Bioculturally valuable but not necessarily worth the price: Integrating different dimensions of value of urban green spaces

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A B S T R A C T

The social processes that took place in the past left a mark not only on cultural heritage but also on ecosystems and biodiversity, which is now depicted in the concept of biocultural diversity. The related "biocultural value" represents yet another dimension of the value of urban green spaces which we attempt to integrate into monetary valuation with the use of hedonic pricing. We compare the impacts of different green spaces on property prices in Łódź, Poland, differentiating green spaces based on their biocultural value. Furthermore, we use quantile regression and analyze the heterogeneity of estimates according to the price of the apartment. Our study indicates that while there is a general desire to live close to the green space, biocultural value does not translate into any positive impact on property prices.

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1. Introduction

Before the Industrial Revolution, the area of today's city of Łódź, Poland was covered with forest and only a few human settlements. One of them was called the Priest's Mill (Księży Młyn). Its name came from the mill erected there in medieval times on the Jasień river. The mill's operation required the creation of an artificial reservoir, which became a new habitat for fauna and flora and influenced the local biodiversity. Because of the availability of water and wood for fuel, it was here that some of the most important textile factories were established, contributing to the international economic success of Łódź (Berbelska et al., 1998). This rapid development of the city was immortalized in "The Promised Land", a novel by Władysław Reymont, the Nobel Prize Laureate. It involved not only constructing factories but also palaces for factory owners and managers, surrounded by lush gardens, and more modest green spaces to be used by factory workers.

The above case of the Priest's Mill reflects the idea that biocultural diversity is an effect of manifold social processes that took place in the past and have shaped the present day ecosystem (Elands et al., 2015). Examples of ecosystem properties influenced by historical social processes include specific habitat types (e.g.

within old and often derelict factory buildings located on the verge of green spaces or artificial water reservoirs created to generate electricity and fire protection for those factories), and assemblages of specific species (e.g. tree and shrub species planted in the industrialists' gardens). This understanding of biocultural diversity goes beyond the traditional one, which linked to various biodiversity conservation practices of indigenous peoples (Cocks, 2006; Elands et al., 2015). In particular, Elands et al. (2015) indicated that the "Green Circle of Tradition and Culture" (GCTC), which was designated in Łódź to underline the special biological and cultural value of certain areas in the city, represents one of the conceptual expressions of biocultural diversity. The GCTC is an irregular ring around the city center and consists of green spaces as well as postindustrial areas and other historically important locations. The GCTC is also the effect of the cultural diversity which was a trademark of Łódź in the 19th century and which shaped the character of the city. However, even within the bioculturally diverse GCTC one can differentiate areas of higher and lower biocultural value. In the case of two complexes of green spaces, historical human interventions have been particularly important from the point of view of their present biodiversity, and on these grounds they can be separated from the rest of green spaces belonging to the GCTC.

In this study, we hypothesize that the biocultural value of green spaces is reflected in the prices of the properties located nearby. We are only interested in the impacts that green spaces from the GCTC exert on property prices, as we assume that postindustrial areas or other culturally important locations have a limited impact on prop-

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erty prices (as they are omnipresent in the city). More specifically, we use the hedonic pricing method in the case study of the city of Łódź to check whether green spaces representing the highest biocultural value have a stronger impact on property prices than those with a lower biocultural value. In this way we attempt to integrate the monetary and non-monetary (biocultural) dimensions of the value of urban green spaces. 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 this study, we focus on the city center because we want the analysed properties to be close to the GCTC, as the impact of green spaces tends to diminish over growing distances (Kong et al., 2007). The focus on the city center also makes it possible to explore another aspect of monetary valuation of green spaces – the variation of estimates within different price segments. We presume that these price segments can be characterized by different rules of pricing (Kostov, 2009; Liao and Wang, 2012). To test this, in addition to estimating a spatially autoregressive model, we perform spatial quantile regression. Due to the environmental focus of this study, we explore only the variation in the influence of green spaces on apartment sale prices within different price ranges.

In the following section, we present the methods used in this study, along with more specific information on our case study city. The results in Section 3 are followed by a discussion that addresses integrating monetary and biocultural values, and the disparities between the different price segments. Section 5 offers conclusions.

2. Material and methods

2.1. Case study city

With about 700,000 inhabitants, Łódź is the third largest city in Poland and covers an area of 293 km². Łódź grew to the size of a large city only in the industrial age, when Jewish, German, Russian and Polish manufacturers transformed the small peripheral town into one of the largest European centers of the textile industry. The population grew 800 times in one hundred years: from 767 inhabitants in 1820, to 600,000 in 1914 (Liszewski, 2009).

The history of Łódź is essential to the perspective of our study: most of the present GCTC was founded or built during the Industrial Revolution and resulted from mutual efforts of different cultures. Some of the green spaces still have trees that formed the ancient forest of Łódź and were incorporated into the private properties of rich manufacturers, especially Helenów Park and Źródliska II Park (Olaczek, 2010; Olaczek and Bonisławski, 2008). Both of these form part of the two green space complexes of particularly high biocultural value which we treat separately from the rest of the GCTC for comparative purposes. The first complex, the so-called Łódka River Gardens (LRG), consists of three parks and two palaces with gardens. The second complex – the Priest's Mill – is formed by Źródliska I and II Parks, green squares adjacent to the parks, and the reservoir on the Jasień river mentioned in the opening paragraph. Most of these green spaces date back to mid-19th century, whereas most of the rest of the GCTC was founded in the beginning of the 20th century.

As indicated by Elands et al. (2015, p. 5), the GCTC represents one of the manifestations of biocultural diversity, as it is a product of a co-evolving social-ecological system, hence it contains the broad spectrum of "human values and practices in respect to living with biodiversity". The concept of the GCTC was introduced to protect the natural and cultural heritage of the city and is included in spatial planning documents and various tourism development strategies for the city (Kaczmarek et al., 2006; Wysmyk-Lamprecht et al., 2007).

Apart from the two green space complexes mentioned above, which are extraordinarily important from the biocultural perspective, we also separated two cemeteries from the original GCTC. The reason for this was that previous hedonic pricing studies indicated that cemeteries are often considered as disamenities (Tse and Love, 2000) or – at best – are insignificant in explaining property prices (Saphores and Li, 2012), contrary to other types of green spaces. All of the green spaces used in the study are shown in Fig. 1.

The data on transaction prices is from the Łódź City Geodesy Center. We received the information on all apartments sold in the years 2011–2013 in Łódź (more than 12,000 records). However, due to our focus on the city center the sample was limited to 5088 transactions. We then eliminated two outliers (two extraordinarily expensive new buildings in the city center), which left us with 5018 observations. Buffer zones of 1000 m around the green spaces belonging to the GCTC marked the boundaries of the study area.

2.2. Hedonic pricing

Hedonic pricing is an econometric method for dividing the price of a good into the prices of its components. By analyzing the price of a car, for example, one can determine how much car buyers value its components, such as the horsepower of an engine (Goodman, 1998), and – analogously – by analyzing the price of a real estate property one can find the perceived value of proximity to a green space. Since the 1970s, hedonic pricing has been frequently used in environmental studies (Anthon et al., 2005; Brander and Koetse, 2011). The standard formulation of a hedonic pricing equation is:

$$P = \alpha S + \beta E + \gamma L + \varepsilon \qquad (1)$$

where P is the vector of real estate prices, S, E and L are the sets of, respectively, the structural, environmental and locational attributes of the real estates, α, β and γ are the coefficients assigned to these attributes (indicating how the price will change if a given attribute changes by a single unit, *ceteris paribus* (Nordman and Wagner, 2012)), and ε is the vector of random error.

In this study, environmental attributes are mainly represented by distances to the nearest entrances to green spaces. As a *novum* to the hedonic pricing studies, we introduce a new categorization of green spaces based on their biocultural value. In order to also capture the condition of general ambience, we include the percentage of greenery in the 500 m buffer. To control for the expected positive impact of other green spaces (i.e. not belonging to the GCTC), we also calculated the distances to those green spaces with a view to insert them into the model. However, due to the strong negative correlation with the distance to city center, we had to transform these distances into dummy variables, indicating only an exceptional closeness to a non-GCTC green space. After a series of estimations, the threshold of this "exceptional closeness" was calculated at 59 m as the greatest distance for which the impact of a non-GCTC green space was still significant. For similar reasons, we had to remove the distance to the Doły Cemetery (which had a strong correlation with distance to the LRG).

The set of structural variables consists of the age of the building, the total area of the apartment, and the story on which the apartment is located. As we did not expect a linear relationship between the age of a building or the story and the apartment's sale price, we included these characteristics as dummy variables. The locational variables contain information on distances to the nearest sports and educational facilities as well as shopping centers, public transport hubs, and the city center. To control for locally constant omitted variables, we also introduced spatial fixed effects for each of 26 administrative units covered by our study area. The list of variables is complemented by the quarter trend (the average