBDs gave the highest amounts. The small sample sizes for some RBDs and the associated lack of representativeness of the population means that the numbers should be considered as indicative estimates at best.

Table M.15
Payment Card CV WTP by Country

Country	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
England	49.1	30	1,267
Wales	53.3	30	122

Source: NERA

There is little difference in the payment card CV WTP amounts given by English and Welsh residents.

Table M.16
Payment Card CV WTP by Rural / Urban Area

Rural / Urban?	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Rural	50.5	30	302
Urban	49.2	30	1,087

Source: NERA

There is little difference between urban and rural areas in respect of mean and median payment card CV WTP amounts.

M.1.1.6. Sensitivity of Payment Card CV WTP to Respondent Characteristics or Reaction to the Instrument

Table M.17
Payment Card CV WTP by Respondent's Sex

Sex	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Male	56.3	40	591
Female	44.4	25	798

Source: NERA

Males have a significantly higher mean and median payment card CV WTP than females. Given that the sample contains a larger number of females than males, this suggests that WTP estimates for the population will need to be weighted by sex.

Table M.18
Payment Card CV WTP by Respondent's Age

Age	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
18 - 29	53.0	30	199
30 - 64	50.5	30	899
65 +	43.9	25	290

Source: NERA

Older respondents have a somewhat lower mean and median payment card CV WTP than younger respondents on average in the sample.

Table M.19
Payment Card CV WTP by Respondent's Level of Education

Level of Education	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Primary	30.50	20	234
O levels, GCSE or CSE (1+ passes), NVQ Level 1 or foundation level GNVQ	45.10	25	388
5+ O, CSE grade 1's or GCSE A-C; School certificate; 1+ A or As; NVQ level 2 or intermediate GNVQ	45.40	30	177
2+ A levels; 4+ As; Higher School Certificate; NVQ Level 3; or Advanced GNVQ	59.20	50	161
First Degree, Higher degree, NVQ Level 4/5; HNC; HND; Qualified teacher status; Qualified medical doctor, dentist; nurse; midwife; health visitor	66.50	50	376
Other / Don't know	28.50	20	38
Refused	29.00	20	15

Source: NERA

Respondent's level of education has a significant effect on payment card CV WTP amounts, with the more educated giving larger values on average.

Table M.20
Payment Card CV WTP by Respondent's Understanding of the Questionnaire

	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Understood completely	54.5	40	844
Understood a great deal	45.7	30	355
Understood somewhat	33.7	20	131
Understood a little	35.1	20	36
Did not understand very much	15.5	10	11
Did not understand at all	57.1	20	7
Other	20.0	20	2
Missing	73.3	80.0	3

Source: NERA

Respondents who understood the questionnaire completely, or a great deal, gave higher values than other respondents.

Table M.21
Payment Card CV WTP by Respondent's Effort in Answering the Questionnaire

Respondent effort	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Gave questions careful consideration	53.2	35	1,031
Gave questions some consideration	38.6	20	320
Gave the question very little consideration	32.9	20	29
Other	61.7	25	6
Missing	73.3	80.0	3

Source: NERA

Respondents who gave the questionnaire careful consideration gave higher values than other respondents.

Table M.22
Payment Card CV WTP by Respondent's Level of Fatigue

	Mean WTP	Median WTP	N
Maintained concentration throughout	51.4	30	1,212
Lessened concentration in later stages	36.2	20	165
Other	32.8	20	9
Missing	73.3	80.0	3

Source: NERA

Respondents who maintained concentration throughout gave higher values than other respondents.

Table M.23
Payment Card CV WTP by Respondent's Reaction to the Local Water Environment Quality Map

Local Map vs Expected Status	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Great deal better	50.4	30.0	52
Somewhat better	57.8	32.5	142
As expected	46.8	30.0	408
Somewhat worse	49.5	30.0	428
Great deal worse	49.8	30.0	347
Don't know	28.8	22.5	12

Source: NERA

Table M.24
Payment Card CV WTP by Respondent's Reaction to the National Water Environment Quality Map

National Map vs Expected Status	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Great deal better	54.0	20.0	17
Somewhat better	41.4	30.0	93
As expected	49.0	30.0	483
Somewhat worse	50.4	30.0	490
Great deal worse	51.3	40.0	291
Don't know	48.0	30.0	15

Source: NERA

There appears to be no effect on payment card CV WTP with respect to differences between the water environment quality map and respondents expectations.

M.1.1.7. Sensitivities of CV WTP to SP Instrument Design Features

Table M.25
Payment Card CV WTP by Ordering of CE and CV Questions

Order of CE and CV Quesions	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
CE then CV	56.1	40	708
CV then CE	42.7	20	681

Source: NERA

Respondents who received the payment card CV question first gave lower payment card CV WTP values than respondents who had first answered the CE questions.

Table M.26
Payment Card CV WTP by No Deterioration Cost Amount

Cost of Maintaining Current Water Environment Quality	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
£5	49.7	30	470
£10	46.9	30	447
£20	51.8	30	472

Source: NERA

The size of the no deterioration cost amount appears to have no consistent effect on payment card CV WTP values.

Table M.27
Payment Card CV WTP by Waterbody Type Example Used

Waterbody Type Example Used	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
Lake	49.5	30.0	346
Rural river	47.8	27.5	358
Transitional / Coastal	51.2	30.0	340
Urban river	49.6	30.0	345

Source: NERA

The water body type example used in the survey show material appears to have little or no effect on payment card CV WTP values.

Table M.28 presents PC CV WTP amounts by the degree of environmental improvement contained in the scenario put to respondents.

Table M.28
Payment Card CV WTP by Environmental Improvement Scenario

Environmental Improvement Scenario	Mean WTP (£/hh/yr)	Median WTP (£/hh/yr)	Sample Size (Freq)
75% good status in 2015	48.6	30	706
95%good status in 2015	50.4	30	683

Source: NERA

Table M.28 suggests that respondents' PC CV WTP amounts are not sensitive to the amount of improvement offered to them in the PC CV scenario. However, because there several versions of the survey, and with any type of field randomization of the versions it is inevitable that one obtains different numbers of completed interviews for each version, it is necessary to look for sensitivity using a formal statistical model that incorporates the experimental design. The multivariate analysis included in this report has shown that willingness to pay responses did display the expected sensitivity to scope of environmental improvement offered.

M.1.2. Econometric Analysis of PC CV WTP Amounts

In this sub-section we report on our econometric analysis of payment card CV WTP amounts. This analysis seeks to 'explain' WTP by fitting regression models.

In building a model to explain the payment card willingness to pay, we identify eight different groups of variables which can have a significant impact on willingness to pay:

- Environmental changes (level of high quality / low quality, at the national and local level);
- Disposable income (income, adjusted for household composition);
- Use of the environment (contact activities, fishing, etc…);
- Attitudes towards the environment (opinion on pollution control, membership to an environmental club, spending priorities, reactions to the maps, most important wfd benefit…);
- Other demographics, e.g. sex, age, education, sec;
- Geography - RBD, Country, urban/rural;
- Survey instrument features: ordering of the questionnaire, water body type example;
- Comprehension of questionnaire: e.g. understanding, concentration, fatigue.

Our strategy is to first estimate a model using the variables which appear to have the most impact when looking at univariate descriptive statistics, and then test different specifications for each of the eight groups identified above.

Our first step, however, is to choose the best specification between a "linear" specification, where our dependent variable is the final *wtp*, and a "log-linear" specification, where the dependent variable is *ln(1+wtp)*.

M.1.2.1. Initial Model Specification: Linear Versus Log-Linear

Our first model explains the payment card willingness to pay (either as stated by respondents or transformed using the natural logarithm) as a function of:

- The change in the level of High Quality for the local area (delta_hl);
- Income as a continuous variable (as well as a dummy variable to capture an effect for respondents who did not answer to the income question);
- Use/non use activities (contact activities, fishing, or other activities)
- Attitude to pollution control and membership to an environmental club;
- Sex and education (primary, level 1/2, level 3/5);
- RBD;
- Order of the questionnaire (cv_first); and
- Level of understanding of the questionnaire.

To choose the best specification between a linear specification (dependent variable = final *wtp*), and a "log-linear" specification (dependent variable = *ln(1+wtp)*), we compare results from our first model, using three different sample specifications. More precisely, we look at the R^2 and at the distribution of fitted willingness to pay.

As explanatory variables are different in the linear and the log-linear model, we construct an R^2 for the log-linear model which is directly comparable to the R^2 reported in the linear specification. The calculation of a comparable R^2 is needed because the dependent variable is different for the two models. The calculation was performed as follows:

1. Regress $\ln(1+wtp)$ on different explanatory variables
2. Predict $\ln(1+wtp)$ using the model in step 1: $p\_\ln(1+wtp)$
3. Compute the residuals e_i
4. Generate the adjustment factor for the prediction of (1+wtp): $adj = \frac{1}{N}\sum \exp(e_i)$
5. Predict wtp: $p\_wtp = \exp\left(p\_\ln(1+wtp)\right)\cdot adj - 1$
6. Compute average wtp: wtp_bar
7. Compute comparable R2 = $\frac{\sum\left(p\_wtp - wtp\_bar\right)^2}{\sum\left(wtp - wtp\_bar\right)^2}$

Table M.29 below presents our first model estimated in “linear” and “log-linear form”.

Table M.29
PC CV OLS Regression Results: Initial Model – Linear and Log-Linear Specifications

	Linear Model	M1 - Log -linear - Sample: pref
delta_hl	8.400	0.232
	(12.27)	(0.31)
income_cont	0.014	0.000
	(0.00)**	(0.00)**
income_miss	1.056	0.064
	(3.33)	(0.09)
use	5.964	0.254
	(3.23)*	(0.10)**
pollution control?	9.363	0.427
	(3.42)**	(0.11)**
Member of club?	7.343	0.152
	(3.37)**	(0.07)**
sex	-10.908	-0.185
	(2.79)**	(0.07)**
edu_12	9.889	0.213
	(2.89)**	(0.10)**
edu_35	21.815	0.532
	(3.73)**	(0.10)**
rbd==Anglian	16.062	0.342
	(5.29)**	(0.14)**
rbd==Dee	18.526	0.379
	(7.19)**	(0.15)**
rbd==North West	10.174	0.210
	(4.57)**	(0.13)
rbd==Northumbria	21.729	0.290
	(10.45)**	(0.22)
rbd==Severn	19.891	0.344
	(5.50)**	(0.12)**
rbd==Solway Tweed	11.789	-0.046
	(8.62)	(0.22)
rbd==South East	-2.343	0.079
	(5.18)	(0.14)
rbd==South West	12.126	0.276
	(7.81)	(0.16)*
rbd==Thames	5.318	0.067
	(3.50)	(0.10)
rbd==Western Wales	5.297	-0.268
	(7.14)	(0.26)
cv_first	-12.959	-0.395
	(2.68)**	(0.07)**
understood	4.850	0.303
	(3.46)	(0.12)**
Constant	10.343	1.961
	(11.11)	(0.30)**
Observations	1389	1389
R^2	0.132	0.167
Comparable R^2		0.395

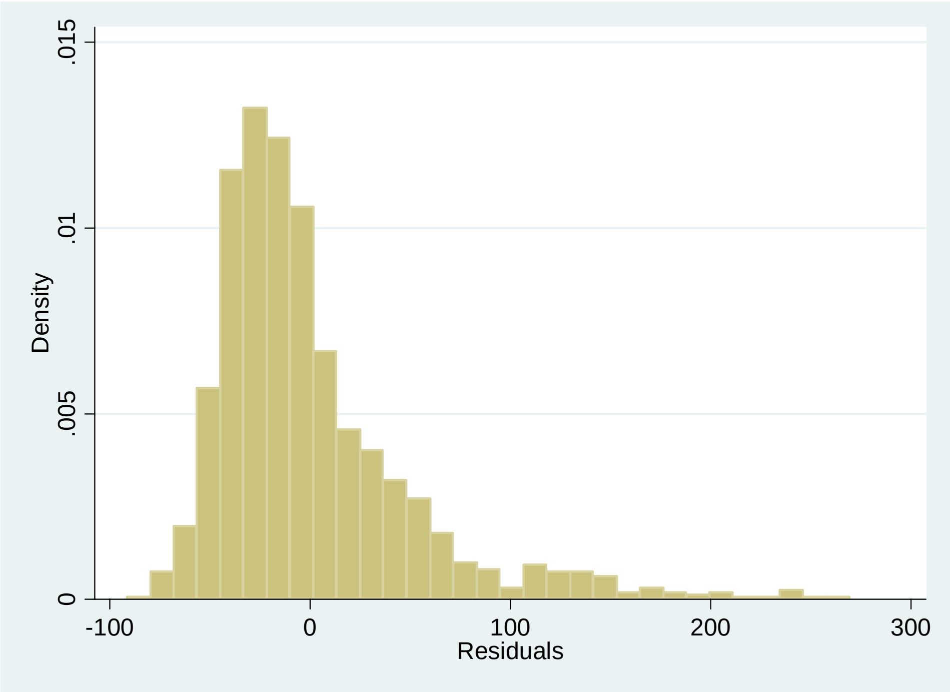
*Source: NERA; Standard errors in parentheses; * 2-sided p < 0.10, ** 2-sided p < 0.05; sample used is* pref *for both models; the dependent variable in the linear model is* wtp_final*; in the log linear model it is* ln_wtp
Note: in certain cases 1-sided p-values would be more appropriate, eg for delta_hl, given the alternative hypothesis is that the coefficient is greater than zero, rather than not equal to zero. A 1-sided p-value will be lower than a 2-sided p-value thus leading to a greater likelihood of rejecting the null hypothesis that the coefficient is equal to zero.

Table M.30
Distribution of Fitted WTP from Initial Model, and Sample WTP

Model	N	mean	sd	min	p25	p50	p75	max
Linear	1389	49.5	19.3	-0.1	36.1	48.8	62.0	116.2
Log-linear	1389	54.4	33.0	7.6	32.4	47.3	67.5	295.9
Sample WTP	1389	49.5	53.0	0	15	30	60	300

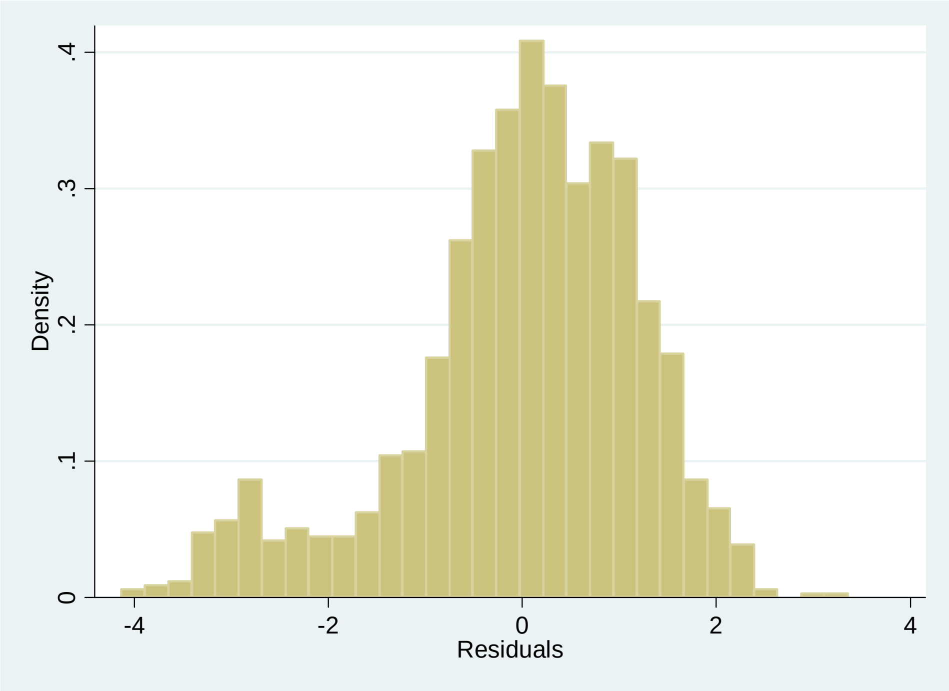
Source: NERA

Figure M.1
Distribution of Residuals from Linear Model



Source: NERA

Figure M.2
Distribution of Residuals from Log-Linear Model



Source: NERA

The log-linear specification fits the data significantly better than the linear specification as evidenced through a higher R^2 statistic. The residuals from the log-linear model depart from normality somewhat, with a cluster of residuals at the lower end of the distribution. These correspond to the large spike of responses at £0 WTP.

M.2. Sensitivity of WFD Benefits Survey Valuation Results to Inclusion / Exclusion of Respondents from the South West Water Company Area

Introduction

This note responds to a letter by Deryck Hall (CC Water) and discussions with Camilla Lundbak (DEFRA) regarding the sensitivity of WTP results from the WFD Benefits Survey to one aspect of sample selection. The hypothesis CC Water raised was that WTP results for England and Wales from the survey may have been significantly lower had the sample included residents of the South West Water Company area instead of the respondents we interviewed at the sampling points which were randomly selected for the South West RBD. Those South West RBD sampling points were all outside the region served by South West Water, which has the highest average household water and sewerage bills in England and Wales. It was agreed between Camilla Lundbak, Deryck Hall and NERA (by phone and e-mail) that the CC Water hypothesis would be explored in two ways. First we would test the sensitivity of WTP to the average water and sewerage bill in respondents' company areas for the original sample of responses, by adding the average bill for the region as a new explanatory factor and revisiting the econometric modelling to form a co-efficient for this factor. Secondly, we would compare the England and Wales mean WTP for the original sample against the England and Wales mean WTP derived by modelling with each of two amended datasets. The two amendments would be as follows: first, we would replace the WTP amounts for all South West RBD respondents with zero, and second, we would replace the WTP amounts for all South West RBD respondents with half the England and Wales mean WTP. The remainder of this note presents our findings from these sensitivity tests.

Sensitivity of WTP to Average Water and Sewerage Bill in Water Company Areas

Table M.31 below presents parameter estimates from two regression models. The first model is the adopted PCCV regression model for aggregation, estimated on the *pref* sample. This model is the same as that included in Table 10.13, p.66, of the draft final report. The second model in Table M.31 is identical except for the inclusion of an additional variable *ln_avewsbill*. This variable is the natural logarithm of the average water and sewerage bill in the respondent's water company area. Since the dependent variable in this model is *ln_wtp*, the natural logarithm of the WTP amount stated by respondents, the coefficient on *ln_avewsbill* is interpreted as the elasticity of WTP with respect to the average water and sewerage bill. Thus, it represents the percentage change in WTP for a percentage point change in the average water and sewerage bill.

Table M.31
Adopted PCCV Regression Model for Aggregation – Plus Extra Variable Measuring Average Water and Sewerage Bill in Respondent's Company Area

Variable	PCCV Regression Model	
	Original Model (in DF Report) (coef | s.e.)	Model Including Extra Variable (coef | s.e.)
ln_delta_hl	0.822	0.919
	(0.487)*	(0.489)*
ln_inc	0.260	0.262
	(0.045)***	(0.045)***
income_miss	1.400	1.415
	(0.279)***	(0.278)***
children	0.127	0.136
	(0.074)*	(0.075)*
use	0.257	0.250
	(0.103)**	(0.103)**
pol_control	0.439	0.436
	(0.112)***	(0.112)***
sex	-0.187	-0.190
	(0.069)***	(0.069)***
edu_12	0.155	0.149
	(0.101)	(0.101)
edu_35	0.500	0.493
	(0.104)***	(0.104)***
wales	0.038	-0.009
	(0.132)	(0.134)
cv_first	-0.408	-0.408
	(0.066)***	(0.066)***
understood	0.271	0.274
	(0.119)**	(0.119)**
ln_avewsbill		0.391
		(0.250)
Constant	0.531	-1.762
	(0.409)	(1.503)
Observations	1389	1389
R-squared	0.16	0.16
Comp R2	0.30	0.31

Source: NERA

*Dependent variable=*ln_wtp*; estimator used: OLS; robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1% (all for 2-sided* t *tests).*

The results above show that the coefficient on *ln_avewsbill* is 0.391. This implies that a household in Region A, with an average water and sewerage bill 100% higher than (i.e. double that of) Region B, is expected to be WTP 39.1% more than a household in Region B. For example, a household in a region with an average bill of £400 would be WTP 39.1% more for WFD improvements than a household in a region with an average bill of £200. This finding from the data runs counter to the hypothesis that higher regional water and sewerage bills are likely to lead to lower WTP amounts. The standard error on the coefficient estimate is large, however, at 0.250, which means that we would not generally regard the coefficient as statistically significantly different from zero, and so would not consider the average water and sewerage bill in the company area to be a reliable predictor of WTP for WFD improvements.

We note that household water and sewerage bills for individual households vary more within each company than the variation between companies in the average household bill. We do not have the data for the individual household water and sewerage bills for our respondents. Household bill size will vary within our random sample of respondents and will be correlated to some extent with some of our explanatory variables such as income and household size. Its influence on WTP, if any, along with the influence of other unobserved factors, will be present in our mean WTP results.

Table M.32 presents a similar set of results for the DCCV model. The first model presented in the table is the adopted DCCV logit model for aggregation, estimated on the *pref* sample. This is the same as that presented in Table 10.27, p.74, of the draft final report. The second model in Table M.32 is identical to the first except for the inclusion of an additional variable, *avewsbill*, which measures the average water and sewerage bill in the water company area. This variable, along with *dc_bill*, the cost amount for improvements presented to respondents, has been divided by 100 for ease of interpretation of the parameter estimates. This has the effect of increasing the parameter estimates by a factor of 100 but has no other effects on the model.

Table M.32
Adopted DCCV Logit Model for Aggregation – Plus Extra Variable Measuring Average Water and Sewerage Bill in Respondent's Company Area

	DCCV Logit Model	
	Original Model (in DF Report) (coef | s.e.)	**Model Including Extra Variable (coef | s.e.)**
dc_bill	-1.238	-1.239
	(0.101)***	(0.101)***
ln_inc	0.398	0.398
	(0.093)***	(0.093)***
income_miss	2.009	2.007
	(0.554)***	(0.554)***
pol_control	0.501	0.501
	(0.180)***	(0.180)***
club	0.420	0.421
	(0.174)**	(0.175)**
edu_35	0.434	0.434
	(0.156)***	(0.156)***
cvfirst_dcposition_0_1	0.570	0.570
	(0.194)***	(0.194)***
concentration	0.566	0.566
	(0.184)***	(0.184)***
avewsbill		-0.010
		(0.168)
Constant	-1.656	-1.624
	(0.545)***	(0.762)**
Observations	1389	1389
Pseudo R2	0.16	0.16

Source: NERA
*Dependent variable=*dc_choice*; estimator used: logit; robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1% (all for 2-sided* t *tests);* dc_bill *and* avewsbill *were divided by 100 for the models here.*

The coefficient on *avewsbill* is -0.01. The effect on expected WTP of an increase of £1 in the average water and sewerage bill in the household's company area is derived by dividing minus this coefficient by the coefficient on *dc_bill*. This yields a value of -0.008, which means that a household with an average water and sewerage bill in their company area of £400 is predicted to have a WTP that is £1.60 less than a household with an average water and sewerage bill in their company area of £200. However, the standard error on the coefficient on *avewsbill* is 0.168, which is far larger than the coefficient itself, implying a lack of statistical significance and that the coefficient is probably best interpreted as being equal to zero. Thus, for the DCCV model, average water and sewerage bill in the company area has no effect on WTP.

Sensitivity of Average National WTP to Extreme Values of SWW WTP

Table M.33 presents mean WTP values for a package of WFD improvements for England and Wales for three datasets of stated or revised figures. The third row is the mean of the WTP figures as stated in the original (*pref*) set of respondents. In the first row, the stated WTP amounts for the 61 respondents from the South West RBD were replaced by zeros, and the mean WTP was recalculated. In the second row, the WTP amounts for the 61 South West RBD respondents were replaced by half the England and Wales average, as derived from the full *pref* sample, including those in the original sample from the South West RBD..

Table M.33
Sensitivity of Average National WTP to Extreme Values of SWW WTP

Sensitivity Check	E&W Mean WTP (£/hh/yr)	Difference from Original Sample Mean (%)
Mean if all 61 SW RBD WTP values set to zero	47.01	-5.0
Mean if all 61 SW RBD WTP values set to half E&W average	48.13	-2.8
Original Sample Mean	49.50	0

Source: NERA; WTP results are pref *sample means.*

The first row shows the effect of taking the most extreme possible assumption. This is that, had we drawn a sample including only South West Water Company area residents to represent the South West RBD they may all have given WTP amounts of £0. If that had occurred the England and Wales sample mean stated WTP would have fallen by 5%.

The second row shows a less extreme assumption, that the 61 respondents may have stated WTP amounts which were on average half the national average. If that had occurred the England and Wales sample mean stated WTP would have been 2.8% lower than the mean stated WTP for the random sample actually drawn.

Conclusion

The modelling of the average regional bill as a possible explanatory factor, and the extreme value sensitivity checking, suggest that the WTP results for England and Wales from the survey are unlikely to have been notably different had the random sample for the SW RBD included residents of the South West Water Company area.

M.3. Aggregation Tables

Table M.34
PCCV WTP Aggregation to 95% Scenario

Variable	Coeff	Pop value all incomes)			Pop value (low income)			Pop value (med income)			Pop value (high income)		
		England	Wales	E&W	England	Wales	E&W	England	Wales	E&W	England	Wales	E&W
ln_delta_hl	0.671	0.583	0.463	0.576	0.583	0.463	0.576	0.583	0.463	0.576	0.583	0.463	0.576
ln_inc	0.258	6.411	6.218	6.401	5.298	5.298	5.298	6.215	6.215	6.215	7.313	7.313	7.313
income_miss	1.411	0	0	0	0	0	0	0	0	0	0	0	0
children	0.126	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%
use	0.266	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%
pol_control	0.445	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
sex	-0.181	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
int_sex	-0.218	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
edu_12	0.186	36%	35%	36%	36%	35%	36%	36%	35%	36%	36%	35%	36%
edu_35	0.511	35%	31%	34%	35%	31%	34%	35%	31%	34%	35%	31%	34%
wales	0.041	0%	100%	6%	0%	100%	6%	0%	100%	6%	0%	100%	6%
cv_first	-0.409	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
understood	0.258	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Constant	0.762	1	1	1	1	1	1	1	1	1	1	1	1
SUM		3.23	3.12	3.22	2.94	2.88	2.94	3.18	3.12	3.18	3.46	3.40	3.46
Exp(SUM) = median wtp		25.30	22.69	25.15	18.99	17.90	18.92	24.05	22.67	23.97	31.93	30.10	31.82
Mean wtp | (exp(u))	1.769	44.77	40.14	44.49	33.59	31.66	33.47	42.55	40.11	42.40	56.50	53.25	56.30

Table M.35
DCCV Model Aggregation to 95% Scenario

Variable	Coeff	Pop value all incomes)			Pop value (low income)			Pop value (med income)			Pop value (high income)		
		England	Wales	E&W	England	Wales	E&W	England	Wales	E&W	England	Wales	E&W
dc_bill[1]	-1.236	6.411	6.218	6.401	5.298	5.298	5.298	6.215	6.215	6.215	7.313	7.313	7.313
ln_inc	0.395	0	0	0	0	0	0	0	0	0	0	0	0
income_miss	2.066	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
pol_control	0.538	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%
club	0.437	35%	31%	34%	35%	31%	34%	35%	31%	34%	35%	31%	34%
edu_35	0.4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
cvfirst_dcposition_0_1	0.562	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
concentration	0.562	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
sex	-0.295	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
int_sex	-0.284	0%	100%	6%	0%	100%	6%	0%	100%	6%	0%	100%	6%
wales	0.268	1	1	1	1	1	1	1	1	1	1	1	1
Constant	-1.314												
Mean WTP		167.0	181.4	167.9	131.5	152.0	132.6	160.8	181.3	161.9	195.9	216.4	197.0
Median WTP		167.0	181.4	167.9	131.5	152.0	132.6	160.8	181.3	161.9	195.9	216.4	197.0

Source: NERA

Appendix N. Comparator Benefit Valuation Studies

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
Eftec (2002) "Valuation of Benefits to England and Wales of a Revised Bathing Water Quality Directive and Other Beach Characteristics Using Choice Experiment Methodology."	CE	809 respodents from England and Wales	Determine WTP for changes in water quality and other beach attributes likely to arise from a revised EC Bathing Water Directive			
Carson, R.T. and R.C. Mitchell (1993), "The Value of Clean Water: The Public's Willingness to Pay for Boatable, Fishable and Swimmable Quality Water," Water Resources Research 29(7) 2445-2454	CV	National probability sample using cluster sampling (cluster n = 61). Response rate of 79%. A total of 813 households, 70% of which yield reliable data.	Determine WTP for improvements to water quality in a variety of water body types.	Total (Boatable to Swimmable) $242	Total (Boatable to Swimmable) $24 to $40 billion, mean of $29.2 billion (1990 dollars)	
Huber, Joel and W. Kip Viscuzi (2006) Economics of Environmental Improvement, Report to the EPA, USA.	CE	A total of 4,257 respondents interviewed in six waves from October 2002 to October 2004. Use of Knowledge Networks panel. Average completion rate of 75%.	Estimate the benefits of improvements to inland surface water.	Each 1% improvement in national water quality had a mean value of $39 and a median value of $20.		Regional valuations were made on an iterative basis and national evaluations followed this format using referenda questions.
Bateman, et al (2006) "Does Phosphate Treatment for Prevention of Eutrohpication Pass the Benefit Cost Test?", CERGE Working Paper EDM 06-13	CV	1,254 households in and around Norwich	Determine WTP to reduce the impact of eutrophication.	Users mean £75.41 and median £69.07	£169.89 million	

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
Andrews, K. et al, (1999) "Potential Costs and Benefits of Implementing the Proposed Water Resources Framework Directive," Report No: DETR 4477/5	NA	"Top-down" aggregate data using a methodology developed and reported in the Foundation for Water Research's manual (1996)	Construct a cost benefit analysis of the WFD.		Benefit assuming the smallest gap (that is least improvement) £1,643 million, largest gap £6,165.	
NVA 2003 Joint National Research	Likelihood of WTP	Customer research with a representative sample of 6,000 bill payers.	Develop research on the priorities for the water industry and what services and improvements would best suit customer needs.	Company preferred plans for improved services varied - minimums and maximums offerred.	Majority of customers (46% probably and 14% definitely) were willing to pay for the company preferred plan.	
Eggert and Olsson (2006) - Heterogeneous preferences for marine amenities: A choice experiment applied to water quality	CE	800 individuals 18-65 years from the Swedish Register of Inhabitants. Swedish west coast Skagerak and Kattegatt.	Estimate the benefits of improving coastal water quality with respect to fishing possibilities, bathing water quality and biodiversity levels.	WTP mean values: Lower BioDiversity - SEK 1400 ($209.14) Improve Fish Stock - SEK1200 ($179.26) Water Quality - SEK 600 ($89.63) Higher BioDiversity - SEK 600 ($89.63)		High levels of environmental concern and that substantial values are at stake. The most urgent action is firstly to prevent further depletion of marine biodiversity and secondly to improve cod stocks. Improved water quality and improved marine biodiversity are also important.
Jones, Bateman, Wright (2003) - Estimating arrival numbers and values for informal recreational use of British Woodlands	Meta-analysis of CV, ITCols, ITCml, TC, and ZTC methods	Numerous studies, varied sample sizes	Estimate transferable monetary assessments of the value of woodland visits through a meta-analysis of previous valuation	1.24£/person/visit		Willis et al dominates meta analysis ZTC method substantially higher results

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
			studies.			
Hanley, Wright, Alvarez-Farizo (2005) - Estimating the economic value of improvements in river ecology using choice experiments: an application to the water framework directive	CE, Benefits tranfer experiment	210 responses from each. River Wear, in County Durham, England and River Clyde, in Central Scotland.	Estimate the value of improvments in three components of ecological status: healthy wilflife and plant populations, absence of litter/debris in the river, and river banks in good condition with only natural levels of erosion	benefits transfer experiment failed prices varied between two rivers RP Logit Approach, Ecology - Aesthetics - Banksides River Clyde -38.7, 28.57,42.99 respectively River Wear - 12.19,12.07,12.67 respectively Both Rivers - 20.17,16.91,21.53 respectively All figures in pounds	No aggregate benefits transfer could be assessed	
Hanley, Bell, Alvarez-Farizo (2002) - Valuing the Benefits of Coastal water Quality Improvement Using Contingent and Real Behaviour						

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
Georgiou, Bateman, Cole, Hadley (2000)	CV, Contingent Ranking	675 sample of local residents in the Birmingham area (346 Type T, 329 Type B)		£3-5 per household per annum for a unit increase in RFF water quality scale Contigent Ranking produced higher results; Contigent Valuation may have been biased downwards as a result of the existence of incentives for respondents to understate their true WTP Distance Decay: 36 miles for large improvement, 17 miles for smallest Scope Insensitivity: Mixed Ordering Effect: Some, but not significant - ordering may be factor in scop sensitivity		23% unable to respond to open-ended CV whil <2% unable to give a ranking response
Azevedo et al. (2003) - Iowa LakesValuation Project: Summary and Findings from Year 1	CE	8000 Iowa residents, 4423 were returned	Provide estimates of the value that Iowan's place on their water resources.	Data on visits to water resources, Preference for improvements, No WTP values		
Egan et al. (2004) - Recreation Demand Using Physical Measures of Water Quality	CV	8000 Iowa residents, 4423 were returned	Incorporate rich set of physical water quality attributes, as well as site nd household characteristics, into a model of recreational lake usage in Iowa	Average CV: 1) all 128 lakes improved 2) 9 zone lakes improved 3) 65 impaired lakes improved Per choice occasion $4.01 $0.76 $0.09 Per Iowa household $208.68 $39.71 $4.87	Average CV: 1) all 128 lakes improved 2) 9 zone lakes improved 3) 65 impaired lakes improved For all Iowa households $240,649,000 $45,788,092	

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
					$5,612,219	
Adamowicz et al (1995) - Estimating the passive benefits of Britain's Inland Waterways	CV	758 households across GB	Measure the overall value of canals	Value of "maintenance" to canals: strategic responses removed - £6.78 mean all respondents - £6.66 mean		
Fisher et al (2002) - The Environmental Benefits of the Environmental Programme in the Periodic Review of the Water Industry (PR04)	see table printout					

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
Mclleland et al. (1992) - METHODS FOR MEASURING NON-USE VALUES: A CONTINGENT VALUATION STUDY OF GROUNDWATER CLEANUP	CV	National mailing of 5000 households	This study constitutes the third in a series of studies conducted for the USEPA exploring the use of the contingent valuation method (CVM) for valuing environmental benefits. The CVM is the only methodology now available for measuring non-use benefits which likely comprise a large portion of values for environmental commodities. The measurement of the total benefits (including use, altruistic, bequest and existence values) of cleaning up contaminated groundwater	Mean WTP - Full Sample, Regression Sample, Box-Cox - Monthly water bill increased every month for the next ten years (US Dollars). Complete Cleanup - 11.58, 11.70, 7.01 Containment - 5.96, 6.38, 3.95 Public Treatment - 7.98, 7.18, 4.02 National - no context 2.67, 2.98, 1.34 National - context - 2.03, 2.15, 1.13 Ten % Shortfall - 6.98, 7.38, 3.86 Seventy % Shortfall - 21.95, 22.99, 13.34		The initial value question in each version of the survey is the individual's willingness to pay fro complete cleanup of a hypothetical groundwater contamination from a leaking lanfill leading to a potential 50% shortage in domestic water supply

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
DEFRA (2004) - Valuation of health benefits associated with reductions in air pollution	CE	665 interviews (England, Scotland, Wales)	To generate empirical estimates of how much people in the UK are willing to pay for reductions in the health risks associated with air pollution	Extra mths in Normal Health (1/3/6) - 60.15, 67.72, 80.87 Extra mths in Poor Health (1/3/6) - 15.86, 11.53, 17.31 Avoiding Hospital Admission - 36.49, 35.34, 35.15 Avoiding Breathing Discomfort - 40.17, 31.31, 33.52 £ per year per household Trimmed Means - 4 responses top/bottom removed from each subsample	Value of a person-year in normal health (1-3-6) - £27,630 - 9,430 - 6,040 - argument made that single day should be applied in policy Value of a person-year in poor health (1-6) - £14,280 - 7,280 Value of preventing respiratory hospital admission - £1,310 - 7,110 Value of preventing 2-3 days of breathing discomfort - £1,280 - 5,580	

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
Willis et al. (2003) - The Social and Environmental Benefits of Forest in Great Britain	CV	Used previous study of 15,000 recreational visits to 42 forests in Scotland and Ireland. Conducted new survey of English and Welsh forests using landscape study of over 400 residents across England Scotland and Wales.	Provide estimates of each of these social and environmental benefits in terms of -marginal values, as an input into forest management, and -their total value across forests and woodlands in Great Britain, to assess the importance of woodlands to the British economy.	Marginal Benefits of Woodland: £1.66 to £2.75 for each recreational visit • £269 per annum per household, for those households with a woodland landscape view on the urban fringe • 35p per household per year for enhanced biodiversity in each 12,000 ha (1%) of commercial Sitka spruce forest; 84p per household/year for a 12,000 ha increase in Lowland New Broadleaved Native forest, and £1.13 per household/year for a similar increase in Ancient Semi Natural Woodland • £6.67 per tonne of carbon sequestrated • £124,998 for each death avoided by 1 year due to PM10 and SO2 absorbed by trees, and £602 for an 11 day hospital stay avoided due to reduced respiratory illness • A cost of 13p to £1.24 per	Annual and capitalised social and environmental benefits of forests in GB (£ millions, 2002 prices) Environmental benefit Annual value Capitalised value Recreation 392.65 11,218 Landscape 150.22 4,292 Biodiversity 386.00 11,029 Carbon sequestration 93.66 * 2,676 Air pollution absorption 0.39 * 11 Total 1,022.92 29,226	* An approximation, since carbon sequestration, and probability of death and illness due to air pollution, varies over time. More carbon is sequestrated in early rotations than in later rotations, resulting in an annuity stream that is inconsistent over multiple rotations. Similarly for air pollution, that results in an individual's life being shortened by a few days or weeks at the end of the individual's life at some point in the future.

Reference	Stated Preference Method	Sample	Context for Study	Results (Individual Level)	Results (Aggregate)	Notes
				m3 where water is lost to abstraction for potable uses, although for most areas the marginal cost is zero. The externality cost of woodland on water quality has been 'internalised' within forestry through the application of guidelines on woodland planting and conditions attached to forest certification.		
Li et al. (2004) - Using Choice Experiements to Value the Natura 2000 Nature Conservation Programs in Finland	CE, CV	4000 Finns, aged 18 to 70, randomly selected from the census register (2400 binary choice contigent valuation, 1600 with a choice experiment).	Estimate the values that the Finnish households would place on different preservation levels.	Preservation Area willingness - per person per year Mean WTP (willingness to pay for an increase) = 782 FIM ($181.42) Mean WTA (willingness to accept for a decrease)= 3422 FIM ($793.9)		

Appendix O. CRP Caveats Regarding 4b/c Report

CRP caveats regarding 4b/c report and challenges for the future

The Nera report and accompanying Annexes represent a very significant contribution to the evidence base on implementing the Water Framework Directive in a proportionate manner. Nevertheless there are some important caveats regarding the report which this annex seeks to summarise. There are differences of opinion regarding the importance of these caveats and the extent to which they are adequately dealt with in the report. The following represents a joint view from the CRP members and is included in this report as an aid to the interpretation of the results and to help set the agenda for further work in this area.

There is limited theoretical justification underpinning the recommended range of benefit values that should be applied in further policy analysis. The reports recommendation of a conservative interpretation of the results represents a practical way of balancing some of the remaining issues that are outlined below.

Distributional issues associated with benefits

- The analysis of responses and summary statistics reveal quite clearly that there are distributional issues associated with the incidence of benefits. The mean benefit values are the correct statistic to use to summarise average benefits and to calculate aggregate benefits. However important information is contained in the median values (which show the willingness to pay level which half the population would support). The median results of this survey are indicative of the extent to which water environment benefits accrue to relatively affluent sectors of society. Reference should be made to the median values when using the mean values. It is a challenge for this and future benefits analysis to adequately capture the distributional issues associated with the goods being provided.

Wider context

- Past benefits analysis have been open to criticism because of their local and type specific focus. This can lead to respondents over-estimating their willingness to pay because they do not consider the wider context. By focussing on all water bodies at the national level this survey has avoided the majority of this so-called location based single issue bias – this was one of the principal reasons for selecting the national approach. However on a wider scale this survey remains a single issue survey, due to its focus on one type of benefit - the water environment - as opposed to all other water and non water welfare improving choices. Considerable effort has been made to remove this bias but it cannot be guaranteed that it has been completely mitigated. This work reveals the important challenge to future research of balancing the benefits of a specific focus (better comprehension of the good in question) against the benefits of better context. It will be important to compare the results of this work with studies which offer a wider context of choices, particularly given that most respondents rated other issues above water environment ones in terms of their concerns (Table 8.3) . However these wider context studies will need careful scrutiny in terms of their methodology and how they address the difficulty of properly describing the environmental and other goods being examined. In addition it should be borne in mind that specific measures may also deliver non water environment benefits not included within this study.

Knowledge of the current state of the water environment

- This research has demonstrated very clearly the degree to which water benefits analysis is currently constrained by scientific understanding of the current ecological status of water bodies and future improvements to them and also the ability to communicate this information in text and visual materials to the general public. It should be borne in mind that the baseline status examined in this work is current status based on the latest available information, not status that would be expected in the absence of the WFD. Additional assumptions about expected improvements need to be made in order to estimate the incremental benefits of the WFD. The descriptions of the current status and the "good" being supplied in terms of better ecological quality were the best that could be provided on the basis of currently available information. It is recognised that this information was incomplete and that more detailed information will be available from which to develop the RBMPs. Improvements in the science may reveal that the assumptions used in this report misrepresent either the current status or expected status. This is clearly a limitation and an important caveat regarding the current work. The model developed to estimate benefits is capable of producing revised benefits estimates on the basis of different assumptions regarding current and expected quality and hence can be re-run as and when better scientific information becomes available.

Sampling

- Considerable effort was put into this survey in terms of identifying the appropriate sample frame. Several alternative sampling approaches were carefully discussed before choosing a random approach. Unfortunately this random approach means that some politically sensitive areas were not sampled. In this case no sampling was undertaken in the area of England with the highest water and sewerage bills – customers covered by South West Water who might be assumed to have a lower WTP than the rest of the population. Sensitivity testing clearly shows that even if they had a vastly reduced willingness to pay it would not alter the results of the survey significantly. While the CRP members accepted the results of this sensitivity they also recognise the political sensitivity of this issue and gave consideration to undertaking a separate sample in the South West Water customer area. However it was agreed that given the clear results of the sensitivity analysis this would be a wasteful use of public funds. This experience poses interesting questions for future sample design to determine the practical merits of choosing between alternative random sample draws and the unknown bias this choice may introduce.

Future use of these results outside the current decision context

- The practice of benefits transfer has often been found to apply values which are several years if not decades out of date. However, the results of this survey are valid within a specific context and timeframe. The Steering Group is conscious that the values derived from this study may be used in a variety of purposes and decision contexts for which they have not been designed. The Steering Group cannot advocate the use of these values in this way. The passage of time itself renders the results less and less appropriate for policy analysis as important context factors change. In order to extend the shelf-life, the benefits estimation model contains context variables which can be readily updated. This includes important public attitude variables which were cross-referenced on the basis of a contemporaneous survey of the general public. This omnibus survey can be repeated relatively quickly and cheaply and should be done before using the values in the beyond the immediate future.

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