Landscape and Urban Planning 146 (2016) 11–19

Contents lists available at ScienceDirect

Landscape and Urban Planning

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

Research paper

Hedonic pricing and different urban green space types and sizes: Insights into the discussion on valuing ecosystem services

Piotr Czembrowski*, Jakub Kronenberg

University of Lodz, Faculty of Economics and Sociology, POW 3/5, 90-255 Lodz, Poland

HIGHLIGHTS

- We attempt to capture the impact of nine categories of urban green space plus general ambient condition.
- Only the most obvious and important categories have an impact on apartment prices.
- Hedonic pricing captures phenomena that are already well-understood and known to real estate buyers.
- "Environmental amenities" are more relevant in hedonic pricing than "ecosystem services".

ARTICLE INFO

Article history:
Received 27 March 2015
Received in revised form 22 October 2015
Accepted 24 October 2015
Available online 9 November 2015

Keywords:
Urban forest
Urban parks
Cemeteries
Post-socialist city
Environmental amenities
Central and Eastern Europe

ABSTRACT

In order to differentiate the potential key benefits associated with different urban green spaces, we divided green spaces into nine categories, depending on their type and size. Additionally, we used the percentage of green space in a 500 m radius to represent the general ambient condition. Our sample consists of 9346 apartment sales' transactions that took place in Lodz, Poland in 2011–2013. The stepwise regression reduced the number of variables from the initial 48 to 24 in the standard model, and to 26 in the fixed effects model (considering the effects of different districts). The impacts of various green space categories were consistent in both models: the largest forest and large parks were the most important and, together with small forests and the percentage of green space in a 500 m radius, positively influenced apartment prices. Cemeteries had a negative impact on apartment prices. Our results show that people do value nature, but unfortunately we cannot determine for which specific reasons. Hedonic pricing seems to be too general for that purpose, in that it only depicts the impacts of the best-known green spaces and the general ambient condition. In this way, our findings contribute to the broader discussion on applying hedonic pricing to the valuation of ecosystem services.

1. Introduction

Buying a house or an apartment is one of the most important transactions a person makes in his/her life. When entering into such a transaction people consider many aspects, and due to the long-lasting effects of the transaction they are not willing to make too many compromises. Based on an analysis of real estate data, hedonic pricing lets us spot and measure the preferences towards attributes that cannot be sold separately, and some of which are not sold at all in the market, such as a nice neighborhood, proximity to a city center, or the recreational aspects of the nearby green space (Baranzini, Ramirez, Schaerer, & Thalmann, 2008).

Although the early "environmental" hedonic pricing studies were aimed at finding the marginal willingness to pay for green space in general (for example, More, Stevens, & Allen, 1988 made an attempt to value urban parks in Worcester, US), recent research has shown that various types of green space may have different impacts on the price of a particular property. Larson and Perrings (2013) found that proximity to large parks as well as water bodies and deserts increases the sale price of a house in the Phoenix Metropolitan Area, whereas the proximity of small parks and agricultural land decreases it. Similarly, Anderson and West (2006) found a positive impact of neighborhood and special parks, golf courses, lakes and rivers, and a negative impact of cemeteries in Minneapolis–St. Paul metropolitan area. Tyrväinen (1997) found that the further is the distance to a water course, the lower is the price of a property in Joensuu, Finland, while increasing the distance to the nearest wooded recreation area increases the price of a house. Luttik (2000) tested the same hedonic pricing model

* Corresponding author. Tel.: +48 42 635 53 53.
E-mail addresses: piotr.czembrowski@uni.lodz.pl (P. Czembrowski), kronenbe@uni.lodz.pl (J. Kronenberg).

http://dx.doi.org/10.1016/j.landurbplan.2015.10.005
0169-2046/

in different parts of the Netherlands and found out that the proximity of green areas was statistically significant in 24 cases, and not significant in 14 (although all the significant parameters were positive, indicating that a proximity to green space increases property prices). Clearly, the different impacts that the different types of green space exert on property prices may depend on a number of other circumstances.

Here, we aim to distinguish the influence of nine different types of green space on property prices: small parks and small forests (smaller than 18,000 m^2); medium parks and medium forests (18,000–200,000 m^2); large parks and large forests (larger than 200,000 m^2); the single largest forest that constitutes a category on its own (over 13,000,000 m^2); cemeteries; and allotment gardens. In addition, we used a percentage of greenery in a 500 m radius as a proxy of the more general ambient condition. The above division was meant to reflect the different needs that these green areas satisfy, or to some extent the different ecosystem services that they deliver. Indeed, several authors have suggested that hedonic pricing that distinguishes between different green space types or features can be used to estimate the value of ecosystem services (Tyrväinen & Miettinen, 2000; Sander & Haight, 2012; Gómez-Baggethun, & Barton, 2013). Inasmuch as we distinguish so many different green space types and features in our model, we also consider the applicability of hedonic pricing to study the value of ecosystem services.

We performed our research in Lodz, the third largest city in Poland. The literature on hedonic pricing from Central and Eastern Europe is scarce, especially compared to western countries (Brander & Koetse, 2011). The study most comparable to ours in terms of location and methodology was conducted in Prague by Melichar and Kaprová (2013). In order to distinguish the impact of different types of green space they analyzed protected areas, urban forests, and agricultural land, also taking into consideration the size of those areas. In Poland only three hedonic pricing studies are of relevance. Borkowska, Rozwadowska, Śleszyński, and Żylicz (2001) used a very high number of variables to explain property prices in Warsaw, 24 of which turned out to be significant. The research showed that a view of a green space from one side of the building and proximity to a major green space increase the property price, while climbing plants growing on buildings and proximity to a small green space decrease it. Several hedonic pricing studies focused on suburban areas in Poznan county, revealing positive impacts of lakes and forests on the prices of both building plots (Łowicki, 2010) and agricultural land intended for conversion into building plots (Łowicki, 2012).

This paper is organized as follows. In the following Section 2 we briefly describe the methodology of hedonic pricing, our study area and the green spaces we differentiated, as well as the collection and processing of the data into variables. We also list the econometric challenges common to hedonic pricing and the means we used to overcome these challenges. The results are described in Section 3, followed by a discussion of the findings in the context of the hedonic pricing literature, and the relationship between hedonic pricing and the increasingly popular "valuation of ecosystem services." Section 5 offers conclusions.

2. Methods

Hedonic pricing is an economic method for isolating the impacts of individual attributes of a good or a service on the price of that good or service. Although it can be used to deconstruct the prices of various goods/services (the first hedonic pricing conducted by Court in the late 1930s concerned cars, Goodman, 1998), it has gained recognition as a method that can assign value to non-market components of real estate sales or rental prices (Baranzini et al., 2008). In such a case hedonic pricing boils down to estimation of the following 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 sets of vectors of structural, environmental and locational attributes, respectively, of the analyzed properties, and α, β and γ are the vectors of estimated regression coefficients, while ε is the vector of random error. The set of structural variables usually contains information about area, number of rooms, age of the building, technical condition, and other characteristics of the analyzed property that could influence its price. The environmental and locational variables are mainly the distances to various amenities, such as the city center or the nearest forest – measured either in a straight line (Melichar & Kaprová, 2013; Tyrväinen & Miettinen, 2000) or using street routes (Nicholls & Crompton, 2005; Tyrväinen, 1997). Sometimes the environmental attributes are represented by the vicinity or "the view" of a green space (Borkowska et al., 2001; Luttik, 2000; Nicholls & Crompton, 2005). Other authors considered air and noise pollution as important environmental attributes (Bayer, Keohane, & Timmins, 2009; Chattopadhyay, 1999; Kim, Park, & Kweon, 2007; Smith & Huang, 1995). The number and character of variables considered in various hedonic pricing studies depend on the specific objectives of each study and the availability of data. Therefore, we first present the data and then proceed with a more specific description of how we processed them and the specific form of our model.

2.1. Study area

Our study site was Lodz, a city in central Poland with ca. 710,000 inhabitants and an area of 293 km^2. The real estate market in Lodz is relatively large and we consider it mature enough to reveal the preferences of buyers towards various attributes of the traded apartments. It should be noted that the free market was introduced in Poland only in 1989, and that this country well illustrates the drastic changes that have occurred in real estate markets in post-socialist countries (Augustyniak, Łaszek, & Olszewski, 2014; Lux & Sunega, 2014; Sillince, 1990). The freedom to purchase houses and apartments has made it possible to capture peoples' preferences as reflected in market, bringing about socio-spatial changes in post-socialist cities, with suburbanization, fragmentation of social space and gentrification of certain areas (Marcińczak & Sagan, 2011; Tsenkova & Polanska, 2014). We collected the data on apartment sales for 2011–2013, which was a stable period with no major events in the real estate market, and only a slight downward price trend (Hładysz, 2013).

Lodz is a very useful case study because different types of green space are unevenly spread around the city and many areas which are otherwise similar have different availability of green space. Forests make up about 7% of the city area, parks—3%, allotment gardens—2%, and cemeteries—1%. Based on a statistical analysis of basic indicators related to urban green space planning, including changes in the area of green spaces, Baycan and Nijkamp (2012) observed that Lodz scored poorly in this field compared with other European cities. Lodz has also scored poorly in pan-European studies on urban green space availability (Fuller & Gaston, 2009; Kabisch & Haase, 2013), which suggests that the increasingly scarce green spaces should be a desired non-market good. Indeed, the only Polish study using a direct valuation method in the context of urban greenery was performed in Lodz and suggested that its inhabitants were willing to pay for increasing the number of streetside trees in the city center had they been given such an opportunity (Giergiczny & Kronenberg, 2014).