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LAND USE AND RECREATION VALUES IN RURAL GERMANY: A HEDONIC PRICING APPROACH

1. INTRODUCTION

Landscapes are associated with a high variety of amenities (Moran 2005) such as aesthetic, recreational and cultural values (Fleischer, Tsur 2009: 132-153; Oueslati, Salanie 2011: 1-6). In addition, landscapes are the source for farming activities and forestry (Marangon, Tempesta 2008), and represent valuable ecosystems for many rare and endangered species. The various demands for landscapes often lead to conflicts between tourism, agriculture, forestry and nature protection. One major objective in the efforts to preserve landscapes is to make their benefits more visible to build support for landscape planning and future interventions by policy and administration.

Different economic methods can be applied in order to capture the value of landscape features and related amenity values. Within the group of Stated Preference Methods (*SPM*) (e.g.: Contingent Valuation Method), the respondents are directly asked about their preferences for hypothetical transformation of the considered environmental good (Bateman et al. 2002; Adamowicz et al. 1998: 64-75; Bennett, Blamey 2001).

In contrast, Revealed Preference Methods (*RPM*) such as the Travel Cost Method (*TCM*) and the Hedonic Pricing Method (*HPM*) try to infer the value of a non-market good by observing the actual behaviour of individuals on related markets (Alriksson, Öberg 2008: 244-257; Willis, Garrod 1993: 1-22; Melichar, Rieger 2009). The *TCM* estimates the recreational value of open space by analysing the travel expenditures of visitors to that site (Bateman 1993).

Concerning the real estate market, the overall assumption of the *HPM* is that house prices are affected by a bundle of variables and that the price of the real estate is determined by a particular combination of the characteristics (Melichar,

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Rieger 2009). Besides intrinsic factors such as the size and age of the house, also the location of the property itself can significantly affect the property price (Kolbe et al. 2012; Bolitzer, Netusil 2000: 185-193). In this regard, a broad literature analyses the impact of environmental variables on property values by using the *HPM* (e.g.: Kitchen, Hendon 1967: 357-361; Weigher, Zerbst 1973: 99-105; Schulz, King 2001: 239-259).

Empirically, most of the *HPM* studies have been applied to value urban assets (Vanslembrouck et al. 2005: 17-30). Examples include studies such as Morancho (2003: 35-41), and Melichar and Rieger (2009). Moreover, past hedonic studies are often applied to narrow geographical locations (regions, counties, cities) (Gibbons et al. 2013).

Due to recent developments in the capturing, analysis and presentation of spatial data, a larger amount of geo-coded data now has become available for statistical analysis. This growing availability of geo-coded environmental data provides new opportunities to use more accurate data on environmental quality to a larger amount in *HPM* studies (Gibbons et al. 2013; Kong et al. 2007: 240-252; Choumert et al. 2009).

This paper explores the effects of environmental variables on housing prices in rural areas by using geo-coded landscape variables for Germany. The randomly drawn sample consists of rental prices and structural variables (e.g. size, capacity) for 986 geo-coded holiday apartments and cottages located all over Germany. The geo-coded data on land use were drawn from the CORINE Land cover project of the European Environment Agency (*EEA*).

In addition, geo-coded data on the location of major German cities were also included in order to control for spatial effects in the hedonic price function. Using a Geographical Information System (*GIS*), we calculated the coverage of different landscape features in pre-defined buffers around accommodations. To our best knowledge, this is the first nationwide study valuing the amenity value of different land use types using the *HPM* approach and geo-coded data on landscape quality in Germany.

The paper is structured as follows: Section 2 highlights the valuation of environmental qualities with *HPM*. Section 3 describes the data set, environmental variables, the functional form and the results. In Section 4, the results are critically reflected. Section 5 provides some concluding remarks.

2. THE VALUATION OF ENVIRONMENTAL QUALITY WITH HEDONIC PRICING METHOD (*HPM*)

The overall assumption of the *HPM* with respect to real estate is that house prices are affected by various variables (structural, locational), and it is assumed that the price of the real estate is determined by the particular combination of characteristics it displays (Melichar, Rieger 2009).

In contrast to preference based valuation methods such as Contingent Valuation (*CV*), where the respondents are directly asked about their preferences for the hypothetical transformation of the environmental good under valuation, the *HPM* allows for inferring the value of a non-market good by observing the actual behaviour of individuals on related markets (Willis, Garrod 1993: 1-22; Melichar, Rieger 2009).

According to Bateman (1993), the *HPM* depends on the following assumptions:

a) The Willingness to Pay (*WTP*) is an appropriate measure of benefits.

b) Individuals are able to perceive environmental quality changes, and that these changes affect future net benefit streams of a property and therefore are willing to pay for environmental quality changes.

c) The entire study area is treated as one competitive market with perfect information regarding house prices and environmental characteristics.

d) The housing market is in equilibrium market, meaning individuals continually re-evaluate their location so that their purchased house constitutes their utility maximising choice of property given their income constraints.

If these assumptions of the HPM are properly taken into account, the method can reveal valuable information about the value of environmental attributes (Bateman 1993).

The factors which affect the house price can be differentiated into intrinsic (structural) and extrinsic variables (Bateman 1993). The price of the real estate (*P*) is a function of the structural or intrinsic variables (*S*) (e.g. the size of the house, its age, number of rooms), geographic variables (*N*) such as the number of schools or quality of public transport in the neighbourhood, and variables which describe the environmental quality (*Z*) (e.g. air quality, number of green space in the neighbourhood) (Bateman 1993; Morancho 2003: 35-41):

$$P = f(S_1, \dots, S_k, N_1, \dots, N_m, Z_1, \dots, Z_n) . \qquad (1)$$

A large amount of literature analyses the effects of open space on property values by using the HPM (Lutzenhiser, Netusil 2001: 291-298; Acharya, Bennett 2001: 221-237; Irwin 2002: 465-480; Kitchen, Hendon 1967: 357-361; Weigher, Zerbst 1973: 99-105; Schulz, King 2001: 239-259).[1]

Different individual open space variables have been included in these hedonic models. For example, many studies examine the influence of the size of the nearest open space area on housing prices (Morancho 2003: 35-41). Others include the total quantity of surrounding open space areas (Acharya, Bennett 2001: 221-237) or the visibility of open space (Morancho 2003: 35-41; Benson et al. 1998: 55-73). In addition, many studies include distance effects in their analyses of open space variables in HPM (Bolitzer, Netusil 2000: 185-193, Smith et al. 2002, Morancho 2003: 35-41).

Most of the studies prove a capitalisation of environmental variables in housing prices, but the considered structural variables (e.g. size, age) have a greater influence on the price function.

Empirically, very few *HPM*-studies have been applied to a rural context. Examples for rural applications include Bastian et al. (2002: 337-349), Vanslembrouck et al. (2005: 17-30) and Gibbons et al. (2013).

The application by Vanslembrouck et al. (2005: 17-30) investigates the effects of agricultural landscapes on rural tourism in Flanders (Belgium), applying a hedonic pricing approach. They found, among others, an inverse relation between the presence of fodder crops (maize) and the price variable (a 1% increase of the share of fodder crops would result in a price decrease of 1.3%).

According to Vanslembrouck et al. (2005: 17-30), fodder crops are associated with intensive livestock farming for which tourists have low preferences. In addition, they also prove an inverse relation between the presence of forestland and house prices. Vanslembrouck et al. (2005: 17-30) argue that one reason for the inverse relation between the forest variable and the price could be that rural tourists prefer open spaces over an enclosed landscape. They also prove the positive influence of permanent grassland on the price variable (a 1% increase of permanent grassland leads to a 7.3% price increase).

According to Vanslembrouck et al. (2005: 17-30), this might be an indicator for the positive preferences of rural tourists for grazing animals since the presence of permanent grassland is often associated with livestock (grazing). Vanslembrouck et al. (2005: 17-30) conclude that intrinsic characteristics (e.g. lodging capacity, rating, credit cards accepted) have the highest impact on the prices for rural tourism, but agricultural activities also significantly influence the price.

Using an impressive sample of 1 million housing transactions in England, Gibbons et al. (2013) consider a large number of environmental characteristics.

[1] For an overview of *HPM* studies on open space see, e.g. McCornell and Wallis (2005).

They show, among others, the positive influence of the presence of rivers and lakes, the coastline and forestland on the housing prices. For example, a 1 km increase in distance to the coastline results in a 0.14% fall in house prices and the same increase in distance to rivers – a 0.93% fall.

Gibbons et al. (2013) also investigate the effect of nature protection on housing prices and found a 17.36% increase in house prices if the house is located in a National Park (relative to mean). The study also proves a negative influence on the price variable for the share of open space and grassland.

The application by Bastian et al. (2002: 337-349) incorporates a randomly drawn sample of 138 transacted land sales and aims to measure recreational and scenic amenities of landscapes in Wyoming (USA). The findings of this study indicate, among other things, that view diversity rather than uniformity is more highly valued.

3. THE ANALYSIS OF HOLIDAY PROPERTIES IN GERMANY

3.1. Data and functional form

3.1.1. House price data

The data set covers rental prices for the year 2013 for 493 holiday apartments and 493 cottages located all over Germany. The sample was randomly drawn from a commercial internet database for booking holiday accommodations containing over 22 000 holiday rentals in Germany.

In addition to rental prices, the data set contains information on 11 structural variables of the real estate (e.g. size, capacity) and the geographic location coordinates of the accommodations. Table 6 (see: Appendix) provides a description of all structural data employed in this analysis.

The price (dependent) variable used in the analysis is the rental price per apartment or cottage and week in the high season and accommodation prices are assumed to be non-negotiable.

According to the overall theoretical assumptions of the *HPM* (see: Bateman 1993), it is further assumed that individuals are able to perceive environmental quality changes and these changes affect future benefits of the properties. Moreover, the study area is treated as one competitive market and it is assumed that individuals are fully informed about house prices, location and environmental characteristics.

3.1.2. Environmental and location variables

German landscapes are versatile and the result of various land use interests. In order to analyse the impact of the predominant land use on real estate prices we incorporated the following habitat categories into the analysis: forest, arable land, grassland, freshwater (rivers and lakes), marine water (Baltic Sea, North Sea) and wetland.[2]

These categories were constructed from the CORINE Land Cover (*CLC*) project by the European Environment Agency (*EEA*) (*EEA* 2006). The category "*forest*" contains all broad-leaved forest, coniferous forest and mixed forest. "*Arable land*" refers to all non-irrigated arable land, all pastures and natural grassland sites are part of the category "*grassland*" and all inland water courses and water bodies belong to the category "*freshwater*". The category "*sea*" contains all German marine water bodies (Baltic Sea, North Sea), and all inland marshes and peat bogs sites are part of the category "*wetland*".

In order to control for additional location variables, we further incorporated geo-coded data on the location of 76 major German cities with more than 100 000 inhabitants.

The capitalisation of green space in *HPM* studies is predominantly examined with respect to the coverage of the land use features under consideration. We calculated the coverage of every single land use category mentioned above in pre-defined buffers of 1 km, 5 km and 20 km around the real estate, resulting in 18 different coverage variables. We than compared the coverage variables of each land use category to identify the coverage variable with the strongest influence on the price variable and the highest explanatory power (e.g. we controlled for the price effect of the coverage of forest within a 1 km buffer, followed by the coverage of forest within a 5 km buffer, followed by a 20 km buffer).

This procedure allowed us not only to draw conclusions about the effects of land use pattern on the price variable, but also whether these effects differ in the various buffer zones. In order to control for additional location variables, we further estimated the distance between the real estate and the nearest major German city in a continuous fashion (Euclidian distance). Table 6 (see: Appendix) provides a summary statistics of all variables.

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[2] The data set contains the following *CORINE*-categories: Forest = 311, 312, 313 (Broad-leaved forest, Coniferous forest, Mixed forest); Arable land = 211 (Non-irrigated arable land); Grassland = 231 (Pastures); River and Lakes = 511, 512 (Water courses, Water bodies); Marine waters = 523 (Sea and Ocean); Wetlands = 411, 412 (Inland marshes, Peat bogs) (*EEA* 2006).

3.1.3. The model

The literature does not provide much guidance about the most appropriate functional form in *HPM* analysis, although the specification is known to affect implicit prices (Vanslembrouck et al. 2005: 17-30; Melichar, Rieger 2009). Functional forms that have been applied in the literature include linear, quadratic, semi-log, log-log and Box-Cox transformation (Cropper et al. 1988: 668-675). The functional form is mostly determined empirically by testing different functional forms, whereas the model evaluation is mainly based on overall goodness-of-fit (Vanslembrouck et al. 2005: 17-30). Considering the variables of interest (land use), the best statistical results in the analysis were obtained by applying the semi-log functional form. This functional form can be described as follows (Log-Linear):

$$\ln P = b_l + b_i X_i + d_i D_i + \mu_i \, . \tag{2}$$

where: P is the price of the dependent variable, X_i the independent continuous variable, D_i the independent discrete variable, b_l the intercept, b_i and d_i the partial regression coefficients and μ_i the error term (Vanslembrouck et al. 2005: 17-30).

3.2. Results

The regression outputs are illustrated in Table 1. All models are highly significant and most of the coefficients are in line with expectations. Table 2 gives an indication of the unit price changes and the resulting implicit prices. Overall, six of the structural attributes significantly influenced the price of the rural accommodation, and their impact is higher than the impact of most of the landscape characteristics.

Table 1. Regression outputs

Variables	**Apartments (*n*=493)**	**Cottages (*n*=493)**
	Coefficient	**Coefficient**
	(t-Statistics)	**(t-Statistics)**
ln_size	0.330^{***}	0.498^{***}
(m^2)	(6.16)	(9.94)
capacity	0.081^{***}	0.065^{***}
(person)	(10.23)	(8.57)
smoking	-0.079	-0.49
(1=yes, 0=no)	(-1.65)	(-1.36)

Table 1. Continuation

Variables	Apartments (*n*=493) Coefficient (t-Statistics)	Cottages (*n*=493) Coefficient (t-Statistics)
pets	0.045	-0.015
(1=yes, 0=no)	(1.48)	(-0.50)
barrier free	0.005	-0.032
(1=yes, 0=no)	(0.13)	(-0.76)
internet	0.123***	0.179***
1=yes, 0=no)	(4.15)	(5.63)
terrace	-0.070	-0.047
(1=yes, 0=no)	(-1.85)	(-0.89)
garden	-0.057	-0.048
(1=yes, 0=no)	(-1.82)	(-1.33)
sauna	0.054	0.143**
(1=yes, 0=no)	(1.07)	(3.43)
pool	0.040	0.135*
(1=yes, 0=no)	(0.64)	(2.35)
guest bathroom	0.086*	0.044
(1=yes, 0=no)	(2.02)	(1.20)
rat5km_forest	-0.004***	-0.003***
	(-5.45)	(-3.83)
rat5km_arable land	-0.005***	-0.003***
	(-6.45)	(-4.07)
rat5km_grassland	-0.006***	-0.004***
	(-5.01)	(-3.25)
rat20km_river/lake	0.012*	0.013**
	(2.28)	(2.72)
rat20km_sea	0.004***	0.005***
	(5.37)	(6.08)
rat20km_wetland	0.054**	0.038
	(2.91)	(1.89)
dist_city	0.001*	-0.001
	(2.26)	(-0.34)
constant	4.761***	4.077***
	(22.87)	(19.73)
Adjusted R^2	0.66	0.68

All results relate to a semi-log model. Significance level: * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Sources: www.traumferienwohnungen.de, (*EEA* 2006).

Based on the regression outputs, an increase of the size of an apartment by 1 m^2 would result in a 0.46% change of the price variable (2.78 €) for apartments and 0.49% (4.28 €) for cottages. The capacity of the accommodation also positively influences the price. Here, a one-unit increase (1 person) results in a 8.1% (49.00 €) increase in the apartment price and 6.5% (56.81 €) increase in the cottage price. The provision of internet results in a 12.3% (74.42 €) price increase for apartments and a 17.9% (156.45 €) price increase for cottages. Moreover, the availability of a sauna leads to an increase in cottage prices of 14.3% (124.98 €). Also, the availability of a pool positively influences cottage prices and leads to an increase of 13.5% (117.99 €). Moreover, an additional guest bathroom leads to an increase of apartment prices of 8.6% (52.03 €).

As we expected, many of the location and environmental variables significantly influence the price of the rural accommodation. Growing distances to the nearest major city positively influence the price of apartments (0.1% or 0.61 €). Finally, six coverage variables have a significant influence on the price variable of holiday apartments.

Table 2. Implicit prices for structural and landscape variables

Variable	**% Changes in rental prices**		**Implicit prices (per week in the high season) relating to average prices in 2013[a]**	
	Apartments	**Cottages**	**Apartments**	**Cottages**
Structural variables				
Increase in size by 1 m^2	0.46% increase	0.49% increase	2.78 €	4.28 €
Increase in capacity by 1 person	8.1% increase	6.5% increase	49.00 €	56.81 €
Internet available	12.3% increase	17.9% increase	74.42 €	156.45 €
Sauna available	n.s.	14.3% increase	n.s.	124.98 €
Pool available	n.s.	13.5% increase	n.s.	117.99 €
Guest bathroom	8.6% increase	n.s.	52.03 €	n.s.
Increase of distance to nearest major city (1 km)	0.1 % increase	n.s.	0.61 €	n.s.
Increase of coverage by 1%				
Forest coverage	0.4% decrease	0.3% decrease	-2.42 €	-2.62 €
Arable land coverage	0.5% decrease	0.3% decrease	-3.03 €	-2.62 €
Pasture coverage	0.6% decrease	0.4% decrease	-3.63 €	-3.50 €
Rivers/Lakes coverage	1.2% increase	1.3% increase	7.26 €	11.36 €
Marine water coverage	0.4% increase	0.5% increase	2.42 €	4.37 €
Wetland coverage	5.4% increase	n.s.	32.67 €	n.s.

a – The average rental price in the high season is 605 € for apartments and 874 € for cottages. Significance level: * p<0.05; ** p<0.01; *** p<0.001; n.s. = not significant.

Sources: www.traumferienwohnungen.de, (*EEA* 2006).

The presence of rivers, lakes and wetlands positively influence the price variable of holiday rentals. A 1% increase in the share of rivers and lakes results in a price increase of 1.2 % (7.26 €) for apartments and 1.3 % (11.36 €) for cottages. Also, the presence of wetlands positively influences the price. For a 1% increase of wetland coverage within a 20 km-buffer around holiday apartments, rural tourists are willing to pay an additional 5.4% (32.67 €). The results further show an inverse relationship between the presence of forests, arable land

and pastures within a 5 km-buffer around holiday accommodations. For example, a 1% increase of arable land within a 5 km-buffer around the accommodation would result in a decrease of the price variable of 0.5 % (-3.03 €) for apartments and 0.3% (-2.62 €) for cottages. The 1% increase of forestland would result in decreasing apartment prices of 0.4% (-2.42 €) (0.3% or -2.62 € for cottages).

4. DISCUSSION

The results of the hedonic price function show a capitalization of structural and environmental variables in rental prices for holiday accommodations. Among the structural variables the availability of internet has the highest impact on the price variable and leads to an increase in rental prices of 74.42 € for apartments and for cottages of 156.45 € per week. The strong price changes relative to other structural variables indicate that the internet variable covers additional structural qualities of the accommodation. For example, it is likely that internet is particularly available in such accommodations with a higher standard (e.g. technical equipment) or higher quality (e.g. modern and recently renovated accommodation) – all factors we could not control for in our analysis.

Concerning the environmental variables, all freshwater and marine water variables have a positive impact on the price variable. These results are in line with the literature (e.g. Lansford, Jones 1995: 341-355; Nelson 2010: 485-504; Gibbons et al. 2013) and indicate tourist preferences for accommodation located near rivers, lakes and the sea or accommodation surrounded by high shares of these land use categories. Among the "*water-variables*" the presence of wetlands has an especially high influence on the price variable, which is five times higher than the influence of marine water. More than 50% (72.209 hectares) of the wetland areas in Germany are located within nature protection areas. In this regard, conservation areas are often associated with particular environmental qualities such as higher air and water quality or particular ecological qualities (e.g. high biodiversity). One explanation for the strong influence of wetlands on the price variable might be that the wetland variable covers additional environmental qualities.

The distance to major cities has a negative impact on the price variable. These findings indicate that tourists prefer more distant and rural accommodation, confirming the results by Bastian et al. (2002: 337-349). The regression outputs further show an inverse relation between the coverage of forestland, grassland and arable land around accommodations and rental prices indicating negative tourist preferences for these land use categories. In order to clarify whether this inverse relation holds for different coverages, we decided to carry out a more specified analysis and defined dummy coded coverage variables for forest, arable land and pasture (e.g. 0–20%, >20–40%, >40–60%) (see: Tables 3–5).

Table 3. Impact of forest coverage on rental prices in a 5 km-buffer around the accommodation[3]

Variables	Coefficient (t-value)
Forest coverage of 0–20%	0.109*** (4.25)
Forest coverage of >20–40%	0.040 (1.55)
Forest coverage of >40–60 %	-0.080** (-3.00)
Forest coverage of >60–80 %	-0.128*** (-3.62)
Forest coverage of >80–100%	-0.038 (-0.65)

Significance level: * p<0.05; ** p<0.01; *** p<0.001.

Sources: www.traumferienwohnungen.de, (*EEA* 2006).

Table 3 shows a positive effect on rental prices for forest coverage in the range of 0–20% in a 5 km-buffer around accommodation. This positive relation then turns into an inverse relation for forest coverage above 40% in a 5 km buffer around accommodation. The negative impact on rental prices increases for forest coverage above 60%. Similar results can be found for different categories of arable and pasture coverages (see: Tables 4 and 5). The inverse relation between rental prices and high shares of pastures, arable and forestland indicates tourist preferences against a dominating land use type and towards more diverse and open landscapes. These results confirm similar findings by Bastian et al. (2002: 337-349) and Vanslembrouck et al. (2005: 17-30).

Table 4. Impact of pasture coverage on rental prices in a 5km-buffer around the accommodation[4]

Variables	Coefficient (t-value)
Pasture coverage of 0–15%	0.127*** (4.16)
Pasture coverage of >15–30%	-0.043 (-1.14)
Pasture coverage of >30–45 %	-0.204*** (-3.64)
Pasture coverage >45–60 %	-0.169* (-2.46)
Pasture coverage >60–70%	-0.112 (-0.69)

Significance level: * p<0.05; ** p<0.01; *** p<0.001.

Sources: www.traumferienwohnungen.de, (*EEA* 2006).

[3] The results relate to a semi-log model (apartments and cottages) with all structural and landscape variables, where only the dummy coded forest variables were replaced. The coefficient and significance levels only changed slightly.

[4] The results relate to a semi-log-model (apartments and cottages) with all structural and landscape variables where only the dummy coded grassland variables were replaced. The coefficient and significance levels only change slightly.

Table 5. Impact of arable land coverage on rental prices in a 5 km-buffer around the accommodation[5]

Variables	Coefficient (t-value)
Arable land coverage of 0–20%	0.108*** (4.51)
Arable land coverage of >20–40%	-0.017 (-0.70)
Arable land coverage of >40–60 %	-0.065* (-2.07)
Arable land coverage of >60–80 %	-0.128** (-3.07)
Arable land coverage of >80–100%	-0.205 (-1.88)

Significance level: * p<0.05; ** p<0.01; *** p<0.001.

Sources: www.traumferienwohnungen.de, (*EEA* 2006).

A hedonic pricing study could prove a capitalisation of structural and landscape variables in rental prices for holiday accommodation in Germany. There are some aspects, however, which might limit the findings of this study. The *CORINE* land cover data only contain spatial objectives with a minimum size of 25 hectares, leaving out objectives with smaller sizes. The exclusion of these accumulated areas could limit the estimation of land use coverages, especially in larger buffer areas (e.g. 20 km) around accommodation. Moreover, the *CORINE* land cover data are subject to interval data recording and only available for the year 2006, whereas the house price data were drawn in 2013. The time gap between the land use data recording and housing data collection might lead to measurement errors when estimating the impact of land use on rental prices.

One aspect often discussed in relation to *HPM* is the bias occurring from omitted or unobserved variables (Abbott, Klaiber 2011: 1331-1342). The landscape variables incorporated in our analysis (e.g. coverage of forest, arable land) might be associated with additional land use characteristics (e.g. land use intensity, structural elements, landscape profile, grazing animals) and environmental qualities (e.g. water and air quality) which have an impact on tourist preferences and therefore influence rental prices for holiday accommodations. In addition to land use and environmental variables, the tourism infrastructure also is known to influence the hedonic price function of holiday rentals, but these aspects were beyond the scope of our study.

[5] The results relate to a semi-log-model (apartments and cottages) with all structural and landscape variables where only the dummy coded arable land variables were replaced. The coefficient and significance levels only change slightly.

5. CONCLUSIONS

The application of the *HPM* proves a capitalisation of landscape variables in rural accommodation prices, but structural variables such as the capacity of the accommodation have a greater effect on the price variable. Among the landscape variables the presence of rivers, lakes, wetlands and the sea in particular result in higher accommodation prices. The results also show a positive influence of low shares of grassland (<15%), forests (<20%) and arable land (<20%), indicating tourist preferences against a dominating ecosystem/land use type and towards more diverse and open landscapes. Moreover, tourists also prefer holiday accommodation distant to major cities.

The application of the *HPM* shows that the type of land use and resulting landscape features has an impact on rental prices for holiday accommodation. Therefore, the study provides helpful information regarding tourist preferences towards different landscapes and their capitalisation. Future research should consider additional environmental and location variables in order to generate broader knowledge concerning the amenity value of land use and landscape features. In this regard, the growing availability of geo-coded land use data potentially provides new opportunities in this field of research.

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ABSTRACT

Rural landscapes provide a high variety of environmental and recreational benefits, yet knowledge of the amenity values associated with land use is still limited. This paper analyses the amenity values associated with different land uses by applying the Hedonic Pricing Method (*HPM*). The sample consists of 986 rental prices for holiday apartments and cottages in Germany for 2013. The data set provides detailed information on several structural variables such as size and capacity of the accommodation. In order to analyse the impact of land use on rental prices, we incorporated coverage variables for the six land use and ecosystem types: forest, arable land, grassland, freshwater (rivers and lakes), marine water and wetlands. We further investigated the impact of the distance to the nearest major city on rental prices to control for additional location variables. The results show a capitalisation of structural and land use variables in rental prices. Among the land use variables, the coverage of rivers and lakes, marine waters and wetlands in a 20 km-buffer around the accommodation in particular has a high positive impact on the price variable. Additionally, the results show an inverse relation between rental prices and high shares of pastures, arable and forestland, suggesting tourists' preferences towards more diverse landscapes.

UŻYTKOWANIE ZIEMI I WARTOŚĆ REKREACYJNA NIEMIECKICH KRAJOBRAZÓW: PODEJŚCIE HEDONICZNE CEN

ABSTRAKT

W wiejskich krajobrazach można dostrzec wielką różnorodność środowiska, co zapewnia zwiększanie wartości rekreacyjnych, związanych z użytkowaniem gruntów, które jednak w dalszym ciągu są ograniczone. W artykule analizuje się wartości rekreacyjne związane z różnym użytkowaniem gruntów wykorzystując metodę wyceny hedonicznej (*HPM*). Próba składa się z 986 wakacyjnych cen wynajmu apartamentów i domków w Niemczech w roku 2013. Zestaw danych zawiera szczegółowe informacje na temat kilku zmiennych strukturalnych, takich jak wielkość zakwaterowania. W celu przeanalizowania wpływu użytkowania ziemi na ceny wynajmu, możliwe jest włączenie sześciu rodzajów użytkowania typów gruntów i ekosystemów, tj.: lasy, grunty orne, łąki, wody świeże (rzeki i jeziora), wody morskie i tereny podmokłe. Następnie zbadano wpływ odległości od najbliższego większego miasta na ceny wynajmu po to, aby kontrolować dodatkowe zmienne lokalizacji. Wyniki wskazują na kapitalizację zmiennych strukturalnych i odpowiadających za wykorzystanie ziemi. Wśród zmiennych użytkowania gruntów duży, pozytywny wpływ na zmienną cenową dla buforu 20 km, mają przede wszystkim odległość do rzek i jezior, wód morskich i terenów podmokłych. Wyniki pokazują również odwrotną zależność między ceną wynajmu, a wysokim udziałem gruntów ornych, lasów i pastwisk, co sugeruje preferencje turystyczne dla bardziej zróżnicowanych krajobrazów.

Appendix

Table 6. Descriptive statistics of structural and landscape variables (cottages *n*=493; apartments *n*=493)

Variables	Mean	Std. Dev.	Min	Max
Dependent Variables				
Price (Week/Main season)				
Cottage	873.84	561.38	182	6000
Apartment	604.93	381.23	196	2940
Intrinsic Variables				
size (m^2)				
Cottage	101.67	62.76	24	800
Apartment	66.9	31.57	18	300
capacity (maximum capacity-persons)				
Cottage	6.14	2.68	2	30
Apartment	4.53	2.49	1	30
smoking allowed (0=no/1=yes)				
Cottage	0.22	0.41	0	1
Apartment	0.11	0.31	0	1
pets allowed (0=no/1=yes)				
Cottage	0.65	0.47	0	1
Apartment	0.52	0.5	0	1
barrier free (0=no/1=yes)				
Cottage	0.14	0.35	0	1
Apartment	0.14	0.35	0	1
internet available (0=no/1=yes)				
Cottage	0.39	0.48	0	1
Apartment	0.5	0.5	0	1
terrace available (0=no/1=yes)				
Cottage	0.91	0.28	0	1
Apartment	0.8	0.39	0	1
garden available (0=no/1=yes)				
Cottage	0.79	0.4	0	1
Apartment	0.54	0.49	0	1
sauna available (0=no/1=yes)				
Cottage	0.19	0.39	0	1
Apartment	0.1	0.3	0	1
pool available (0=no/1=yes)				
Cottage	0.08	0.27	0	1
Apartment	0.06	0.24	0	1
guest bathroom available (0=no/1=yes)				
Cottage	0.57	0.49	0	1
Apartment	0.19	0.39	0	1
Location variables				
Distance to the city centre (km)				
Cottage	45.84	27.9	0	125.29
Apartment	43.15	32.46	0	127.05

Table 6. Continuation

Variables	Mean	Std. Dev.	Min	Max
Landscape variables				
Share of Forest within 1 km buffer around accommodation (%)				
Cottage	18.53	23.18	0	99.98
Apartment	17.35	20.22	0	95.67
Share of Arable land within 1 km buffer around accommodation (%)				
Cottage	24.22	27.67	0	99.98
Apartment	18.81	26.66	0	99.98
Variables	**Mean**	**Std. Dev.**	**Min**	**Max**
Share of Grassland within 1 km buffer around accommodation (%)				
Cottage	17.42	21.59	0	99.98
Apartment	16.34	21.94	0	99.98
Share of Rivers/Lakes within 1 km buffer around accommodation (%)				
Cottage	4.33	10.38	0	54.95
Apartment	2.61	7.95	0	64.25
Share of Marine Waters (Baltic, North Sea) within 1 km buffer around accommodation (%)				
Cottage	2.81	8.73	0	50.84
Apartment	3.11	9.58	0	74.08
Share of Wetland within 1 km buffer around accommodation (%)				
Cottage	0.32	2	0	24.15
Apartment	0.19	1.48	0	22.88
Share of Forest within 5 km buffer around accommodation (%)				
Cottage	26.84	25.51	0	98.4
Apartment	30.86	24.91	0	97.98
Share of Arable land within 5 km buffer around accommodation (%)				
Cottage	24.78	21.89	0	92.87
Apartment	20.44	21.84	0	92.86
Share of Grassland within 5 km buffer around accommodation (%)				
Cottage	14.83	15.01	0	75.16
Apartment	13.06	14.23	0	68.92
Share of Rivers/Lakes within 5 km buffer around accommodation (%)				
Cottage	3.23	7.76	0	52.56
Apartment	2.68	6.59	0	54.03
Share of Marine Waters (Baltic, North Sea) within 5km buffer around accommodation (%)				
Cottage	8.06	17.26	0	85.86
Apartment	8.06	17.86	0	83.94
Share of Wetland within 5 km buffer around accommodation (%)				
Cottage	0.47	1.31	0	12.86
Apartment	0.35	1.03	0	10.81
Share of Forest within 20 km buffer around accommodation (%)				
Cottage	25.81	21.23	0	79.28
Apartment	29.74	20.15	0	75.67

Variables	Mean	Std. Dev.	Min	Max
Share of Arable land within 20 km buffer around accommodation (%)				
Cottage	25.07	16.6	0	73.16
Apartment	23.46	18.27	0	75.99
Share of Grassland within 20 km buffer around accommodation (%)				
Cottage	13.48	11.5	0.27	73.35
Apartment	12.41	10.46	0.27	58.97
Share of Rivers/Lakes within 20 km buffer around accommodation (%)				
Cottage	1.81	3.33	0	17.51
Apartment	1.56	2.98	0	16.92
Share of Marine Waters (Baltic, North Sea) within 20 km buffer around accommodation (%)				
Cottage	13.31	21.53	0	77.96
Apartment	11.08	21.47	0	81.29
Share of Wetland within 20 km buffer around accommodation (%)				
Cottage	0.47	0.77	0	5.7
Apartment	0.46	0.81	0	5.64

Sources: own calculations, www.traumferienwohnungen.de, (*EEA* 2006).