TOURIST MOBILITY AND PUBLIC TRANSPORT USE ON EXCURSIONS

Cattaruzzo, Sebastiano[1]; Miravet, Daniel[2]; Gutiérrez, Aaron[2]*

[1] Università Ca' Foscari Venezia, Department of Economics, 30123 Venice, Italy

[2] Universitat Rovira i Virgili, Research Group on Territorial Analysis and Tourism Studies, Department of Geography, 43480 Vila-seca, Catalonia, Spain

*Corresponding author: aaron.gutierrez@urv.cat / T. (+34) 977558147

Abstract: Tourism destinations, particularly those characterized by mass tourism, face ongoing challenges in promoting public transport as a key component of destination sustainability and competitiveness. Public transport reduces dependence on private vehicles, enhances visitor mobility, and broadens the array of accessible attractions. This study, based on a survey conducted at Costa Daurada (n=1,954), a Mediterranean coastal destination in South Catalonia, examines the determinants influencing visitors' choices between private vehicles and public transport for excursions. The multivariate probit model reveals a persistent preference for private vehicles, highlighting structural barriers to public transport adoption. The findings contribute to understanding how behavioural shifts and contextual factors impact tourist mobility choices and offer insights for promoting sustainable transportation.

Keywords: Tourists' mobilities, excursions, modal choices, public transport, sustainable tourism

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CRediT authorship contribution statement

Sebastiano Cattaruzzo: Writing – original draft, Formal analysis. **Daniel Miravet:** Writing – original draft, Writing – review & editing, Methodology, Conceptualization. **Aaron Gutiérrez:** Writing – original draft, Writing – review & editing, Project administration, Funding acquisition, Data curation, Conceptualization.

1. Introduction

Excursions are vital for tourist destinations, as they enhance stays, prevent overcrowding, and promote sustainable development. Their role is particularly significant in mature coastal destinations, where their image can be deteriorated if the competition strategy adopted is restricted to attract a massive number of visitors eager for the sun and the beach (Bujosa et al., 2015; Almeida & Garrod, 2018). This situation is likely to lead to the massification of the coastal spaces (Li et al., 2019). On the contrary, the promotion of day-trips from the accommodation enhances the attractiveness of the destination as the range of potential activities and visits increases, taking into account that the choice of destination is made based on what potential destinations offer (Prebensen et al., 2012; Paulino et al., 2025). Moreover, excursions allow longer lengths of stay, and contribute to the dispersion of visitors as well as the distribution of the income generated (Gutiérrez & Miravet, 2016a).

To this end, tourists face a crucial choice between private vehicles and public transport for excursions, which impacts destination management. The development of a public transport network that suits the needs of visitors holds significant advantages. In this vein, an efficient transport system contributes to the development of the destination and enhances its chances of being selected by potential tourists as the costs of holidays decrease (Prideaux, 2000; Zhao et al., 2024). The use of public transport among tourists mitigates environmental and traffic negative externalities derived from mobility by motorized public transport (Koens et al., 2018; Kim et al., 2024a). Moreover, an appropriate coverage of the tourist catchment area enhances destination competitiveness, and improves accessibility by reducing reliance on private vehicles and broadening access to attractions (Gronau & Kagermeier, 2007; Miravet et al., 2021a). Finally, as part of the tourist experience, it has a affects tourist satisfaction and well-being (Thompson & Schofield, 2007; Kim et al., 2024b).

COVID-19 pandemic severely impacted tourism, causing a decline in international travel and changes in visitor profiles, behaviours and attitudes during their stay (Farzanegan et al., 2021; Duro et al., 2023a; Mallick et al, 2025). At the same time, it also had a huge impact on transport systems (Jenelius & Cebecauer, 2020). The critical relationship between tourism and transport demand led to a more pronounced drop of public transport ridership in the context of mobility decisions driven by leisure travel at tourist destinations (Delclòs-Alió et al., 2022). Moreover, Zaragozí et al. (2023) found evidence that while private vehicle usage rebounded post-pandemic, recovery of tourists' public transport use lagged. Despite the relevance of public transport use for tourism activities and enabling sustainable intra-destination mobility, research focusing on the use of public transport in coastal destinations is rather scarce.

Considering all the above elements, the research question that this article addresses is: what factors influence tourists' choices between private vehicles and public transport for excursions in Mediterranean coastal destinations?

In this investigation, we examine survey data from tourists who visited Costa Daurada during the first post-COVID-19 summer. Costa Daurada is a mass coastal destination where public transport services have played a significant role in tourist mobilities during recent years (Gutiérrez & Miravet, 2016a; Miravet et al., 2021a). We sought to scrutinise the evolving dynamics of tourism mobility and excursions in the post-pandemic transformed landscape. A crucial feature of our analysis involved parsing the intricate relationship between excursion choices, reliance on public transportation, and the prevalent use of private vehicles, while our central aim was to discern the post-pandemic reconfiguration that characterised tourism mobility. In this context, we specifically elucidated the

nuanced role of public transport, the mode of transportation most profoundly affected during the pandemic.

Our empirical approach utilized a multivariate probit model to explore the interconnected elements influencing tourists' transport mode choices, specifically accounting for the correlations between unobserved factors across multiple outcomes. This model allows to jointly estimate related decisions while addressing potential endogeneity issues, with its structure reflecting the survey's design, which was tailored to capture key determinants such as traveller preferences and characteristics. By explicitly incorporating these components, the model provided a robust framework for understanding the interplay of factors driving transport choices in the context of sustainable tourism. The study aims to provide insights into the broader challenges faced in the post-pandemic world. We sought not only to identify the determinants shaping these travel choices but also to proactively address the implications thereof for sustainable tourism mobility planning. By identifying the challenges faced by public transport, we provide potential solutions for future scenarios, which would foster a resilient and sustainable framework for tourism mobility in destinations marked by high inter-urban visitor mobility.

The present study is outlined as follows: section 2 gives the context of the study, summarising and reporting the main results found in the literature. Section 3 describes the study area along with the evolution of tourists' arrivals and use of public transport services after the pandemic. Section 4 presents the survey data, its collection method, and the main descriptive statistics. Section 5 details the methodological approach, while Section 6 contains the results and the discussion thereof. Section 7 offers the conclusion.

2. Background

2.1 Excursion-related benefits for touristic destinations and their determinants

Day trips beyond the location of the tourists' accommodation are basically determined by the appealing of attractions and their accessibility from the accommodation (Mckercher & Lew, 2004; Paulino et al., 2020), as attractions compete against each other within a context of money and time budget restrictions (Domènech et al., 2023a). For this reason, the sort of destination shapes tourists' decisions related to excursions: excursions during holidays at rural and coastal destinations are much more likely compared to urban destinations (Zamparini et al., 2022). Previous works have found also a strong association between excursions and the choice of mode of transport, as evidence showcases a reciprocal effect (Masiero & Zoltan, 2013; Le-Klähn, et al., 2015).

Regarding socio-demographic characteristics, nationality emerges as an important determinant of excursions (Le-Klähn, et al., 2015; Domènech et al., 2023a; Bursa et al., 2022), being the exception Masiero & Zoltan (2013), who obtained no significant effect. The education level attained, according to Domènech et al. (2023a), increases the chances of undertaking excursions. On the contrary, no significant effect was found by Le-Klähn, et al. (2015). Regarding other socio-economic characteristics such as age, gender, income or work, there is no evidence of a significant impact (Masiero & Zoltan, 2013; Le-Klähn, et al., 2015; Zamparini et al., 2022).

The role of individual-specific features, which include psychographics, preferences, and cultural perspectives is attached to the individual motivations and perceptions. In this sense, journeys to further locations from the place where accommodation is located stem from the feeling of something lacking at the place where the tourist stays overnight, along with prior knowledge or motivations derived from visitors' wishes (Fennell, 1996). Preferences for visiting historical places or

the feeling of ease when moving around the destination have a positive effect on the decision of undertaking excursions (Masiero & Zoltan, 2013; Le-Klähn, et al., 2015). Conversely, the goal of being physically active, feeling safe and secure, rediscovering oneself or experiencing landscape or nature have the opposite effect (Masiero & Zoltan, 2013).

With respect to the specific characteristics of the travel and the holiday, longer stays are linked to a higher probability of undertaking excursions (Domènech et al., 2023a; Zamparini et al., 2022). The type of accommodation also plays a key role, as tourists staying at hotels and other sort of commercial accommodation have a higher probability of undertaking excursions compared to those who stay overnight at second homes and friends' and relatives' places (Masiero & Zoltan, 2013). Similarly, repeaters are also more prone to move beyond the destination (Masiero & Zoltan, 2013; Le-Klähn, et al., 2015). Evidence related to spending and travel party is mixed. In the first case Domènech et al. (2023a) report a positive impact, while no significant influence is found by (Masiero & Zoltan, 2013). Finally, travel party exerts a significant influence on the likelihood of undertaking excursions according to Zamparini et al. (2022), while Le-Klähn, et al.. (2015) state that no significant effect arises.

The post-COVID landscape requires a re-evaluation of these dynamics. Understanding how factors moderate excursion choices is crucial for policies which aim to return to and surpass pre-pandemic public transportation use. Unlike daily commuters, visitors have diverse options and limited knowledge.

2.2 Mobility at destination and determinants of public transport use among tourists

Studies have traditionally focused on tourists' transportation choices to reach a destination, overlooking their subsequent decisions once there. Emerging research on this latter topic examines how tourists move during vacations, considering the impacts on tourism flows, accessibility, cost distribution, and environmental effects (Le-Klähn et al., 2015; Domènech et al., 2023a; Albalate & Bel, 2010; Hall, 2008; Więckowski, 2021).

Efficient public transportation management in tourist areas requires attention beyond network design to factors influencing tourist ridership. As stated by Domènech et al. (2023b), literature in the field identifies two central aspects as the main determinants of modal choices at the destination: travel mode used to reach the destination and the places that are visited during the stay. Regarding the mode of transport selected to travel to the destination, empirical evidence concurs that those who fly or travel by means of public transport are much more likely to have a more sustainable mobility during their holiday as they are less likely to use a private vehicle unless they decide to rent one for some days (Bieland et al. 2017; Gutiérrez & Miravet, 2016a). The relationship between modal choices and the places visited is reciprocal, in the sense that decisions on excursions depend on the availability of transport and modes of transport are chosen based on the visiting preferences (Masiero & Zoltan, 2013; Le-Klähn, et al., 2015). This is one of the primary reasons why conceptually and methodologically, this research underscores the need for precise estimation strategies.

Local and regional characteristics matter, as urban and densely-populated areas naturally incentivise public transport use (Zhou et al., 2024; Zientara et al., 2025). However, rural and sprawled areas require viable solutions to be inclusive (Paulino et al., 2025; Waleghwa & Ioannides, 2024). How the service is provided is a substantial issue. It is critical that the whole catchment area throughout which the tourist is likely to move is properly covered (Gronau & Kagermeier, 2007) while adequate bespoke campaigns must be designed so that the information properly reaches potential users

(Miravet et al., 2021b). Service quality, comfort, and efficacy perceptions all play a role, revealing the intricate interplay between destination choices and available transport modes (Le-Klähn et al., 2015; Masiero & Zoltan, 2013). Finally, restrictions to the use of the private vehicle foster the switch to public transport, especially for those visitors who reached the destination using their own motorized private vehicle (Gronau & Kagermeier, 2007).

Finally, other determinants include holiday and destination characteristics (Gross & Grimm, 2018; Gutiérrez et al., 2019; Le-Klähn & Hall, 2015). In this sense, the main elements that characterize the holiday, such as accommodation, length of stay, expenditure, accompanying parties and planned visits — have been found to yield a significant influence in transport decisions (Gross and Grimm, 2018; Gutiérrez & Miravet, 2016a; Le-Klähn et al., 2015; Domènech et al., 2023a). Furthermore, visitor-specific traits, such as nationality, gender, and education, also play their part (Gross and Grimm, 2018; Gutiérrez & Miravet, 2016a; Hough & Hassanien, 2010; Le-Klähn et al., 2015; Masiero & Zoltan, 2013).

2.3 Transportation choices and tourism in rapidly changing environments

Public transport use has faced unique challenges in its recovery compared to other modes of transportation following periods of mobility disruption. Although the pandemic is no longer a central influence, its potential long-term effects on travel behaviour remain relevant to understanding and addressing current patterns. Public transit experienced a slower recovery due to factors such as perceived infection risk, despite inconclusive evidence linking its use to the spread of COVID-19 (Harris, 2020; Hu et al., 2021). Furthermore, the recovery trajectory of public transport use has shown significant variation across territorial contexts, shaped by access to alternatives, the substitution of trips with online activities, and shifts in trip purposes (Nikolaidou et al., 2023; Long et al., 2023; Matson et al., 2023).

In leisure mobility, tourists—due to their flexibility in travel schedules and mode choices—have exhibited an even slower return to public transport compared to other population groups (Zaragozí et al., 2023). The altered profiles of tourists during the pandemic, combined with an increased emphasis on domestic travel for recovery, have compounded this effect (Yang & Smith, 2023). In 2024, overall international tourist arrivals were still below 2019 levels, highlighting ongoing shifts in tourism dynamics (UNWTO). These changes in visitor behaviour and profiles compromises public transport use among tourists, especially in destinations emphasizing short-range excursions, such as coastal or rural areas (Paulino et al., 2025; Waleghwa, & Ioannides, 2024).

Understanding these dynamics is critical for planning resilient transportation systems that can better adapt to future disruptions. Various studies have begun to address post-pandemic heterogeneity in responses, resilience and/or recovery of public transport users (Wang et al., 2022; Manout et al., 2023; Dai & Taylor, 2023), but there is a noticeable gap in research focusing specifically on tourists' ridership. This study seeks to address the identified research gap by contributing new empirical evidence to the ongoing debate, through an analysis of excursion patterns and the choice between public transportation and private vehicles in a coastal destination in the European Mediterranean region.

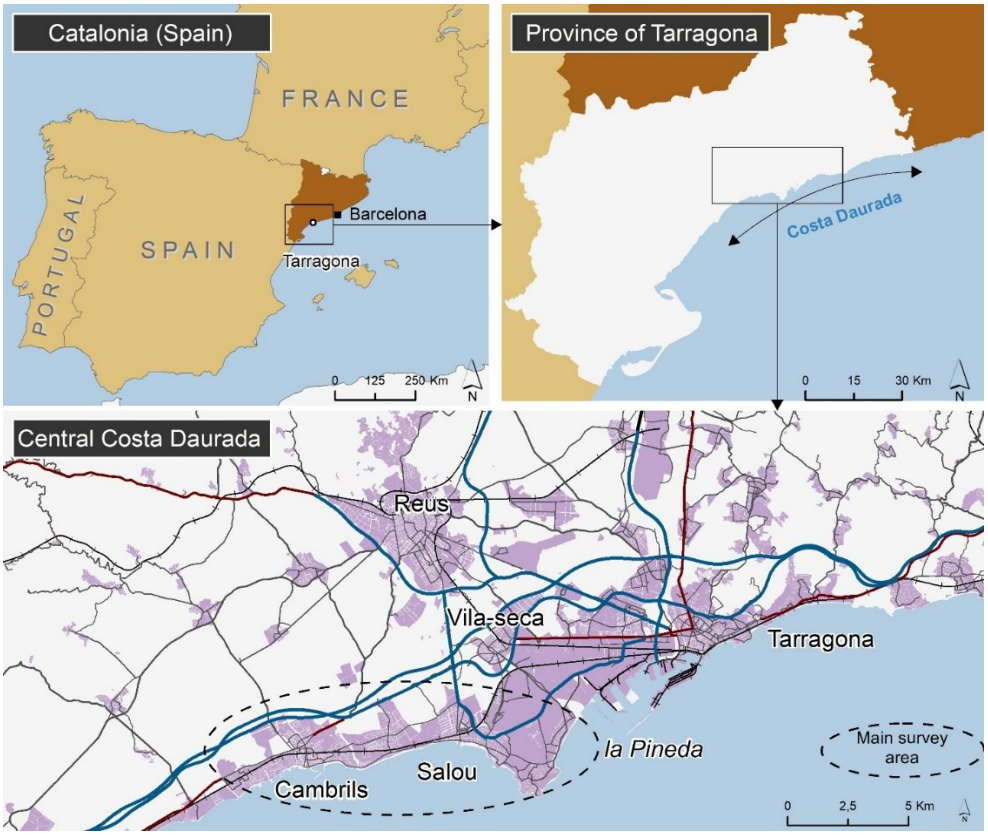
3. Study area

3.1 Costa Daurada

Costa Daurada is a mature Mediterranean coastal destination located 100 km south of Barcelona. It attracts more than 5 million visitors per year (5.3 million arrivals in 2024, according to the data

collected by Eurecat Tourism Observatory) and around 20 million overnight stays (19.9 million in 2024, according to the same source). Besides beaches, it boasts several venues of cultural and historical interest. Despite its intrinsic touristic position, several urban centres, such as Tarragona and Reus (each with more than 100,000 inhabitants), and many non-touristic occupations are present in the area (Figure 1). Strong seasonality is a main feature that characteristics the destination. Indeed, according to Eurecat Tourism Observatory, 71% of arrivals and 80% of overnight stays concentrate from June to September.

Figure 1. – Study Area



Public transport demand in the study area is heavily influenced by tourism activity, seasonal patterns, and connections with major cities, including Barcelona. Currently, the municipalities within the study area are served by train lines, interurban bus lines, and urban bus services which connect them to each other and to the main cities of the region (including Tarragona and Reus) as well as to Barcelona. Together with the frequent train service, the interurban bus services in the study area play a vital role in facilitating transportation for both residents and tourists. During the summer months, the region experiences a considerable flow of commuters and travellers looking to explore the coastal attractions and natural beauty of the area. As a result of the use of public transport by tourists, its ridership experiences an important seasonality (Gutiérrez and Miravet, 2016b), with high concentration of demand during the peak tourist season. According to the data provided by the Consortium of Public Transport of Camp de Tarragona, in 2019 the number of journeys by public transport was 2.6 times higher in July compared to January across the region. If the analysis is restricted to the municipalities belonging the Costa Daurada, the number of journeys multiplied by 7.3. In 2021, nonetheless, differences clearly shrunk: in Camp de Tarragona, demand in July was 2.3

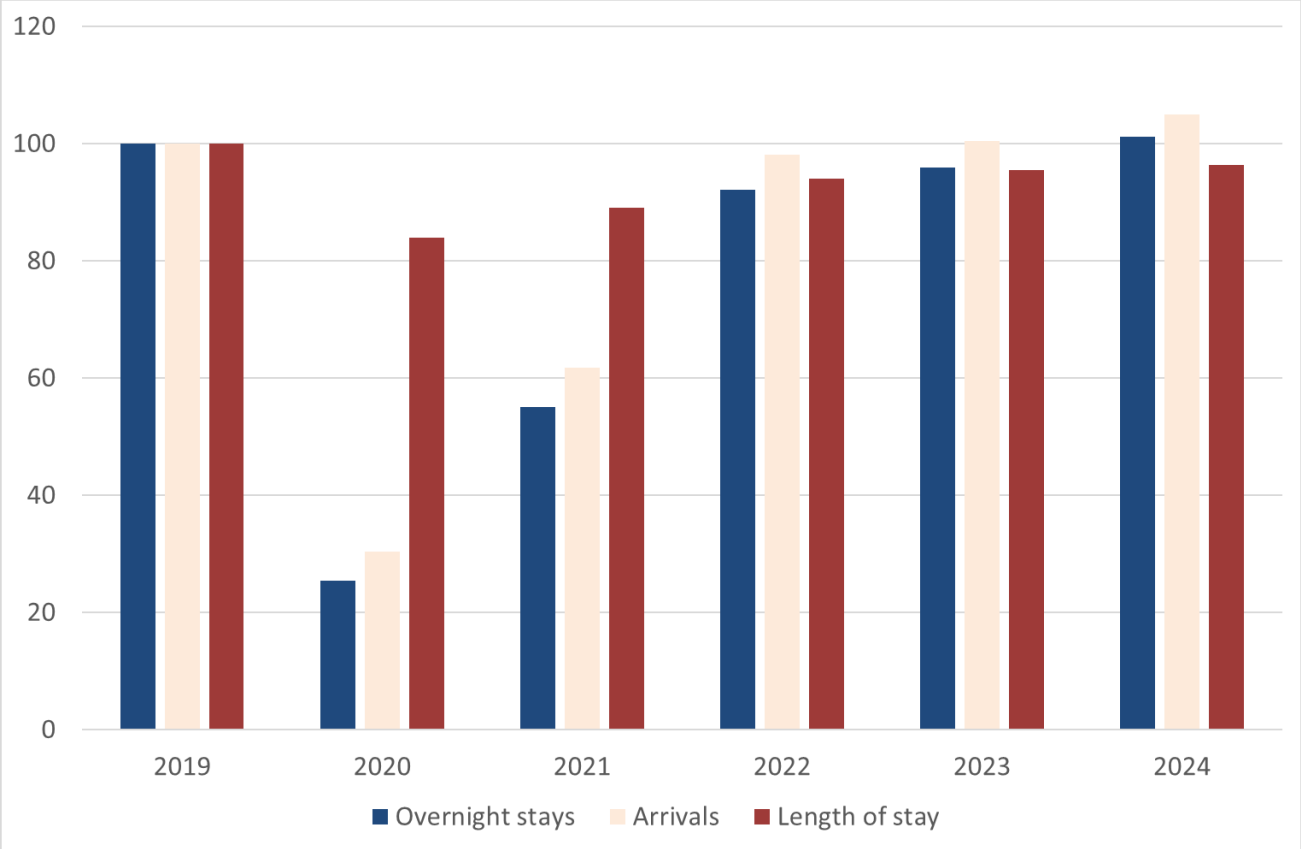
times larger compared to January, while in the Costa Daurada, 4.3 times. In 2024, multiplying factors did not recovered yet: 2.0 and 4.4 respectively.

3.2 Evolution of tourism demand and tourists' public transport ridership after the pandemic

During the pandemic, both tourism demand and the use of public transport services dropped severely at tourist destinations, as the two are heavily-connected phenomena with a high degree of interdependence (Delclòs-Alió et al., 2022). Figures 2 and 3 show the evolution of tourist arrivals, overnight stays, and public transportation ridership since 2019. Data reveal that in 2024 the number of arrivals and overnight stays exceeded the records of 2019. Nonetheless, this apparent recovery has not been complete for tourists' length of stay. In 2021 it was 11% below 2019 and still 4% in 2024. Disaggregating between Spanish and international visitors, it is noted that national tourists' length of stay in 2021 was 2% below 2019, while in 2024 it was 3% above. Conversely, international tourists' length of stay in 2021 was 12% shorter compared to 2019, and still 11% in 2019. These figures portray a change in the behaviour of international tourists, who are the ones who are more likely to undertake excursions in the area (Domènech et al., 2023b)

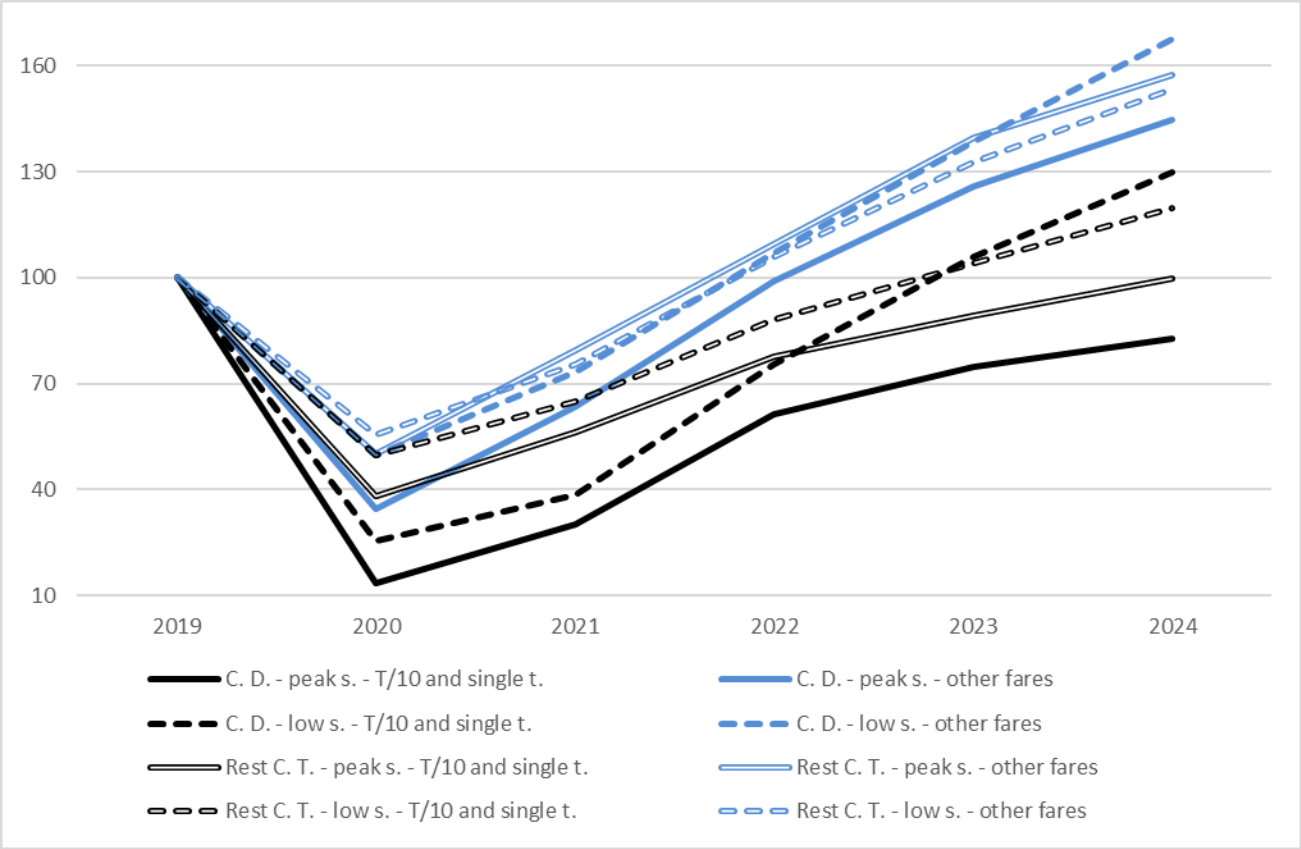
The recovery of public transport follows two different trajectories, depending on whether the majority of users of the services are residents or visitors (Zaragozí et al., 2023). To assess the evolution of tourists' public transport ridership it is assumed their choice of fares is concentrated around T-10 and single tickets (Gutiérrez et al., 2020), given that the characteristics of these fares are particularly appealing for visitors. Tourists' demand for interurban buses in the municipalities of the Costa Daurada during the peak tourist season (June to September) in 2024 was still 17% below the demand in 2019, while in the rest of the Camp de Tarragona, which do not host such a number of visitors, was at the same level of 2019. By contrast, ridership using the remaining fares ("non-tourist fares") was clearly above the records prior to the pandemic during the low and the peak season alike. The figure also showcases that during those periods of the year when the presence of tourists is scarce, the demand of T-10 and single tickets clearly exceeds prior-to-the-pandemic records, and the Costa Daurada is not an exception. Hence, figure 3 pinpoints an evident divergence in the evolution of visitors' and locals' use of public transport. It must be considered that the lower tourist ridership compared to 2019 occurred despite a 50% reduction in ticket fares funded by the national and regional governments.

Figure 2.- Evolution of arrivals and overnight stays at Costa Daurada (2019=100)



Source: Own elaboration, using the data provided by the Eurecat Tourism Observatory

Figure 3.- Evolution of public transport ridership at Costa Daurada (2019=100)



Source: Own elaboration, using the data provided by Consortium of Public Transport of Camp de Tarragona.

The figures make it apparent that while the return of tourists is evident, the recovery of tourists' public transport ridership continues to be sluggish.

4. Data

This study utilizes data collected from tourists visiting Costa Daurada based on an explicitly-designed survey. In August 2021, we conducted an on-site survey with 1,954 visitors to the area, gathering information on their profile, the characteristics of their trip and stay, and the perceived impact of COVID-19 on their lives, visit, and activities at the destination. The selection of individuals to be surveyed was randomly conducted at key locations which attract many tourists. Particular attention was given to the sample composition and to the inclusion of questions which allow use to carefully trace the characteristics which may hinder the validity of the results—namely, information regarding the mode of arrival and choices to visit surrounding areas.

Data include broad information on the sociodemographic profiles of visitors and the characterisations of their demand through its questions related to their stays; example data include the type of accommodation, length of stay, travel party, previous visits to the area, and estimation of their daily expenses. We asked how they arrived in Costa Daurada, as well as their mobility patterns throughout the vacation (in terms of secondary destinations and transport modes). Finally, the profiling also included standard questions regarding gender, age, working situation, education, and country of origin.

Table 1 presents the descriptive statistics of the sample used in the study. The variables are divided into two categories: binary and continuous. Binary variables are presented as proportions, with the mean representing the percentage of observations that fall into the affirmative category (e.g., "Excursions" with a mean of 0.487 means that 48.7% of the sample went on excursions during their visit). In particular, the excursion variable is an aggregation that tracks whether or not visitors moved around their main destination.

Private vehicle use was prevalent among the majority (66.8%) of respondents, while a smaller percentage (19.5%) relied on public transportation to move around the area during their stay. Spanish nationals constituted a significant portion (89.5%) of the sample. Only 15.1% of respondents reached Costa Daurada by bus, train, or plane. In addition, 67.4% identified themselves as salaried workers, while 8.5% were autonomous workers; 43.6% reported having attained higher education. In terms of travel party, 43.2% of respondents travelled with children. Accommodation preferences were more evenly distributed, with 39% opting for hotels, 16% choosing apartments, and 39% staying with family, friends, or in second homes.

Respondents also demonstrated a penchant for exploration beyond Costa Daurada, with 33.7% visiting Barcelona and 28.3% exploring Tarragona and/or Reus. This indicates the region's role as a gateway to neighbouring tourist destinations. Since the survey was launched in 2021, controls related to COVID-19 had to be included. The study also revealed that 27.7% of respondents were travelling for the first time after the Covid-19 pandemic. Moreover, 81.8% of respondents reported being fully vaccinated.

For continuous variables, the minimum (min) and maximum (max) values are reported. The mean and standard deviation provide information about the central tendency and the dispersion of the variable, respectively. The mean age of the sample is 44.2 years, with a standard deviation of 15.9 years. The "massification" variable, which measures the perceived level of overcrowding at the destination in a scale from 1 to 5, where 1 corresponds to lack of overcrowding and 5 to high overcrowding levels, has a mean of 3.1 with a standard deviation of 1. Finally, the "Trust in public places (factor)" variable is a factor variable with a mean of 0 by construction; it measures the level of trust in public places at the destination, and it is determined through a set of questions asking how the individual felt in different public contexts.

Table 1 – Descriptive statistics of the sample

Variable	%
Excursions	0.487
Private Vehicle use	0.668
Public Transport use	0.195
Nationality (Spanish)	0.895
Gender (female)	0.506
Gender (non-binary)	0.003
Gender (male)	0.491
Arrived by bus/train/plane	0.151
Autonomous worker	0.085
Salaried worker	0.674
Non-worker	0.241
Educational attainment (superior)	0.436
Traveling with children	0.432
First timer in Costa Daurada	0.137
Accommodation - hotel	0.389
Accommodation - apartment	0.160
Accommodation - residence family/friends house or second	0.390

Accommodation - other	0.061			
Visited Barcelona	0.082			
Visited Costa Daurada	0.337			
Visited Tarragona/Reus	0.283			
Visited other places	0.061			
High expenditure	0.388			
Low expenditure	0.247			
Missing expenditure	0.365			
First time traveling after Covid	0.277			
Had Covid-19	0.139			
Fully vaccinated	0.818			
Friend with bad symptoms	0.131			
Continuous variables				
Variable	**mean**	**sd**	**min**	**max**
Age	44.195	15.865	7	91
Length of stay	13.658	20.932	1	180
Massification	3.054	1.184	1	5
Trust in public places (factor)	0.000	0.955	-2.992	1.353
The number of observations is 1954 for all the variables reported.				

Finally, through correlation analysis (Table A2 in the Appendix), we stress how the selected explanatory sets are free of possible dangerous pairwise correlation which may hinder the analysis by hiding significant effects. Furthermore, in terms of potential multicollinearity issues, we stress how the dependent variables do not inflate variance in a significant manner.

5. Modelling approach

In dealing with binary dependent variables, the standard approach is to use a probit model. Despite leading to similar estimations, in this analysis we favour the probit over the logit specification for its alignment with the assumption of an underlying latent variable driving tourists' transport choices, as the decision-making process is conceptualized as involving unobservable preferences or utilities (Maddala, 1983). Furthermore, the probit model's reliance on the normal distribution makes it less sensitive to extreme values in the dataset, which is particularly relevant in this study of tourist transport preferences, where outlier behaviour is not expected to dominate (Train, 2009). However, as shown by Masiero & Zoltan (2013), there might be a mutual causality relationship—here, between the decision to take an excursion and the choice of mode of transport. For this reason, the present study utilises a multivariate probit model to examine the factors that significantly influence going on excursions, while controlling and analysing the non-negligible role that choosing public transport over private transport might have. The multivariate probit model is a type of correlated binary response regression model which simultaneously estimates the influence of multiple independent variables on multiple dependent variables while allowing for the error terms to be correlated. Individually, the probit models can be represented as follows:

$$Y_i^* = \beta_i X + \varepsilon_i \text{ where } i = 1, \dots, N \qquad (1)$$

Y_i^* corresponds to the unobserved vector which represents the propensity of individuals to take each option *i*, β_i is a vector containing the coefficients to be estimated for each option *i*, *X* reports the observed selected determinants, and ε_i is the error term proper of each option. Especially in the context of multivariate probit estimations, the variance-covariance matrix of the error terms assumes compelling relevance, as it takes the form of:

$$\sum = \begin{matrix} 1 & \dots & \rho_{1,N} \\ \vdots & \ddots & \vdots \\ . & \dots & 1 \end{matrix}$$

This matrix reports correlations between the available binary options beyond the controlled variable used in the model. For one thing, a positive (negative) correlation suggests that the options are complements (substitutes). For another thing, these values also highlight whether or not the options are indeed interrelated and require the joint modelling approach.

The dependent variables in this study represent binary responses (1 corresponds to use, 0 to non-use) to the questions regarding taking excursions, using public transport, and using private vehicles. The independent variables are the same for all regressions and include: trip characteristics (such as stay duration, type of accommodation, excursion destinations); subjective characteristics (such as perception of massification, trust in public places, and reaction to the pandemic); and sociodemographic characteristics (such as income, age, nationality, education level, and gender).

This model choice assumes independence among the irrelevant alternatives (Greene, 2003) and is appropriate when the binary dependent variables are closely linked and are influenced by similar factors. As noted in the literature (Greene, 2003), the multivariate probit model is a form of the correlated binary response regression model which allows for the error terms to be freely correlated, making it appropriate for modelling the interdependent relationships between the dependent and independent variables in this study. Additionally, the assumption of independence among the irrelevant alternatives—which is inherent in the multivariate probit model—is reasonable, given the close link between the dependent variables and the similarities in the factors influencing them. Except for the binary nature of the dependent variables, the multivariate probit model shares close similarities with the "seemingly unrelated regression" (SUR) framework, as both approaches allow for the modeling of multiple equations with correlated error terms, enabling the joint estimation of related processes while accounting for interdependencies among outcomes (Zellner, 1962; Greene, 2003). Finally, we stress that this modelling choice allows us to estimate possible pairwise correlations among the unobserved characteristics of individuals contained by the error terms of each equation; intuitively, estimating significant correlations strengthens the validity of the model choice. To carry out the estimations, we employed the Cappellari and Jenkins (2003) simulation-based approach, implemented in STATA as the *mvprobit* command.

6. Results

6.1 The baseline model

The results presented in Table 2 show the multivariate probit estimation of the effect of various variables on the probability of going on excursions, using private vehicles, and using public transportation. The sample size for this analysis is 1,954 observations. The variables included in the model are relevant to understanding the mobility patterns of tourists, as discussed in previous research (Masiero & Zoltan, 2013; Le-Klähn et al., 2015; Gutiérrez & Miravet, 2016a).

First, the most relevant result is the fact that the correlation between excursions and private vehicle use is significant, while the correlation between excursions and public transport is not significant. These results indicate a preference for private vehicles over public transportation when going on excursions and indicate that public transportation is less important for excursions than private vehicles. It is worth noting that individuals may use both modes of transportation to move around, as we found a significant and positive correlation between private vehicle usage and public transport

usage. In this sense, individuals who are likely to move around by private vehicle are also likely to use public transport services, given that they are the ones going on excursions. This positive correlation reflects a complementary relationship, rather than substitution, between modes. Second, with respect to the effect of the arrival mode of transportation, it is apparent that tourists who opt for public transportation to reach their destination are less inclined to use private vehicles for their local transportation needs. In line with previous works (Gutiérrez and Miravet, 2016a; Miravet et al., 2021b), this study found that the mode of arrival shapes tourists' transportation behaviour at the destination, contributing to a more conscious travel experience that is better for the environment, for the residents, and for tourists themselves.

Third, it is compelling that length of stay is positively and significantly associated with the use of public transportation. This supports the notion that availability and accessibility of public transportation can provide visitors the opportunity to expand the geographical scope of their visits, consequently extending their overnight stays (Le-Klähn and Hall, 2015, Gutiérrez & Miravet, 2016a). Higher expenditure patterns are also positively correlated with excursions, suggesting that tourists who stay longer and spend more are more likely to undertake excursions. Fourth, the analysis reveals that Spanish tourists are less likely to undertake excursions than are non-Spanish tourists. This result supports the hypothesis that the change in tourist profile brought by the pandemic might have altered transport choices at destinations, as the share of national tourists in 2021 visiting the area was much higher compared to prior to the pandemic.

The concept of "massification" emerges as a significant factor influencing the use of public transportation during a tourist's visit. The results reveal a positive association between the tourist massification perception and the propensity to use public transportation. This result can emerge as striking at first sight; however, it might be the consequence of a fear of high concentrations of people on-board public transport vehicles (Gutiérrez et al., 2021). A second potential underlying explanation is the positive correlation between the use of private vehicles and public transport to undertake excursions; in that case, individuals with a greater perception of massification at the destination would be more inclined to visit other places.

An interesting result arises from the influence of "trust in public places" on public transportation use, as this has a negative impact on tourists' propensity to use public transport during their visit. Intriguing questions are sparked as to the underlying reasons for this finding. It is possible that tourists who have a higher level of trust in public places might feel more comfortable exploring the destination on foot or using alternative modes of transport, like bicycles; this alternative perspective suggests that tourists with greater confidence in the safety and cleanliness of public spaces may opt for more immersive and active means of transportation than public transport during their visit.

Important to note is the impact of COVID-specific variables on tourists' transportation choices. An interesting finding reveals that fully vaccinated tourists demonstrated a lower likelihood of using public transportation. It must be considered that the survey was conducted during the summer of 2021, when the process of vaccination was still unfinished; at that time, the groups that were more likely to have received full vaccination were “risk groups” (e.g., senior citizens, other vulnerable groups in the population). As a result, despite their vaccination status, some travelers might have preferred to minimise close interactions with strangers, opting for private transportation options or exploring on foot in order to maintain social distancing.

Finally, the remaining regressors show results that are in line with most of the literature on the topic. Female tourists show a lower likelihood of going on excursions, and tourists with higher educational levels and those visiting Costa Daurada for the first time are more likely to undertake excursions. Accommodation types (i.e., apartments and residences, family/friends' houses or second homes) show a positive association with excursions, indicating that tourists staying in these accommodations may be more inclined to go on excursions in the region.

As to the determinants of private vehicle use (PV_use), the analysis reveals that Spanish tourists are less likely to use private vehicles than non-Spanish tourists. Additionally, tourists with higher educational levels and those travelling with children are more likely to use private vehicles. This implies that factors such as convenience, flexibility, and family-oriented travel preferences play a role in tourists' choice of private vehicle use. In contrast, the determinants of public transportation use (PT_use) show that Spanish tourists are less likely to use public transportation than non-Spanish tourists. However, female and non-binary tourists show a higher likelihood of using public transportation than male tourists. The variable "Visited Costa Daurada" shows a positive correlation with PT_use, indicating that tourists who have already visited the region are more likely to use public transportation for their travel needs.

The study also shows that the accessibility and availability of public transportation is positively related to visiting other locations within Costa Daurada; however, this does not hold true for cities like Tarragona and Reus, or even Barcelona. This may indicate that due to their proximity, coastal areas are potentially more attractive, easier to access, and efficient in terms of transportation.

Table 2 – Empirical results from the multivariate probit estimation of the baseline model

VARIABLES	(1) excursions	(2) PV_use	(3) PT_use
Nationality (Spanish)	-0.598***	-0.308**	-0.582***
	(0.105)	(0.121)	(0.118)
Gender (female)	-0.117*	-0.0987	0.181**
	(0.0605)	(0.0691)	(0.0733)
Gender (non-binary)	-0.750	-0.651	1.052*
- reference cat. "male"	(0.559)	(0.574)	(0.573)
Arrived by bus/train/plane	0.109	-0.812***	0.655***
	(0.0874)	(0.0952)	(0.0922)
Salaried worker	0.0226	-0.294**	-0.248**
	(0.107)	(0.132)	(0.122)
Non-worker	0.0119	-0.441***	-0.201
- reference cat. "autonomous worker"	(0.121)	(0.144)	(0.138)
Log(Age)	-0.0838	0.215**	0.0114
	(0.0909)	(0.0999)	(0.107)
Educational attainment (superior)	0.148**	0.267***	-0.0375
	(0.0618)	(0.0710)	(0.0757)
Traveling with children	0.0970	0.349***	-0.0752
	(0.0643)	(0.0737)	(0.0774)
Stay duration	0.00310*	0.000962	0.00415**
	(0.00165)	(0.00185)	(0.00183)
First timer in Costa Daurada	0.183**	0.104	-0.00486
	(0.0913)	(0.103)	(0.109)
Accommodation - apartment	0.334***	0.315***	0.325***
	(0.0895)	(0.104)	(0.107)
Accommodation - residence family/friends house or second	0.370***	0.301***	0.306***
	(0.0749)	(0.0846)	(0.0935)

Accommodation - other	0.0635	0.600***	0.394***
- reference cat. "hotel"	(0.128)	(0.162)	(0.152)
Visited Barcelona		-0.0259	0.0449
		(0.139)	(0.129)
Visited Costa Daurada		-0.359***	0.305***
		(0.112)	(0.106)
Visited Tarragona/Reus		-0.0403	0.103
		(0.0993)	(0.0960)
Visited other places		0.413**	0.0144
		(0.184)	(0.143)
High expenditure	0.359***	0.359***	-0.0236
	(0.0805)	(0.0924)	(0.0968)
Missing expenditure	0.197**	-0.327***	-0.286***
- reference cat. "low expenditure"	(0.0818)	(0.0891)	(0.102)
Massification	0.0648**	0.421***	0.0524*
	(0.0263)	(0.0326)	(0.0314)
Trust in public places (factor)	0.0672**	0.168***	-0.144***
	(0.0318)	(0.0378)	(0.0363)
First time traveling post-Covid	-0.143**	0.152*	-0.00213
	(0.0684)	(0.0804)	(0.0815)
Had Covid	0.131	0.151	0.0884
	(0.0876)	(0.103)	(0.0993)
Fully vaccinated (2 doses)	-0.133	-0.208**	-0.412***
	(0.0870)	(0.101)	(0.0970)
Close contact with severe cases	0.0906	-0.0795	0.297***
	(0.0879)	(0.100)	(0.0984)
Constant	0.173	-1.030**	-0.592
	(0.364)	(0.417)	(0.434)
Rhos - w.r.t. eqn. 1		0.360***	0.0730
		(0.0852)	(0.0751)
Rhos - w.r.t. eqn 2			0.425***
			(0.0589)
Observations		1954	
Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1			

6.2 Disaggregating excursions into specific destinations

The previous section highlights several critical insights into tourist mobility patterns at Costa Daurada. First, the significant correlation between excursions and private vehicle use, coupled with the lack of significance for public transport, underscores a pronounced preference for private vehicles over public transport for excursions. Notably, the complementary relationship between private vehicle and public transport use suggests that tourists engaging in excursions often use both modes, rather than substituting one for the other. Second, tourists' mode of arrival strongly influences their local transport choices, with public transport arrivals correlating with reduced private vehicle use at the destination, consistent with prior research. Third, length of stay is positively linked to public transport use, emphasizing its role in expanding tourists' travel reach and supporting longer stays. Fourth, the pandemic's influence on transportation behaviour is evident, with vaccinated tourists and those perceiving tourist massification showing reduced public transport use, likely reflecting concerns about safety and crowding. Finally, demographic and accommodation-related factors, such as gender, education, and accommodation type, shape transport choices, alongside a marked distinction in behaviour between Spanish and non-Spanish tourists.

These findings provide a nuanced understanding of tourist transport preferences and behaviours, setting the stage for the destination-specific analysis. By disaggregating the dependent variable into the three most visited destinations, Barcelona (BCN), the Costa Daurada (CD), and Tarragona/Reus (TAR-REU), this section explores whether these results are consistent across destinations or reflect destination-specific dynamics.

First, by looking at the dependency scores (the rhos) in this disaggregated setup, we gain more precise insights into the preferences between private vehicle and public transport across the main visited secondary destinations. What emerges is that part of the previous dependency result was driven by the aggregation: contrarily, we observe that the use of public transport relates positively with the probability of visiting the three locations considered: Costa Daurada, Tarragona / Reus and Barcelona. Generally, the estimated dependency outcomes confirm the relevance of our methodological choice, both from an informative and an empirical point of view. And what is more relevant, the rhos that gather the correlation between these three tourist destinations with public transport use are all positive and significant. Given that the three destinations share in common the fact that they have a more than acceptable accessibility from the surveyed area by means of public transport, we can conclude that supply characteristics of the provision of the service emerge as a key aspect that shapes ridership figures.

Second, the length of the stay relates positively to both the probability of using public transportation and that of visiting Barcelona, thus strengthening the idea that longer stays have multiple direct and indirect benefits for the territory. This also holds, to a smaller extent, for the likelihood of visiting cities like Tarragona and Reus. For one thing, they are associated with more people using public transport; for another thing, extra days of vacation increase the chances to visit the surrounding areas, thus reducing the negative effects of the massification phenomenon.

Third, the evidence regarding the means of transport used to get to the destination is validated. This is an important robustness proof in terms of modelling. In addition, it reinforces the idea that if destinations can offer a good local transportation system to individuals arriving by a form of mass transportation, this induces tourists to move around without using a private vehicle and to use public transport instead. In addition, a weak positive relationship with visiting Tarragona/Reus emerges.

Furthermore, as expected, massification results in more use of private vehicles, to escape from the crowds. Trust in public places shows a seemingly surprising trend: it relates positively to car use and negatively to public transport use. However, a direct explanation lies in the fact that people using cars face many fewer "worrisome" situations compared to bus takers, for instance. These affect individual perceptions and, consequently, their trust in public places.

As to the COVID-specific variables and their interpretation, in this empirical setting we confirm the previous results—namely, that fully vaccinated tourists demonstrate a lower likelihood of using public transportation.

The results from the previous section hold for education level, as we confirm that more educated people are more likely to use a private vehicle. Nevertheless, disaggregating by destination, we can now observe that these people are also more likely to visit cultural cities, such as Tarragona and Reus. Furthermore, we confirm the results showing that travelling with children induces more use of private vehicles, but at the same time it increases the likelihood of visiting cities such as Reus and Tarragona. Generally, people who are more willing to spend money during their vacations seem to prefer private vehicles as a means of transportation. This also results in an increased likelihood of

going on excursions. This finding points to the necessity to make public transport an attractive option for wealthier and more spendthrift travellers.

Table 3 – Disaggregated empirical results from the multivariate probit estimation of the baseline model

	(1)	(2)	(3)	(4)	(5)
VARIABLES	BCN	CD	TGN-REU	PV_USE	PT_USE
Nationality (Spanish)	-1.185***	-0.344***	-0.548***	-0.280**	-0.647***
	(0.117)	(0.101)	(0.102)	(0.115)	(0.108)
Gender (female)	0.0133	-0.160***	-0.0411	-0.0743	0.160**
	(0.0927)	(0.0611)	(0.0640)	(0.0697)	(0.0719)
Gender (non-binary)	-0.157	-4.595	-0.197	-0.546	0.905
- reference cat. "male"	(0.834)	(92.68)	(0.578)	(0.590)	(0.582)
Arrived by bus/train/plane	0.113	0.0126	0.164*	-0.828***	0.643***
	(0.119)	(0.0887)	(0.0897)	(0.0946)	(0.0911)
Salaried worker	-0.204	0.0520	-0.218**	-0.314**	-0.244**
	(0.149)	(0.110)	(0.111)	(0.134)	(0.120)
Non-worker	-0.359**	0.104	-0.118	-0.465***	-0.195
- reference cat. "autonomous worker"	(0.176)	(0.124)	(0.126)	(0.145)	(0.136)
Log(Age)	-0.185	-0.0112	-0.123	0.235**	0.00467
	(0.141)	(0.0915)	(0.0961)	(0.101)	(0.105)
Educational attainment (superior)	0.121	-0.0153	0.186***	0.278***	-0.0283
	(0.0962)	(0.0631)	(0.0659)	(0.0716)	(0.0743)
Traveling with children	-0.0591	0.0436	0.187***	0.354***	-0.0682
	(0.0984)	(0.0652)	(0.0672)	(0.0742)	(0.0763)
Stay duration	0.00739***	0.00109	0.00329*	0.000915	0.00440**
	(0.00229)	(0.00162)	(0.00168)	(0.00183)	(0.00180)
First timer in Costa Daurada	0.222*	-0.0138	0.219**	0.0900	-0.00278
	(0.126)	(0.0935)	(0.0949)	(0.104)	(0.108)
Accommodation - apartment	0.229*	0.172*	0.230**	0.309***	0.338***
	(0.129)	(0.0906)	(0.0934)	(0.105)	(0.105)
Accommodation - residence family/friends house or second	0.0328	0.252***	0.310***	0.273***	0.339***
	(0.122)	(0.0756)	(0.0797)	(0.0844)	(0.0916)
Accommodation - other	0.0587	0.00384	-0.106	0.628***	0.378**
- reference cat. "hotel"	(0.203)	(0.134)	(0.144)	(0.164)	(0.150)
High expenditure	0.406***	0.237***	0.478***	0.330***	0.0325
	(0.133)	(0.0824)	(0.0887)	(0.0921)	(0.0939)
Missing expenditure	0.0694	0.146*	0.319***	-0.360***	-0.246**
- reference cat. "low expenditure"	(0.145)	(0.0836)	(0.0918)	(0.0886)	(0.0996)
Massification	0.0455	-0.0214	0.0440	0.434***	0.0500
	(0.0403)	(0.0266)	(0.0277)	(0.0327)	(0.0309)
Trust in public places (factor)	-0.0286	0.0277	0.0726**	0.165***	-0.135***
	(0.0460)	(0.0325)	(0.0334)	(0.0382)	(0.0357)
First time traveling post-Covid	0.000824	-0.126*	-0.107	0.162**	-0.0178
	(0.102)	(0.0699)	(0.0724)	(0.0808)	(0.0800)
Had Covid	-0.0512	0.187**	0.0533	0.132	0.110
	(0.130)	(0.0880)	(0.0913)	(0.104)	(0.0981)
Fully vaccinated (2 doses)	-0.143	-0.0286	-0.0402	-0.218**	-0.411***
	(0.126)	(0.0885)	(0.0912)	(0.102)	(0.0959)
Close contact with severe cases	0.334***	0.0132	0.138	-0.0711	0.305***
	(0.123)	(0.0899)	(0.0914)	(0.101)	(0.0969)
Constant	-0.104	-0.261	-0.297	-1.232***	-0.397
	(0.554)	(0.364)	(0.380)	(0.409)	(0.420)
Rhos - w.r.t. eqn. 1		0.283***	0.468***	0.155**	0.135**
		(0.0575)	(0.0603)	(0.0645)	(0.0630)
Rhos - w.r.t. eqn 2			0.855***	0.0486	0.253***
			(0.0485)	(0.0435)	(0.0457)

Rhos - w.r.t. eqn 3	0.127***	0.213***
	(0.0454)	(0.0457)
Rhos - w.r.t. eqn 4		0.396***
		(0.0553)
Observations	1954	

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

7. Discussion and conclusions

Enhancing tourists' use of public transport for their urban and interurban mobility during their stay is pivotal for destination sustainability and for mitigating the potential negative externalities of tourism in cities and regions (Miravet et al., 2021a). Previous evidence has suggested that tourists have shown a slower recovery of public transport usage after the COVID-19 pandemic in comparison with residents (Zaragozí et al., 2023). Despite this substantial impact on ridership (Delclòs-Alió et al., 2022), limited evidence in the literature depicts the varied recovery of the public transport demand of tourists. Within that context, our study adds new evidence which facilitates a better understanding of the determinants of tourists' use of public transport during their stays in a post-COVID-19 summer. The lasting influence of the pandemic on tourist choices is noteworthy, with an emphasis on the role of private vehicles in excursions. This highlights the need for public discourse, targeted marketing, and improved public transport to promote sustainable choices. Our research informs policy considerations by revealing a preference for private vehicles for excursions and emphasising the interconnectedness of public transport, longer stays, and the destination's well-being (Le-Klähn et al., 2014). Addressing the lingering impact of the pandemic on public transport is imperative in order to ensure that we do not regress from the progress made in reducing car-dependent tourism mobility.

7.1 Main findings

The most remarkable result is the preference for a private vehicle for excursions during one's stay. Nonetheless, the evidence also indicates that this situation can be reverted, since there is a complementary relationship between motorised private vehicles and public transportation, rather than one of substitution. Besides, a significant complementarity between the use of public transport and excursions to locations which are easily accessible by this means of transport has been found. Hence, people travelling to their destination by car should be likely to switch to public transport at the destination if the circumstances are suitable. Nevertheless, the complementary use of the two modes during excursions challenges the traditional view of mode substitution. Additionally, the influence of tourist massification perception and 'trust in public places' on transport mode choices introduces novel behavioural factors for consideration.

In line with previous works, visitors arriving via mass transportation are less inclined to use private vehicles (Gutiérrez and Miravet, 2016a; Miravet et al., 2021b). Similarly, we found a positive correlation between the length of stay and boarding a public transport vehicle (Le-Klähn and Hall, 2015). Nationality also emerges as a central factor (in light of the changes in the composition of arrivals), given the distinct pattern of behaviour between domestic and international visitors.

Our findings support Viana-Lora et al.'s (2021) conclusions on COVID-19's impact on tourist mobility, emphasising transportation's role in destination attractiveness. They also align with Delclòs-Alió et al.'s (2023) investigations into COVID-19's effects on recreational walking and tourist public transportation use in coastal Catalonia. Employing a multivariate probit model was ideal for our analysis, given the multiple binary variables. Robustness was ensured by employing

multivariate probit modelling, which accounted for the interdependencies among binary transport mode choices, capturing the complexity of tourist decision-making processes. Furthermore, the survey data used in the analysis were explicitly designed to align with the model's requirements, ensuring the collection of variables that accurately reflect the underlying factors influencing these correlated choices, thus producing reliable and context-specific estimates. The survey data, collected from key tourist locations in Catalonia, guarantees representativeness and enhances external validity. With 1954 participants, our results are robust and likely applicable to other mature coastal destinations with similar characteristics. This approach provides a comprehensive analysis of the factors influencing destination competitiveness and attractiveness.

7.2 Implications

The evidence obtained in this study supports previous works highlighting the importance of managing tourists' mobilities at destinations (Dredge- & Jamal, 2013). To this end, the sustainability and the competitiveness of tourist destinations can be undermined if the public transport loses its appeal. In the particular case of mature coastal destinations, where excursions are decisive to maintaining their attractiveness (Almeida & Garrod, 2018; Bujosa et al., 2015), public transport is a critical tool to achieve this objective (Prideaux, 2000). We have shown a scenario where a change in the profile of visitors and their behaviour has led to a significant reduction of tourists' public transport demand at the destination. Financial pressure on transport operators caused by a decline of users is likely to hinder the provision of a sufficient number of services, which can result in an aggravation of the phenomenon in the mid- and long term. Likewise, some secondary attractions might lose their attractiveness if segments of visitors are reluctant to use public transport, or if the level of service is inadequate.

Excursions and public transport ridership at certain tourist destinations are highly dependent on tourist flows (Gutiérrez & Miravet, 2016b). Our findings portray a context characterized by deep changes in tourists' profiles and their behaviour during their stay at the destination, which are drivers of a slower return to public transport after the pandemic. Needless to say, this reflects an evident degree of uncertainty when designing the provision of public transport services due to a lesser stability of flows compared to the ones of the resident population (Miravet et al., 2021a). The exploration of the determinants of these particular mobility patterns can contribute to the design of the policies that must lead to increase their use again. As highlighted by Tang et al. (2023), although there is virtually no one-size-fits-all policy to improve mobility resilience for diverse populations, in this consideration, we argue that not only should socioeconomic features be considered but also territorial-specific planning. Indeed, an unexpected shock impacts each territory differently, and policy solutions should include careful consideration of its specific characteristics: the proof of this is that, in the context of tourist destinations, even though certain factors generate consensus among researchers, evidence related to the effects of other determinants is mixed (Gross & Grimm, 2018). In these circumstances, careful attention must be paid to the diversity of segments of tourists who visit a destination (Domènech et al., 2023b): analysis of the willingness to visit attractions, and the modes of transport which are chosen most often by each segment, is key to deciphering the formulas that can make public transport attractive (Miravet et al., 2021b) and thus increasingly recover those segments who are reluctant to board public transport vehicles. Only then will it be possible to design effective targeted campaigns aimed at recovering specific groups of individuals who otherwise would stay away from public transport (Long et al., 2023).

According to the results, excursions seem more attractive for visitors using a private vehicle at their destination. The temptation for destination managers could be to deploy a distribution of the public

space which prioritizes the needs of tourists who use private vehicles. The consequence would be the development of tourist destinations oriented to car users. Consistent with this scenario, Nieuwenhuijsen & Khreis (2016) found a direct correlation between the modal share of private vehicles and the percentage of land devoted to them. As suggested by Zheng and Peeta (2015), the implementation of transit-oriented development (TOD) leads to the opposite scenario, wherein mobility patterns see gains in terms of sustainability. As put forth by Thombre & Agarwal (2021), TOD is a suitable strategy to reverse private vehicles' growing modal share since the pandemic. Even though TOD schemes are desirable and can be fully applicable at tourist destinations, the situation is complex, as access to secondary attractions depends on their accessibility via public transport systems (Masiero & Hrankai, 2022). Therefore, a symbiotic relationship exists between public transport and attractions, which leads to the need to promote them simultaneously. Consequently, we urge the devising and implementation of tourist strategic plans which involve a coordinated development of tourists' products and of tourists' mobility plans.

This study's findings extend TOD principles by providing a detailed understanding of how tourists' transport choices are shaped by factors like perceived massification and post-pandemic behavioural shifts. These insights are particularly valuable for designing resilient transportation systems in tourism-dependent regions, offering strategies for integrating public transit into broader sustainability goals. In conclusion, this paper contributes to TOD research by addressing a novel population group—tourists—using a sophisticated modelling approach to analyse interdependent transport behaviours. The insights into post-pandemic dynamics, mode complementarity, and destination-specific impacts offer actionable knowledge for future transport and tourism planning.

7.3 Limitations and future lines of research

While specific to the context of our study area, the insights gained in this research could hold relevance for broader tourist destinations. Nevertheless, caution is needed when applying these findings to areas with different transport systems and levels of tourism demand. For this reason, it would be advisable applying similar analyses to other sort of destinations. Likewise, future works should examine whether the alterations in public transportation ridership remains over time.

On the other hand, our study focused the analysis on the demand side. New research should be conducted on the supply side, specifically jointly focusing on public transport provision and tourism products. Research should particularly analyse the role and impacts of potential public policies promoting sustainable tourism mobilities. Debate on the role of public transport for residents and visitors is also crucial. Evaluating the effectiveness of marketing campaigns, and mobility and tourism policies in encouraging public transport use and understanding determinants of success or failure can inform targeted strategies and policies. Assessing their impacts on tourist behaviour will provide insights for future interventions.

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Appendix

Table A1 – Variance Inflation Factor

Variable	VIF	1/VIF
Non-worker	3.23	0.3098
Salaried worker	3.05	0.3281
High expenditure	1.82	0.5482
Missing expenditure	1.79	0.5578
Age	1.6	0.6266
Accommodation - 2nd house	1.58	0.6329
Visited Tarragona/Reus	1.42	0.7027
Stay duration	1.41	0.7076
Fully vaccinated (2 doses)	1.35	0.7412
Visited Costa Daurada	1.31	0.7649
Accommodation - apartment	1.29	0.7769
Nationality - Spanish	1.28	0.7784
Visited Barcelona	1.23	0.8149
Travelling with children	1.21	0.8280
First timer in Costa Daurada	1.17	0.8551
Public transport use	1.15	0.8663
Massification	1.14	0.8788
Accommodation - other	1.13	0.8873
Educational attainment - superior	1.12	0.8909
First time traveling after Covid	1.11	0.9029
Trust in public places	1.1	0.9128
Had Covid-19	1.09	0.9191
Gender - woman	1.08	0.9272
Friend with bad symptoms	1.05	0.9490
Gender - non-binary	1.02	0.9846
Mean VIF	1.42	

	(1)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
(1) Excursions	1																												
(2) Private vehicle use	0.160*	1																											
(3) Public transport use	0.170*	0.131*	1																										
(5) Nationality - Spanish	-0.162*	-0.033	-0.196*	1																									
(6) Gender - woman	-0.008	0.017	0.061*	-0.006	1																								
(7) Gender - non-binary	-0.017	0	0.043	-0.011	-0.056	1																							
(8) Public transport use	0.061*	-0.186*	0.250*	-0.232*	0.082*	0.028	1																						
(9) Salaried worker	-0.021	0.060*	-0.122*	0.056	-0.065*	0.019	-0.131*	1																					
(10) Non-worker	0.014	-0.128*	0.100*	-0.017	0.134*	-0.031	0.151*	-0.809*	1																				
(11) Age	-0.045	-0.003	-0.101*	0.110*	-0.012	-0.017	-0.156*	0.123*	-0.192*	1																			
(12) Educational attainment - superior	0.067*	0.174*	-0.03	0.023	0.073*	0.026	-0.062*	0.219*	-0.221*	0.076*	1																		
(13) Travelling with children	0.083*	0.257*	-0.032	-0.060*	0.102*	0.026	-0.146*	0.076*	-0.102*	-0.090*	0.121*	1																	
(14) Stay duration	0.082*	-0.038	0.101*	-0.011	0.077*	0.004	0.042	-0.238*	0.243*	0.260*	-0.077*	-0.068*	1																
(15) First timer in Costa Daurada	0.041	0.024	0.037	-0.193*	0.012	0.032	0.128*	-0.003	0.017	-0.161*	-0.04	0.014	-0.127*	1															
(16) Accommodation - apartment	0.084*	0.079*	0.078*	-0.123*	0	0.026	0.05	-0.069*	0.065*	-0.191*	-0.011	0.105*	-0.045	0.115*	1														
(17) Accommodation - 2nd house	0.100*	-0.003	0.066*	0.073*	0.043	-0.025	-0.015	-0.120*	0.127*	0.198*	0.026	-0.058*	0.384*	-0.266*	-0.349*	1													
(18) Accommodation - other	-0.019	0.090*	0.03	-0.002	-0.003	-0.014	0.005	0.032	-0.049	-0.023	0.02	0.130*	-0.060*	0.066*	-0.112*	-0.205*	1												
(19) Visited Barcelona	0.306*	0.076*	0.135*	-0.341*	0.004	0.017	0.103*	-0.035	-0.006	-0.069*	0.016	0.029	0.065*	0.093*	0.099*	-0.021	0.001	1											
(20) Visited Costa Daurada	0.731*	0.042	0.148*	-0.083*	-0.048	-0.04	0.017	-0.024	0.027	0.002	-0.008	0.021	0.063*	-0.022	0.023	0.090*	-0.024	0.143*	1										
(21) Visited Tarragona/Reus	0.645*	0.114*	0.149*	-0.169*	0.012	0.006	0.068*	-0.053	0.027	-0.031	0.069*	0.101*	0.086*	0.041	0.064*	0.089*	-0.038	0.252*	0.468*	1									
(22) Visited other	0.262*	0.126*	0.062*	-0.100*	-0.003	0.024	-0.001	-0.031	-0.024	0.045	0.085*	0.035	0.111*	-0.058*	0.022	0.088*	0.032	0.172*	0.075*	0.161*	1								
(23) High expenditure	0.122*	0.265*	0.049	-0.024	0.052	0.013	-0.04	0.05	-0.102*	0.075*	0.136*	0.205*	0.023	-0.036	0.057	0.043	0.002	0.088*	0.061*	0.124*	0.085*	1							
(24) Missing expenditure	-0.016	-0.229*	-0.071*	-0.076*	-0.027	-0.004	-0.011	-0.026	0.056	0.124*	-0.121*	-0.084*	0.162*	-0.038	-0.052	0.083*	-0.026	-0.029	0.013	0.001	-0.03	-0.604*	1						
(25) Massification	0.081*	0.362*	0.026	-0.004	0.097*	0.052	0.031	0.047	-0.05	-0.155*	0.107*	0.164*	-0.075*	0.025	0.078*	-0.067*	0.026	0.027	-0.024	0.055	0.068*	0.118*	-0.119*	1					
(26) Trust public places	0.069*	0.187*	-0.106*	0.004	0.024	0.022	-0.025	0.083*	-0.104*	-0.04	0.087*	0.175*	-0.090*	0.068*	0.032	-0.075*	-0.008	-0.011	0.015	0.067*	0.046	0.093*	-0.062*	0.191*	1				
(27) First time travelling after Coivd	-0.023	0.106*	0.017	-0.122*	0.018	0.007	0.052	-0.084*	0.042	-0.012	-0.035	0.087*	-0.065*	0.176*	0.058	-0.144*	-0.001	0.053	-0.04	0.002	-0.035	0.055	-0.047	0.134*	0.055	1			
(28) Had Covid-19	0.062*	0.078*	0.064*	-0.026	0.02	0.004	0.046	-0.037	0.034	-0.147*	0.015	0.05	-0.022	0.026	0.019	-0.014	0.008	0.021	0.049	0.034	0.033	0.036	-0.083*	0.082*	0.091*	0.039	1		
(29) Fully vaccinated (2 doses)	-0.076*	-0.056	-0.182*	0.075*	-0.018	0.002	-0.127*	0.184*	-0.184*	0.448*	0.056	-0.027	0.013	-0.098*	-0.134*	0.029	-0.023	-0.077*	-0.023	-0.039	-0.023	0.001	0.104*	-0.042	0.009	-0.051	-0.213*	1	
(30) Friend with bad symptoms	0.04	0.042	0.095*	0.035	0.053	0.033	0.04	-0.047	0.048	-0.085*	0.011	0.059*	0.007	0.031	0.029	0.025	-0.005	0.061*	0.009	0.046	0.021	0.058	-0.090*	0.057	0.044	0.044	0.151*	-0.088*	1