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Does revealed happiness affects preferences for urban green spaces? An analysis of stated residential choices

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Abstract

This paper examines the influence of people's revealed happiness on their preferences for urban green spaces on the basis of their residential choice. We applied a choice experiment (CE) that focuses on trade-offs between private housing characteristics and the environmental aspects of neighborhood. To estimate the impact of happiness on respondents' preferences for urban green spaces, the stated preference data is combined with self-reported happiness data. Accounting for the endogeneity, the results show that happiness have a positive impact on people's willingness to pay for living close to urban parks and forest. Happier people are ready to pay more for urban green spaces.

Key words:

Choice experiment; Hybrid choice model; residential location choice;

1. Introduction

In the environmental evaluation literature, numbers of studies prove that environmental elements, such as noise (Urban and Maca,2013;Van Praag and Baarsma, 2005; Weinhold, 2013), flood (Luechinger and Raschky, 2009), air pollution(Ferreira et al., 2013; Levinson, 2012; Welsch, 2002; 2006; 2007;) and environmental amenities (Brereton et al., 2008; Ferreira and Moro, 2010; 2013; Smyth et al., 2008;), can improve on people's revealed happiness. But conversely, there is no study shows the feeling of happiness has an impact on people's preferences for environmental attributes.

Discrete choice modelling (DCM) has been increasingly applied for the analysis of choice behaviors, such as residential locations. Numerous authors have proposed alternative discrete choice models to represent a behaviorally more realistic choice process. One of the difficulty of DCM is to measure factors such as decision-makers' latent attitudes, e.g. happiness, which may influence the choice process. The feeling of happiness may an impact of on respondents' choices which the researcher does not usually observe.

This study investigates the influence of people's revealed happiness on their preferences for urban green spaces on the basis of their residential choice. A survey which collects stated preference data from a choice experiment and hedonic housing data was carried out. To measure the effect of revealed happiness on choice decision, a hybrid choice model was applied.

2. The feeling of happiness and choice decision

Mild positive feelings, such as happiness, may have an import impact on people's choice (Mogilner et al., 2012). Previous literature shows that being in a positive mood affects individuals' cognitive processing, which can influence the types of choices they make. For instance, when people are in a positive mood, they are more likely to engage in heuristic processing (Schwarz and Clore1983), to be optimistic about favorable events occurring (Wright and Bower 1992), to think abstractly rather than focus on immediate and proximal concerns (Labroo and Patrick 2009), and to evaluate people and objects more favorably (Adaval 2003; Forgas1990; Forgas and Ciarrochi 2001; Isen and Shalker1982; Meloy 2000). Positive mood also influences choice directly—both in terms of the way in which people make choices (e.g., producing faster decisions; Isen and Means1983) and in terms of the choices people make. For example, people in a positive mood tend to choose less risky options(Isen and Patrick 1983), more variety across options (Kahnand Isen 1993), and more prosocial alternatives (Fishbachand Labroo 2007; Oishi, Diener, and Lucas 2007).

3. Method

3.1. Discrete CE methodology

The CE theory is based on the Lancasterian consumer theory (Lancaster, 1966), combined with the random utility theory (RUM, McFadden, 1974). Pioneered by Adamowicz et al. (1994), the CE has become a popular stated preference (SP) method for environmental valuation. The central assumption of the CE method is that the utility derived from any option depends on the attributes/characteristics of the goods. It involves the generation and analysis of choice data through the construction of a hypothetical market using a survey.

In this article, we chose to estimate preferences with a RUM model using SP data obtained from a CE (Hanley, 2002; Abildrup et al., 2013). One advantage of using a CE is the avoidance of multicollinearity at the attribute level. The large number of potential attributes that have an impact on housing prices and the multicollinearity among these attributes may cause a significant bias in estimations. Furthermore, multicollinearity may be caused by the fact that households with the same preferences (and same socio-demographic characteristics) will choose the same location (Irwin, 2002). Another advantage of the CE approach is the possibility of *ex ante* modeling of new green spaces. The last problem that we could solve with CE, and that may be the most important, is the problem of omitted variable bias. Those unobservable neighborhood characteristics that matter to households are often expected to be correlated with the amenity of interest, implying that the estimated amenity value may be biased (Kuminoff et al., 2010).

3.2. Experimental design

Studies using CE to elicit individuals' preferences rely on an experimental design. A number of important decisions should be made at the design stage, which includes identifying relevant residential attributes and the attribute levels. In order to focus on the trade-offs between private housing characteristics and the environmental attributes of a neighborhood, five attributes affecting residential choice and their levels were identified. This choice is based on meetings with experts from the Urban Development Committee of Nancy, previous surveys on forest recreation in the Lorraine region where situates the Nancy city (Abildtrup et al., 2013), and interviews of residents in Nancy.

We applied a procedure called "pivot design" where the hypothetical alternatives are pivoted around the reference alternative (status quo). The reference alternative in our CE is the respondent's actual residence. This induces more realism and can provide greater specificity than the standard approach because the hypothetical alternatives in our chosen sets are related to the current situation of the respondents. The pivot design technique is based on a number of theories derived from behavioral and cognitive psychology, economics, case-based decision theory and minimum-regret theory (see Gilboa et al., 2002; Kahnemann and Tversky, 1979; Starmer 2000). Many studies have applied this technique (Hensher and Green, 2003; Hensher, 2004, 2006; Hensher and Rose, 2007; Train and Wilson, 2008). In the interview, respondents are first asked to describe their current residence with respect to the selected attributes. They are then requested to choose between three residential options. Among the options, one is their actual house. The other two hypothetical alternatives are described in relation to the attributes of their current residence with some change of the attributes. Other attributes of residences that are not explicitly included in the CE are assumed to be the same for all alternatives.

Table 1 presents the five attributes selected in our CE and the attribute levels. The first attribute is the "distance to peri-urban forest". Previous studies showed that the distance to the forest may affect the residential choice. Applying the hedonic pricing method, Tyrvainen and Miettinen (2000) found that house prices decrease with the increase of distance between the house and a forest in Finland. Other hedonic pricing studies show that house and land prices rise with proximity to forests (e.g., Mansfield et al., 2005;

Thorsnes, 2002; Tyrvainen and Miettinen, 2000) or increase with the proportion of forest land in the region (Hand et al., 2008). Based on the spatial distribution of all peri-urban forests, interviews and experts' suggestions, we set three levels of distance to the forest.

The second attribute is the "distance to parks". Urban parks are considered in our CE because they may serve as a substitute or a complementary site (Troy and Wilson, 2006; Termansen et al., 2008), influencing the recreation demand of peri-urban forests. There is also numbers of study who investigate the relationship between urban park and housing price. Access to urban parks has a significant value for the local population, as shown by empirical studies that apply hedonic models (e.g., Poudyal et al., 2009; Sander and Polasky, 2009; Hoshino and Kuriyama, 2010) as well as those based on stated preference methods (Brander and Koetse, 2011; del Salazar and Menéndez, 2007). We also set three levels of distance to parks with the same method used to establish the distance to peri-urban forests.

The attribute "scenic view of green spaces" is used to estimate the value generated by aesthetic amenity. Households are normally willing to pay for having scenic amenity around their house (Cavailhès et al., 2009; Sander and Polasky, 2009).

Finally, we add the size of living space and price as housing characteristic attributes. Using these important housing attributes, we were finally able to observe people's trade-offs between private housing amenities and environmental amenities with a limited budget. Note that we do not include all the other attributes, e.g., public infrastructure, which may influence the choice of residence. It is possible to do this since we carry out an experiment where we tell the respondents that the hypothetical alternatives are exactly the same as the current alternatives, except with respect to the five attributes in our CE.

Table 1 House attributes and their levels in the CE

Attribute	Level
Distance to peri-urban forest	Current 2 km further 4 km further
Distance to park	Current 500 m further 1000 m further
Scenic view of green spaces	With view No view
Size of living space (m2)	-10% Current +10%
Price/rent of house	-15% -10% -5% Current +5% +10%

One example of our choice scenarios is presented in Table 2. The CE presents three alternatives to a respondent. Each of them has the same five different attributes. The five attributes, with their different levels, have 324 combinations using a full factorial design. It is not realistic to include all alternatives in a CE. We therefore used a B-efficient design (Sándor and Wedel, 2001) that only made it possible to estimate the main effects and the interaction between the two attributes of distance. This interaction term was included to investigate the substitution between parks and forests. The priors used for CE design are obtained from a pilot study of 86 house owners. Using the software Ngene, we constructed a D-efficient design with 12 different choice sets. Each choice set contains a "status quo" option. Some of the respondents may have a view of green space and the others may not. For this reason, a conjoint segment design is applied. (Sándor, Z., and M. Wedel, 2005) The form of our choice situation is described in Table 2. The question asked is: "Imagine that, at the time you did choose your current residence, the following two other alternatives existed. Assuming that all other characteristics stay the same, only these five attributes vary. Which residence would you have chosen among the three options?"

Table 2 Example of a choice situation

Attributes	Current house	Alternative 1	Alternative 2
Distance to forest	Current distance	2 km further	Current distance
Distance to park	Current distance	500 m further	1000 m further
Scenic view of green spaces	Current view	No view	With view
Size of the house	Current size	10% more	10% more
Price/rent of the house	Current price/rent	15% less	5% less
I prefer (choose only one please!) →	□	□	□

3.3. Survey and data description

Our study area is Nancy city plus its surrounding area, which had 124,217 households in 2006, according to French National Institute of Statistics and Economic Studies (INSEE) statistics. It is the biggest urban agglomeration in Lorraine region, France. Forest covers nearly 166,000 ha, representing more than 32% of the territory. Compared to the forestry rate in France, which is 26%, Nancy and its surrounding area is a heavily forested region. The urban green spaces data we considered in this study includes urban parks, greenbelts, playgrounds, and private gardens. Nancy currently has 23 urban parks open to the public. These parks include spaces with solitaire trees but not forest cover and are very different from peri-urban forests.

Collaborating with a survey company, our online survey was carried out in January, 2014. The questionnaire consisted of an introduction, four main sections and a map of Nancy. The introduction briefly presented the survey and the institutions conducting it. The first section aimed to obtain information about the respondents' recreational activities, such as the number of visits to forests around Nancy. The purpose of the second section was to collect information about the respondents' actual residences, such as the size of living spaces, housing prices and scenic views of green spaces. The third section was designed to obtain personal information about the respondents. The forth section, a CE, like the one described above, was implemented. In each questionnaire, a map of Nancy was included to help the respondents to find the forest they lived close to and visited the most often. Fanally, respondents are asked to reveal their happiness level on a scale of one to ten. The respondents are all adults (+18 years old) who live in Nancy and its surrounding area, which is our study area. We questioned only one member per household. All respondents were asked to provide information about their primary residence. On average, the interviews lasted 15 minutes. A total of 129 house owners accepted to respond to our survey and 124 of the questionnaires were sufficiently complete to be used for our analysis. The variables used in the analysis are described in Table 3.

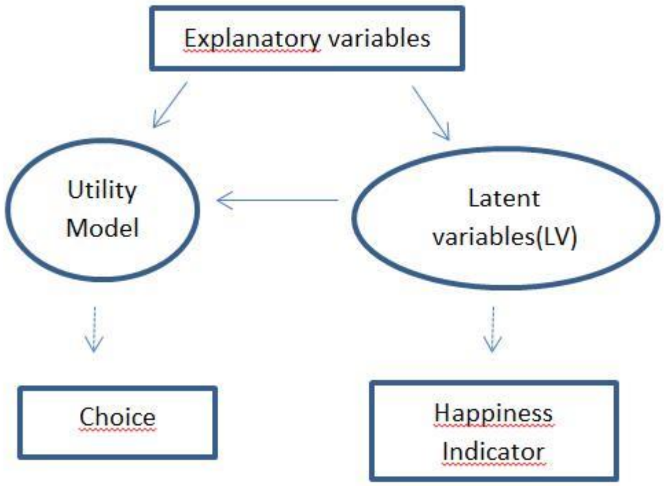
Table 3 Description of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Distance to forest	124	5.35	4.688	0	20
Distance to park	124	5.349	6.654	0	35
Living space of house m^2	124	118.544	49.065	21	400
Housing price €	124	157469.2	77888.23	35000	500000
View of green spaces	124	58.1%		0	1
Revealed happiness level	124	7.395	1.592	1	10
Revealed family satisfaction	124	7.669	1.622	1	10
Revealed health satisfaction	124	8.073	1.673	2	10
Education level	124	2.718	1.130	0	4
Income €/month	124	2995.968	1263.136	1000	8000
Private garden (dummy)	124	78.22%		0	1

3.2. Model specification: a hybrid choice model

Few studies argue that responses to attitudinal questions, such as revealed happiness, cannot be incorporated into the choice model directly, since this may lead to measurement error and potential problems with endogeneity bias due to omitted variables (Ben-Akiva et al. 1999; Ashok, Dillon, and Yuan 2002; Ben-Akiva et al. 2002; Hess and Beharry-Borg 2012). In our case, the unobserved individual variables affecting their statement on happiness may very well also affect their choices across housing alternatives. Therefore, we address this by introducing a hybrid choice model (HCM). HCM can be viewed as an expanded discrete choice modeling framework, which integrates different types of models into a single structure that is estimated simultaneously. Basically, HCMs incorporate a latent variable model into a discrete choice model in order to improve the explanatory power of the choice model by considering the effects of decision makers' latent attitudes. The HCM framework of this study is illustrated in Fig. 1. The ellipses represent unobservable variables, while the rectangles represent observable variables. Each of these sub-models comprises a structural component and a measurement component. Since the latent attitudes (i.e. latent variables) cannot be directly observed from revealed choices, they should be identified through a set of attitudinal indicators. The latent variable model permits identifying latent constructs as a function of the indicators, and capture the causal relationships between exogenous explanatory variables and the latent variables. By simultaneously integrating discrete choice and latent variable models, the latent variables can be treated as explanatory variables in the utility functions of choice alternatives. According to the models included, this structure has also been referred to as the integrated choice and latent variable (ICLV) model.

Figure. 1 The structure of hybrid model



2.2.1 Structural equation of a latent variable

$$\mathrm{LV} = \mathrm{constant} + \mathrm{r}_{\mathrm{education}} * \mathrm{education} + \mathrm{r}_{\mathrm{health}} * \mathrm{health} + \mathrm{r}_{\mathrm{family}_{\mathrm{satisfaction}}} * \mathrm{fa}_{\mathrm{happy}} + \mathrm{r}_{\mathrm{lnavinc}} * \mathrm{lnavinc} + \mathrm{r}_{\mathrm{yard}} * \mathrm{yard} + \tau \quad (1)$$

The latent variable “LV” depends on numbers of social characteristics variables. We assume LV can explain simultaneously the choice utility and happiness. τ is an error term with i.i.d. distribution.

2.2.2 Measurement model for the happiness indicator

There are different perceptions and cognitions about happiness. Some studies assume happiness meaning the same thing to all individuals (Layard, 2005; Myers and Diener, 1995). Others argue that the meaning of happiness is different across individuals(Gilbert, 2006). In addition, studies find that there are different types of happiness according to cultures (Tsai et al.,2006) and age (Mogiler, et al., 2011). Another issue with revealed happiness data is that they are bounded from below and from above. This implies that one can neither observe a decline in happiness if it was in the lowest category in the preceding period, nor an increase if it was in the highest category. A way of addressing this problem is by collapsing the information of happiness variables in two categories (high/low) and applying a binary choice model (Welsch and Ferreira, 2014). For these reason, we treat the revealed happiness only as a psychological feeling instead of considering utility as other happiness studies. And we separate the happiness data in to two categories. The measurement model is a logit which describes the probability that happiness is more than 6:

$$\Pr(\text{happy} > 6) = \left[1 + e^{(\gamma * LV + \sigma)}\right]^{-1} \qquad (2)$$

γ is a scale factor. And we assume that the latent variable LV may explain the happiness indicator.

2.2.3 Random utility model for the description of choice utilities

The choice model is a mixed logit (ML) model. All attribute is the CE is specified as random parameter with normal distribution. The ML model uses random parameters to account for individual heterogeneity in preferences (Hensher and Greene, 2003; Greene and Hensher, 2010). Generally, it is assumed that the preferences vary across respondents but not across choices for the same respondent (Revelt and Train 1998). A panel specification allows for repeated choices for each individual.

In a given sample with *N* respondents, each respondent *n* faces *T* choice situations. Every choice situation has a choice set of *J* alternatives. The utility for respondent *n* choosing alternative *j* in the choice set in situation *t* is:

$$U_{njt} = \beta_n * X_{njt} + \mu_n * X_{njt} * LV + \varepsilon_{njt}, \quad n = 1, \dots, N, \quad j = 1, \dots, J \quad t = 1, \dots, T \quad (3)$$

where X_{njt} is the observed five CE attributes of this study and β_n is a vector of individual-specific taste coefficients with a density function $f(\beta|\theta)$ where θ are the parameters of the distribution. The unobserved error term ε_{njt} is assumed to be Gumbel-distributed. The LV is the latent variable which can explain both the utility of choice and happiness level. The error term ε_{njt} and the error term τ in the structural model of LV are independent. The latent variable LV varies simultaneously in equation (1), (2) and (3).

4. Estimate results

The results are shown in table 4. In our study, an Alternative Specific Constant (ASC) is specified in the model for the status quo alternative in order to capture the systematic component of a potential status quo effect according to Scarpa et al. (2005). The ASC is statistically significant at the 1% level. The positive parameter estimate for ASC captures a systematic status quo effect. All other attributes being equal, respondents prefer to choose the status quo alternative, i.e., the houses they are actually living in. That is to say, respondents show an affinity for this alternative beyond what the specific attribute levels for this alternative relative to the other two alternatives would predict. The distance to parks strongly affects people's choice of a residential location. The random parameter of distance to park is significantly different from zero at the 5% level. The mean of the parameters are negative because people's utility decrease as the distance to urban green spaces increase. There results suggest that residents are willing to pay more for living 1 km closer to parks on average. The standard deviation parameter of distance to forest and distance to parks are significantly different from zero at the 1% level. This shows that people's preferences for living close to forest and parks are different. The parameter of living space is significantly different from zero at the 1% level and has a positive effect. Not surprisingly, the square of the variable "living space" has a significant effect at the 1% level and a negative impact. This implies that the marginal WTP for one extra square meter of living space will decrease when the living space increases. The mean parameter of the view of green spaces is significantly different from zero at the 1% level, with a positive sign showing the importance of a view in the individual's choice of residential location. It is also important to consider the significance of the standard deviation parameter which indicates the hetegeneity of preference of view.

Table 4 Parameter estimates for the MNL, ML and LC model

Mixed logit model

Parameter	Value	Robust Std err	Robust t-test	p-value
mean of parameter				

ASC	1.73	0.201	8.63	0.00
distance forest	-0.0557	0.0457	-1.22	0.22
distance park	-0.416	0.205	-2.03	0.04
house price	-0.102	0.0250	-4.08	0.00
living space	0.105	0.0236	4.45	0.00
living space2	-0.000154	6.95e-05	-2.21	0.03
view	1.33	0.194	6.88	0.00
standard deviation of parameter				
distance forest _sd	-0.329	0.0687	-4.79	0.00
distance park _sd	0.978	0.196	5.00	0.00
living space _sd	-0.0793	0.0147	-5.40	0.00
view _sd	1.63	0.260	6.27	0.00
Interaction terms of environmental attribute and latent variable				
distance forest *LV	-0.00466	0.00207	-2.25	0.02
distance park *LV	0.159	0.0512	3.11	0.00
house price*LV	0.0367	0.00982	3.73	0.00
structural equation of latent variable (LV)				
cons	-3.72	1.28	-2.92	0.00
education	0.275	0.122	2.26	0.02
Family satisfaction	0.280	0.0670	4.18	0.00
Health satisfaction	0.214	0.0725	2.95	0.00
ln(income)	0.170	0.139	1.22	0.22
yard	-1.08	0.527	-2.04	0.04
Happiness indicator				
gamma	1.83	0.664	2.76	0.01
Nb of respondents =	124			
Nb of choices obs. =	1488			
McFadden's R^2 =	0.292			

The structural model LV is both significant in happiness measurement model and choice utility model as component of interaction terms.

The coefficient of LV*distance to forest is negative. It suggests happier people anticipate more loss when they live further to forest. (See table 1. In the choice experiment, we propose them only to live further to forest/parks.) The coefficient of LV*distance to parks is positive. It shows happier people anticipate less loss when they live further to parks.

The coefficient of LV*price is positive. It indicates that happier people wants to pay more for house in general.

The scale parameter “gamma” in the health indicator function (see section 2.2.2) is significantly positive. So the “LV” function has a significant positive effect on revealed happiness. The parameters in LV indicate people with higher education, more family satisfaction and better health condition are normally happier. The insignificance of income is common in happiness studies. For example, Tversky and Griffin (1990) find that although respondent will choose the position with higher salary, her happiness only increases if she earns more than one’s colleagues, even the salary is lower. A negative sign of “yard” indicates having a private yard can make people less happy. Generally, people anticipate a loss of value if they live further to parks and gardens. And their preferences are heterogeneous because the significance of standard deviation.

5. Discussion and conclusion

This is a pioneer study who investigates the impact of the feeling of happiness on people’s preferences for urban green spaces based on their residential location choices. A hybrid choice model is applied to account for the endogeneity of happiness. The results of this study prove that the revealed happiness has an impact on people’s preference for urban green spaces. Furthermore, the results show the impacts of happiness on forests and parks are different. Happier people are less willing to live further to forest. But surprisingly, we find that happier people anticipate less well fare lost if they live further to parks. One possible explanation is happier people are more tolerant of the loss of urban artificial green space such as parks. But they anticipate more loss face to natural landscape deterioration, such as living further to forest. Further estimation is needed for to explain this result.

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