Ecological Economics 130 (2016) 166–175

Contents lists available at ScienceDirect

Ecological Economics

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

Integrating non-monetary and monetary valuation methods – SoftGIS and hedonic pricing

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ARTICLE INFO

Article history:
Received 10 September 2015
Received in revised form 25 May 2016
Accepted 13 July 2016
Available online 3 August 2016

Keywords:
Urban green space
Value integration
Value pluralism
Urban ecosystem services
Environmental valuation

ABSTRACT

In order to address the increasing need for improved linkages between different value perspectives, we examine the possibility of integrating two valuation methods: the non-monetary softGIS and monetary hedonic pricing. We find them compatible and their output more comprehensive compared to traditional valuation based on one value perspective. The public participatory softGIS survey delivers information on the perception of urban green spaces, which we use as a criterion for dividing green space categories in a hedonic pricing model. We find that the perception expressed in the survey is generally consistent with the impact on property prices in the case of formal green spaces. However, it is inconsistent when it comes to informal ones: places identified as lacking well-maintained greenery exert a positive influence on property prices, while positively evaluated informal green spaces had no impact at all. We identify the latter as a typical trade-off between different value perspectives: informal green spaces are perceived differently following a monetary and a non-monetary approach.

1. Introduction

Valuation of nature is attracting more and more attention in modern discussions on environmental protection, and is most often associated with monetary methods that fit into the overarching economic paradigm (Kallis et al., 2013). Valuation results are expected to create a platform for communication between environmentalists and the decision makers, who are used to thinking in economic terms (Kumar, 2010). Relatively early in the discussion on valuation it was argued that special attention needs to be paid to "improve linkages between ecological and economic methods and to develop improved protocols for valuation studies" (Bingham et al., 1995, p. 74). More recently, calls for integrating different valuation approaches have intensified, increasingly requiring researchers to go beyond standard techniques of examining problems from a dominant economic perspective (Norton and Noonan, 2007; Dendoncker et al., 2013; Hubacek and Kronenberg, 2013; Martín-López et al., 2014). Indeed, the challenge of integrated valuation is currently perceived as a frontier in the study of ecosystem services (Gómez-Baggethun et al., 2014; Kronenberg, 2014), with the objective of integrating economic, socio-cultural and ecological value perspectives, as well as monetary and non-monetary valuation techniques.

In response, new integrated valuation approaches have been developed, especially through multi-criteria evaluations and their extensions (Martinez-Alier et al., 1998; Zoppi, 2007; Munda, 2008; Aznar et al., 2011; Frame and O'Connor, 2011), but also attempting to integrate different valuation methods and approaches. The latter indicate the potential to combine different monetary valuation methods, as well as monetary valuation with non-monetary valuation methods, which are aimed at revealing human preferences in a more comprehensive and accurate manner. Examples include combining choice experiment with the travel cost method to estimate the individual opportunity cost of travel time in the travel cost method (Czajkowski et al., 2015). More comprehensively, monetary valuation methods have been complemented with a discourse analysis component (Wilson and Howarth, 2002) and deliberative processes (Spash, 2007; Lo and Spash, 2013) to depict the broader social and political context of eliciting monetary values. This is especially important when combined with transparency of the process, and makes it possible to reveal the broader social and shared values in addition to the individual values which are typically revealed in standard valuation techniques (Kenter et al., 2015). For the same reason, integrated valuation should contain an important participatory component (Fontaine et al., 2014). Finally, other authors performed independent valuation studies using different monetary and non-monetary methods, and then standardized and compared the results of those studies to check if these different approaches provide consistent and/or complementary information (e.g. Martín-López et al., 2014).

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http://dx.doi.org/10.1016/j.ecolecon.2016.07.004
0921-8009/

In particular, several studies have already attempted to integrate different valuation methods in urban and peri-urban settings, where the diversity of perspectives and values is exceptionally significant. This diversity results from high population density (with people attracted to cities from many different backgrounds), and the fact that in cities many types of green spaces are situated close together. This diversity is reflected in the growing importance of research into cities and urban ecosystem services (Hubacek and Kronenberg, 2013; Haase et al., 2014). In this context, Langemeyer et al. (2015) combined the travel cost method with the pebble distribution method to ascribe monetary values to the different benefits sought by visitors to the Montjuïc Park in Barcelona, Spain. Their study included an additional non-monetary ranking of preferences towards the different benefits related to visiting the park, and the results of these two approaches were compared and discussed.

Others followed mixed-method approaches, combining but not necessarily integrating different valuation methods or value perspectives. In these cases, the non-monetary component was meant to help explain the monetary valuation part of each study and to understand the broader context of monetary valuation results (e.g. the motivations or deeply-held values behind those revealed in monetary valuations). For example, Vollmer et al. (2015) followed a mixed-methods approach to value cultural services provided by an urban river in Jakarta, Indonesia. Their study combined household surveys, a choice experiment and ethnographic interviews and indicated how a mixed-methods approach can help frame and interpret quantitative, monetary valuation results. Similarly, Kenter (2014) contrasted a traditional, individual choice experiment with a choice experiment carried out after a deliberative exercise, and a third, post-deliberative, group choice experiment. This study, carried out in the peri-urban Inner Forth estuary in Scotland, further included non-monetary components, such as conceptual systems modelling and participatory mapping. One of its objectives was to study how group deliberation processes influence values, and how group values differ from individual values. An example of this was a case study of the UK National Ecosystem Assessment Follow-on, which itself was a large-scale project undertaken to highlight the broad, multidimensional aspects of ecosystem values and valuation methods (UK NEA, 2014).

In line with the above attempts, our objective is to integrate two valuation methods – the non-monetary softGIS survey and monetary hedonic pricing – in order to better understand the preferences towards urban green space expressed by residents of our case study city, the city of Łódź in Poland. SoftGIS evaluates the perception of urban environment based on local, experiential knowledge of city residents and users (Kahila and Kyttä, 2009; Kyttä et al., 2013; Rantanen and Kahila, 2009). Hedonic pricing can be used to estimate the impact of different types of green spaces on real estate prices (Rosen, 1974; Tyrväinen, 1997). In this study we use softGIS to incorporate green space evaluations based on the residents' own experience into a hedonic pricing model. In this context, we formulated two hypotheses:

i) that areas identified as valuable in the softGIS survey will also positively affect apartment sale prices in a hedonic pricing study, while areas evaluated negatively will negatively affect apartment sale prices; and
ii) that these two valuation methods can be used complementarily, and that softGIS survey results constitute a useful contribution to a hedonic pricing study by providing distinctions between various urban green spaces based on people's revealed perception of the value of nature, which seems more accurate than the traditional one based only on the green space area.

This article is organized as follows: in the following section we describe softGIS and hedonic pricing methods, as well as how and where we integrated them. Section 3 lists the results and is followed by a discussion that revisits our hypotheses in Section 4, and conclusions in Section 5.

2. Methods

2.1. SoftGIS

To incorporate the perceived value of urban green space in place-based research, it is necessary to represent participant perception of this value with geographical features, preferably in a GIS environment. Talen (2000) proposed incorporating local knowledge of urban residents directly into GIS to facilitate the data collection process and support planning by better reflecting the needs and concerns of residents. SoftGIS is a specific variant of such a public participation GIS (PPGIS) approach, rooted in environmental psychology and humanistic geography. It is used to capture spatially explicit perceptions of the quality of urban green space, based on individual experiences in the living environment (Rantanen and Kahila, 2009; Kyttä et al., 2013). Respondents' responses are marked on interactive maps or geo-questionnaires, which makes them easily incorporated into the GIS environment, integrated with other types of data, and analyzed and synthesized using quantitative and spatial methods, thus providing new location-based research possibilities (Kahila and Kyttä, 2009; Czepkiewicz, 2013; Jankowski et al., 2015). In a similar vein, participatory mapping and PPGIS have been used to elicit values attributed to environmental amenities in natural resources management, forestry and tourism planning (Alessa et al., 2008; Brown and Weber, 2011; Sijtsma et al., 2012; de Vries et al., 2013; Brown and Fagerholm, 2015). In the context of urban green spaces, researchers have used PPGIS to elicit attitudes (Balram and Dragićević, 2005) and values attributed to green spaces (Tyrväinen et al., 2007), and to measure physical activities and health benefits in urban parks (Brown et al., 2014).

2.2. Hedonic Pricing

Hedonic pricing is an econometric method isolating the impacts of individual attributes of a good on its price (Goodman, 1998). The most popular application of hedonic pricing is the valuation of environmental amenities based on real estate prices. We followed the standard formulation of a hedonic pricing multiple regression model:

$$P = \alpha S + \beta E + \gamma L + \varepsilon$$

where P is the vector of property sales or rental prices, and S, E and L are the vectors of, respectively, the structural, environmental and locational attributes of the analyzed properties, and are the vectors of estimated regression coefficients, and is the vector of random error. Assuming that the market is in equilibrium, the estimated parameters can be interpreted as the marginal willingness to pay for the attributes (Rosen, 1974).

Environmental variables are most often represented by the distances to various types of green spaces. Environmental quality can also be represented by characteristics of the environment in the most immediate vicinity of the property, such as percentage of greenery, number of trees, or indexes of air quality and noise pollution (Tyrväinen, 1997; Melichar and Kaprová, 2013). Most hedonic pricing studies have indicated the positive influence of environmental amenities in explaining real estate prices (More et al., 1988; Martin et al., 1989; Tyrväinen and Miettinen, 2000; Kestens et al., 2005; Nicholls and Crompton, 2005; Larson and Perrings, 2013). There have, however, been exceptions. For example Tyrväinen (1997) found that the proximity to a forested park significantly decreases the property price in Joensuu, Finland. Also, Saphores and Li (2012) found that building owners benefit from an increase of the number of trees surrounding their properties, but not from an increase in the number of trees on the parcel itself.

The first environment-oriented hedonic pricing studies aimed at estimating the perceived value of urban green space as a whole, without any division into distinct green space categories (e.g. More et al., 1988). When it was clear that green spaces do have an impact on real