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A stated preference experiment to value access to quiet areas and other local environmental factors

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The local environment influences people's perceptions of their quality of life and their overall well-being in many different ways. Whilst there are a wide range of local environmental factors that can impact on individuals' well-being, there is relatively little empirical evidence on this subject. In particular, there is a dearth of knowledge on their economic valuation, commonly expressed in terms of how much money individuals are prepared to pay for improved conditions. The aim of this study was to estimate how much individuals would be prepared to pay, in terms of council tax, to obtain improvements or to avoid deteriorations in a wide range of local environmental factors. These include: urban quiet areas; fly-tipping; litter; fly-posting; graffiti; dog-fouling; discarded chewing gum; trees; light pollution (obscuring the stars); light intrusion (into the home) and odour. This study provides what we believe to be the first value for quiet areas and also indicates how important quiet areas are relative to a range of other local environmental factors.

1 Introduction

The aim of this study was to estimate how much individuals would be prepared to pay, in terms of council tax, to obtain improvements or to avoid deteriorations in a wide range of local environmental factors. The environmental factors investigated were: urban quiet areas; fly-tipping; litter; fly-posting; graffiti; dog-fouling; discarded chewing gum; trees; light pollution (obscuring the stars); light intrusion (into the home) and odour

The emphasis was on local or neighbourhood effects, so individuals' willingness to pay for improved conditions as experienced in their locality. The study does not cover the benefits of improved environmental factors for those who are visitors to an area or indeed the respondents' experiences of these environmental factors in places other than their locality.

The key method used to estimate willingness to pay values was Stated Preference. In designing the stated preference experiment several challenges were apparent. Firstly, representing each factor at clearly distinct levels and relating those levels to current experience. Secondly, presenting the attributes in a fashion that can be clearly understood by respondents. Thirdly, developing an approach to handle a large number of attributes. Fourthly, reducing the scope for biased responses, especially responses designed to influence the policy outcome rather than to express genuine preferences. Finally, adopting a method that allows the valuations obtained to be transferred across circumstances.

In the next section we briefly review the available valuation literature. This is followed by a discussion of the development of the approach and how challenges were addressed. The next section describes the implementation process and some initial findings. The next section examines the model results and finally conclusions are drawn.

2 Studies in the literature

A number of revealed and stated preference studies have addressed different elements of environmental quality. Additionally it is possible to consider the opportunity costs incurred in improving the quality experienced. For example, the cost of street cleansing to local authorities in England was £858 million in 2008/9 and this excludes costs incurred by highway authorities [1], while [2] estimate the cost of light pollution in the US to be $7 billion per annum in terms of wasted energy.

We could not identify any hedonic pricing studies in the academic literature that explicitly and precisely provide a value for the aspects of interest here. Studies have been carried out of for example tree canopies or urban forest [3] but not street trees. A UK study explored variation in prices with respect to area cleanliness at a very aggregate level [4]. Essentially such proxy market based approaches are not suited to the exploration of disaggregate and changeable factors in the environment. A small number of studies using Contingent Valuation (CV) or stated choice (SC) approaches were identified that have explored one or more of the attributes of interest. These include litter [5,6,7], fly-posting [5], graffiti [5], dog fouling [6], discarded chewing gum [5], light pollution [8] and odour [7,9]. For a number of factors no stated preference studies were identified, these include; fly-tipping; light intrusion, trees and quiet areas. The values are quite diverse and not directly comparable.

For many factors no individual valuation studies could be found in the academic literature. However, there are some studies that are useful in looking at for example, the diversity of opinion on fly-posting [10].

3 Methodology

3.1 Challenges

In the introduction, five challenges were identified in developing stated preference experiments to value local environmental factors.

Levels were clearly defined for each factor based on previous experience and the focus groups conducted as part of this study. A key feature within these stated preference experiments is the linking of the levels for each attribute to respondents' experiences by identifying the "as now" level which is that currently experienced in their local environment. Respondents are also asked to rate every level of each attribute which allows the derivation of values for each step along a rating scale. These features contribute to our ability to meet the second and fifth challenges.

The Priority Ranking (PR) approach was designed to deal with a large number of attributes at one time, thereby contributing to the third challenge. Partly as a result of this and partly as a result of masking the purpose of the exercise, PR offers less invitation to strategic bias than conventional stated preference exercises, thereby helping overcome the fourth challenge. This is particularly important where the questionnaire touches on contentious issues. In our previous work on aircraft noise, the values derived from the PR exercise were lower and more believable than those derived from a standard though transparent Stated Choice exercise [11]. Further detail on the PR design is provided in section 3.2.

3.2 Priority Ranking Design

The priority ranking (PR) approach was inspired by the priority evaluator, developed [12] to identify public preferences in decisions affecting the quality of life. It has been used when there has been a need to evaluate a large number of variables, such as the many different types of rail rolling stock and station facility attributes and diverse quality of life issues. However, the conventional priority evaluator has problems in that the process of allocating a fixed points budget across attributes variations with different 'points prices' induces linear-dependency[1].

The approach used here is similar in offering a wide range of factors. But instead of using a budget to purchase improvements from the current situation we ask respondents to identify their most preferred improvement from a set. The preferred improvement is then eliminated from the set and the respondent is asked for their preferred improvement from this revised set and so on until all improvements are ranked in order of preference.

Accommodating such a large number of factors in a conventional choice experiment is feasible, but the demands placed upon individuals in trying to evaluate two options characterised by for example the thirteen attributes used in the aircraft noise study (Wardman and Bristow 2008) [11] or the eleven attributes under consideration here would be considerable. There is evidence to indicate that task complexity can influence valuations, largely through the use of simplifying but inappropriate choice rules or ignoring attributes.

The challenge therefore is to be able to cover a wide range of factors in a single exercise yet ensure that the task is manageable. To do this an approach has been developed which involves the evaluation of factor variations one at a time rather than the conventional procedure of multiple trade-offs. It is thought that if offered a whole series of improvements (or deteriorations) to specific factors, respondents can more readily state which (one-dimensional) factor variation they would most like to achieve than they could weigh up the net benefit of (multi-dimensional) differences in a whole range of factors between two alternatives.

The factors have different means of presentation and numbers of levels (see appendix 1 for the final post-piloting version of the design). Five variables have a textual presentation, each with five levels except where indicated in brackets: light pollution (3); light intrusion (4); access to quiet areas; odour and dog fouling. Six factors are represented pictorially: litter (4); graffiti; discarded chewing gum (3); trees (4); fly-tipping (4) and fly-posting. The locally-paid council tax is used as the payment vehicle. This attribute has seven levels in order to introduce more variation into this key factor and to allow for uncertainty as to individuals' monetary valuations (three different scales were also used again to increase the range to ±£20 per month). Council tax was used as the most appropriate payment or compensation mechanism for local quality of life factors.

[1] This is a statistical property whereby there is an exact linear relationship between the attributes and hence it would not be possible to estimate parameters indicating the importance of each attribute. Such a property is built-in with this form of priority evaluator.

The starting point is to identify the respondent's current situation. Respondents were asked to state their perceived current position. They were then asked to consider improvements to the established current situation. These are all the levels of the factors to the right of the current levels. The respondent was asked to state which improvement would be most preferred from this set. Initially, this should logically be a factor level in the right hand column. They were then asked to disregard this improvement, treating it as if it were no longer available, and asked to state which was now the preferred improvement. This process continued until all the possible improvements had been ranked in order of preference.

Having completed the ranking of improvements, the respondent then proceeded to evaluate the deteriorations. The deterioration which was regarded to be worst was identified first. As with the improvements respondents were then asked to disregard this level and identify the worst from the remaining set and so on until all the deteriorations had been evaluated.

The PR experiment formed part of a wider survey covering attitudes, socio-economic characteristics, rating of factors and a further stated preference exercise.

3.3 Survey implementation

The survey was implemented in the form of a group hall test. Survey staff provided explanations at each stage of the survey and were available to help if needed. The pilot surveys took place in Leeds in January 2011 and assisted in refining and shortening the overall survey. The main surveys were conducted in Manchester, London and Coventry, in each of which three sub-locations were identified to be representative of: the inner city; suburbs and rural/semi-rural environments[2]. The surveys ran from 22nd January to the 13th February 2011.

The final sample size was 561. 53.5% were female, slightly above the 51% figure for England. 53.1% were aged 18 to 44; 29.2% 45 to 59 and 16.9% were over 60. With respect to the population of England this is under-representative of the over 60 age group which forms 27% of the population.

4 Models

For analysis the rank data has been converted into pairwise comparisons. Effectively, each improvement (deterioration) is compared with the other possible improvements (deteriorations). A multi-nomial logit model is then estimated. As the respondents had rated each of the levels on a scale of 0 (worst) to 10 (best) a model has been developed to value a move of one point on the rating scale. This should enable direct comparison between values for different factors. The ratings models are shown in Table 1 (appendix 2). With the exception of fly-posting, all the coefficients are of the correct sign and significant in the improvements model. The deteriorations model has wrong sign coefficients for light intrusion and light pollution. For the remaining variables, the improvements and deteriorations models yield coefficients which are generally not greatly different.

[2] In the case of London two suburban locations were used as no rural or semi-rural location was identified.

We therefore estimated a combined model (1), pooling improvements and deteriorations data, allowing for scale differences between the two data sets and for variations in parameters that were somewhat different between the two separate models. The scale (0.92) is not significantly different from one indicating that the two data sets have essentially the same scale. Separate coefficients for improvements and deteriorations were specified for light intrusion, light pollution and fly-posting.

We then allowed for those who stated that, in some form or other, they did not fully account for council tax in making their decisions in combined model (2). Some people stated that did not believe council tax reductions would occur. An incremental effect on the tax coefficient for these respondents, was significant and positive, indicating that they have a lesser sensitivity to the tax reductions offered as expected. Others stated that they focussed primarily on the environment factors. These were also found to have a positive and significant incremental effect on the tax coefficient, as expected, to the extent that it implies they took no account of tax whatsoever. Finally, there were some who stated that they paid more attention to increases, who had a very strong incremental effect denoting a tax sensitivity almost twice as high as the base. This increased sensitivity does not seem plausible and we take this to represent protest responses towards council tax increases.

The monetary valuations implied by the combined ratings model are reported in Table 2 (appendix 2). These use the council tax numeraire (-0.0334) from combined model (2) that is free of the effects of not believing tax reductions, placing attention on environmental factors and protest response.

For light intrusion and light pollution, the values for the improvements model are used. We are unable to obtain sensible values for fly posting. Values are provided for a unit change in the rating of a factor and also for the maximum possible improvement from a rating of zero to ten.

The valuations show considerable variation across attributes; it would have been disconcerting to have obtained similar values. Since we have expressed each attribute in common units, that of a 0-10 rating scale, we can readily identify the importance of different attributes. The largest valuations are quite clearly for litter and fly-tipping. Then there are a series of attributes with similar 'medium' valuations. These are trees, odour, chewing gum, dog fouling and quiet areas. Light pollution, graffiti and light intrusion have relatively minor valuations. This pattern of valuations seems plausible.

Table 2 also contains a ranking of each factor in terms of the reported importance ratings which can be compared with the ranking of each factor in terms of implied SP valuation. A Spearman correlation coefficient of 0.77 indicates a high degree of correspondence between the SP valuations and the importance ratings**.** This is an encouraging finding. Moreover, our inability to recover a significant correct sign fly-posting valuation may be because, as indicated by the importance ratings, this factor is the least important of all those here considered.

5 Conclusions

Values have been derived for ten local environmental factors on a comparable basis using a priority ranking form of stated preference. The two most important factors in terms of ranking and value were found to be litter and fly-tipping. Light intrusion and pollution and graffiti have the lowest values and ratings. Access to quiet areas lies in the middle ground.

Acknowledgments

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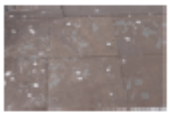
Appendix 1: Priority Ranking Experiment

Section 4

We would now like you to consider the various local environmental factors that have just been shown to you and identify which situation best describes the current situation you experience

	Worse Situation				Better Situation
Light pollution on a clear night	I can't see the stars		I can see some stars		I can see many stars
Discarded chewing gum					
Litter					
Light intrusion at night	Light intrusion that affects my sleep or that of someone else in my household	Light intrusion that I can't block out with heavy curtains but doesn't affect my sleep	Light intrusion into my home that I can block out with heavy curtains		No light intrusion from any source
Trees					
Fly-tipping					
Access to quiet areas	No quiet areas around here	Quiet area within 15 minutes walk of home	Quiet area within 10 minutes walk of home	Quiet area within 5 minutes walk of home	Quiet area within a 1 minute walk of home
Graffiti					
Odour	Bad smells all the time	Bad smells occur weekly	Bad smells occur every month or so	Bad smells occur once or twice a year	No bad smells
Fly-posting					
Dog fouling occurs	Always dog mess in view	Every minute when walking	Every 5 minutes or so when walking	Every 15 minutes or so when walking	Never or very rarely
Council Tax you would pay	£15 more each month	£8 more each month	£5 more each month	As Now	£5 less each month	£8 less each month	£15 less each month

Appendix 2

Table 1 Rating Models (t statistics in brackets)

	Improvements	Deteriorations	Combined(1)	Combined(2)
Chewing Gum	0.0931 (20.4)	0.0667 (23.5)	0.0769 (24.5)	0.0725 (29.9)
Dog Fouling	0.142 (30.4)	0.0324 (11.4)	0.0689 (18.7)	0.0631 (27.0)
Fly-Posting	-0.0003 (0.1)	-0.0124 (4.2)		
Fly-Posting Imp			-0.0083 (1.6)	-0.0125 (2.5)
Fly-Posting Det			-0.0121 (3.7)	-0.0092 (3.2)
Fly-Tipping	0.109 (23.6)	0.126 (61.5)	0.132 (36.5)	0.124 (67.3)
Graffiti	0.052 (11.7)	0.00875 (3.2)	0.0203 (7.8)	0.0188 (8.1)
Light Intrusion	0.0209 (3.8)	-0.0067 (2.2)		
Light Intrusion Imp			0.0141 (2.6)	0.0112 (2.1)
Light Intrusion Det			-0.0054 (1.7)	-0.0045 (1.5)
Litter	0.129 (30.5)	0.138 (41.7)	0.138 (38.7)	0.132 (51.8)
Light Pollution	0.0329 (5.4)	-0.0274 (8.5)		
Light Pollution Imp			0.0253 (4.2)	0.0211 (3.6)
Light Pollution Det			-0.0279 (7.8)	-0.0255 (7.9)
Odour	0.0704 (13.6)	0.0621 (27.8)	0.0676 (25.1)	0.0638 (30.1)
Quiet	0.0281 (5.2)	0.0486 (19.7)	0.0477 (18.8)	0.0456 (20.2)
Trees	0.109 (19.7)	0.0663 (17.8)	0.0827 (21.7)	0.0779 (25.3)
Council Tax + not believe + focus environment + attention increases	-0.0333 (20.3)	-0.0241 (20.4)	-0.0278 (23.4)	-0.0334 (23.3) 0.0110 (3.3) 0.0325 (15.3) -0.0315 (11.0)
Observations	50826	134285	185111	
ρ^2	0.07	0.12	0.040	0.041

Table 2 Values per person per month (£) (confidence interval in brackets)

	Value of a Unit Rating Change	**Value of a Move from Worst to Best[3]**	**Stated Preference Rank**	**Importance Rating Rank**
Chewing Gum	2.17 (1.96 – 2.38)	21.7	4	7
Dog Fouling	1.89 (1.69 – 2.09)	18.9	6	3
Fly Posting	-	-	-	11
Fly Tipping	3.71 (3.39 – 4.03)	37.1	2	2
Graffiti	0.56 (0.42 – 0.71)	5.6	9	8
Light Intrusion	0.34 (0.02 – 0.65)	3.4	10	9
Litter	3.95 (3.59 – 4.31)	39.5	1	1
Light Pollution	0.63 (0.29 – 0.98)	6.3	8	10
Odour	1.91 (1.72 – 2.10)	19.1	5	6
Quiet	1.37 (1.20 – 1.53)	13.7	7	4
Trees	2.33 (2.07 – 2.59)	23.3	3	5

[3] Not everyone will rate the worst level we offered as zero and the best level we offered as 10. Hence this valuation will overstate the benefit of moving from the worst to best level. The difference in actual ratings supplied, provides a more accurate and lower indication of willingness to pay, often around half the amount here.