Ecological Economics 92 (2013) 67–77

Contents lists available at SciVerse ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Spatial preference heterogeneity in forest recreation

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ARTICLE INFO

Article history:
Received 13 January 2011
Received in revised form 26 November 2012
Accepted 3 January 2013
Available online 4 February 2013

Keywords:
Forest recreation
Forest attributes
Spatial heterogeneity
Choice experiment
Error-component model
Cluster-effects model

ABSTRACT

In this study, we analyze the preferences for recreational use of forests in Lorraine (Northeastern France), applying stated preference data. Our approach allows us to estimate individual-specific preferences for recreational use of different forest types. These estimates are used in a second stage of the analysis where we test whether preferences depend on access to recreation sites. We find that there is significant preference heterogeneity with respect to most forest attributes. The spatial analysis shows that preferences for forests with parking and picnic facilities are correlated with having access to such forests while for the other attributes considered (dominant tree species, trekking paths and presence of lake and rivers) we find no correlation between stated preferences and accessibility.
This implies that the problem of endogenous distances in the travel cost method (Parsons, 1991) may be present in the estimation of welfare economic values for parking and picnic facilities in the analyzed model. The results underline the importance of considering spatial heterogeneity of preferences carrying out economic valuation of spatial-delineated environmental goods and that the spatial variation in willingness to pay for such goods is not only explained by the users' transport costs of accessing the sites.

1. Introduction

This paper analyzes the preferences for forest recreation, with a focus on spatial preference heterogeneity. Spatial factors get increasing attention in environmental valuation. For example, distance decay functions are included in the economic valuation of spatially delineated ecosystem services and are especially important when aggregating individual values and carrying out benefit transfer (e.g., Bateman et al., 2006). Distance decay functions are not necessarily associated with spatial preference heterogeneity but, in the case of use values, reflect variations in transport costs and availability of substitute sites (Schaafsma et al., 2011). Other environmental valuation studies have addressed spatial preference heterogeneity on a rather coarse scale by, for example, including regional dummies in the estimated choice model or estimating separate models for different locations (e.g., Bergmann et al., 2008; Broch et al., 2013; Brouwer et al., 2010).

The main objectives of this study are: (1) to estimate recreational users' preferences for forest attributes; and (2) to estimate the determinants of the preference heterogeneity. Spatially heterogeneous preferences may be a result of spatial sorting where individuals select their location of residence according to their preferences for recreation opportunities. If access to forest recreation is correlated with the preferences, it is important to consider the endogeneity of travel distance in the application of the travel cost method (Parsons, 1991; Randall, 1994). Furthermore, if recreation opportunities influence the choice of residence location welfare effects of changes in access to recreation sites may differ in the short-term and long-term due to changed composition of the local population over time (see e.g. Klaiber and Phaneuf, 2009).

In this study, we estimate the preferences for forest recreation applying a Choice Experiment (CE) where respondents are asked to choose between the forest they usually go to and two hypothetical forests. Asking the respondents to make hypothetical choices allows us to account for potential endogeneity of site attributes (e.g., travel distance) and thus reduce the potential estimation bias in applications based on revealed preferences. We model forest choice by applying a random parameter error component model that allows us to account for preference heterogeneity as well as for the repeated choice panel structure of the data. Due to the repeated choices made by each respondent, we are able to estimate individual-specific utility model coefficients. These estimates are used in a second-stage analysis where we estimate the potential spatial determinants of the preferences for forest recreation. To our knowledge, this has not been previously attempted in the environmental valuation literature. Individual-specific willingness-to-pay estimates for rural landscape improvements have been derived from a mixed logit model and spatially analyzed in Campbell et al. (2008, 2009). Their spatial analysis is mainly explorative and does not attempt

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http://dx.doi.org/10.1016/j.ecolecon.2013.01.001

to estimate spatial determinants of preferences. An explorative analysis of spatial distribution of preferences was also carried out by Baerenklau (2010) who applied a latent class approach to the estimation of backcountry hiker preferences in southern California. Compared to previous studies (Baerenklau, 2010; Birol et al., 2006; Brouwer et al., 2010; Campbell, 2007; Campbell et al., 2008, 2009) on preference heterogeneity, we include variables representing the spatial proximity to recreation sites with different site attributes. Our study uses empirical data from a CE with recreational attributes of forests in Lorraine. Lorraine is a heavily forested region. Forest covers nearly 850,000 ha, representing more than 35% of the territory (this rate is 29% at the national level). A previous survey conducted in 1997 (Despres and Normandin, 1998; Normandin, 1998) on ecological and recreational services of forests in Lorraine reveals that Lorraine forests are heavily visited, with an average of 40 visits/family/year and only 4% of households that never visit forest sites.[1] For this study, we carried out a Web-based survey by sending the questionnaire to an Internet panel of residents in Lorraine.

We find significant heterogeneity in the preferences for different forest attributes, describing the forest structure and the presence of recreational facilities. In a spatial analysis of the individual preferences, we find some evidence of a link between the strength of preferences and access to forests, i.e. forests with picnic and parking facilities. The next section briefly reviews the economic literature concerning spatial aspects and feedback effects in the valuation of recreational sites and amenities. In the third section we describe our empirical approach for estimating forest recreation values, addressing spatial issues explicitly. Next, we describe the data used, followed by the estimation results. Finally, we conclude the paper with a discussion of the results and the implications of spatial preference heterogeneity for recreational modeling and forest policy.

2. Spatial Heterogeneity and Preferences for Amenities

The economic analysis of changes in access to recreational sites or changes in quality of environmental sites is inherently spatial (Baerenklau et al., 2010). First, a recreational site has a specific spatial location. The distance between the site and the potential visitor influences the costs of a visit and, accordingly, the probability that the site will be visited. Consequently, the aggregate demand for recreational use of a given site strongly depends on its distance from population centers. However, alternative sites that may serve as substitutes or complementary sites (Termansen et al., 2008; Troy and Wilson, 2006) also influence the demand for recreational use of a given site. This implies that the spatial configuration of the recreational sites is important for the economic value. Therefore, consideration of the distance effect on the demand side and the spatial configuration of the recreational sites must be included in the valuation of recreation sites. The spatial configuration of recreational sites does not only concern the spatial distribution of sites but also the recreational quality of the individual sites and of their substitutes.

Secondly, an additional source of spatial heterogeneity of the economic value of recreation sites is preference heterogeneity. Benefit estimations of recreation have revealed significant variation in preferences for forest recreation and for different forest site characteristics (Brey et al., 2007; Christie et al., 2007; Termansen et al., 2008). Spatial preference heterogeneity is theoretically consistent with the sorting models inspired by Tiebout (1956) and has been confirmed in empirical analyses based on Roback's (1982) hedonic model framework. This framework assumes that house prices and wages depend, in part, on access to natural amenities and reflect peoples' amenity-dependent residential location choices (e.g., Schmidt and Courant, 2006). Workers prefer to be in areas with access to amenities which implies a high demand for housing (higher rents) and a high supply of labor in such areas (lower wages).[2] In an empirical study of the amenity value of forests in Arizona and New Mexico, Hand et al. (2008) found that increasing forest density in a region implies higher rents and lower wages in that region. Spatial heterogeneity in preferences for environmental amenities has been confirmed in empirical studies. Schläpfer and Hanley (2003) reported that attitudes to landscape protection are strongly associated with the local landscape. The presence of distance decay functions in valuation studies may also reflect spatial preference heterogeneity (Bateman et al., 2006). For example, Birol et al. (2006) found that the utility of wetland management attributes depends on the distance from the location of residence to the wetlands considered, and Brouwer et al. (2010) found that water quality improvement in a river system depends on the location of the respondents. Campbell et al. (2009) reported significant regional differences in the preferences over rural landscape improvements in Ireland.

Thirdly, if households choose their residential location according to their preferences for environmental quality, e.g., access to forests, we would consequently expect that preferences for environmental quality are spatially heterogeneous and may depend on the spatial configuration of the environmental quality. Furthermore, if preferences for forest recreation depend on income and other socio-demographic factors and these factors influence the residential location choice, we also expect to find spatial heterogeneity in preferences for forest recreation (Baerenklau, 2010; Kuminoff, 2009). However, another effect leading to spatially heterogeneous preferences is what Nielsen et al. (2007) refer to as an accustomization effect, i.e. people develop preferences for what is close to them. While the neoclassical concept of *Homo Economicus* entails an assumption of stable preferences which would preclude such an effect, what has been known for centuries in psychology is by now also more or less agreed upon in behavioral and experimental economics; people do not in general have stable preferences over time, rather their preferences develop and evolve over time (Norton et al., 1998). Empirically, it is extremely difficult to disentangle the spatial sorting effect, i.e. individual chooses location according to preferences, from the accustomization effect, i.e. individuals develop preferences according to the location where they have decided to live.[3]

Spatial sorting due to heterogeneity in preferences and in the access to recreation sites has implications for the welfare economic analysis of policies that influence access to and quality of recreation sites.[4] As mentioned in the introduction, the travel distance between a visitor and the recreation site cannot be considered exogenous if spatial sorting occurs. Instrumental variables have typically been used to cope with endogenous quality attributes (travel distance, congestion, among others) in applications of the travel cost method (Murdock, 2006; Parsons, 1991; Timmins and Murdock, 2007) and property characteristics (local open space, among others) in the hedonic pricing model (Cavailhès et al., 2009; Irwin, 2002; Irwin and Bockstael, 2001). In welfare economic analysis of situations with potential sorting a general equilibrium framework has been applied to model the sorting mechanisms explicitly (e.g. Klaiber and Phaneuf, 2010; Sieg et al., 2004; Smith et al., 2004; Walsh, 2007; Wu et al., 2004). For example, Smith et al. (2004) find that the estimated welfare effects of reductions in ozone concentrations in the Los Angeles

[1] In the survey they did not ask the number of individuals from the households going together at a visit, implying that the number of visits per person cannot be calculated.

[2] Note that it is unclear whether amenities have an positive or negative impact on wages if amenities also affect firm productivity (Roback, 1982).

[3] We thank one reviewer for pointing out that this can be thought of as a "chicken or egg" conundrum: Do people choose to live in an area because they have preferences for recreational opportunities in that area, or do their preferences for recreation develop to reflect the recreational opportunities in the area they live in? We agree with the reviewer that it is most likely a combination of the two.

[4] Here we consider spatial sorting as the determinant of spatial heterogeneity. However, presence of accustomization would also complicate welfare economic analysis as preferences also in this case would be endogenous to changes in environmental quality.