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Forest proximity impact on undeveloped land values: A spatial hedonic study

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ABSTRACT

In the study we examine the impact of the Las Wolski forest in Krakow (Poland) on undeveloped land values using the hedonic regression method, using OLS (ordinary least squares), SAR (Spatial Autoregressive Model) and SEM (spatial error model).
Although the discussion on the economic role of forests has been carried out for decades in mature market economies, there is scarce evidence based on data from emerging markets that were subject to a post-socialist transition. Another reason to undertake the study is the strong belief that new econometric tools (mainly spatial hedonic regression) can lead to more robust understanding of the influence of forest proximity on property values.
We found strong evidence of a positive impact of forest proximity on undeveloped property transaction prices, although the importance of this variable is considerably smaller than that of other factors controlled for. On average a one hundred meter increase in distance from the forest decreases land value by 3%.

1. Introduction

This article investigates the positive externalities of public urban forests and parks opened to the public. The role of open areas, including parks and urban forests has been described in a number of scientific publications in the context of the social, cultural and sustainable development profits (Cömertler, 2007).

The sustainable development of a city requires an implementation of long-term planning policy in order to preserve existing and create new green areas (for a complex analysis of relations between sustainable growth and green areas see Chiesura, 2004). In reality, this is not always put into practice, as green spaces within a city's boundaries are often exposed to rapid and uncontrolled development. Part of the post-socialist legacy of many large cities is that former urban policies have restrained the growth, and seriously distorted the spatial equilibrium. As noticed by Shepotylo (2012), post-socialist cities in transition face an exceptional bundle of challenges related to tensions between the heritage of socialist urban policies and growing market economies. The ongoing transition of post-socialist cities in Poland to the market economy (1989–2013) has been accelerated by significant migrations of rural population to the major metropolitan areas. One of the major problems faced in the process is the role of green urban areas (e.g., parks, urban, and peri-urban forests), and how to balance their protection with development demands.

One of the reasons why it is important to study this subject is to develop the economic arguments that would help to make decisions regarding the new housing space, while, at the same time, protect scarce forest resources in the urban area.

The paper explores the impact of an urban forest on the value of the surrounding land. It is obvious that, while discussion on the economic role of forests has occurred for decades in mature market economies, there is little evidence based on data from emerging markets that were subject to post-socialist transition. Also, the results of several prior studies do not fully apply to the post-socialist urban context. A further reason in undertaking the study is to explore whether new econometric tools (mainly spatial hedonic regression) can lead to a more robust understanding of the intrinsic value of forest proximity to property price. We discuss the results of the study by examining the influence of the Las Wolski forest on surrounding undeveloped land prices, based on transaction data in Krakow.

2. Previous research

Research on non-production forest functions has been undertaken for several decades, mainly in highly developed countries. One of the most important topics in the empirical research is undoubtedly the economic impact of forests on adjacent areas (Weicher and Zerbst, 1973). This effect is visible, especially in urban and suburban areas, due to a shortage of green areas. According to the literature, there are numerous direct and indirect effects of green areas in the urban context. A list of potential direct and indirect benefits may include (for a discussion see ECOTEC, 2008):

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- pollution and health issues: green infrastructure reduces pollution (lowering the risk of asthma and heart disease, for example).
- recreation: properly maintained urban forest provides footpaths and cycle paths, thus providing low-cost recreation.
- improvement in the work environment: green spaces near workplaces reduce sickness absence, which leads to increased productivity, and employees are thus more highly motivated.
- real property values: both proximity and the views of natural landscapes can influence residential property values, as natural amenities are both scarce in the urban context and highly demanded by investors.
- ecosystem: green spaces in cities provide primary habitat for various species, increase biodiversity, reduce pressure on drainage, provide fundamental flood defense, and, reduce temperature amplitude in the city.

As noted earlier, the economic effects arising from the existence of green areas in an urban setting, maintained by public expenditures, have been the object of numerous studies. Although, we have looked for evidence from different economies and urban regimes, we find that the majority of the empirical studies originate from the United States (see Table 1). We review articles written in English, and therefore, our literature review is selective. The same situation is found in Brander and Koetse's (2011) meta-analysis of value of an urban open space. Notable examples of non-American literature come from the United Kingdom (Cheshire and Sheppard, 1995), the Netherlands (Luttik, 2000), Spain (Bengochea-Morancho, 2003), and Finland (Tyrväinen, 1997; Tyrväinen, and Miettinen, 2000). To our knowledge Bazyl (2009) is the only hedonic study that has aimed at capturing the impact of park proximity on property prices in Poland.

Broadly speaking, the empirical evidence is based on the relation between urban green areas and property values. The urban green areas are not homogenous; the categories consist of: greenbelts, parks and forests. Moreover, studies differ in terms of the property type being examined. Some investigate the housing market (both single-family and multi-family), whereas others focus on the land market.

In regard to the methodology employed, the most common technique used to assess the impact of the park on the value of the surrounding areas is the hedonic method, created on the basis of consumer theory by Lancaster (1966) and refined by Rosen (1974) and others. It can be applied to the valuation of environmental amenities (Palmquist, 1992). The hedonic methodology will be discussed further in Section 3.

The first studies on the topic were carried out in the United States in the 1960s. The results are not entirely consistent, mainly due to the methodology and models used. For example, a study by Knetsch (1964) has shown that the benefits arising from the proximity of a location in an attractive area such as waterfront may cause an increase in the value of the adjacent land. In another study, Weiss et al. (1966) found no significant effect on the value of the recreational areas on real estate. One of the first studies on the impact of the park on the value of the adjacent land is Hendon (1971). Notable empirical results demonstrating the positive effects of green spaces and proximity to parks on property values are summarized in Table 1.

Empirical studies on the impact of parks on property values in the immediate vicinity were carried out mainly in urban areas. As noted by Brander and Koetse (2011), supply is vital to the willingness to pay for any environmentally related property attributes. When green areas are easily accessible, and there are many parks, their impact on the value of the neighboring land is not significant. However, in a situation of serious shortage of recreational areas, or cities with a small amount of green space, the impact of parks on property values in the immediate vicinity should be significant. Similar conclusions arise from the study by Cheshire and Sheppard (1995), based on English data.

An interesting example of this effect is a study that analyzes the impact of large parks in Bastrop County near Austin, Texas (Nicholls and Crompton, 2005). Their results suggest that the price premium associated with the proximity of the property to a public open space in the rural area can be limited by the large supply of the undeveloped land. The situation may change, however, with a decrease in the availability of green areas related to suburbanization (Nicholls and Crompton, 2005).

Another factor limiting the impact of parks on the property values may be the nature of detached houses — in particular, the size of home gardens. When the property land area is large (a garden can be treated as a private recreational space) the impact of the park on the price will be small. In this situation, private recreation space will be a substitute for public space offered by the park (Miller, 2001). We can also assume that the proximity of the park is more important to multifamily housing than to single-family housing. Multifamily housing developments, especially the ones that have been built in the post-socialist period, are known for their high density.[1]

The value of the park or forest may depend on its preservation, the presence of paths and landscape architecture (to facilitate the use of forest and direct recreational facilities), as well as the environmental quality. For example, a study conducted in Toronto shows that the value of the park (environmental and esthetic) depends on its biodiversity (Millward and Sabir, 2011). Snyder et al. (2008) examined the major factors influencing the market prices for undeveloped forest land in northern Minnesota, based on buyers' perceptions of relevant forest characteristics. One surprising result was that merchantable timber volume did not increase the property price significantly, contrary to less intuitive factors like water frontage. Recently, Edwards et al. (2012) conducted a Pan-European explorative study, finding that the most salient structural attributes of forests are size of the trees and size of clear-cuts, but there are substantive differences between countries and regions in the structure of preferences.

Studies in other countries also support the hypothesis of a positive impact of the city park on property prices. According to a study conducted in Hong Kong (Jim and Chen, 2010) park proximity increases housing value by about 17%. The most important factor attributed to park proximity is the availability of walking routes and recreation areas, which account for some 15% of the value increase, but there are other important aspects considered by buyers. According to the study, park view from the apartments also contributes to the increase in value — by approximately 2%. In another study, Tyrväinen and Miettinen (2000) estimated that a one kilometer increase in the distance to the nearest forested area lowers the market price of the dwelling by an average of 5.9%. Luttik (2000) also finds evidence for positive impact of green areas on property prices, based on a hedonic study in Netherlands, as does Bazyl (2009), who used a spatial hedonic model to study dwelling prices in Warsaw (Poland). However, the results of the latter are inconsistent due to the low quality of the data used (measurement error in geographic coordinates).

The impact of a green area on property prices can change in time, along with the changes within the park itself. An interesting study on the impact of the revitalization of parks on neighborhoods was carried out in 2003 by New Yorkers for Parks and Ernst & Young in New York, the results confirming the positive impact of a well-kept city park on the value of property (New Yorkers for Parks and Ernst & Young, 2003).

In summary, based on previous research we can identify at least four important empirical generalizations:

- The positive impact of the park on the prices of neighboring properties has been observed in different cities around the world, in significantly different economic and cultural conditions.
- The relative strength of the impact of proximity to a park on property values may vary depending on: the size of the park, its biodiversity, the degree of accessibility and park maintenance. On average, values of the properties in park proximity increase by about 20% (Crompton, 2005).

[1] The building density is the quotient of the total of all overground story area and the plot surface on which the building stands.