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# Tourist Accommodation Choices in Nature-Based Destinations: The Case of Geotourism Destination Kras/Carso

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**Abstract:** This paper explores the relationship between accommodation choices and visitor interests, and characteristics in the emerging cross-border Karst Geopark, a geologically rich nature-based destination. It examines how demographics, interests, and activity preferences influence lodging decisions. Findings indicate that older visitors, women, and repeat tourists favor agritourism, whereas first-time and cross-border travelers prefer private rooms for greater flexibility. Additionally, interests in geotourism and cycling significantly shape accommodation preferences. The study highlights the need for destination managers and accommodation providers to tailor offerings to visitor expectations, enhancing tourism benefits. Methodological limitations, including sample imbalance and overlooked external factors, are discussed, with recommendations for future research to refine predictive models and incorporate supply-side attributes. These insights provide valuable guidance for policymakers and tourism stakeholders in developing targeted, sustainable accommodation strategies.

**Keywords:** geotourism; accommodation choice; interests; market segmentation; nature-based destinations; Firth's bias correction method

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## 1. Introduction

Accommodation is an essential component of the tourist experience (Tajeddini et al., 2021) and accounts for a significant portion (30–40%) of tourist expenditure (Aguiló et al., 2017). As such, it is understandable that this area has attracted the attention of researchers since the 1980s (e.g., Atkinson, 1988; Knutson, 1988). The preferences and choice of accommodation are influenced by various factors, including the characteristics of individual establishments, such as type, quality, location, facilities, and price (Lockyer, 2005), the type and characteristics of the destination (Kemperman, 2021; Ortaleza & Mangali, 2021), and the characteristics of the tourists themselves (Chen et al., 2017; McKercher et al., 2023). Understanding the importance and impact of these factors for different types of destinations provides deeper insight into market segmentation and the customization of the destination offer to selected target segments (Liu et al., 2015).

The above points are crucial both for the strategic development of destinations and for service providers. Rural areas and nature-based destinations, typically characterized by a rich natural environment, sparse population, traditional economic activities, cultural and environmental vulnerability, and limited accommodation capacity are particularly sensitive when it comes to how development is carried out and investment in infrastructure.

Geoparks and other destinations with distinctive geological attractions represent a growing segment of nature-based tourism that has garnered increasing attention in the academic literature (Ólafsdóttir & Tverijonaite, 2018; Xu & Wu, 2022). However, the

accommodation sector within these destinations has received relatively limited focus. In contrast to "typical" rural destinations, this type of nature-based tourist destination often involves limited agricultural and other traditional activities, or these activities are not carried out in close proximity to the main attraction. The aim of this study is to address this gap by examining the relationship between tourists' interests and characteristics and their accommodation choices at these specific nature-based tourist destinations. Tourists' interests have been identified as a key factor, particularly by researchers focusing on their spatial behavior at the destination and personalized trip recommendations (e.g., Kramer et al., 2006; Lim et al., 2018). The research was conducted in the Karst region, where activities have been ongoing for several years to establish a geopark. By proposing Firth's (1993) penalized-likelihood estimation—a method widely used in multiclass discrete choice modeling in other fields—this study addresses the issues of unbalanced datasets and separation, challenges that are often overlooked in tourism and hospitality research.

## 2. Literature Review

### *2.1. Characteristics of Tourists and Accommodation Choice*

Natural and rural destinations have been studied in several cases, both in terms of visitor characteristics, motivations, and interests (Dong et al., 2013; Maestro et al., 2007; Park & Yoon, 2009) and how they relate to accommodation choice (Andika & Baiquni, 2021; Gössling & Lane, 2015; Pina & Delfa, 2005; Rogerson & Rogerson, 2014).

The studied characteristics influencing choice of accommodation varied depending on the purpose or focus of the study and the type of destination where the study was conducted. Chen et al. (2017), in their research on international visitors in Taiwan, highlight factors such as trip duration, first-time visit, income, age, gender, number of lodgers, and country of origin. Pina and Delfa (2005), on the other hand, also included education, company during the trip, knowledge of the destination, previous experiences, and activities at the destination in their study, which they carried out in the rural area of Murcia. Gunasekaran and Anandkumar (2012) and Ingram (2002) also focused on rural areas examining the importance of visit motivation in the context of alternative accommodation. Pulido-Fernández et al. (2024) added the mode of travel, the total number of travelers, and their employment in a survey conducted in southern Spain. Additionally, Chu and Choi (2000), in the case of Hong Kong, studied the differences between leisure and business travelers in the hotel choice process. In marketing research, interests are a crucial element of a tourist's lifestyle and personality, and they have frequently been incorporated into segmentation studies (Wind & Green, 2011). Pearce (2019) argues that the interests of tourists who independently organize their trips significantly influence their travel patterns, as well as their choice of activities and accommodations. Vargas et al. (2021) agree that tourists' interests and preferences directly affect touristic behavior. Interestingly, Pulido-Fernández et al. (2024) found that the effects between tourists' interests at the destination and their choice of accommodation type go both ways, suggesting that the choice of accommodation also influences tourists' activities during their stay at the destination.

### *2.2. Geoparks as a Specific Nature-Based Tourist Destinations*

Geotourism is a form of nature-based tourism (Fung & Jim, 2015; Sadry, 2009). Hose (2008, p. 38) defined geotourism from the supply-side perspective as »The provision of interpretative facilities and services to promote the value and societal benefit of geological and geomorphological sites and their materials, and to ensure their conservation, for the use of students, tourists and other casual recreationalists«. On the other hand, from the demand side, Pralong (2006, p. 20) defines it as »a multiinterest kind of tourism that utilises natural sites and landscapes containing interesting earth-science features«. Geotourism

encompasses various forms of geological features, tourist displays, and activities—ranging from caving, quarry tours, and rock excavation to underground trails, museums, and diverse forms of adventure tourism in geological settings (Newsome & Dowling, 2010). R. Dowling and Pforr (2021) classify geotourism as a form of special interest tourism. Furthermore, R. K. Dowling and Newsome (2017) argue that geotourism takes place at geological sites, where it provides an understanding of Earth sciences through respect and learning. In this context, the preservation of geological diversity is essential. However, Frey (2021) notes that the geological significance of resources alone does not ensure the sustainable tourism development of an area; rather, these resources must also be connected to cultural heritage and involve various stakeholders. In a similar vein, R. Dowling and Pforr (2021) emphasize that, for a complete understanding and appreciation of a geological area, it is necessary to be familiar with not only the abiotic elements of geology but also the fauna, flora, and cultural landscape of the area, as these form an inseparable part of the area's overall picture.

In practice, destinations that feature geological attractions vary greatly—from those where geological features are the sole element of appeal to those that are also rich in other natural and cultural heritage attractions; some are touristically developed and established, while others are in the early stages of tourism development. Furthermore, the organizational forms of DMOs and the intensity and approaches of destination management also differ (Newsome et al., 2012).

To achieve a harmonious and sustainable development of these destinations that will offer tourists a comprehensive experience of the area, it is important to connect different attractions and amenities and create integrated tourism products (Panasiuk, 2017). Geoparks are a typical form of such integration. In 2024, there were already over 200 global geoparks (UNESCO, 2024), which, in addition to environmental protection, aim to ensure coordinated management, sustainable development, stakeholder networking and a holistic presentation of the area (Ruban, 2018). One of the challenges of geopark management is the heterogeneity of "geotourists", ranging from experts to "casual" visitors for whom geology may only serve as a backdrop for various outdoor activities (Gordon, 2018).

### *2.3. Discrete Choice Models in Hospitality*

This study is also connected to the literature on discrete choice models, particularly those based on random utility maximization. These models are widely used in diverse fields, including tourism and hospitality. The framework, pioneered by McFadden (1974, 1986), offers a robust basis for examining decision-making processes involving a finite set of mutually exclusive and collectively exhaustive alternatives. Choice data for these models can originate from two main sources: stated preference experiments, where individuals indicate preferences in hypothetical, controlled scenarios, and revealed preference data, which reflect actual behavior observed in real-world contexts (Louviere, 2000; Louviere & Woodworth, 1983). While revealed preference data offer valuable insights into genuine choice behavior, they are often limited by challenges such as high collinearity and restricted variability among explanatory variables (Brownstone et al., 2000). Although the majority of tourism-related studies employing discrete choice modeling have focused on destination choice (for an extensive review, see Kemperman, 2021; Masiero et al., 2015; Nicolau & Mas, 2006), there are notable applications in hospitality research as well. For instance, Chen et al. (2017) examined the factors influencing accommodation choice in Taiwan, while Pina and Delfa (2005) and Albaladejo-Pina and Díaz-Delfa (2009) explored preferences for rural vacation homes. However, accommodation supply is typically unbalanced in terms of the share of different accommodation types, leading to sample class imbalance and situations where complete or quasi-complete separation occurs. Although both issues—

class imbalance and (quasi-)separation—can affect the accuracy of estimation in multiclass discrete choice models (Albert & Anderson, 1984; King & Zeng, 2001), they remain widely overlooked in tourism and hospitality studies. To address these issues, we propose using Firth's (1993) penalized-likelihood estimation. Firth's method has become a standard approach in medical statistics for handling small sample sizes or rare event data in logistic regression (Puhr et al., 2017). It has also gained importance in other fields, such as transport crash analysis (e.g., Jalayer et al., 2021), market segmentation (e.g., Kessels et al., 2019), and other domains.

## 3. Materials and Methods

### *3.1. Area of Research*

Our study focusses on the Slovenian–Italian border region of the Dinaric Karst, also known as the Classical Karst (Hajna et al., 2010), where a cross-border geopark is to be established. This region holds significant tourism potential due to its geomorphological and speleological features, its remarkable aesthetic value and its close links to historical, archeological and ethnological resources (Ruban, 2018). The planned geopark (Figure 1) covers 936 km$^2$ and is located in the north-eastern part of the Adriatic Sea. It comprises five municipalities in Slovenia and twelve in Italy (Bensi et al., 2022).

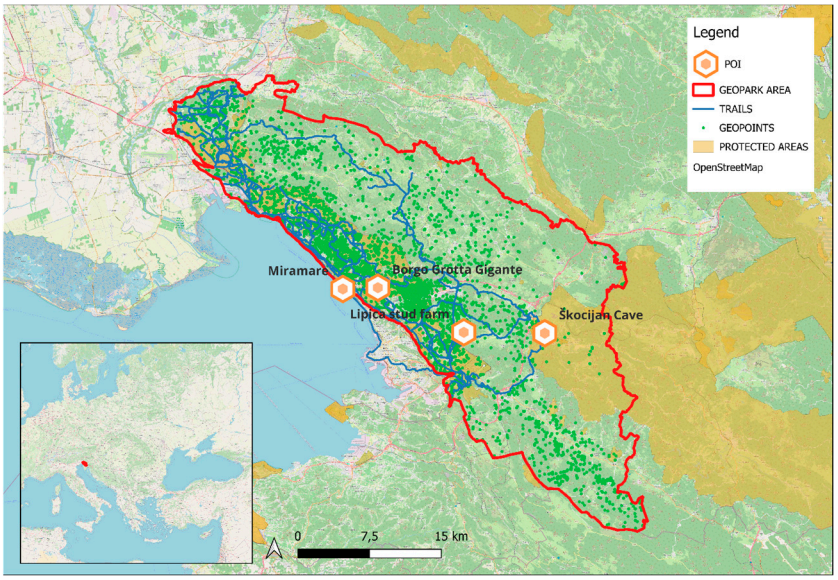



**Figure 1.** The area of the emerging Kras-Carso geopark.

Geotourism has long been established in this region, mainly due to the extensive network of caves (over 3400), with the Škocjan Caves (declared a UNESCO World Heritage Site in 1986) and Grotta Gigante being the most famous attractions (Bensi et al., 2022; Stepišnik & Trenchovska, 2018). One of the most significant heritage attractions of the region is the Lipica Stud Farm, which was inscribed on the UNESCO World Heritage List in 2022. In addition, the distinctive cuisine, traditional customs, events, and, to a lesser extent, archeological sites, botanical gardens, quarries, and heritage from the First World War offer further attractions for tourists (Bensi et al., 2022). The area is also popular among recreational tourists (cycling and hiking). More than ten cycling routes have been developed, and guided cycling tours are organized. Additionally, the area features numerous smaller sacred sites and a few museums, although they currently hold only limited tourist significance.

There are no comprehensive official data regarding accommodation capacity and tourist visitation in the emerging geopark area, so we provide available data for the

municipalities that encompass the geopark. Furthermore, the methodologies for capturing statistical data are not comparable across the two sides of the border.

On the Slovenian side, in the five communities of the emerging geopark area, there were approximately 3028 beds in 2023, with 404,974 overnight stays recorded annually and an average length of stay of 1.77 days (SORS, 2025).

On the Italian side, approximately 18,400 beds were available in geopark communities, with almost 640,000 arrivals and more than 750,000 overnight stays, according to ISTAT (2025). Almost one third (31.5%) of these were in hotels or similar establishments, which accounted for 60% of arrivals. Campsites accounted for 18.2% of all accommodation, private rooms for 36.5%, while agritourism made up only 3% of all accommodations, with "other accommodation establishments" accounting for the remainder (ISTAT, 2025).

Additionally, the area on the Slovenian side is predominantly characterized by transit tourism—only the Škocjan Caves, one of the attractions, records over 185,000 visitors annually (Park Škocjanske jame, 2023).

### *3.2. Data and Methods*

The data for this study were collected using a survey questionnaire conducted as part of the Interreg Kras/Carso II project (co-founder by the Interreg V-A Italy–Slovenia Cooperation Programme 2021–2027). The field survey was carried out on both sides of the border between June 2023 and June 2024. The sample was selected using a stratified quasi random sampling method, targeting adult visitors at predefined locations, including popular tourist attractions and hiking trails. Six trained surveyors invited tourists to complete the questionnaires by scanning the QR code and were available to provide explanations and assistance if needed to ensure the accurate completion of the survey. They rotated throughout the data collection period. Respondents completed the questionnaire digitally on their mobile devices. Special attention was given to minimizing bias that could violate the assumption of independence between observations. To this end, the repeated inclusion of members from the same organized groups, such as school field trips or guided bus excursions, was systematically avoided. In total, 481 individuals participated in the survey, with a final valid sample comprising 319 domestic and international visitors. The characteristics of the sample are presented in Table 1.

The survey questionnaire was designed to capture socio-demographic data (e.g., gender, age, income, education, country of origin), information on interest in specific destination elements, satisfaction with the offered services, travel party details, accommodation choice, and a section on willingness to pay (WTP) for geopark attraction visits, which is not relevant for this study. The main interests and satisfaction were measured using a 5-point Likert scale, while age, income, education, and other characteristics were measured using categorical variables, as shown in Table 1. The questionnaire was developed in collaboration with the other project partners and in consultation with major tourism stakeholders in the area of interest. A pilot survey was administered to 30 visitors to collect feedback and suggestions. The final version of the questionnaire was translated from Slovenian into Italian, German, and English.

It is important to note that the original questionnaire included a greater number of levels for certain categorical variables than those used in this study. For example, age was initially recorded with seven levels, education with four levels, income with five levels, travel party information with seven levels, and the dependent variable, accommodation choice, with eight levels. The process of collapsing levels was guided by theoretical considerations, previous research, and sample characteristics. For instance, travel party composition was consolidated into three categories: alone, family with children and couples, and friends and colleagues (similar to McKercher et al. (2023)). Similarly, accommodation

type was grouped into six categories: agritourism, apartment, campsite, guesthouse, hotel, and private room. Transit visitors, which were also recorded, were excluded from the present analysis. Collapsing of the levels was also necessary due to the underrepresentation of certain groups in the survey. However, despite this adjustment, some accommodation types remained under-sampled, which further contributed to low frequencies in certain categories of the observed variables. This limitation is a key constraint of our research, that also significantly influences the computational methods used in the analysis.

**Table 1.** Descriptive statistics (attributes and levels).

| | | Agritourism (N = 20) | | Apartment (N = 119) | | Camp (N = 45) | | Hotel (N = 93) | | Guesthouse (N = 25) | | Private Room (N = 17) | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interests (5-point Likert scale) | | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. | Mean | Std. Dev. |
| (Q6a) Built heritage | | 4.9 | 0.4 | 4.4 | 1.2 | 4.3 | 1.3 | 4.5 | 1.1 | 4.2 | 1.4 | 4.8 | 0.7 | 4.5 | 1.1 |
| (Q6b) Sacred heritage | | 4.3 | 1.3 | 4.0 | 1.5 | 4.2 | 1.5 | 4.2 | 1.3 | 4.4 | 1.2 | 4.2 | 1.4 | 4.2 | 1.4 |
| (Q6c) Traditional crafts | | 4.5 | 1.3 | 4.2 | 1.3 | 4.2 | 1.2 | 4.4 | 1.2 | 4.2 | 1.4 | 4.5 | 1.1 | 4.3 | 1.3 |
| (Q6d) Flora and fauna | | 4.5 | 1.3 | 4.8 | 0.7 | 4.6 | 1.0 | 4.8 | 0.7 | 4.6 | 1.0 | 4.8 | 0.7 | 4.7 | 0.8 |
| (Q6e) Geological features | | 4.4 | 1.3 | 4.9 | 0.6 | 5.0 | 0.3 | 4.8 | 0.7 | 5.0 | 0.0 | 4.8 | 0.7 | 4.9 | 0.7 |
| (Q6f) Authentic gastronomy | | 4.8 | 0.6 | 4.7 | 0.8 | 4.5 | 1.1 | 4.8 | 0.7 | 4.5 | 1.2 | 4.9 | 0.5 | 4.7 | 0.9 |
| (Q6g) Museums | | 4.3 | 1.3 | 4.1 | 1.4 | 4.0 | 1.5 | 4.1 | 1.4 | 4.0 | 1.4 | 4.1 | 1.2 | 4.1 | 1.4 |
| (Q6h) Traditional events. customs | | 4.5 | 1.1 | 4.4 | 1.1 | 4.3 | 1.3 | 4.5 | 1.0 | 4.8 | 0.7 | 4.5 | 0.9 | 4.5 | 1.1 |
| (Q6i) Thematic nature trails/parks | | 4.7 | 0.7 | 4.7 | 0.9 | 4.5 | 1.0 | 4.8 | 0.7 | 4.6 | 0.8 | 4.5 | 1.1 | 4.7 | 0.8 |
| (Q6j) Thematic bike paths | | 4.6 | 1.0 | 3.5 | 1.7 | 3.5 | 1.7 | 3.5 | 1.7 | 2.8 | 1.8 | 3.9 | 1.6 | 3.5 | 1.7 |
| | | N | Pct. | N | Pct. | N | Pct. | N | Pct. | N | Pct. | N | Pct. | N -total | Pct. -total |
| No. of visits | First time (ref) | 10 | 50.0 | 94 | 79.0 | 35 | 77.8 | 71 | 76.3 | 21 | 84.0 | 11 | 64.7 | 242 | 75.9 |
| | More than 1 | 10 | 50.0 | 25 | 21.0 | 10 | 22.2 | 22 | 23.7 | 4 | 16.0 | 6 | 35.3 | 77 | 24.1 |
| Both sides of border? | I don't know (ref) | 5 | 25.0 | 30 | 25.2 | 9 | 20.0 | 19 | 20.4 | 3 | 12.0 | 1 | 5.9 | 67 | 35.8 |
| | No | 6 | 30.0 | 47 | 39.5 | 21 | 46.7 | 28 | 30.1 | 14 | 56.0 | 4 | 23.5 | 120 | 64.2 |
| | Yes | 9 | 45.0 | 42 | 35.3 | 15 | 33.3 | 46 | 49.5 | 8 | 32.0 | 12 | 70.6 | 132 | 85.2 |
| Travel party | Alone (ref) | 0 | 0.0 | 7 | 5.9 | 4 | 8.9 | 11 | 11.8 | 0 | 0.0 | 1 | 5.9 | 23 | 14.8 |
| | Family, Couples | 19 | 95.0 | 73 | 61.3 | 32 | 71.1 | 66 | 71.0 | 16 | 64.0 | 11 | 64.7 | 217 | 73.3 |
| | Friends, Colleagues | 1 | 5.0 | 39 | 32.8 | 9 | 20.0 | 16 | 17.2 | 9 | 36.0 | 5 | 29.4 | 79 | 26.7 |
| Age | 18–34 (ref) | 5 | 25.0 | 56 | 47.1 | 21 | 46.7 | 34 | 36.6 | 14 | 56.0 | 8 | 47.1 | 138 | 51.1 |
| | 35–54 | 8 | 40.0 | 53 | 44.5 | 17 | 37.8 | 42 | 45.2 | 7 | 28.0 | 5 | 29.4 | 132 | 48.9 |
| | 55+ | 7 | 35.0 | 10 | 8.4 | 7 | 15.6 | 17 | 18.3 | 4 | 16.0 | 4 | 23.5 | 49 | 15.6 |
| Education | College or more (ref) | 16 | 80.0 | 97 | 81.5 | 37 | 82.2 | 83 | 89.2 | 17 | 68.0 | 15 | 88.2 | 265 | 84.4 |
| | High school or less | 4 | 20.0 | 22 | 18.5 | 8 | 17.8 | 10 | 10.8 | 8 | 32.0 | 2 | 11.8 | 54 | 21.0 |
| Wage | ≤2.000 eur (ref) | 11 | 55.0 | 79 | 66.4 | 28 | 62.2 | 57 | 61.3 | 18 | 72.0 | 10 | 58.8 | 203 | 79.0 |
| | >2.000 eur | 9 | 45.0 | 40 | 33.6 | 17 | 37.8 | 36 | 38.7 | 7 | 28.0 | 7 | 41.2 | 116 | 44.8 |
| Gender | Male (ref) | 4 | 20.0 | 54 | 45.4 | 23 | 51.1 | 44 | 47.3 | 9 | 36.0 | 9 | 52.9 | 143 | 55.2 |
| | Female | 16 | 80.0 | 65 | 54.6 | 22 | 48.9 | 49 | 52.7 | 16 | 64.0 | 8 | 47.1 | 176 | 53.0 |
| Location | Italy (ref) | 14 | 70.0 | 65 | 54.6 | 16 | 35.6 | 44 | 47.3 | 9 | 36.0 | 8 | 47.1 | 156 | 47.0 |
| | Slovenia | 6 | 30.0 | 54 | 45.4 | 29 | 64.4 | 49 | 52.7 | 16 | 64.0 | 9 | 52.9 | 163 | 84.0 |
| Country | Austria (ref) | 2 | 10.0 | 10 | 8.4 | 4 | 8.9 | 14 | 15.1 | 1 | 4.0 | 0 | 0.0 | 31 | 16.0 |
| | France | 2 | 10.0 | 12 | 10.1 | 8 | 17.8 | 6 | 6.5 | 2 | 8.0 | 5 | 29.4 | 35 | 34.7 |
| | Italy | 7 | 35.0 | 27 | 22.7 | 7 | 15.6 | 16 | 17.2 | 4 | 16.0 | 5 | 29.4 | 66 | 65.3 |
| | Germany | 4 | 20.0 | 12 | 10.1 | 9 | 20.0 | 13 | 14.0 | 7 | 28.0 | 3 | 17.6 | 48 | 25.7 |
| | Other | 5 | 25.0 | 58 | 48.7 | 17 | 37.8 | 44 | 47.3 | 11 | 44.0 | 4 | 23.5 | 139 | 74.3 |

The multinomial logit (MNL) model is widely used in discrete choice modeling for choice sets with more than two alternatives. It estimates parameters via maximum likelihood estimation (MLE), which is efficient and unbiased under standard conditions. However, the MNL model relies on the independence of irrelevant alternatives (IIA) assumption, meaning the relative odds between any two alternatives must remain unchanged by the presence or attributes of other alternatives (Train, 2009). To address such limitations, alternative models have been developed, including the nested multinomial logit (NMNL) (McFadden, 1974, 1981, 1986), which accommodates nested data structures, and the mixed multinomial logit (MMNL) (McFadden & Train, 2000), which accounts for individual het-

erogeneity among decision-makers. However, in cases with small sample sizes, highly unbalanced data, or situations where complete or quasi-complete separation occurs, maximum likelihood estimation (MLE) fails to produce reliable estimates (Albert & Anderson, 1984; Firth, 1993). While this phenomenon has been mostly studied in the context of logistic regression, it also affects MNL models (Cook et al., 2018). In our case, the data exhibit complete separation for the conditions "party: alone" and "accommodation: Agritourism" as well as "party: alone" and "accommodation: Guesthouse". Additionally, quasi-complete separation[1] is observed in several other instances involving very low frequencies.

Simple solutions, such as removing or collapsing the variables causing complete separation, are inadequate. The rare classes (agritourism and guesthouse) are the primary focus of interest, lack theoretical justification for collapsing, and such approaches do not fully resolve the issue. Moreover, removing an important predictor from the dataset could introduce specification bias (Zorn, 2005).

A more effective solution to address this problem is to apply bias correction methods. One widely used approach (Zorn, 2005) is the Firth (1993) penalized-likelihood strategy, originally proposed for reducing bias in logistic regression estimates. This method has since been extended to address issues of separation and small-sample bias in various models, including logistic regression (Heinze & Schemper, 2002), multinomial logistic regression (S. B. Bull et al., 2002; Kosmidis & Firth, 2011), conditional logit models (Heinze & Puhr, 2010), and others, and has been proven to be more accurate than a broad class of generalized linear models (Van der Paal, 2014).

The Firth method modifies maximum likelihood estimates of the model parameter $\beta_r$ $(r = 1, \ldots, k)$ which are obtained as solutions to the score equation $(\partial \log L)/(\partial \beta_r) \equiv U(\beta_r) = 0$, where $L$ is the likelihood function, and $k$ is the number of parameters to be estimated. Firth replaced the standard score function with a modified score function (Heinze & Schemper, 2002):

$$U^*(\beta_r) \equiv U(\beta_r) + \frac{1}{2}\mathrm{tr}[I(\beta)^{-1}\frac{\partial I(\beta)}{\partial \beta_r}] = 0 \ (r = 1, \ldots, k) \quad (1)$$

where $U^*(\beta_r)$ is the modified score function, *tr* is the trace function, and $I(\beta)^{-1}$ is the inverse information matrix evaluated at $\beta$. Although the above principle applies to logistic regression, similar penalization techniques have also been extended to the multinomial logit (MNL) model. For further details, see S. Bull and Kay (2007) and Kosmidis and Firth (2011).

In this study, we first applied the Firth–MNL method to estimate the accommodation choice model. The choice set included six options; agritourism, apartment, camp, hotel, pension, and room. additionally, we estimated a set of separate Firth logistic models for each accommodation choice (1 = agritourism, 0 = otherwise; 1 = apartment, 0 = otherwise; 1 = camp, 0 = otherwise; 1 = hotel, 0 = otherwise; 1 = pension, 0 = otherwise, 1 = room, 0 = otherwise) using the R package brglm2 0.9.2. (Kosmidis, 2017). The mean bias-reduction score was used for the model estimation (Firth, 1993). The separate Firth logistic regression models were fitted as an additional check for the multinomial model, as it is unrealistic to assume that the IIA assumption—where alternative accommodations are symmetric substitutes—holds. For instance, hotels and pensions are closer substitutes for each other than hotels and camps, and a hypothetical reduction in income is more likely to shift visitors from hotels to pensions rather than to camps.

Although a mixed or hierarchical model would be a preferred choice to address this issue, to the best of our knowledge, there are no mixed or hierarchical models currently available that incorporate the Firth estimation strategy. An additional reason for using separate Logistic regression models is the presence of strong multicollinearity among some important predictors, which, in cases with single, separate models, might be avoided when

different set of predictors are used for each binary outcome. We also suspect that factors influencing the choice of "camping" might differ significantly from those influencing the choice of "hotels", and separate models can better capture these differences.

The variable selection process for the Firth-corrected multinomial logit (MNL) model was guided by prior research, significance levels, and model robustness. Variables were selected manually, excluding insignificant variables and those with high multicollinearity (VIF > 10) from model specification. For logistic regression, the process began with full model specifications, followed by a stepwise backward elimination procedure based on the penalized likelihood ratio test to identify the best model. To improve interpretability, the estimated coefficients were transformed into odds ratios (OR).

## 4. Results

The descriptive statistics (Table 1) show that, among the elements of tourists' interests, 'geological features' received the highest rating, followed by "flora and fauna" and "authentic gastronomy". In contrast, the lowest-rated aspects were "thematic bike paths", "museums", and "sacred heritage". With the exception of thematic bike paths, all categories had an average rating above 4 on a 5-point Likert scale, with standard errors ranging from 0.8 to 1.3, indicate consistency in visitors' preferences, with most respondents sharing similar views on what they find appealing about the destination.

Table 2 presents the results of the Firth-corrected MNL model, reporting odds ratios (OR) and standard errors (in parentheses). In the table, only statistically significant results ($\alpha \leq 0.1$) are reported. The findings suggest that tourists interested in geological features are less likely to choose agritourism over apartments (OR = 0.39). In contrast, those interested in cycling (OR = 2.03), women (OR = 3.59), and travelers aged 55 and older (OR = 9.35) show a higher preference for agritourism compared to apartments.

**Table 2.** Results of Firth's penalized likelihood multinomial logit (MNL) model (odds ratio estimates with standard errors in parentheses).

| Reference = Apartment | Agritourism | Camp | Hotel | Pension | Private Room |
|---|---|---|---|---|---|
| (Intercept) | 0.039 | 0.652 | 0.795 | 0.074 | 0.165 |
| Q6d (Flora and fauna) | 0.958<br>(0.343) | 0.662 *<br>(0.153) | 0.930<br>(0.210) | 0.662<br>(0.171) | 0.867<br>(0.289) |
| Q6e (Geological features) | 0.397 **<br>(0.146) | 1.601<br>(0.681) | 0.817<br>(0.208) | 1.657<br>(0.877) | 0.689<br>(0.240) |
| Q6j (Thematic bike paths) | 2.032 ***<br>(0.114) | 1.045<br>(1.430) | 1.006<br>(1.315) | 0.832<br>(0.230) | 1.144<br>(0.411) |
| Both sides of border? (Yes) | 0.427<br>(0.297) | 1.275<br>(0.658) | 1.532<br>(0.608) | 2.384<br>(1.674) | 5.344 *<br>(4.597) |
| Travel party (Friends, Colleagues) | 0.817<br>(1.410) | 0.414<br>(0.318) | 0.335*<br>(0.204) | 3.916<br>(6.159) | 0.989<br>(1.050) |
| Gender (Female) | 3.597 **<br>(2.130) | 0.783<br>(0.288) | 0.980<br>(0.292) | 1.103<br>(0.503) | 0.784<br>(0.393) |
| Age (55+) | 9.354 ***<br>(7.305) | 1.590<br>(0.931) | 2.137<br>(1.035) | 1.882<br>(1.266) | 2.174<br>(1.496) |
| Location (Slovenia) | 0.577<br>(0.378) | 1.984 *<br>(0.812) | 1.879 *<br>(0.623) | 1.634<br>(0.827) | 2.182<br>(1.220) |

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; AIC: 1006.963; log-likelihood: −438.4816.

Additionally, tourists traveling with friends and colleagues (OR = 0.33) are less likely to choose hotels, while those drawn to flora and fauna (OR = 0.66) tend to prefer apartments over campsites. In terms of location, visitors of the Slovenian side of the border are

more likely to stay in hotels (OR = 1.98) and campsites (OR = 1.87) than in apartments. Meanwhile, those exploring both sides of the border are more inclined to choose private rooms (OR = 5.3). While the MNL model provides valuable insights, the results from the Firth-corrected logistic models (Table 3) offer further nuances.

**Table 3.** Results of separate Firth logistic regression models (odds ratio estimates with standard errors in parentheses).

| | Agritourism | Camp | Hotel | Apartment | Guesthouse | Private Room |
|---|---|---|---|---|---|---|
| (Intercept) | 0.001 ** | 0.196 | 0.182 * | 0.998 | 0.002 ** | 0.005 *** |
| No. of visits? (1 or more) | 2.610 * (1.402) | | | | | |
| Both sides of border? (Yes) | 0.234 ** (0.161) | | | | | 4.891 * (4.196) |
| Travel party (Friends, Colleagues) | 1.558 (2.680) | | 0.299 ** (0.153) | 1.950 (1.015) | 5.880 (8.765) | |
| (Q6b) Sacred heritage | | | | 0.865 * (0.073) | | |
| (Q6d) Flora and fauna | | 0.724 * (0.136) | | 1.277 (0.210) | | |
| (Q6e) Geological features | 0.427 *** (0.124) | 1.819 (0.678) | | | 1.532 (0.746) | |
| (Q6j) Thematic bike paths | 1.867 *** (0.408) | | | | 0.761 ** (0.090) | |
| (Q6f) Authentic gastronomy | | 0.753 * (0.125) | | | | |
| (Q6i) Thematic nature trails/parks | | 0.709 * (0.125) | 1.351 * (0.241) | | | |
| Age (55+) | 4.681 ** (3.349) | | | 0.437 ** (0.176) | | |
| Gender (Female) | 3.582 ** (1.975) | | | | | |
| Location (Slovenia) | 0.357 * (0.223) | 1.948 * (0.668) | | 0.602 ** (0.153) | | |
| Education (High school or less) | | | 0.598 (0.225) | | 2.186 * (1.022) | |
| Country (France) | | | | | | 16.321 * (24.841) |
| Num.Obs. | 319 | 319 | 319 | 319 | 319 | 319 |
| AIC | 121.6 | 257.4 | 381.6 | 416.1 | 171.7 | 130.7 |
| BIC | 170.6 | 283.8 | 404.2 | 450.0 | 201.8 | 157.1 |
| Log.Lik. | −47.812 | −121.72 | −184.79 | −199.042 | −77.85 | −58.37 |
| RMSE | 0.21 | 0.34 | 0.44 | 0.47 | 0.26 | 0.22 |

* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$.

The decision to use separate Firth logistic regression models is discussed in previous sections. Although the results of the MNL model and the separate logistic regressions are not directly comparable—due to differences in coefficient interpretation—certain patterns emerge across both approaches. As seen in the MNL model, the logistic regression results confirm that tourists interested in cycling (OR = 1.86), women (OR = 3.58), and those aged 55 and older (OR = 4.68) are more likely to choose agritourism, whereas those drawn to geological features (OR = 0.42) are less likely to do so. Additionally, tourists surveyed on the Slovenian side of the border (OR = 1.94) are more inclined to stay at campsites. Similarly, those visiting both sides of the border prefer private rooms (OR = 4.89), while travelers with friends or colleagues (OR = 0.29) are less likely to opt for hotels.

Further insights from the logistic models reveal that repeat visitors (OR = 2.61) show a stronger preference for agritourism, while those exploring both sides of the border (OR = 0.23) are less likely to do so. Tourists with a keen interest in the plant and animal life of the Karst region are less likely to stay at campsites (OR = 0.72), as are those who prioritize typical gastronomy (OR = 0.75). Additionally, travelers with only a secondary education

are more inclined to choose guesthouses (OR = 2.18) over other accommodation types, while those interested in sacred heritage are less likely to opt for apartments (OR = 0.86).

## 5. Discussion

Accommodation capacities are a key factor in the development of tourism in a given area, influencing the marketing position of a destination, its economic performance, the number of tourists, and, ultimately, the involvement and quality of life of the local residents. The quantity and structure of different types of accommodation define the suitability and attractiveness of the destination for various guest segments (McKercher et al., 2023). Rural life enthusiasts and families are, for example, more often the target groups for agritourism (Zawadka, 2019), while young people may not feel as comfortable in home hosting and agritourism, as cohabiting with hosts can evoke a feeling of "control" (Lynch, 2005); business travelers may feel similarly, as their focus is not on quiet rural environments. Furthermore, Pulido-Fernández et al. (2024) found that tourists seeking authentic experiences at a destination tend to avoid hotels. On the other side, destination attractions, marketing strategies, amenities, and transport connections attract specific segments of tourists, requiring providers to adapt to evolving demand. This dynamic process requires continuous monitoring and strategic oversight by destination managers, including DMOs and policymakers, to optimize tourism benefits while mitigating challenges for stakeholders.

Analysis of a geologically rich, nature-based destination reveals that primary tourist interests are centered on geological attractions (e.g., karst landscapes and caves), biodiversity (flora/fauna), and authentic gastronomy—attributes consistent with the region's geotourism identity. While the lower interest in sacred sites and museums is understandable given their relatively minor significance (although we assess that potential exists), the limited expressed interest in thematic bike paths is likely a result of sampling bias. Due to logistical constraints and the sporadic nature of tourist presence, only a small proportion of respondents were approached near the cycling routes.

A comparison of individual segments reveals that older visitors, women, and repeat visitors to the destination are more likely to choose agritourism over other types of accommodation. These visitors typically seek a more peaceful retreat and tend to stay at the destination for longer periods (Zawadka, 2019). Sullins et al. (2010) claim that repeat visitors often choose agritourism based on positive previous experiences. Older tourists, more often, choose agritourism, also to support less developed areas and show respect for traditions and customs, which they encounter more easily in this type of accommodation (Varmazyari et al., 2018). In contrast, tourists who have visited or plan to visit both sides of the border show a clear preference for private rooms, which facilitate quicker location changes. A similar trend is observed among first-time visitors, who are more likely to opt for shorter stays and focus on iconic attractions (Anwar & Sohail, 2004). Random and short-stay visitors are not inclined to choose agritourism accommodations, as time constraints allow only for brief activities, leaving little time or desire to engage more deeply with local people and lifestyles (Sullins et al., 2010). As shown previous studies, travel party composition plays a significant role in accommodation choices (Pina & Delfa, 2005; McKercher et al., 2023). Our findings indicate that travelers accompanied by friends or colleagues are less likely to choose hotels, likely due to a preference for socializing beyond the "active" part of the day. The choice of accommodation type is also influenced by education level. Similar results were reported by McKercher et al. (2023), who found a disproportionate share of university-educated tourists being attracted to resorts. In our case, tourists with lower formal education are more likely to choose a guesthouse over other types of accommodation. However, without additional information, it remains challenging to draw substantive conclusions from this finding.

Building on the findings of Pina and Delfa (2005) and McKercher et al. (2023), our results further support the view that accommodation preferences are closely linked to the activities planned at the destination and the interests of tourists. The results of our study indicate that in the emerging geopark area, those interested in geological features are less likely to choose agritourism, while cycling enthusiasts are more likely to opt for this type of accommodation compared to others (with a notably lower probability of selecting a pension). Sullins et al. (2010) found that the choice of agritourism as a type of accommodation is often linked to visitors' clear interests in destination activities, and agritourism provides ideal conditions for cycling (e.g., bike storage, absence of elevators, etc.). Segments with an interest in the plant and animal life of the karst landscape or in typical gastronomy are less likely to choose campsites. This trend is particularly understandable for the latter group, as camping enthusiasts typically seek an escape from routine, relaxation, rejuvenation, and time spent with family and friends in a natural environment (Brooker & Joppe, 2013). Furthermore, tourists with an interest in sacred heritage exhibit a lower likelihood of selecting an apartment compared to other forms of accommodation.

However, it is important to emphasize that the relationship between interests and accommodation choice can sometimes be obscured by factors such as unfamiliarity with the destination, time constraints, or overlooked considerations. For instance, time-poor tourists often chose their accommodation in close proximity to attractions they intend to visit (Shoval & Raveh, 2004). Additionally, in their study on whether tourists choose accommodation near attractions of interest, Derek et al. (2017) interestingly found that tourists' subjectively expressed preferences do not necessarily match the objective situation at the destination. Given the high proportion of transit/one-day visitors to the area, who typically visit only one or two attractions, it is sensible to encourage an increase in agritourism establishments. These are more commonly chosen by older tourists, who tend to stay longer, return to the destination, and have an interest in its traditions and customs. A significant portion of these offerings are also available during the low season, which is less suitable for recreational activities and outdoor geological site visits. A key component of seasonality reduction and the extension of the average length of stay is the development of integrated tourist products. The content of these products should "dictate" the strategic direction for the structure and distribution of accommodation facilities.

## 6. Conclusions

This study highlights the relationship between various tourist characteristics, including their interests, at the emerging geopark Karst destination, and the type of accommodation selected. While the destination is primarily known for its geological landmarks, it offers a diverse range of experiences, including traditional cuisine, cycling routes, architectural and religious heritage, war heritage, and premium equestrianism at the Lipica stud farm. Interests in different activities, along with socio-demographic and situational factors, play a significant role in determining accommodation choices. Understanding the preferences of different visitor segments is therefore crucial for effectively guiding the development of the destination.

The results of our study can provide valuable insights for DMOs and tourism development policymakers, as well as accommodation service providers in nature-based destinations, particularly those emphasizing geological attractions. DMOs can leverage our findings to mitigate seasonality, reduce the spatial concentration of tourist visits, and influence tourist behavior by strategically guiding and diversifying the structure and distribution of accommodations (McKercher et al., 2023). Accommodation providers, in turn, can tailor their offerings to specific target segments and align them with the attractions and activities available in the surrounding area. For instance, near cycling-themed paths,

agritourism would be a more suitable accommodation choice than a hotel or guesthouse. Conversely, agritourism may not be the most appropriate option near geological attractions.

Our research has both content-related and methodological limitations. The choice of accommodation is influenced by a wide range of specific factors, not all of which could be included in this study. In addition to the tourist characteristics considered, other factors could have been incorporated, such as tourists' perceptions of the aesthetic aspects of the location, familiarity with reviews from previous accommodation users, and so on (Albaladejo-Pina & Díaz-Delfa, 2009). Moreover, accommodation choice is also affected by weather, seasonality, time constraints, and other situational factors (Kim Lian Chan & Baum, 2007). Our selection of variables was based on a thoughtful evaluation of practices and findings from previous studies, as well as an understanding of the particularities of the chosen destination. However, future research could benefit from considering these additional factors, among others.

Another limitation of our study is the use of the survey method. As acknowledged in the methodological section, survey-revealed preference data often suffer from issues such as multicollinearity and restricted variability among explanatory variables. Furthermore, the mix of rural and urban contexts within the area influenced the accommodation supply, which was highly unbalanced in terms of the share of accommodation types. This imbalance was reflected in our sample. Additionally, the questionnaire included a large set of categorical variables, which are more prone to data separation compared to continuous variables or those with greater overlap in their values (Hosmer et al., 2013). As a result, certain accommodation categories were under-sampled, leading to highly unbalanced data and instances of complete or quasi-complete separation. To address these challenges, the data were analyzed using discrete choice modeling with Firth bias correction (Firth, 1993). Additionally, combining both revealed and stated preference methods could provide a more comprehensive understanding of accommodation choices by capturing both actual and hypothetical preferences, thus offering a more robust analysis. Given these limitations, caution must be exercised when interpreting and generalizing the results.

Furthermore, for more reliable and directly applicable results, it would be essential to include, alongside the characteristics and preferences of tourists, the attributes of the supply side. There can be significant variations in the quality, location, and other aspects of accommodation facilities within the same category. We acknowledge, however, that incorporating these elements presents a significant methodological and implementation challenge.

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## Note

[1] For MNL models, Nusrat and Rahman (2022) empirically defined a threshold for such cases, suggesting that observations accounting for a maximum of 15% of the total sample can be classified as "near-to-separation".

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