Research in Transportation Business & Management 48 (2023) 100861

Contents lists available at ScienceDirect

Research in Transportation Business & Management

journal homepage: www.elsevier.com/locate/rtbm

Cycling tourism in Italy: Multimodal transport behaviours in a latent class analysis

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ARTICLE INFO

Keywords:
Bike tourism
Latent class analysis
Demand segmentation
Multimodal transport
Cycling holidays

ABSTRACT

In the last years, sustainability has become an important issue in tourism debate, and more, cycling tourism as an alternative and green way of travel during holidays has gained popularity. However, the choice of other transport means, complementary to bikes, is of key importance to address the sustainability of cycling experiences. In this paper, we used primary data collected from an on-line survey on bike tourism in Italy in 2020. Besides socio-demographic and bike-related questions, 858 individuals were asked about their own transport modes to move across destinations during cycling holidays. A latent class analysis has been used to identify three groups of people with segmented preferences for bike tourism experiences, including destinations, accommodation, and multimodal behaviours. We found that the largest latent class in Italy is composed by bike tourists with the highest share of females compared to the other two classes, under 60 years old, and with a strong preference for collective transport means. Both from a management and policy perspective, our results support the claim for investments to improve the transport connection among tourism destinations, and to stimulate the creation of bike-friendly environments and tourism facilities.

1. Introduction

Sustainability is a major and current topic in the debate of tourism development, especially for the impact that different kinds of tourism have on local economies and destinations (Satta, Spinelli, & Parola, 2019). When assessing tourism and its effects on sustainability, one of the primary aspects to consider is the type of transport means used to travel and their characteristics (Buongiorno & Intini, 2021; Gössling, 2002; Gössling & Peeters, 2015). In fact, despite in the past the use of motorized vehicles dominated over bicycles and public or collective transport in many EU countries (EEA (European Environmental Agency), 2018; Hjalager, 2015; Ritchie, 1998), in the last years, bicycles have gained popularity when we talk about tourism, as these provide eco-friendly, healthy and natural travel experiences (Han, Meng, & Kim, 2017; Lamont, 2009; Saayman & Saayman, 2012).

During COVID-19 pandemic public transport was perceived rather - or a strong shift of its users towards private cars was imperative. The shift towards active mobility represented – at least on short routes – an option that combines sustainability and safety. As a result, many governments and local municipalities have started introducing anti-COVID cycle-friendly policies (among others, see Nikitas, Tsigdinos, Karolemeas, Kourmpa, & Bakogiannis, 2021). This propensity might shape not only the daily systematic mobility patterns but also the mobility habits during holidays. As tourism contributes to create value for a territory (Martini, Buffa, & Notaro, 2017), a well-developed cycling tourism can therefore be an important industry that helps to enrich the local environment and ensure employment positions. Moreover, the development of bike tourism can be a significant factor in the move towards a sustainable, smart and inclusive society (Scuttari, Lucia, & Martini, 2013). According to the triple bottom line perspective (Dhiman, 2008), cycle tourism lies in the interplay of environmental, economic, and social elements (Gazzola, Pavione, Grechi, & Ossola, 2018; Maggi, Ossola, Grechi, & Crotti, 2021). From an economic point of view, it could be an effective way to extend the peak season in several tourism destinations, to revive the economic activities which are facing low volumes and to increase the local employment rate (Akadiri, Lasisi, Uzuner, & Akadiri, 2018). Regarding the environmental issues, cycle tourism is a sustainable way to enjoy free time and it is clearly compatible with reduced greenhouse gas emissions occurred by the transport system (Koçak, Ulucak, & Ulucak, 2020). Finally, from a social point of view, the direct contact of tourists with local communities is a great opportunity for interpersonal interactions and exchanges of

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https://doi.org/10.1016/j.rtbm.2022.100861
Received 13 December 2021; Received in revised form 23 May 2022; Accepted 4 July 2022
Available online 8 July 2022

cultural elements; moreover, cycling tourism has a limited effect on the carrying capacity of the destination (Maggi & Fredella, 2012), allowing a harmonious coexistence between tourists and residents (Kim, Uysal, & Sirgy, 2013; Maltese, Zamparini, & Amico, 2021).

Several considerations can be jointly involved in a single choice of tourism destinations and/or transport means (Nkurunziza, Zuidgeest, & Van Maarseveen, 2012; Rejón-Guardia, García-Sastre, & Alemany-Hormaeche, 2018). From a sustainability perspective, the choice of transport means to be paired with the use of bikes during cycling holidays (to reach the destination and/or to move within it) often depends on the intensity of transport interconnection between or within different places. From a market perspective, the choice of cycle tourism destinations is generally affected by: (i) sociodemographic characteristics, (ii) the existence and quality of bike-friendly facilities and built environments, and (iii) the preferences of bike tourists in terms of accommodations and related features, including the proximity to bike lanes, dedicated guides, services to maintain and recover cycles, advice on special dietary requirements for cyclists, etc. (Dolnicar, 2008; Weed et al., 2014). In this sense, acquiring the status of 'bike-friendly' accommodation means ensuring dedicated services, thus, making tourists willing to revisit the destinations (Lamont & Buultjens, 2011).

Although Italy is one of the most visited countries in the world and has reported a relevant growth in terms of cycling tourism in the last years (Isnart-Legambiente, 2019, 2020), until today the literature has paid scant attention on its cycle tourism potential. To contribute to fill that gap in the literature, this paper has a two-fold goal. First, we aim at studying profiles of Italian bike tourists by using a data segmentation approach. Second, the role of multimodality in that segmentation is investigated by considering the transport means used by bike tourists to travel between the destinations of their cycling holidays. This type of holidays could be defined as experiences where the use of bikes is dominant, and other transport means could be jointly utilised to travel between different places (Magris & Ross, 2018). In addition, according to the literature on tourism, at least one overnight stay is required in order to qualify bikers as cycling tourists, which tend to book a central accommodation to reside and explore the region from this place (Aschauer et al., 2021). Specifically, the following research questions are posed:

1. Which types of latent groups of Italian cycle tourists could be identified, according to multimodal transport behaviours?
2. What is the role of individual characteristics, travel-related elements, and cycling habits in the categorisation of the cyclists among the latent groups?

The structure of the paper is organised as follows. In Section 2, the recent literature about bike tourists' segmentation and cycle tourism in Italy is provided. In Section 3, the data collection and the methodology are presented. Section 4 describes the summary statistics on the considered variables and the main results coming from the latent class analysis, while Section 5 discusses the results by a comparative point of view. Finally, the conclusions and the implications for future managerial practice and policymakers are provided in Section 6, where also the contribution to scholarly knowledge and the limits of the study are underlined.

2. Literature review

2.1. Cycle tourists' motivations and profiles

The first strand of literature that is related to this research deals with the demand analysis of bike tourism. In the last years, significant research into the use of bike for leisure has been made, and a few studies on the demand of cycle tourists have covered various locations, e.g., England (Moran, Tressider, & McVittie, 2006) and South Africa (Streicher & Saayman, 2010). Specifically, Moran et al. (2006) underlined the value created by the recreational cycle tourism in the Glentress site forests in Scotland. The study analysed a sample of 147 tourists and studied the influence of their own sociodemographic characteristics on volumes of mountain biking. The results showed that specific factors (i.e., travel costs, bike skills, age, and past bike experiences) significantly affect the decisions of people to get involved into bike-based recreational activities. Similarly, Streicher and Saayman (2010) studied the motives of cyclists behind the participation in the biggest cycling event in South Africa. It has been found that some intrinsic elements are key factors, namely, the attractiveness of the organisation, personal motivation, and willingness to relax.

Even though past research has investigated the demand for cycling tourism by assessing heterogeneous features and preferences, yet very few papers have considered the bike tourists' segmentation to address their own multidimensional needs, including the travel conditions to reach the destinations or the transport infrastructures available at the destinations. Based on the Australian Federal Government's 2003 Tourism White Paper, for instance, Lamont and Buultjens (2011) collected data from the subscribers of an Australian cycling magazine and paid attention to three drivers of bike tourism: (a) road safety, (b) infrastructures, and (c) transfer of bicycles by using public or collective transport. The authors identified five categories of bike tourists based on the scope and duration of the trip, and on the distance of the travel away from home: (a) independent, (b) recreational, (c) competitive, (d) participatory-events, and (e) passive-participation cycle tourists. In Canada-based research, Damant-Sirois, Grimsrud, and El-Geneidy (2014) studied the determinants of bike tourism by considering seven factors: (a) weather conditions and physical effort, (b) time efficiency, (c) dislike cycling near cars along the roads, (d) quality of bike infrastructure, (e) support from institutions, (f) cycling identity and enjoyment, and (g) parental encouragement. The authors analysed data collected from Canadian cyclists which revealed four distinct types: (a) dedicated, (b) path-using, (c) fair weather utilitarian, and (d) leisure cyclists. Concentrating on the economic effect of leisure-time cycling on destinations, Weed et al. (2014) performed a meta-analysis involving bike tourists classified by distance travelled and overnight stays, resulting in seven types of cycling groups: (a) far "holidayers", (b) near "holidayers", (c) cycle tourers, (d) far day trippers, (e) near day trippers, (f) far residents and (g) near residents. In this research, transport-related features were partially included, and only a slight effect of the quality of public transport on cycling tourism was detected. Recently, using data from a sample of 1281 participants in an annual one-day road race held in the Balearic Islands in Spain, Rejon-Guarda et al. (2018) identified the reasons beyond the participation of bike lovers in sporting events, and subsequently (by a latent class analysis) found three groups of cycle tourists. Endurance sporting bicycle tourism is a particular phenomenon, of some size and importance in itself and this is a specific niche where people's motivations are usually very different from "travelling" cycling tourism in many aspects. Interestingly, the authors described the differences among the three groups not only in terms of sociodemographic variables (e.g., gender, age, level of education, country of origin), but also by using information about the preferred accommodations and the amount of trip expenses. However, in that case, no insights from the usage of other transport means (besides bikes) were retrieved and processed. Summing up, the use of latent class analysis to study the segmentation of bike tourists has been revealed a promising method. However, from a management perspective, in order to provide a sound knowledge of bike tourists' drivers on destination choice, this research strategy should include not only sociodemographic, travel-related characteristics, and data about bike habits, but also accommodation features as well as the use of public/private transport means in a multimodal way.

2.2. Cycle tourism in Italy

The second strand of literature this paper contributes is related to the

cycle tourism in Italy. According to Isnart and Legambiente (2020) study, the prevailing reasons for Italian cycling tourism, as declared by more than 50% of the native tourists and by 63% of the foreign visitors, regard the natural beauty of the landscapes and their richness in term of cultural heritage. However, cycle tourists are motivated also by several other aspects, such as the consideration of sustainability issues, and bike-specific features that expect to find in the Italian destinations. Unfortunately, in the scientific literature only few papers about cycle tourism in Italy and bike tourists' choices are currently available. From a qualitative point of view, Gazzola et al. (2018), using semi-structured interviews, uncovered both the current tourism situation and projections for the future expansion of remote and rural areas of the province of Varese (Lombardy), and other areas in Liguria and Piedmont regions. What is evident from this analysis is that, since these areas have a huge potential for further growth as touristic attractions, sustainable development strategies for bikes and other low-impact transport means could be easily implemented. Another example of cycle tourism development, where the concept of sustainability remains a priority, is the case of "The Tyrrhenian Cycling Path" project, analysed by Fossi and Au-Yong-Oliveira (2021). The main scope of the project was to connect dispersed cycle path routes through transport infrastructures and systems, creating unique opportunities for the local economies as well. Interestingly, the authors stressed that the effective involvement of local stakeholders (including public transport agencies) produced a successful action plan and encouraged the transferability of likewise strategies in other Italian regions. Petino, Reina, and Privitera (2021) showed the beneficial effects of combining tourism strategies involving simultaneously the promotion of cultural sites, and the protection of the surrounding environments by also supplying connected transport systems. From an economic perspective, the proposed strategy emphasises the decentralisation of the tourist activities from coastal areas towards the rural parts of the island Sicily. In fact, since the second type of areas are characterised by higher than average rates of ageing populations and high unemployment rates (which means that these areas have higher than average socio-economic problems) economic growth is difficult to achieve and tourism growth could help significantly to this aim. Interestingly, in this line, Ruocco, Iglesias, Blandón, and Melella (2020) presented a full plan of enhancement of the inner areas of the Cilento National Park in Italy – and, in particular, of the area of Magna Graecia – starting from the re-positioning of rural areas in economic distress (Fyall, 2019). The authors showed the dynamics of cycle tourism as a powerful instrument to revive places after natural disasters, e.g., the Gran Sasso Italian area hit by the 2009 earthquake (Di Giacobbe, Di Ludovico, & D'Ovidio, 2021), as well as to match territorial characteristics with tourists' requirements and substitute traditional destinations with bike-friendly and emerging places for heterogeneous types of cycling tourists. In general, Bergantino, Buongiorno, and Intini (2021) recently provided a relevant overview of the Italian picture, underlining that Italy has made substantial steps towards the spread of a culture of cycling. In fact, cycle tourism is a constantly growing sector, showing at the same time an increasing demand for specialised professionals and bike products, as stressed in the report of Isnart-Legambiente (2020). Given this tendency, in 2019 the contribution of cycle tourism on the Italian economy has been estimated to be equal to 4.6 million euros, which sums to 5,6% of the total consumption of tourists in Italy. Importantly, it was estimated that the 58.000 km of the Italian cycle path system could generate even more than 5 times the current amount of spending if they are regularly maintained and kept in good conditions. This observation is reinforced by the fact that the profile of typical cycle tourists is composed by individuals of wealthier economic status, spending on average 75 euros per day (Isnart-Legambiente, 2020). Furthermore, the cited report showed that bike tourism is mostly experienced by men (on average 80%), between 31 and 40 years old (40%), and with a high level of education (34%). In 2019, foreign tourists preferring Italy as a cycling tourism destination mostly came from Germany, United States and France, amounted almost 34.4 million, and outnumbered local tourists, that were estimated to 20.7 million (Isnart-Legambiente, 2020).

3. Data and methodology

3.1. Data collection and variables

In the light of the limited availability of information about bike tourists' habits in Italy, in collaboration with *Federazione Italiana Ambiente e Bicicletta* (FIAB), i.e., Italian Federation on Environment and Bicycle, we designed an online survey targeted to tourists which use bikes as main travel mode. Actually, in order to gather such primary data, we inserted the following introductory paragraph in the survey: "*This questionnaire is aimed at those who make tourism using, in their travels, the bicycle as main vehicle or accessory to other means. The goal of the survey is to understand the dynamics of choice and travel habits of the Italian cycling tourists*". While the design of the survey was made in collaboration with FIAB members as technical experts, the distribution, to enlarge the number of potential respondents, was based on different instruments: mailing lists of several associations and scientific organizations (i.e., FIAB, Touring Club of Italy, Legambiente, The Italian Society of Transport and Logistics Economists, etc.), web-based channels linked to bikers' communities (e.g., BikeItalia) and other communities and social networks. The survey was launched between January and February 2020 (i.e., before the occurrence of the Covid-19 pandemic).

The entire questionnaire was structured as follows: a first part contained questions about i) personal information (i.e. age, gender, country and macro-area of residence and bike usage for leisure or commuting activities,), ii) characteristics of cycle tourism: type of bicycle (i.e. electric or muscle), average daily expenditures, destinations (i.e. Italy, abroad) and type of destination (i.e., city, mountain, cultural places, etc.), conditions that favour the development of cycle tourism, perceived economic value of cycle tourism and level of satisfaction, information about cycle tourism experiences from 2017 onward (i.e. number of experiences, year performed the most memorable experience and country in which it took place). The second part of the questionnaire was dedicated to the most significant experience of cycle tourism in terms of duration and further information were collected. Initially the respondents had to provide details about the country they have visited for holidays, the factors that have affected this choice of destination and the collected travel information before their departure. More, we conducted a dual discrimination based on whether the participants declared to use:

a. Bikes as main means of transport to conduct visits and/or excursions and movements across the various travel locations. In that case, other means are used only to reach the first accommodation of the trip (e.g., train, airplane, ferry, etc.) or to connect different destinations (e.g., car, train, etc.).
b. Bikes as secondary means. In that case, all the movements along the trip rely on private or public transport means, while the use of bicycles (owned or rented) is limited to excursions lasting a few hours or daily.

For this specific part of the data collection, we explored variables about nights of accommodation, travelled kilometres, number of people travelling together, daily expenditures, way of trip organisation (i.e., travel agency, cycling association or independently), type of bike and other transport means used, type of accommodation (i.e., hotels, Bed & Breakfast (B&Bs)), level of satisfaction with the services of the accommodation and complementary services offered around the area of accommodation.

For the purposes of this study, we considered the first part of the survey, and we focused our attention on bike tourists' that typically use bikes as primary means of transport during cycling holidays. In addition, in order to consider real and usual preferences of bike tourists, we removed observations related to respondents which had experienced

less than three cycling holidays since 2017. In that way, the choice of other-than-bike transport means can be considered as not influenced by specific travel destinations. The multimodality of the cycle tourism experience was assessed in a direct way by the question '*By what transport mode(s) did you mainly travel among destinations of your cycling holidays?*'. The respondents selected one or more options among different transport means, i.e., private car, train, bus, bikes, and other private means (e.g., camper, minibus, etc.). After a dataset cleaning, by removing bikers not declaring to spend at least one-night stays when travelling (i.e., day-trippers), 858 valid responses were taken into consideration, focusing on tourists experiencing cycling holidays.

Table 1
Summary statistics.

Variable	Survey question	Categories	N	%
Sociodemographic characteristics				
Age	What is your age?	18–35	97	11.3
		36–60	517	60.3
		60+	244	28.4
Gender	What is your gender?	Male	624	72.7
		Female	234	27.3
Macro-region	In which part of Italy do you live?	South/Centre	167	19.5
		North	691	80.5
Transport means	By what transport mode (s) did you mainly travel among destinations of your cycling holidays?	Private transport (car, camper, minibus) except for bikes	263	30.6
		Only bikes	217	25.3
		Collective transport (bus, train, ships, airplanes)	378	44.1
Cycling preferences				
Bike use for commuting	In addition to cycling holidays, how often do you use your bicycle for commuting?	Less than 3 times a week	569	66.3
		More than 3 times a week	289	33.7
Bike use for leisure	In addition to cycling holidays, how often do you use your bicycle for leisure?	Less than 3 times a week	724	84.4
		More than 3 times a week	134	15.6
City bike	In your cycle tourism activities, do you use mainly a city bike?	No	567	66.1
		Yes	291	33.9
Trip-related factors				
Expenses	In the various cycling tourism experiences, what was the average expense daily in euros (€) per person (including overnight stay)?	≤50€	246	28.7
		51€-100€	570	66.4
		100€<	42	4.9
City	In your cycling experiences, what is the frequency with which you choose large cities?	Never/ Sometimes	720	83.9
		Often/Always	138	16.1
Mountain	In your cycling experiences, what is the frequency with which you choose mountain and/or hilly locations?	Never/ Sometimes	280	32.6
		Often/Always	578	67.4
Culture	In your cycling experiences, what is the frequency with which you choose cities of art and culture?	Never/ Sometimes	393	45.8
		Often/Always	465	54.2
Hotel	Mainly, do you choose a hotel as the type of accommodation for your trip?	No	607	70.8
		Yes	251	29.3
B&B	Mainly, do you choose a B&B as the type of accommodation for your trip?	No	567	66.1
		Yes	291	33.9

As summarised in Table 1, for the purpose of the analysis, we created three dummy variables derived from the grouping of transport means. The 3 dummy variables denote the use of respectively private motorized transport (except for bikes), only bikes, or collective transportation to reach the areas intended for bicycle touring.

3.2. Methodology

Using a Latent Class Analysis (LCA) we aimed to identify latent groups of bike tourists that have in common similar combinations of transport mode preferences (Magidson & Vermunt, 2004). Following the LCA method, we assigned to each individual a conditional probability of belonging in one instead of another latent class (see also Magidson & Vermunt, 2001). The advantage of the LCA method – instead of a simple classification of the respondents (according to the transport modes' variables) or a more traditional cluster analysis[1]– lies on the fact that it allowed us to study the concept of multimodality of transport mode selection. Then, after the classification of the cycle tourists in latent groups, we used control variables included in Table 1 to test the significance of these variables on class membership. The estimations were performed by using STATA 16 software. To determine the number of latent classes that fit our sample of bike tourists, models with several distinct numbers of classes have been estimated as shown in Table 2. Once identified the optimal number of classes, we estimated the probability of using each transport mode within each latent group (Fig. 1). Additionally, a multinomial logistic regression to estimate the effect of covariates on the class membership was also used (see Table 3), and the predicted percentages of belonging to the identified latent classes is presented in Table 4.

4. Results

4.1. Sample characteristics

Table 1 gives some descriptive statistics on all the analysed variables, that we have grouped in four categories: (a) the sociodemographic characteristics of the bike tourists, (b) the transport means used to connect the cycling holidays destinations, (c) their cycling preferences, and (d) their trip-related factors. The participants are aged between 30 and 60 years old (60.3%) and are mainly males (72.7%) living in the North of Italy (80.5%). As regards the transport means used among the destinations of the cycling holidays, slightly less than half of the sample (44.1%) prefer collective transport means (bus, train, ships and airplanes) to connect to different destinations. With respect to the cycling

Table 2
Model-fit latent class analysis.

Models	LL	df	AIC	BIC
1 Class	−1.640.3	3	3286.5	3300.8
2 Classes	−1.421.7	7	2857.4	2890.6
3 Classes	**−1.241.2**	**6**	**2494.3**	**2522.9**
4 Classes	−1.239.6	15	2509.2	2580.5

Note: LL = Log-likelihood, df = degrees of freedom, AIC = Akaike Information Criterion, BIC=Bayesian Information Criterion.

[1] LCA and cluster analysis differ mainly in three points: a) cluster analysis assumes that the variables with the most similar scores belong in the same cluster while in LCA latent classes exist and the researcher explains patterns of observed scores across cases, b) cluster analysis uses continuous variables while LCA categorical and c) cluster analysis helps in identifying the case membership in clusters while LCA the probabilities of class membership (Weller, Bowen, & Faubert, 2020).

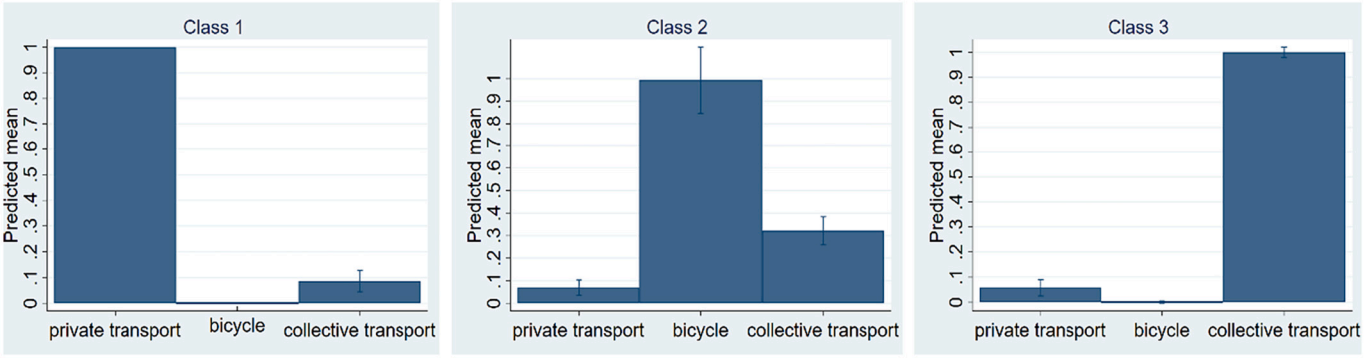

Fig. 1. Estimated marginal probabilities of each transport mode within the classes.

Table 3
Multinomial logistic regression between sociodemographic variables, cycling preferences and trip-related factors on latent class membership.

Reference group: *Class 1*		*Class 2*			*Class 3*		
		Coef.		*SE*	*Coef.*		*SE*
Age (ref. *18–35*)	*36–60*	1.34	***	0.36	0.28		0.30
	≥61	1.26	***	0.39	−0.31		0.36
Gender (ref. male)	*Female*	−0.52	**	0.20	0.86	***	0.26
Macro area of residence (ref. *South/Centre*)	*North*	0.21		0.24	0.32		0.27
Commuting (ref. *less than 3 times a week)*	*More than 3 times a week*	−0.38	*	0.20	−0.23		0.24
Leisure (ref. *less than 3 times a week)*	*More than 3 times a week*	0.25		0.25	0.54	*	0.29
City bike	*Yes*	−0.40	*	0.23	−0.60	**	0.26
Expense (ref. ≤50€)	*51€- 100€*	0.61	**	0.22	−0.04		0.23
	100€≤	0.92	**	0.42	−0.25		0.59
City (ref. *never/ sometimes)*	*Often/ Always*	−0.49	*	0.28	−0.27		0.29
Mountain (ref. *never/ sometimes)*	*Often/ Always*	−0.27		0.19	0.02		0.24
Culture (ref. *never/ sometimes)*	*Often/ Always*	−0.63	***	0.19	−0.18		0.22
Hotel	*Yes*	−0.44	**	0.22	−0.58	**	0.28
B&B	*Yes*	−0.71	**	0.23	−0.35		0.25
Cons		−1.09	**	0.46	−0.35		0.46

Notes: Log-likelihood = −1174.9, $N = 858$, *$p < .1$, **$p < .05$, ***$p < .01$.

preferences, bicycles are used for commuting more than three times a week by 33.7% of the cycle tourists. As regards cycling for just leisure, 15.6% responded to use bikes three times a week. More, 33.9% of the participants prefer city bikes, while 29.7% and 10.3% spend cycling holidays using mountain bikes and electric bikes, respectively. Most of them (66.4%) keep the average daily trip-related expenses between 50 and 100 euros and 28.7% less than 50 euros per person. The cycle tourists opt always or often for mountains (67.4%) or cities with culture attractions (54.2%). Finally, B&Bs are preferred by 33.9% of the participants and 29.3% select hotels as accommodation during cycling holidays.

4.2. Latent class analysis

Based on the lowest value of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), three latent classes of tourists have been finally detected and considered for further analysis (Akaike, 1974; Schwarz, 1978).

Fig. 1 is a graphical representation of the transport modes' probabilities within each one of the three latent classes: *(a) Class 1, (b) Class 2 and (c) Class 3*.

Table 3 shows the results of the multinomial logistic regression. Taking the latent *Class 1* as the reference category, we found that age is a relevant factor to identify the *Class 2*, containing older people, while the female gender is overall relevant to disentangle the three classes, positively related to *Class 2* and negatively to *Class 3* (with respect to the reference *Class 1*). As the respondents in the sample largely reside in the North of Italy, the geographical dummy variable is not significant, while using bikes for commuting helps separating *Class 1* members from *Classes 2*, using bikes in leisure time helps separating *Class 1* members from *Class 3*. Whereas using city bikes is significantly less frequent in both classes of *Class 2* and *Class3* (with respect to the *Class 1*), the expenses' variable is relevant to separate the baseline class from *Class 2* only, where the daily expenditure tends to rise. As for tourism destinations, the most significant factor is represented by the choice of cultural places, which is relatively less picked by *Class 2*. Finally, it is interesting to note that the choice of hotels is a very relevant factor to determine the latent class of bike tourists, with negative sign for *Class 2* and *Class 3* (compared to *Class 1*), while the choice of B&Bs is significant only to separate cycle tourists between *Class 1* and *Class 2*.

Since in this research we were interested in assessing the potential role of transport means used together with bikes or not to move across different places during holidays, we enriched the outcome of the multinomial logistic model (which, however, provides the sign of coefficients only) by estimating the probability of belonging to each different cluster, and we focused our attention on the bike tourists' habits on transport means choice. The expected proportions of bike tourists within each group were calculated by using conditional probabilities (Rejón-Guardia et al., 2018), as reported in Table 4.

Since the results presented in Table 4 revealed latent classes where the choice of transport means to travel across holiday destinations is rather polarised, they are particularly insightful for our purposes. We identified two classes (*Class 1* and *Class 3*) of cyclists using multimodal transport and one class (*Class 2*), which includes tourists moving almost exclusively with own bike.

The first latent *class* of bike tourists (with a predicted proportion of about 30%) presents the highest probability of using private means to reach different places with respect to the other two classes. This group includes bike tourists over 35 years old (95.7%) and of male gender (76.9%). As found in other classes, they mostly reside in the North of Italy (80.0%). This is the class where people are relatively less likely to use bikes for commuting (only 27.1% cycles more than 3 times a week), but where using bike for fun is less frequent (about 84.7%). This group has a relatively higher willingness to pay than the other two, with 78.4% of persons spending more than 50 euros per day during holidays. Regarding the choice of destinations and accommodations, in this class the tourists seem to prefer destinations different from cities (9.8%) and cultural places (42.0%), while mountain and countryside are quite frequent (66.3%). Finally, bike tourists of this class display preference

Table 4
Characteristics of cycle tourists in predicted classes (estimated by conditional probabilities).

Variable		Class 1		Class 2		Class 3	
	Responses	*N = 255*	*29.7%*	*N = 219*	*25.5%*	*N = 384*	*44.8%*
Private transport	0	0	0.0%	204	93.2%	345	89.8%
	1	255	100.0%	15	6.8%	39	10.2%
Bike	0	255	100.0%	1	0.5%	384	100.0%
	1	0	0.0%	218	99.5%	0	0.0%
Collective transport	0	255	100.0%	149	68.0%	0	10.1%
	1	0	0.0%	70	32.0%	384	89.9%
Age	18–35	11	4.3%	34	15.5%	52	13.5%
	36–60	161	63.1%	139	63.5%	217	56.5%
	> 60	83	32.6%	46	21.0%	115	30.0%
Gender	Male	196	76.9%	178	81.3%	250	65.1%
	Female	59	23.1%	41	18.7%	134	34.9%
Area of residence	South/Centre	51	20.0%	39	17.8%	77	20.1%
	North	204	80.0%	180	82.2%	307	79.9%
Commuting	Less than 3 times a week	186	72.9%	140	63.9%	243	63.3%
	More than 3 times a week	69	27.1%	79	36.1%	141	36.7%
Leisure	Less than 3 times a week	216	84.7%	179	81.7%	329	85.7%
	More than 3 times a week	39	15.3%	40	18.3%	55	14.3%
City bike	No	182	71.4%	161	73.5%	224	58.3%
	Yes	73	28.6%	58	26.5%	160	41.7%
Expense	≤50€	55	21.6%	80	36.5%	111	28.9%
	51€- 100€	183	71.8%	134	61.2%	253	65.9%
	100€≤	17	6.6%	5	2.3%	20	5.2%
City	No	230	90.2%	185	84.5%	305	79.4%
	Yes	25	9.8%	34	15.5%	79	20.6%
Mountain	No	86	33.7%	58	26.5%	136	35.4%
	Yes	169	66.3%	161	73.5%	248	64.6%
Culture	No	148	58.0%	99	45.2%	146	38.0%
	Yes	107	42.0%	120	54.8%	238	62.0%
Hotel	No	175	68.6%	171	78.1%	261	68.0%
	Yes	80	31.4%	48	21.9%	123	32.0%
B&B	No	184	72.2%	136	62.10%	247	64.3%
	Yes	71	27.8%	83	37.9%	137	35.7%

for hotels only at 31.4% or B&Bs at 27.8%.

The second class captured an estimated 25.5% of bike tourists and exhibits the highest probability of using only bikes also for travelling among different destinations during cycling holidays (99.5%). Using multimodal solutions including private means (6.8%) or collective transport (32.0%) is less frequent for them. In this class, the male gender is numerically dominant (81.3%), which is true compared to the whole sample and only slightly higher than class 1, and the tourists are relatively younger (79.0% is under 60) and with the lowest willingness to pay (36.5% spends at most 50 euros). It also displays the largest percentage of residents in the North of Italy (82.2%) with a really small difference compared to the other two classes, while, relatively speaking, the frequent use of bikes for leisure is 18.3%, not much different compared to the other two classes. Tourists in this class have the lowest preference for city bikes (26.5%). Among the preferred destinations, mountains and rural places are mostly picked (73.5%) similar to class 1 and 2, and the choice of B&Bs (37.9%) in this group is the most frequent with respect to other two classes.

The third class is the largest class including 44.8% of the sample and consists of people showing the highest probability of using collective transport to move from one place to another during holidays (89.9%). Only 10.2% of respondents selected also private means. Tourists in this class reside in the North of Italy (79.9%) as holds for the other two class, are relatively young, but the over 60s are also well represented (30.0%); moreover, the percentage of female gender is the highest with respect to the other classes (34.9%). Interestingly, this is the class where tourists use bikes are used in highest levels of commuting (36.7%) and are just the same as that for class 2 while slightly different from class 1. As regards the levels of cycling for leisure, they reach 14.3% presenting quite similar intensity with the other two classes. Daily expenses during holidays are between 50 and 100 euros (65.9%), and the use of city bikes is the highest with respect to the other two classes (41.7%). Visiting rural places is relatively prevalent (64.6%), but this is complemented by the highest probability to look for cultural destinations (62.0%) as well. Finally, tourists in this class display similar likelihood of staying in hotels (32.0%) with the first class.

5. Discussion

Given that sustainability has become a critical element for the development of tourist activities, transport policies could give an important contribution. Consequently, there is a huge need to find tailor-made and sustainable transport solutions for the tourism destinations as a key ingredient for the future tourism increase. As such, the analysis allowed us to identify three latent classes of cycling tourists, which highlight the different behaviours of cyclists in terms of multimodal or individual transport means choice, distinguishing between private, bike-based or collective transport options.

In the first class, which can be considered as the less sustainable scenario, about one third of bike tourists tends to connect to different holidays places by using private means, mainly cars. Such tourists are generally aged over 35, spend more at the destination, and appear to frequently choose accommodations that are alternative to hotels and B&Bs such as apartments, camping, or hostels. Not surprisingly, these people do not habitually use bike for commuting, but only for fun and relaxing activities. As a result, those are the tourists which, by naively borrowing from the Plog's framework (Plog, 1974, 2002), could be considered as psychocentric-like people, i.e., characterised by a strong preference for relaxation and individual transport means.

The second class is of particular interest, because it mainly consists of tourists using bikes in almost all their trips, including those who move across destinations, even though the usage of collective transport is not totally negligible (32.0%). They are the less predicted group (25.5%), but they still reveal remarkable features. Positioned at a rather opposite extreme with respect to the above first latent class, here the bike tourists are younger, with a lower willingness to pay during cycling holidays,

and with a relevant preference for B&Bs as accommodation. Mountains and hilly places are slightly more preferred destinations for them compared to the other classes, and they are usually visited by using cycles alternative to city bikes. In this case, we are dealing with tourists probably sensitive to sustainable travels and whose satisfaction during cycling holidays might strongly depend on the quality of bike-related infrastructures connecting different places in Italy (see Bergantino et al., 2021).

Finally, being the most likely latent group (44.8% probability), the third class of bike tourists is the one with the highest transport multimodality levels, as it includes people with very high probability to use collective transport services (89.9%), with a limited probability to move across places by using private transport (10.2%). In a sense, this class is very interesting because its cycling tourists express a clear 'demand' for transport infrastructure and complex multimodal transport systems. Despite outnumbered by male individuals, females are well represented compared to the other two classes, and the use of bikes for commuting is quite frequent as happens in class 2. This segment of bike tourists displays a high interest for cultural places and for transport-related "active" holidays (witnessed by the strong recourse to collective transportation, which implies a more intense physical activity to reach stops/stations or to take those transport means). In general, this class is of high importance because it implies a relatively weaker dependence from private cars, thus, it presents a rather lower impact on the environment. Yet, its detection raised key aspects related to the quality of transport systems and multimodal connections among tourists' destinations.

The findings of this study highlight that there is not only one size fitting all paradigms for the generation or improvement of multimodal and sustainable tourism places. Destinations are called to adopt dynamic solutions, by developing a rich supply associated with a variety of parameters, that will capture the attention of the individuals willing to enjoy pleasant and sustainable holidays at the same time.

6. Conclusions and managerial and policy implications

In this paper, we have performed a latent class analysis with the ultimate scope to identify the existence of latent segments of bike tourists in Italy, according to the choice of different transport means to reach various destinations during cycling holidays, i.e., visiting different places by using only bikes or multimodal solutions (combinations of bikes and other private and/or collective transport means).This implies a data driven focus due to the fact that the latent class analysis identified 3 classes where the stronger between-classes' heterogeneity lies actually in the variable of the multimodal transport choices.

To the best of our knowledge, besides the powerful use of the latent class approach for these purposes, this research is the first application of this methodology in Italy. By employing primary data collected in 2020, it increases the knowledge about habits and preferences of Italian bike tourists. In line with the recent empirical studies on different countries than Italy (e.g., Rejon-Guarda, 2018; Damant-Sirois et al., 2014; Weed et al., 2014 Lamont & Buultjens, 2011), our analysis confirmed the existence (also in Italy) of heterogeneous groups of bike tourists. However, this paper differs from the other for its specific focus on the relevance of multimodal choices (including bikes) to move within the tourist destination.

As regards the destination management implications, the market segmentation gives key information to private companies and local policymakers in orientating their investments and planning a variegated supply of tourist services and infrastructures, according to the different features of bike tourists in Italy. After careful evaluation of what types of cycle tourists the destination wants to attract, and considering also the need to integrate different transport means, targeted interventions, e.g., deployment of cycling lanes, investments in accommodation structures or/and services and transport systems have to be developed. For instance, if a destination is not well-structured to satisfy the needs of passionate bike tourists, it could attract the first group of cycle tourists that are interested to use bikes for fun and relaxing activities and would prefer appartements, camping or hostels for their accommodation. This observation shows to the policymakers that investing in such types of accommodations and further offering cycle touring activities would favour the local development. Furthermore, the indication that this group includes wealthier individuals implies that they would be willing to pay more to have access to high-quality services. The second group of cycle tourists that we have identified is composed by individuals who prefer to visit mountains for cycle tourism and low-cost holidays. This evidence might suggest to the policymakers and local entrepreneurs to enlarge the supply of cheaper accommodation and tourism services. Interestingly, the analysis presented in Table 3 indicates that age and expenses are more likely related with class membership for this tourist segment compared to the previous one. Being female, using city bikes, visiting cultural places, and accommodating in hotels and B&Bs seem to be less important factors for this class compared to the first one. The third group of cycle tourists would prefer multimodal accessible tourist destinations and would point for B&Bs accommodations and cultural places to visit. As a result, places that are characterised by a complex transport system or would have the potential to create it, could attract this segment of tourists. This result might suggest to the policymakers to increase the investments in improving the integration between different transport modes, by increasing the quality of the services, enlarging the number of connections and enhancing the existent ones, also by Mobility as a Service (MaaS) efforts. Moreover, to better satisfy the needs of this last category of tourists and attract them to revisit the destination, it is essential to provide various hotel accommodations and invest in rejuvenating the cultural heritage of the local areas. Since in this group we find he largest share of females compared to the other classes, from a policy perspective, offering a broad range of services for women's needs is strongly suggested.

Having said all that, these types of strategic decisions should not be taken only in blockbuster and renowned destinations but also in rural and emerging ones, that could be positively affected mainly by the improvement of multimodal transport systems (Maggi et al., 2021). Local stakeholders recognise tourism seasonality as an important issue (among other challenges) for the promotion of sustainable transport in the tourism industry (Papatheodorou, Paravantis, & Polydoropoulou, 2016). In this line, Bakogiannis et al. (2020) argued that cycle-friendly places might not necessarily coincide with popular touristic destinations. This important observation must be considered also by the policymakers as it opens the possibilities for the sustainable development of places that otherwise would not have the potential to be labelled as touristic attractions.

Obviously, this work is not without its own limitations. One point to raise regards the fact that the sample consists of participants coming from about 80% from North-Italy regions and only 20% from Centre and Southern areas. However, according to the few available national statistics, we consider the sample still representative as the largest part of Italian bike tourists resides in these regions (Isnart-Legambiente, 2020). The second point might refer to the possibility to consider in another research a larger number of observations, giving the possibility to (eventually) uncover additional latent groups, including different proportions of transport means used to connect various destinations. In addition, we have tried to incorporate in our analysis as much as possible parameters able to capture the cycling behaviour; however, other variables could be relevant in influencing the travel decisions, such as for example the unavailability of good public transport connections or excessive travel distances, etc. These variables could be included in further research. What is more, the data collection and elaboration from other countries could reveal cultural differences in cycling tourism too. For future studies, we advocate additional efforts to evaluate these aspects, so that the analysis could be further improved and compared to heterogeneous geographical contexts.

CRediT authorship contribution statement

Evangelia Pantelaki: Conceptualization, Methodology, Formal analysis, Visualization, Data curation, Writing – original draft, Writing – review & editing. **Daniele Crotti:** Conceptualization, Methodology, Data curation, Investigation, Project administration, Writing – original draft, Writing – review & editing. **Elena Maggi:** Conceptualization, Methodology, Supervision, Investigation, Project administration, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

None.

Acknowledgements

The authors would like to thank the Federazione Italiana Ambiente e Bicicletta (FIAB) for its collaboration in performing the survey and in particular Michele Mutterle and Antonio Dalla Venezia. We also thank the participants of the 2021 Annual Conference of the International Transportation Economics Association (ITEA) and XLII Annual Scientific Conference Italian Association of Regional Science (AISRE) for their insightful comments that substantially improved the paper. Finally, we are grateful to the two anonymous reviewers for their constructive feedback.

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