

# Assessing the Impact of Lake Attributes on Rental Prices: A Hedonic Pricing Study of Lake Ohrid, Albania

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This study aims to quantify the economic value of environmental, structural and locational characteristics that influence rental prices of holiday flats in the Lake Ohrid region of Albania. A hedonic pricing model is applied to a dataset of 164 holiday flats listed on Booking.com, covering weekend stays across the peak tourist season. A partially log-log regression specification is used, with both rental price and flat area log-transformed to account for skewness and diminishing returns. The results highlight the strong effect of natural amenities: lake views and proximity to greenery increase rental prices by approximately 12% and 15%, respectively. Structural features such as larger flat size, greater bed capacity, newer construction, and the inclusion of breakfast services also significantly raise rental prices. In contrast, features like floor level, lift access, parking availability and balconies did not show a significant price effect. The model also reveals that greater distance from the municipal hospital reduces rental price, underscoring the importance of accessibility. These findings offer practical guidance for real estate investors, hospitality providers, and local authorities working to support sustainable tourism and regional development. *Keywords:* non-market valuation, lake attributes, hedonic pricing, Lake Ohrid, Albania

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## Introduction

Revealed preference methods are a cornerstone of non-market environmental valuation<sup>1</sup>, as they are

<sup>1</sup> In environmental economics, non-market valuation methods estimate the value of goods not traded separately in markets (e.g. scenic views, clean air). Since such amenities are capitalized in housing or rental prices but not sold directly, their value is inferred indirectly through methods like hedonic pricing. Throughout this paper, we refer to them as non-market attributes or amenities not separately priced.

grounded in the actual choices and trade-offs made by individuals (Champ et al., 2003). Among these, the hedonic pricing model (HPM), originally conceptualized by Lancaster (1966) and later refined by Rosen (1974), is particularly influential. Rather than viewing real estate as a uniform good, the HPM decomposes property prices into the implicit values of individual

attributes, structural, locational, neighbourhood and environmental, that together shape market value.

In the context of Lake Ohrid, the HPM enables researchers to quantify how ecosystem-related features, such as lake views and proximity to the shoreline, are capitalized into flat rental prices. This approach not only reveals the implicit values driving consumer decisions but also provides policymakers and conservation planners with concrete economic measures of environmental benefits (Barbier et al., 1997; Pearce et al., 2006).

The central research problem addressed in this study is to assess how lake-related environmental characteristics affect the rental prices of holiday flats in the Lake Ohrid region, using the hedonic pricing model as a non-market valuation approach. While previous studies have established the importance of environmental amenities on property values such as lake views and proximity to the water (Baranzini & Schaerer, 2011; Bin et al., 2008), explicit evidence from holiday rental markets remains limited. The unique environmental and spatial context of Lake Ohrid provides an excellent opportunity to investigate how such non-market values are reflected in rental pricing.

This study seeks to answer three main questions: (1) How do environmental factors like lake views, proximity to Lake Ohrid, and park views affect flat rental prices? (2) What is the impact of structural attributes such as flat size, age, floor level and the presence of a lift? (3) How do locational characteristics affect rental prices?

To explore these questions, the study applies the hedonic pricing method to a comprehensive dataset of 164 rental properties sourced from Booking.com, covering nearly all holiday flats and bed-and-breakfast accommodations available during the high season and weekends on the Albanian side of Lake Ohrid. Following an approach similar to Nelson (2010), the model regresses rental prices on a range of explanatory variables, quantifying the marginal contribution of each feature to overall price. This enables a nuanced assessment of consumer preferences and willingness to pay, while accounting for both direct effects and spatial dimensions that shape rental prices in this lakeside market (Taylor, 2017).

The remainder of the paper is structured as follows: Section 2 reviews relevant literature on hedonic pricing and environmental valuation. Section 3 details the data, variables, and econometric model. Section 4 presents the results, followed by a discussion in Section 5. The paper concludes in Section 6 with policy implications, study limitations, and directions for future research.

## Literature Review and Study Hypothesis

### Theoretical Grounds

The hedonic pricing model (HPM), grounded in the Lancaster framework, posits that real estate is best understood as a bundle of characteristics rather than a homogeneous good. Hence, each housing attribute, whether structural, locational, or environmental, contributes implicitly to the overall price (Barbier et al., 1997; Pearce et al., 2006). This approach aligns with Household Revealed Preference methods, which rely on actual market behaviour to infer individuals' willingness to pay (WTP) for environmental or non-market goods (Brown et al., 2007).

In the context of wetlands and lake ecosystems, HPM is classified under Direct Use Values, capturing how properties near these natural resources command price premiums for views, recreation, and other amenities (Barbier, 1989; Barbier et al., 1997). Lake Ohrid, for instance, presents a valuable case study where proximity and scenic vistas are hypothesized to have an appreciable impact on property prices, an observation that holds practical significance for both policy and conservation planning.

Research consistently illustrates that environmental attributes such as lake views, proximity to water bodies, air quality and open green space, are capitalized into property prices (Baranzini & Schaerer, 2011; Bin et al., 2008; Brander & Koetse, 2011; Loomis & Feldman, 2003). For example, lake distance significantly affects housing values (Van Dijk et al., 2016; Wen et al., 2014), while higher water clarity can boost property desirability (Gibbs et al., 2002; Yoo et al., 2014). Coastal and lakeshore studies similarly show that views of water command rent or price premiums (Benjamin et al., 2001).

Moreover, the spatial dimension is crucial: hedonic pricing often incorporates spatial econometric methods to capture the nuanced relationships between property values and proximity to amenities or disamenities (Schläpfer et al., 2015; Wen et al., 2014; Yoo et al., 2014). Empirical evidence reveals that disamenities, such as railroad or road noise and industrial facilities, negatively affect housing prices, whereas amenities, including parks, forest cover and cultural landscapes, lead to measurable premiums (Boes & Nüesch, 2011; Gayer et al., 2000; Netusil et al., 2010; Schläpfer et al., 2015).

### Study Hypotheses

This section outlines the main hypotheses on factors shaping holiday apartment rents in the Lake Ohrid region, drawing on hedonic pricing and tourism accommodation literature.

#### *Environmental Hypothesis*

Scenic quality, often described as ‘a sight for sore eyes’, is a key environmental attribute influencing rental prices in hedonic pricing models, with unobstructed views consistently linked to higher willingness to pay (Baranzini & Schaerer, 2011). Water views, in particular, are capitalized into higher prices or rents (Bin et al., 2008), and can be valued as a direct use component in lake ecosystems (Barbier et al., 1997). Numerous empirical studies report significant price premiums for oceanfront, lakeside, or unobstructed water views (Benjamin et al., 2001). For example, Gibbs et al. (2002) found that improved water clarity and visibility further boost real estate values in lake regions. Lake views increased hotel room rates (Bayramoğlu et al., 2025). Despite strong international evidence, limited research exists for Lake Ohrid rentals. This study aims to fill that gap by testing the following hypothesis:

*H1 Flats with unobstructed views of Lake Ohrid are expected to have higher rental prices than those without such views, all else being equal.*

Proximity to environmental amenities, especially lakes, is a key driver of property value (Loomis & Feldman, 2003; Wen et al., 2014). Closer access to

lakes brings recreational and aesthetic benefits, often resulting in housing price premiums (Van Dijk et al., 2016). Wen et al. (2014) and Schläpfer et al. (2015) show that each additional metre or kilometre away from a lake can significantly lower property prices, confirming a negative distance gradient. Airbnb prices decline with distance from the shore, especially for budget listings (Dudás et al., 2020). This study examines whether similar patterns hold for Lake Ohrid rentals.

*H2 The closer the holiday flat is situated to the shoreline of Lake Ohrid, the greater its anticipated rental price, reflecting the desirability of immediate access to waterfront amenities.*

Green and open spaces positively affect property prices (Brander & Koetse, 2011; Kong et al., 2007). Studies consistently find that proximity to urban green spaces such as parks and forests raises nearby property values, with premiums around 4–5% reported in places like Finland (Tyrväinen & Miettinen, 2000). Trojanek et al. (2018) found that in Warsaw, proximity to green areas within 100 metres increased holiday flat prices by 2.8–3.1% on average, with premiums reaching up to 8% for newly built flats. Some studies in Poland and South Korea found that large parks (>200 ha) may lower nearby property values due to noise, crowding, or privacy concerns (Łaszkiwicz et al., 2022). Park views had no significant impact on housing prices in Castellón, Spain, suggesting limited value if green spaces are not appealing (Morancho, 2003). Based on evidence that green space proximity typically raises property values, this study hypothesizes that nearby greenery positively affects holiday flat rents near Lake Ohrid.

*H3 The presence of greenery and open spaces near holiday flats in the Lake Ohrid region positively influences rental prices, reflecting tourists’ valuation of natural amenities.*

Views of or proximity to parks enhance not only a property’s aesthetic appeal but also its recreational value (Del Saz Salazar & García Menéndez, 2007; Troy & Grove, 2008; Tyrväinen, 1997). Schläpfer et al. (2015) further indicate that rental prices rise with

nearby recreational infrastructure and cultural landscapes, underscoring the tangible market value of urban green space. Crompton and Nicholls's (2022) review found that residences with park views typically enjoy an additional price premium of around 5–6%, beyond the value added by proximity alone. Some studies found no significant price premium for park views, especially when parks were not a major attraction or views were minor or low-quality (Morancho, 2003). To determine whether the presence of parks similarly enhances rental prices in the study area, the following hypothesis is proposed:

*H4 Flats overlooking public parks are hypothesized to attract higher rental prices, attributable to enhanced recreational and aesthetic benefits for residents.*

#### *Structural Hypothesis*

Space in housing, as per Rosen (1974), has a nonlinear relationship with price, where the marginal price decreases as size increases, reflecting diminishing marginal returns. Size of accommodation positively influences its price (Magno et al., 2018). It is positively correlated to the property price (Bowen et al., 2001; Gibbs et al., 2002; Nelson, 2010). A meta-analysis by Sirmans et al. (2006) confirms that larger square footage consistently leads to higher house prices across various studies. Tourism accommodation studies show that larger room or unit size generally allows higher rates (Bilici & Karaahmetoğlu, 2022; Dudás et al., 2020). Extending these findings to the context of short-term rentals in Lake Ohrid, the following hypothesis is tested.

*H5 Greater internal living space (flat area) is associated with higher rental prices, but with diminishing marginal returns as size increases.*

Bed count is recognized as a key driver of rental price in the short-term rental market, primarily by increasing guest capacity and utility, though its impact may differ by accommodation type and market segment (Chen & Xie, 2017; Dudás et al., 2020). To evaluate whether this relationship holds for holiday flats in the Lake Ohrid region, the following hypothesis is proposed:

*H6 A higher number of beds in holiday flats is expected to be positively associated with rental price.*

Flat age often signals building quality and modernization (Freeman, 1993). Unless renovated or historically significant, older flats typically have lower rents due to wear and tear (Taylor, 2017). Research consistently shows a negative correlation between building age and property value in both lake and park areas (Loomis et al., 2024; Wen et al., 2014). Sirmans et al. (2006) confirm this trend across many studies, except where renovations or heritage features add value. Recent findings also show that newer or renovated lakeside flats attract higher Airbnb rates, aligning with renter preferences (Dudás et al., 2020). This study examines whether these patterns apply to rental prices for flats in the Lake Ohrid region.

*H7 Holding other features constant, flat rental prices are expected to decrease with building age, as newer constructions typically offer superior amenities and perceived quality.*

Floor level constitutes a notable structural attribute in hedonic pricing (Freeman, 1993). Higher floors can provide superior views and reduced noise, both environmental and urban, potentially leading to rent premiums (Baranzini & Ramirez, 2005; Gibbs et al., 2002). Empirical evidence often finds a positive link between floor level and housing value, especially in multi-story buildings (Schlöpfer et al., 2015). The magnitude of this effect may vary depending on context, influenced by building design and noise levels. Building on prior research, this study examines whether the relationship between floor level and rental prices holds for holiday flats near Lake Ohrid.

*H8 Higher floor levels in holiday flats near Lake Ohrid are associated with increased rental prices, reflecting the added value of improved views and reduced noise exposure.*

Accessibility attributes, such as having a lift, can significantly enhance a property's appeal, particularly in taller buildings (Freeman, 1993; Greene, 1997). Schlöpfer et al. (2015) note that basic infrastructural

conveniences correlate positively with higher rents. While environmental amenities draw considerable attention in hedonic studies, features like lifts can yield direct utility gains to residents, translating into a measurable market premium. Lifts raise prices for upper-floor units but may reduce value in low-floor, low-cost buildings due to maintenance costs (Zhang et al., 2024). To assess the relevance of accessibility features for rental pricing in this setting, the following hypothesis is proposed:

*H9 The presence of lift access in a building is hypothesized to positively influence rental prices, particularly in multi-story complexes, by enhancing accessibility and convenience.*

The presence of on-site parking facilities, such as dedicated parking spaces or garages, represents a highly valued amenity within a broad range of housing markets. Extensive hedonic pricing research in urban settings has consistently demonstrated that the availability of a garage or dedicated parking facility significantly enhances property values (Sirmans et al., 2006). Empirical studies show that free parking increases prices for short-term rentals, especially in budget markets (Dudás et al., 2020; Wang & Nicolau, 2017), though the effect may be limited in historic areas with scarce parking (Portolan, 2013). Building on this evidence, this study examines whether on-site parking similarly affects holiday flat rental prices in the Lake Ohrid region.

*H10 On-site parking in Lake Ohrid holiday flats is expected to increase rental prices by offering greater guest convenience.*

The presence of outdoor spaces such as balconies and courtyards enhances property desirability and value (Sander & Polasky, 2009; Sirmans et al., 2005; Van Dijk et al., 2016). Balconies, regardless of view, have been shown to increase the value of high-rise residences (Wing Chau et al., 2004), mitigate road traffic noise (Li et al., 2003) and offer rent premiums in short-term rentals (Probulski & Nehrebecka, 2025). While some hotel studies report mixed effects (Santos et al., 2020), balconies remain generally desirable. Gardens and courtyards provide aesthetic, recreational, and well-being benefits (Gibbons et al., 2014;

Portolan, 2013), with lake-facing courtyards especially valued (Luttik, 2000). Building on this literature, the following hypotheses are proposed for the Lake Ohrid rental market:

*H11 Access to a private balcony is expected to boost flat rental prices due to added outdoor leisure opportunities.*

*H12 Flats featuring a private courtyard are hypothesized to achieve premium rental pricing, as such spaces offer unique environmental and lifestyle benefits.*

Offering bed and breakfast services ('Bed\_break') can enhance property value by providing added convenience for guests. Studies across Europe show that breakfast inclusion is an important factor for higher pricing in tourist accommodations (Buiga et al., 2017; Gordan et al., 2024; Kefela, 2014). While the positive effect is strong in most regions, some spatial variation exists (Gordan et al., 2024). To assess whether this pattern holds in Lake Ohrid, the following hypothesis is proposed:

*H13 Offering breakfast services in Lake Ohrid holiday rentals is expected to increase rental prices by enhancing guest convenience.*

Proximity to hospitals is widely recognized as a locational attribute that can affect rental prices. While access to healthcare typically enhances the attractiveness of a property, resulting in higher rents at convenient distances (Gibbons et al., 2013; Gu et al., 2024), immediate adjacency can sometimes decrease rental prices due to negative externalities like noise and traffic congestion (Huh & Kwak, 1997; Waddell & Hoch, 1993). Given the dual role of hospitals as both an amenity and a potential source of disamenities, the net impact of healthcare accessibility on rents requires empirical assessment in specific regional contexts.

*H14 Increased driving time to the nearest hospital is negatively associated with rental prices of holiday flats.*

The interaction between floor level and lift access is crucial for understanding flat values, as higher floors tend to command a premium only when lifts

Table 1 Measure Development

Variable	Measurement (references)	Place in model	Symbol
<i>Ln_Rent</i>	Natural log of flat rate, in euros. (Benjamin et al., 2001; Bowen et al., 2001; Deboosere et al., 2019; Nelson, 2010; Soler & Gemar, 2018)	Dependent variable	<i>Ln_Rent</i>
Environmental attributes			
<b>Lake_View</b>	Dummy variable: 1=lake view, 0=no lake view. (Baranzini & Schaerer, 2011; Bayramoğlu et al., 2025; Benjamin et al., 2001; Bin et al., 2008; Gibbs et al., 2002; Nelson, 2010; Rouwendal et al., 2014)	Independent H1	
Lake_Distance	Walking time in minutes to the lake. (Bowen et al., 2001; Dudás et al., 2020; Schläpfer et al., 2015)	Independent H2	
Greenery	Dummy variable: 1=greenery presence, 0=no greenery presence. (Brander & Koetse, 2011; Trojanek et al., 2018; Tyrväinen & Miettinen, 2000)	Independent H3	
Park_View	Dummy variable: (1=park view, 0=no park view). (Crompton & Nicholls, 2022; Del Saz Salazar & García Menéndez, 2007; Troy & Grove, 2008)	Independent H4	
Structural attributes			
Ln_Flat_Area	Natural log of flat areas, in m <sup>2</sup> . (Bateman et al., 2001; Geoghegan, 2002; S. Sirmans et al., 2005; Tyrväinen & Miettinen, 2000; Wing Chau et al., 2004)	Independent H5	
No_beds	Number of beds available in the flat. (Boto-García & Leoni, 2023; Dudás et al., 2020; Nelson, 2010)	Independent H6	
Flat_Age	Dummy variable (1=new, 0=old). (Loomis et al., 2024; Pandit et al., 2013; Wen et al., 2014)	Independent H7	
Floor_c	Floor level of the flat. The variable has been mean-centred to deal with potential multicollinearity. (Chin et al., 2004; Conroy et al., 2013; Wong et al., 2006)	Independent H8	
Lift	Lift as dummy variable (1=yes 0=no). (Keskin, 2010; Ma et al., 2022; Zhang et al., 2024)	Independent H9	
<b>Park_free_Flat</b>	Has parking in facility. Dummy variable (1=yes, 0=no). (Ma et al., 2022; Portolan, 2013; Wang & Nicolau, 2017)	Independent H10	
Courtyard	Courtyard as dummy variable (1=yes, 0=no). (Gibbons et al., 2014; Luttk, 2000; Portolan, 2013)	Independent H11	
Balcony	Balcony as dummy variable (1=yes, 0=no). (Liebelt et al., 2019; Malia et al., 2024; Probulski & Nehrebecka, 2025)	Independent H12	
Bed_break	Dummy variable. (1=yes, 0=no). (Boto-García & Leoni, 2023; Gordan et al., 2024; Kefela, 2014)	Independent H13	
Locational attributes			
Hosp_distance	Driving time in minutes to the hospital. (Gibbons et al., 2013; Gu et al., 2024)	Independent H14	
Floor_c*_Lift	Interaction between floor level and lift access.	Independent H15	Floor_c;Lift

are available (Chen et al., 2022; Ma et al., 2022; Zhang et al., 2024). Recent studies in Beijing show that lift installations significantly boost the value of upper-floor units, with little effect on lower levels (Zhang et al., 2024). Drawing on this evidence, this study tests whether a similar floor-lift interaction affects holiday flat rental prices in the Lake Ohrid region.

*H15 The positive impact of higher floor levels on rental prices is expected to be stronger when a lift is present, reflecting an interaction between floor and lift availability.*

**Methods and Procedures**

**The study area**

The study focuses on the 31.8 km Albanian shore of Lake Ohrid, which is shared between North Macedonia (64%) and Albania (36%). In the Pogradec region, a diverse range of accommodations, including guest houses, holiday flats and bed-and-breakfasts, operate throughout the year, with heightened activity during the summer season. This study includes almost the totality of lodging options listed in Booking.com, excluding hotels.

**Data**

The dataset was sourced directly from Booking.com, covering virtually the entire hospitality supply in the Pogradec area near Lake Ohrid. Data were collected in two rounds: September 2024 and May 2025, yielding a total of 164 listings (116 from 2024 and 48 from 2025). Each record includes environmental, structural and locational attributes. Distances were measured using Google Maps to ensure precise location data. Given potential rental rate shifts between 2024 and 2025, a two-sample ttest was conducted to evaluate whether the mean rental price in 2025 was significantly higher than in 2024. The results indicate no statistically significant difference (t = -0.76, p = 0.451).

All data were systematically retrieved and compiled in an Excel spreadsheet, where each listing was manually checked for duplicates and verified for consistency across the two collection rounds. Variables were coded following standard hedonic pricing practices to allow for econometric analysis. These variables form the basis for the regression models estimating the determinants of rental prices.

A wide array of attributes was collected, covering environmental, structural, and locational variables. These include views (e.g. lake, park), proximity measures (lake, municipal hospital), greenery, building features (e.g. balconies, floors, lift), apartment-specific characteristics (area, age), parking options, bedroom configuration, and more.

**Measure Development**

Table 1 summarizes the variables: apartment rent per night as the dependent variable, and environmental, structural, and locational attributes as independents. Prices are drawn from Booking.com listings, which, while not direct measures of willingness to pay, allow hedonic models to infer implicit price premiums. Variable selection follows prior literature and is tailored to the Lake Ohrid context.

**Model**

The empirical framework of this study is a hedonic regression model that quantifies how a range of environmental, structural and locational characteristics contribute to flat rental prices. The dependent variable is the natural logarithm of Rent (ln Rent). The logarithmic (ln) transformation reduces skewness, stabilizes variance and allows coefficients to be interpreted as approximate percentage changes.

The specification below details the variables included, the functional form and the rationale for the chosen transformations.

$$\ln(Rent_i) = \beta_0 + \sum_{j=1}^4 \beta_j^{(e)} X_{ij}^{(e)} + \sum_{k=1}^9 \beta_k^{(s)} X_{ik}^{(s)} + X_{i1}^{(l)} + X_{i4}^{(s)} \cdot X_{i5}^{(s)} + \epsilon_i$$

where:

$$\sum_{j=1}^4 X_{ij}^{(e)} = \text{environmental variables (Lake_View, Lak, Greenery, Park_View)}$$

$$\sum_{k=1}^9 X_{ik}^{(s)} = \text{structural variables (Flat_Area, No._beds, Flat_Age, Floor, Lift, Free_Park_Flat, Courtyard, Balcony, Bed_break)}$$

$$X_{i1}^{(l)} = \text{Location variable (Hosp_distance)}$$

$$\beta_j^{(e)}, \beta_k^{(s)}, \beta_m^{(l)} = \text{estimated coefficients for each group}$$

$$\epsilon_i = \text{error term}$$

Table 2 Frequencies for Dummy Variables

Variable	Yes		No	
	Count	%	Count	%
Lake_view	61	37.2	103	62.8
Park_view	76	46.3	88	53.7
Greenery	109	66.5	55	33.5
Flat_Age: Old/new	56	34.1	108	65.9
Lift	28	17.1	136	82.9
Park_free_flat	62	37.8	102	62.2
Courtyard	58	35.4	106	64.6
Balcony	128	78.0	36	22.0
Bed_break	20	12.2	144	87.8

Note N=164

We apply a partially log–log hedonic pricing model, in which the dependent variable (Rent) and selected continuous predictors, such as flat area, are expressed in natural logarithms, while other structural, environmental and locational attributes are included in their original scale. Coefficients on logged variables can be interpreted as elasticities, indicating the percentage change in rental price associated with a 1% change in the predictor, whereas coefficients on non-logged variables reflect the percentage change in price per unit change. Across alternative specifications, the relationship between Rent and Apartment Area consistently exhibited diminishing returns. We evaluated log–log, quadratic, and spline forms, all of which confirmed the flattening of rents at larger sizes. The spline offered the best fit (Adj.  $R^2 = 0.245$ , AIC = 118.4), while the quadratic specification also captured concavity in absolute terms. For parsimony, interpretability, and comparability with the hedonic pricing literature, we retain the log–log form (Adj.  $R^2 = 0.157$ , AIC = 131.7) as the main specification. Cropper et al. (1988) emphasize that semi-log and log–log specifications in hedonic models improve model fit, mitigate heteroscedasticity, and enhance interpretability by allowing results to be expressed as percentage changes or elasticities. In practice, a variety of forms have been adopted: Chaudhry et al. (2013) and Geoghegan et al. (2002) employ log–log models, while Sander and Polasky (2009), Schläpfer et al. (2015), and Benjamin et

Table 3 Descriptive Statistics for Quantitative Variables

	Unit	Mini- mum	Maxi- mum	Mean	St.Dev
Rent	Euro	22	250	52.59	27.92
Lake_dist	Minutes	1	25	4.73	4.60
Flat_Area	m <sup>2</sup>	10	200	58.16	36.95
Floor	Number	1	12	2.98	1.82
No._beds	Number	1	8	2.75	1.23
Hosp_dist	Minutes	1	24	7.04	5.92

al. (2001) apply semi-log specifications. Loomis and Feldman (2003) incorporate both linear and semi-log forms. Earlier studies, including Palmquist (1984), Bockstael et al. (1987), Crompton (2001), and Leggett and Bockstael (2000), demonstrate that these functional forms effectively capture nonlinear relationships and improve the interpretability of hedonic pricing analyses.

The hedonic regression identifies implicit price premiums associated with flat attributes in observed listing data. These premiums should not be interpreted as direct measures of consumer willingness to pay, which typically requires stated preference or experimental data.

**Study Results**

**Descriptive Results**

The dataset comprises several qualitative, binary variables reflecting key features of the flats surveyed (Table 2). Notably, 37.2% of the flats offer a lake view, while 46.3% provide a park view. A considerable proportion, 66.5%, are surrounded by greenery. When it comes to flat age, 34.1% are classified as old and 65.9% as new. Only 17.1% of the flats are equipped with a lift, highlighting limited accessibility, and 37.8% provide free parking for residents. Additionally, 35.4% of flats have access to a courtyard, and balconies are a common feature, available in 78.0% of flats. Finally, breakfast is included in only 12.2% of the listings. These distributions offer a clear overview of the key amenities and characteristics represented in the sample.

Table 3 summarizes the key descriptive statistics for the main quantitative variables in the sample. The overnight rent is 52.59 euros, with a minimum of 22

Table 4 Robust standard errors regression results

Variable	Estimate	Std. Error	Significance
(Intercept)	2.232	0.223	***
Lake_view	0.119	0.056	*
Lake_dist	-0.007	0.007	
Greenery	0.149	0.067	*
Park_view	0.035	0.057	
Ln_Flat_Area	0.222	0.053	***
No_beds	0.096	0.032	**
Flat_Age	0.133	0.055	*
Floor_c	-0.023	0.026	
Lift	0.006	0.105	
Park_free_Flat	0.053	0.061	
Courtyard	-0.037	0.068	
Balcony	0.035	0.061	
Bed_break	0.297	0.084	***
Hosp_dist	-0.009	0.003	***
Floor_c:Lift	0.018	0.039	

Notes Dependent variable: Ln\_rent

Significance codes: \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

Model fit: Residual standard error = 0.314, Multiple R-squared = 0.415, Adjusted R-squared = 0.356, F-statistic = 7.01

euros and a maximum of 250 euros. The mean distance to the lake is 4.73 minutes, ranging from one to 25 minutes. The average flat area is 58.16 m<sup>2</sup>, with flats ranging from 10 to 200 m<sup>2</sup>. The average level is approximately the third floor, while the number of beds per flat ranges from one to eight, with a mean of 2.75. The mean driving time to the municipal hospital is 7.04 minutes, with driving time ranging between 1 and 24 minutes. Overall, the sample demonstrates considerable variation in both housing characteristics and locational attributes.

### Regression Results

Table 4 presents the regression results, showing the relationship between flat rent and various environmental, structural and neighbourhood characteristics.

Diagnostic checks were conducted to ensure that our regression results are statistically valid. First,

since diagnostic tests detected heteroscedasticity in the residuals (Breusch–Pagan  $\chi^2(15) = 27.25$ ,  $p = 0.027$ ; White  $\chi^2(2) = 15.06$ ,  $p < 0.001$ ), we report heteroscedasticity-consistent robust standard errors (White, 1980) to preserve coefficient estimates and ensure valid inference. Next, histograms of residuals and the normal Q–Q plot indicated no violations of the residual normality assumption. Finally, multicollinearity was assessed using Variance Inflation Factors (VIF) on an initial set of 24 predictors. Several variables were sequentially excluded due to excessively high VIFs, and the final model retained only variables with VIFs well below common thresholds (e.g.  $< 5$ ), ensuring no multicollinearity and reliable OLS estimates

The regression model explains about 42% of the variation in rental prices ( $R^2 = 0.42$ ), with the adjusted  $R^2$  dropping to 0.36 after accounting for model complexity. This indicates that some factors affecting rental prices remain unaccounted for. Despite this, the model is statistically significant ( $F = 7.01$ ,  $p < 0.001$ ), confirming that at least one included variable meaningfully predicts rental prices in the Lake Ohrid region.

The regression results are organized by variable group: environmental variables, structural characteristics and locational attributes. Each section discusses the significance and impact of predictors on flat rental prices in the study area.

### Environmental Variables

Among the environmental variables included in the regression model, two factors demonstrated a statistically significant effect on flat rental prices, thereby supporting the corresponding hypotheses.

The presence of a lake view (*Lake\_view: H1*) has a significant positive effect on rental price, with an estimated coefficient of 0.119 ( $p = 0.034$ ). This result supports Hypothesis 1, indicating that flats with a view of Lake Ohrid are associated with higher rental prices compared to those without such a view. The positive association aligns with expectations from hedonic pricing theory, as scenic amenities typically enhance perceived property value. Specifically, holding other factors constant, flats offering a lake view are associated with a 12% higher rental price (since the dependent

variable is log-transformed), confirming the economic relevance of visual environmental amenities in the local market.

Greenery in the vicinity (*Greenery: H3*) of the flat also showed a positive and statistically significant effect, with a coefficient of 0.149 ( $p = 0.027$ ). This finding confirms Hypothesis 3 and highlights the added value of natural surroundings. All else equal, flats situated near green spaces or abundant vegetation tend to achieve approximately 15% higher rents, underscoring the importance of environmental quality in shaping rental prices.

Two environmental variables were not significant, offering no support for the related hypotheses. *Lake\_dist* (H2) showed a negative but insignificant effect ( $\beta = -0.007$ ,  $p = 0.336$ ), suggesting that, once other factors are controlled, marginal distance from the lake does not drive prices – possibly because the *Lake\_view* variable captures most of the amenity value. Likewise, *Park\_view* (H4) was insignificant ( $\beta = 0.035$ ,  $p = 0.533$ ), indicating that proximity to parks does not affect rents in the Pogradec market.

#### *Structural Characteristics*

Several structural characteristics exhibited statistically significant associations with flat rental prices, thereby confirming their respective hypotheses:

The log-transformed flat area (*Ln\_Flat\_Area: H5*) had a strong, positive effect on rental price, with a coefficient of 0.222 ( $p < 0.001$ ). This finding supports Hypothesis 5, demonstrating that larger flats have higher rents, consistent with the law of diminishing returns in property economics. The elasticity interpretation indicates that a 1% increase in flat area is associated with an approximate 0.22% increase in rental price, holding all other variables constant. This underlines the central role of usable space in determining market value.

The number of beds (*No.\_beds: H6*) was also found to be a significant predictor, with an estimated coefficient of 0.096 ( $p = 0.003$ ). This supports Hypothesis 6, confirming that flats offering more beds are able to capture higher rents. Specifically, each additional bed is associated with an estimated 9.6% increase in rental price, further reinforcing the economic value of space and capacity for potential tenants.

*Flat age* (H7) demonstrated a positive effect on rental price, with a coefficient of 0.133 ( $p = 0.017$ ). This supports Hypothesis 7 and may reflect a local preference for newly constructed or recently renovated properties or those with character and a proven record. In this context, switching from old to new flat is associated with a 13.3% increase in rental price, though this pattern may differ in markets where age is negatively perceived.

The inclusion of breakfast (*Bed\_break: H13*) had a significant impact, with a coefficient of 0.297 ( $p < 0.001$ ), supporting Hypothesis 13. Flats that offer breakfast as part of the rental package achieve substantially higher rents, about 30% more, demonstrating the attractiveness of added hospitality services for potential tenants.

The remaining structural variables were not statistically significant, leading to rejection of the related hypotheses. Floor level (H8), lift (H9), their interaction (H15), free parking (H10), courtyard access (H11), and balcony presence (H12) all showed non-significant effects, indicating no measurable impact on rental prices in this market.

#### *Locational Characteristics*

Distance to the municipal hospital (*Hosp\_dist: H14*) was a significant predictor of rental price ( $\beta = -0.009$ ,  $p < 0.001$ ), supporting H14. The negative coefficient indicates that apartments farther from the hospital rent for less, with each additional unit of distance reducing price by about 0.9%. This result highlights the role of accessibility to essential services in shaping demand and reinforces the hospital's importance as a key locational amenity in the Pogradec rental market.

#### **Discussion**

The regression analysis confirms established findings in the literature, showing that environmental, structural, and locational attributes significantly shape holiday flat rental prices in the Lake Ohrid region. Environmental amenities, particularly lake views and proximity to greenery, consistently emerge as strong positive determinants, underscoring the premium tourists assign to scenic and natural surroundings (Baranzini & Schaerer, 2011; Bond et al., 2002; Brand-

er & Koetse, 2011; Loomis et al., 2024; Loomis & Feldman, 2003; Luttkik, 2000; Nelson, 2010; Schläpfer et al., 2015; Tyrväinen & Miettinen, 2000; Wen et al., 2014; Yoo et al., 2014). Structural features such as flat size and number of beds further exhibit strong explanatory power, while additional amenities like breakfast services and newer flat age enhance market appeal (Bowen et al., 2001; Buiga et al., 2017; Chen et al., 2022; Dudás et al., 2020; Gibbs et al., 2002; Gordan et al., 2024; Kefela, 2014; Nelson, 2010; Sirmans et al., 2006; Taylor, 2017).

Locational attributes, especially proximity to the municipal hospital, also align with prior research (Gibbons et al., 2013; Gu et al., 2024; Wen et al., 2014). By contrast, features such as floor level, lift, free parking, balcony, or park view did not show significant effects, suggesting context-specific or limited influence in this market.

These findings suggest that urban planners should prioritize the protection and enhancement of lake views and green spaces, as these amenities substantially increase rental prices and regional appeal for visitors. Integrating parks and maintaining scenic corridors should be central in development and zoning decisions. For building owners and hospitality businesses, investing in properties with natural amenities, such as lake views or proximity to greenery, can yield higher rental returns; while increasing or highlighting guest capacity can further boost competitiveness in the short-term rental market. Additionally, offering value-added services like breakfast has a proven positive impact on rental income, making it a worthwhile strategy for hospitality providers.

This study is not without limitations. The reliance on Booking.com listings may introduce selection bias, as informal or offline rentals are not represented. The hedonic model, while robust, cannot fully account for unobserved heterogeneity or complex interactions among structural, environmental, and locational attributes. The cross-sectional dataset also limits the ability to capture dynamic changes over time. Furthermore, additional variables, such as guest reviews, luxury indicators, accessibility features, or measures of service quality, were not available but could further enrich the analysis. Despite these constraints, the core

results remain valid and reliable, aligning with international evidence and reflecting the realities of the local market. Future research could improve upon this work by collecting broader datasets, including offline and informal rentals, and by incorporating panel data or applying fixed/random effects models to better control for unobserved heterogeneity. Moreover, employing flexible modelling techniques such as splines or generalized additive models (GAMS) could better capture nonlinear or non-additive effects between property characteristics. Additional variables, such as guest reviews, luxury indicators, accessibility features, or measures of service quality, should also be considered to further refine understanding of the determinants of rental prices in the holiday accommodation market.

### Conclusion

This study makes both theoretical and empirical contributions to the literature on non-market valuation by applying a hedonic pricing model to the under-explored tourism market of Lake Ohrid, Albania. It shows that environmental amenities, most notably lake views and greenery, together with structural features such as flat size and capacity, are key drivers of rental prices. Empirically, the paper contributes one of the first systematic applications of hedonic pricing to Albania's hospitality sector, demonstrating that environmental and structural characteristics are consistently internalized into rental values, while average prices remained stable across 2024 and 2025. By filling a major research gap in the Western Balkans, the study contributes new evidence on how transitional tourism economies internalize natural and property amenities into market outcomes. Looking ahead, further research could extend these contributions by integrating seasonal variation and demand-side data, while policy makers and planners can build on the findings to safeguard scenic amenities and guide tourism development strategies that align with market signals.

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