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Cultural landscapes and heritage values: A spatial hedonic approach

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Cultural Landscapes and Heritage Values
A spatial Hedonic Approach

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Abstract

This paper uses a spatial version of the hedonic price method to analyze if landscape attributes related to culture and heritage are capitalized into local property prices. Nearly 5000 property transactions are used to set up a GIS containing both conservation areas and listed sites. The results show that the percentage share of land devoted to preservation areas has a capitalization effect of 8.1% for properties located in the vicinity. The results also show that proximity to listed sites, measured in Euclidean distance has a capitalization effect of 4.4%.

Keywords: Hedonic pricing, Cultural heritage, GIS
JEL Classification: Q26; Q3; R21

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1. Introduction

The main hypotheses tested in this paper are that landscape attributes of the type cultural landscapes and listed sites contribute positively to local housing values thus adding to both public and private incomes. Cultural landscapes defines as land areas that contain a large amount of historic environments and sites with significant aesthetic and cultural values (Mitchell and Buggey 2000). These landscapes belong to some of the most fragile and threaten environments with a great need of improved management and land use policies that take sustainability and conservation needs into account (Mitchell and Buggey; Alanen and Melnick 2000; Hoberg 2001). Consequently, there is an increasing need for research able to quantify the values added. This paper uses the hedonic approach to assess values to these type of landscape attributes, a very useful method as it offers a link between individual valuation and the non market good. Accordingly, property values reflect not only the size and the quality of the property itself but also the quality of the surrounding environment (Can 1992). Proximity variables to define the location of the property in relation to the location of the environments are extracted using spatial data. The paper measures Proximity is measured in terms of *distance to* by the use of Euclidean distance functions and *diversity of* using the Shannon-Weaver diversity index.

Cultural landscapes are public goods that have different degree of publicness depending on their cultural good prestige in terms of aesthetic, spiritual, social, historical and symbolic values. In cases where the value of the site or the environment falls on people living nearby the degree of publicness is low comparing to cases where the value spills over on a national or global population. The latter case often implies cultural heritage sites or cultural landscapes that have been selected to bear UNESCO world heritage status. This paper takes into account that sites and environments can have different degrees of publicness by including local, national and global preservation areas. The focus of this paper is land use as a source of recreational activities. Hence, the sample of properties included in the hedonic estimations includes only temporary (vacation) homes, which are presumably bought on the basis of recreation and aesthetic reasons rather than reasons related to classic urban rent models. The paper analyzes a total sample of vacation homes sold during one year (2007) and covers approximately 5000 transactions carried out in south Sweden. The key empirical findings are that proximity to listed sites has a significant positive effect on property prices with a price premium 4%. The results also show that amount of land use devoted to conservation areas within the neighborhood yields a price premium of 8%.

Research using the spatial hedonic method is focused on attributes that explain landscape heterogeneity rather than on attributes that explain the quality and structure of the property itself (see for example Anas et al 1998; Bockstael and Irwin 2001).

Previous papers have estimated that capitalization effects of different environmental types on local property prices vary with premiums within a range of 4-20% depending on environmental type, quality and structure. Open space, access to urban green space, national parks and forested areas has all shown to yield positive implicit prices (see table 1). There is a large body of research that uses geocoded data in combination with the hedonic price function to estimate amenity assessment on local property prices.[2] However, most papers tend to focus on landscape attributes related to the quality and structure of natural environments often overlooking attributes of the historic environment and its heritages. Historic preservation or heritage conservation refers to the sustainable use of a community's historic resources (Rypkema 1994). From an economic viewpoint it implies extracting and communicating the values added to community leaders and landowners to increase the level of financial support.

Intuitively, landscapes with significant heritage values would generate comparable premiums as they provide equal opportunities for both recreation and aesthetic contentment. Even so, surprisingly few studies using a spatial HPM have focused their attention towards environmental factors related to culture and heritage.

2. Hedonic pricing and cultural heritage

The basic idea of Rosen's (1974) hedonic function is to estimate the demand for characteristics of differentiated goods. Using the hedonic function for housing implies that the demand for each individual property will depend on its characteristics. The purpose of using this approach is to be able to show that property prices are determined by a large number of different factors. For the purpose of this paper, to estimate the impact of landscape characteristics related to cultural and heritage on property prices. The hedonic function in its most basic form implies defining the dependent variable as

[2] Some examples of recent papers using the spatial hedonic price method are listed in table 1.

the price of the j:th house P_j, as a function of its structural, neighborhood and accessibility attributes.

This implies that if H represents the product or commodity class of housing, any individual property (h_j) can be described by a vector of its attributes. If S_n, N_k and A_m represent the vectors of structure, neighborhood and accessibility then h_i is a function of the level of those characteristics and P_{hi} is the hedonic function for H.[3]

$$P_{hj} = P_h(S_{j1} \dots, S_{jn}, N_{j1}, \dots, N_{jk}, A_{j1}, \dots, A_{jm}) \quad (1)$$

Partial differentiation gives the marginal implicit price which is empirically estimated by,

$$R = \alpha + S\beta + N\gamma + A\tau + \varepsilon \quad (2)$$

Here, R represents a vector of property values, S of structural attributes, N of neighborhood and A of accessibility attributes. In order to find location specific variables that are related to the historic environment this paper uses geocoded data to set up a GIS over the studied area.[4] Since historic preservation refers to the protection of buildings, objects, landscapes or other artifacts of historic significance the GIS is constructed to include such landscape attributes. To limit multicollinearity, landscape characteristics of similar type has been grouped together resulting in three different categories; conservation areas consisting of sites that are of community and national interest, listed historical sites and world heritage sites.[5] The variables used in the empirical estimation is based on these landscape attributes and measure both proximity to, and diversity of historical environments. First, proximity is measured as the distance from the centroid of the housing unit to the nearest site area and is measured for all three categories.[6] Similar distance measures are used for calculating proximity to urban centers and water covered areas (ocean, lakes). Second, to include the impact of landscape structure surrounding properties a diversity index of the following type is used,[7]

$$D = -\sum_{k=1}^{K} (P_k) \ln(P_k) \quad (3)$$

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[3] Model can be found in both Rosen (1974) and Freeman (1979,1993).

[4] The spatial data used in this paper has three main sources; property data from the Swedish land survey containing property transactions (realized during 2007) along with relevant housing characteristics. Cultural landscapes, monuments and sites from the Swedish National Heritage Board and preservation areas from each county administrative board.

[5] See Baranzini and Schaerer (2007) for a similar approach.

[6] The proximity measure used in this paper refers to Euclidean distance functions where distance between two points $a = (a_x, a_y)$ and $b = (b_x, b_y)$ is defined as: the distance from each cell in the raster to the closets source:
$d(a, B) = \sqrt{(a_x - b_x)^2 + (a_y - b_y)^2}$

[7] This diversity index has been used in previous papers see for example Geoghegan et al. (1997) and Baranzini and Schaerer (2007).

The index is specified so that a large value of D indicate a landscape with high intensity of conservation areas. Where P_k is the proportion of the site area (within 1000m) dedicated to land use of the landscape type k (relatively to the total site area)[8]. Using site areas for different radius around properties has the advantage of providing a fairly good measure of accessibility. Time sensitivity by car would typically not reflect a true measure of accessibility since it is reasonable to assume that people have chosen their residential location due to other types of accessibilities such as accessibility to pleasant view or accessibility in terms of walking distances. Such accessibilities are strongly affected by the structure of the environment and its terrain and it is normally difficult to obtain quantitative measures for these types of accessibilities. Using a site area enclosing each property provides a good measure of the local living environment as it implies direct access, not necessarily access to view, but most likely access by walking. However, it has the limitation of neglecting recreation areas located further away. Using site areas also implies defining a specific neighbourhood for each property. The location specific features within each site area are thus expected to influence the observed properties in a comparable way (Anselin 1992). (The included environments are illustrated in figure 1).

3. A review of the literature

Environmental resources are often more or less public in their nature. Value assessment of goods that have different degrees of rivalry and excludability can be either direct or indirect. Direct assessment implies asking people of their valuation of some environmental resource or recreational experience whereas indirect evaluation implies observing how people behave on related markets (Colwell and Dilmore 1999). The hedonic pricing method belongs to the indirect group of methods and is used for the purpose of analyzing how individuals value characteristics of differentiated goods (Rosen 1974). Properties are highly differentiated goods where both quality, structure and the surroundings of each individual property can be described using a large number of characteristics. This complexity has made the hedonic price model particularly applied on the residential market (some early examples are Ridker and Henning 1967 and Harsman and Quigley 1991). The basic idea of the spatial HPM is that when people buy housing the amount of money they are prepared to pay also depends on location specific factors (Kain and

[8] Total site area equals total land area within each community which represents the finest administrative unit in Sweden.

Quigley 1970). This implies that when people decide upon their location they are concerned with not only the structure and quality of the property and its lot, but also with the bundle of services and environmental amenities offered at that specific location. Location specific factors can be divided into those related to classic urban rent models and those related to the spatial hedonic model. First, the willingness to pay for property is strongly influenced by accessibility to the bundle of services and public utilities located in the vicinity. This implies that property values are to a large extent explained by the distance between the property and a central market place (Alonso 1964; Mills 1967; Muth 1969). Second, the willingness to pay for property is also influenced by location specific factors related to the quality and structure of the surrounding landscape (see for example Irwin and Geoghegan 2001). According to previous research the spatial HPM works well if it includes both a measure of accessibility to a central place and variables that measure the quality and structure of the surrounding landscape (Bockstael 1996; Irwin and Geoghegan 2001).

Economic valuation of amenities related to nature conservation and land-use diversity are often carried out using different versions of the spatial HPM. Some of the highest observed price premiums (28-60%) are related to view over or accessibility to ocean (Benson et al., 1998; Luttik 2000), other environmental amenities that have shown to yield positive and in some cases high price premiums are open space and urban green areas (Bockstael 1996; Luttik 2000; Tyrväinen and Miettinen 2000). Recent research (table 1) shows that environmental variables related to nature reserves and nature conservation completely dominate the estimations. Surprisingly few, have focused their attention towards landscape attributes related to culture and heritage.[9] Baranzini and Schaerer (2007) are the exception estimating a price premium of 4.9% for view on ancient cathedral.

[9] The purpose here is not to present a full review of previous papers focusing on the spatial HPM but only to give some examples of previous results.

Table 1. Examples of previous papers using a spatial HPM focusing on natural environments

Authors	Environmental Variables and estimated premiums	Sample and geographical scope
Bockstael (1996)	Preserved open space (3.7%) Pasture (0.8%) Forests (0.2%)	n=15929, Maryland USA
Luttik (2000)	View if open space (12%) View over green areas (5%) View over lake (10%) Vicinity to lake (7%)	n=2813 , Randstad, The Netherlands
Geoghegan (2001)	Open space (4.8%)	n=5599 , Maryland, USA
Pearson et al. (2002)	Ocean view (76%) National parks (6.6%)	n=660 (Sydney, Brisbane, Australia)
Chavailles et al (2005)	View over tree covered formations (2.3%) Forested areas (2.7%) Farmlands (close to 0)	n=2520 (Dijon, France)
Kong et al. (2007)	Land use diversity measured as % of land devoted to green space within 500m radius (5.4%) Ease of accessibility to scenery forest measured as accumulated time cost to nearest scenery forest (-0.96%)	n=124 housing clusters, Jinan City, China)
Baranzini and Schaerer (2007)	View over natural environments; tree covered areas, agricultural areas, water covered areas (25%) View over water covered areas (46.9%) View on ancient cathedral (4.9%) Mountain view (5%)	n=10396 , Geneva, Switzerland

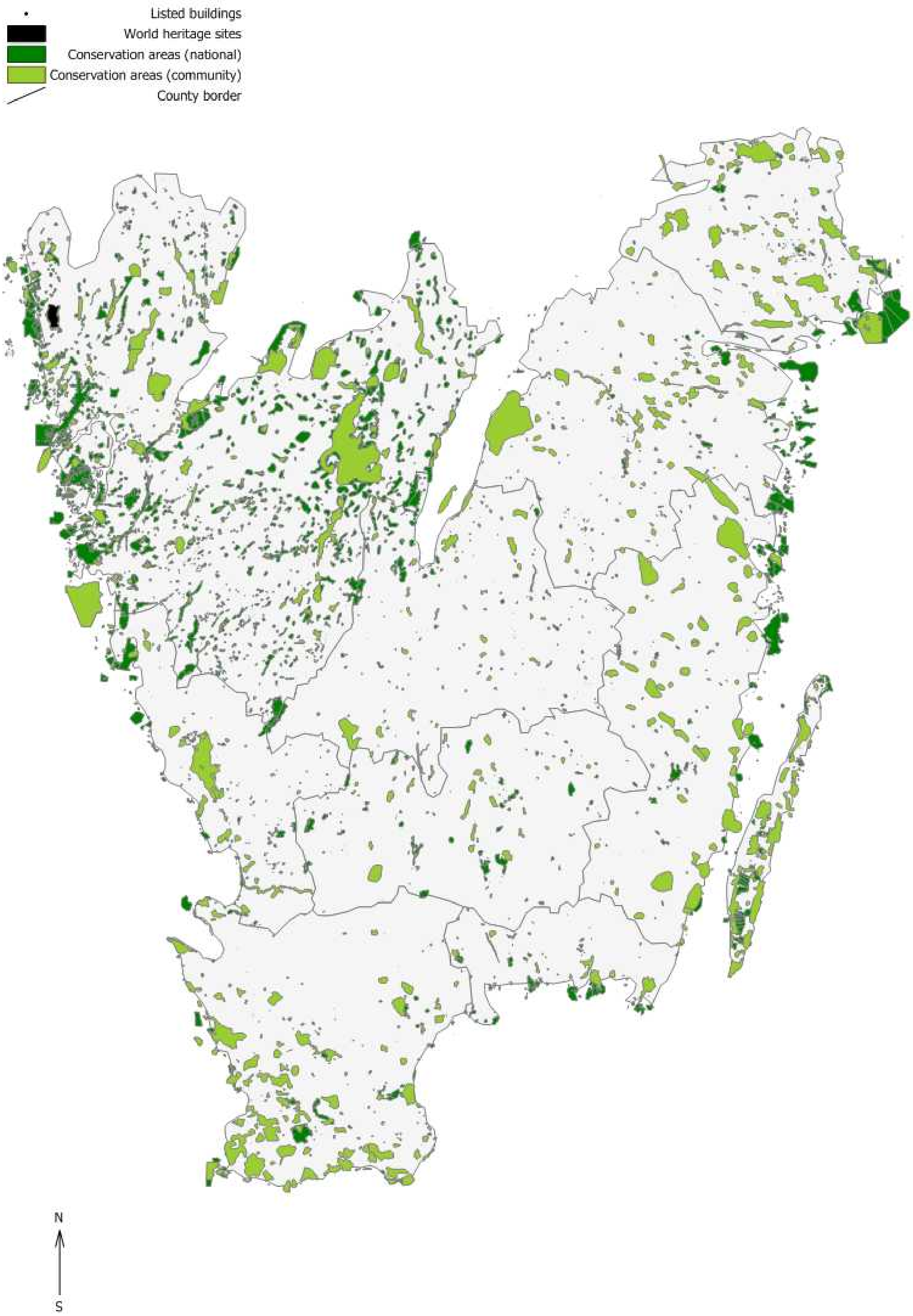

Fig. 1.
Geographic delimitation and distribution. Preservation areas and listed heritage sites, South Sweden.

4. EMPIRICAL ESTIMATION

The transactions data for this paper are from the Swedish land survey and geocoded data of landscape structure from the Swedish National Heritage Board. The sales transactions used to estimate the hedonic model includes transactions realized between December 2006 and January 2008 of temporary homes. This results in a dataset of approximately 5000 housing transactions in south Sweden.

Since the focus of this paper is entirely on location specific attributes, structural variables are limited and included only for the purpose to control for age and size. According to Goodman (1998) the two most important structural variables explaining more than 70% of the variation in transaction prices are dwelling size and age at date of sale. It has also been shown that including a large number of structural attributes as explanatory variables tend to cause a high degree of multicollinearity (Basu and Thibodeau, 1998, Gress, 2004). The structural variables include living area, lotsize and are assumed to be nonlinearly related to the price of a parcel and expect to contribute positively to the price (variables and definitions are found in table 2). Age of house is measured both as number of years since construction and through binary variables to control for perceived quality. Age is assumed to contribute positively if defined as fin-de-siècle and negatively if defined as type 2 and 3 (built during the 50:ties and 60:ties). It is also expected that newer houses will have a positive effect defined as type 3 (built in between 2005-2007). According to theory, proximity to CBD is expected to have a negative coefficient reflecting the trade-off between commuting cost and housing prices and proximity to coastline and lake are assumed to contribute positively to the price. Variables controlling for neighborhood attributes includes measures of congestion and retail service in the vicinity. As the sample of properties consist of only temporary houses presumably bought for vaccational activities congestion is expected to be unappreciative whereas retail service in the vicinity is expected to be appreciated. Since the diversity index indicates a landscape with high intensity of conservation areas of both community and national interest its coefficient is expected to contribute positively to the price. In a similar way proximity to listed buildings and world heritage sites are assumed to add value to the property price reflecting the value they ad in terms of recreation and aesthetic benefits.

Table 2
Explanatory variables and their expected effect on transaction prices

Variable name	Definition	Expected sign
Living area	Property size measured in square meters.	+
Lot size	Lot size measured in square meters.	+
Age of house	Age of house measured as number of years since construction.	+
Type of house		
Type 1	Fin-de-siècle	+
Type 2	Built during 50:ties	
Type 3	Built during 60:ties	
Type 4	Built in between 2005-2007	
CBD	Accessibility to market place measured by distance[a] to nearest large city or town.	+
Coast line	Accessibility to ocean measured by the distance to nearest coast line	+
Lake	Accessibility to lake measured by the distance to nearest lake	+
Congestion	Population density within the community measured by individual/km2	-
Retail service	Retail service in the vicinity measured as number of retail stores within a 2km radius from the centroid of the housing unit.	+
Diversity (Conservation areas)	Percentage of land within site area (1000m) devoted to conservation areas of community and national interest measured by $D_1 = -\sum_{k=1}^{K}(P_k)\ln(P_k)$	? (+)
Proximity to listed sites	Measured as the distance between the centroid of the housing unit and the nearest listed historical site	? (+)
Proximity to World heritage site	Measured as the distance between the housing unit and the nearest WHS.	? (+)

[a] All distance measures are Euclidean. [b] + and – represent increasing and decreasing effects on the transaction price.

A common problem affecting the estimations especially when analyzing transactions data of housing is that quality of property and location tend to show signs of correlation in space (Basu and Thibodeau 1998). This implies that locations near to each other are related and tend to show similar values of their attributes (Gress 2004). There are a lot of different reasons to why housing prices may be spatially dependent and most often they are connected to neighborhood factors (Can 1992). Crime in one area might for example affect the likelihood of crime in a neighboring area thus affecting housing prices and houses that share the same structural characteristics are often built in the same area so that correlation in the housing characteristics can affect prices (Andersson and Andersson 2006). According to Can (1992) spatial correlation is a problem that most often arises from neighborhood attributes and can be avoided by correctly identifying the neighborhoods. To delimit spatial correlation arising from neighborhood factors this paper uses site areas to define a neighborhood for each property which implies a circle of 1000 meters enclosing each property. According to Andersson and Andersson (2006) the problem of spatial correlation becomes less vital when the analysis is focused on slowly changing neighborhood attributes such as landscape structure and composition. In line with prior hedonic estimations the model estimated in this paper specifies as non-linear[10] hence eq 2 is estimated in a semi-logarithmic form (Halvorsen and Polakowski 1981).

5. RESULTS AND DISCUSSION

The main theoretical hypotheses tested in this paper are that landscape structure related to culture and heritage affects local housing prices positively. The results are presented in table 3.[11] The key empirical findings are that first, the diversity index shows a positive and significant impact of 8% on property prices second, proximity to listed sites has a positive and significant effect of 4,5%. Moreover, the results show that structural and accessibility measures follow their expected values in accordance to theory and according to results of prior hedonic estimations. Size and age are both positive and significant whereas the perceived quality as measured by type 1-4 follows the

[10] Implying that price of an additional unit of an attribute will depend on the quantity already supplied as well as the quantities of the other attributes.

[11] To check for spatial autocorrelation the spatial-neighbor-function provided by the GIS software were used to calculate spatial weights for different site areas (500m, 1000m and 2000m). The spatial autocorrelation function was then used to test for spatial dependence using Moran´s I statistic. The test indicates no severe degree of spatial autocorrelation.

expectations. Distance to CBD contributes negatively implying that people do value access to the city center as expected, the estimated coefficient is however significantly lower comparing to previous research (see for example Chesire and Sheppard 1995) which can be explained as a result of only including temporary homes in the estimations. In a similar way proximity to retail service shows a negative

The key empirical findings are that both the diversity index and proximity to listed sites significantly affects property prices in the studied area. The coefficient estimates imply that the size of the premium equals 8% for conservation areas and approximately 4% for listed sites. This result confirms that environmental factors related to culture and heritage yields premiums comparable to those estimated for natural environments.

Table 3
Regression results

Dependent variable lnprice, semi-log model (R^2=0.617), n=4993 Variable name	Coefficients
LNLIVING AREA	0.244*** (0.002)
LNLOTSIZE	0.013*** (0.001)
LNYEAR BUILT	0.016*** (0.001)
TYPE 1	0.196*** (0.013)
TYPE 2	-0.036*** (0.012)
TYPE3	--0.070*** (0.012)
TYPE4	0.308*** (0.015)
CBD	-0.033*** (0.003)
PROXIMITY COAST LINE	-0.229*** (0.011)
PROXIMITY LAKE	-0.187*** (0.028)
CONGESTION	-0.226*** (0.058)
RETAILSERVICE	-0.011*** (0.003)
DIVERSITYCONSERVATION	0.081*** (0.013)
PROXIMITY LISTED SITES	-0.044** (0.021)
PROXIMITY WHS	0.007 (0.043)

***,** and* indicate significance at 1%. 5% and 10% . Standard errors in brackets.

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APPENDIX A

Fig. 2. Studied area and geographic distribution of properties