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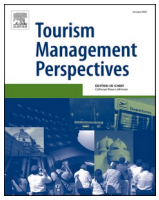

Impact of the COVID-19 pandemic on tourist public transportation use and on its determinants: Evidence from a Catalan coastal destination

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ABSTRACT

Despite the key importance of public transportation for the accessibility, attractiveness, and sustainability of tourist areas, little is known about how the COVID-19 pandemic may have impacted its use among tourists. In response, we compared the likelihood of using transit among visitors in a Catalan coastal area based on surveys conducted in 2019 ($n = 1493$) and 2020 ($n = 1465$). The pandemic caused a significant decline in tourists' use of public transportation, from 54.5% in 2019 to 34.6% in 2020, and in mobility at the destination. Results from a set of bivariate probabilistic models revealed that though most of the traditional determinants of visitors' use of transit remained unaltered, pandemic-related factors were associated with its decline. For the tourism sector and for local authorities and transit agencies, those results characterize the crucial challenge of ensuring the use of public transit among visitors in consideration of its many environmental and social benefits.

1. Introduction

For urban tourist areas, public transportation is a pivotal asset. Having an extensive, frequent, reliable public transportation service enhances tourists' accessibility and satisfaction given the possibility of visiting more places, which can consequently improve destinations' attractiveness and competitiveness (Prideaux, 2000). Beyond that, promoting the use of public transportation among visitors to travel to, within, and from destinations can help to reduce the overall ecological footprint of the tourism sector (Peeters, Szimba, and Duijnisveld, 2007) and thus contribute to advancing to a more sustainable model of tourism (Hall, Gössling, and Scott, 2012; Hall, Le-Klähn, and Ram, 2017).

However, with the outbreak of the COVID-19 pandemic, the global use of public transportation came to a grinding halt. Although the initial cause was drastically lower levels of public mobility owing to government-issued restrictions aimed at limiting the virus's spread (Jenelius and Cebecauer, 2020), an increasingly higher perceived risk of contracting the virus in enclosed, often crowded spaces such as public transportation soon emerged as the chief factor (Shamshiripour, Rahimi, Shabanpour, Mohammadian, and Kouros)., 2020). As a result, the new operational context has not only put transit agencies around the world in a challenging financial position due to reduced ridership (Vickerman, 2021) but could also pose a significant challenge for urban areas worldwide if the travel behavior patterns adopted during the pandemic persist into the mid- and long term. A major part of that challenge comes with having to navigate the negative environmental and social consequences that a prolonged reduction in the use of public transportation would entail.

Thus far, research on how the COVID-19 pandemic has impacted population mobility in general and public transportation ridership in particular has mostly focused on everyday patterns (Abu-Rayash and Dincer, 2020; Anke, Francke, Schaefer, and Petzoldt, 2021; Eisenmann, Nobis, Kolarova, Lenz, and Winkler, 2021; Jenelius and Cebecauer, 2020). As a consequence, little is known about how the pandemic has impacted the use of public transportation among tourists. Such knowledge may be valuable, however, especially in regions where tourist

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mobility can exceed that of residents and alter their spatial patterns as well (Domènech, Miravet, and Gutiérrez, 2020; Gutiérrez, Domènech, Zaragozí, and Miravet, 2020). Considering the unequal incidence of COVID-19 in terms of population demographics and socioeconomic characteristics (Eduardo Antonio-Villa et al., 2021; Karmakar, Lantz, and Tipirneni, 2021), it also seems valuable to explore whether the pandemic may have additionally reshaped the traditional determinants of tourists' use of public transportation.

Considering all of the above, in our study we aimed to provide evidence that can contribute to answering two key questions: How has the COVID-19 pandemic impacted tourists' use of public transportation, and has the pandemic caused changes in the traditional determinants of their use of public transportation at destinations? To that end, we used data from a survey conducted annually among visitors to the urban core of Costa Daurada, one of Spain's main summer coastal destinations. To evaluate the pandemic's impact on tourists' use of public transportation, we compared answers provided by visitors in summer 2019 to those obtained in summer 2020.

2. Background

2.1. Tourists' use of public transportation and its determinants

The study of public transportation use in relation to tourism has traditionally focused on how visitors arrive to or leave certain destinations, which has implications for destinations' visibility and accessibility. In recent years, however, interest in analyzing tourists' use of public transportation at destinations has grown (Le-Klähn, Roosen, Gerike, and Hall, 2015; Miravet, Domènech, and Gutiérrez, 2021). In addition to its environmental benefits, promoting the use of public transportation among visitors helps local authorities and transit operators to plan and manage tourism flows (Liu, Shi, and Jian, 2017). At the same time, providing high-quality transit services also has the potential to improve the overall attractiveness of destinations by increasing the potential number of points of interest that visitors can access while reducing their need to own or rent private modes of transport (Miravet et al., 2021; Thompson and Schofield, 2007). As past studies have additionally shown, the demand for public transportation generated by tourist flows can help to fund and improve existing local transit services. However, the results of the same studies warn that the additional demand from tourism can also result in negative external costs for local users in terms of comfort and congestion (Albalate and Bel, 2010).

The determinants of tourists' use of public transportation at destinations mostly include the characteristics of the location and of visitors themselves, as well as the purpose and characteristics of their visits (Gross and Grimm, 2018). Although the mode of transportation chosen to travel to destinations is generally the most decisive element of intra-destination modal choices (Miravet et al., 2021), the most relevant factor in terms of location characteristics is whether destinations are located in urban settings or in remote or rural areas (Le-Klähn and Hall, 2015). Having an efficient, reliable public transportation system is far more likely in urban and compact destinations, given the demand among both residents and visitors and the higher concentration of points of interest (Le-Klähn et al., 2015).

Tourists' choices to use public versus private modes of transportation when traveling within destinations are also influenced by individual factors such as attitudes, preferences, and demographic and socioeconomic characteristics. Previous studies have shown that the use of public transportation at destinations is associated with tourists' country of origin, gender, level of education, and other indicators of socioeconomic status, as well as with whether they are regular users of public transportation in their day-to-day lives, among other variables (Dominik, Carsten, and Claudia, 2017; Gross and Grimm, 2018; Gutiérrez and Miravet, 2016; Hough and Hassanien, 2010; Le-Klähn et al., 2015; Masiero and Zoltan, 2013; Nutsugbodo, Amenumey, and Mensah, 2018). Beyond that, subjective factors also come into play when visitors have to choose between modes of transportation at destinations—for example, the motivation for their trips and what they expect from their visits (Gross and Grimm, 2018). Other factors that affect public transportation use in general are also relevant when it comes to tourists, including their attitudes toward sustainable modes and their perceptions of service quality, comfort, reliability, and cost (Le-Klähn and Hall, 2015; Nutsugbodo et al., 2018).

In terms of visit-related characteristics, several other factors have been shown to influence tourists' use of public transportation at destinations. Examples include the type of accommodations chosen, the duration of visits, the characteristics of the traveling parties, and their expenditure during their visits (Gross and Grimm, 2018; Gutiérrez and Miravet, 2016; Le-Klähn et al., 2015; Le-Klähn, Gerike, and Michael Hall, 2014; Miravet et al., 2021). Another crucial factor is the mode of transportation used to access destinations, especially considering its potential correlation with the overall profile of visitors, which can result in endogeneity and thus needs to be considered in researchers' analytical designs (Gutiérrez and Miravet, 2016). Another visit-related factor that warrant special attention is the spatial behavior of visitors at destinations—that is, the number of places that they visit during their stays (Le-Klähn et al., 2015). The relationship between deciding what to visit and how to get there is particularly complex and can be regarded as reciprocal: tourists may decide to visit a certain point of interest and later choose to access it via public or private transportation or otherwise decide to visit only locations that are accessible by public transportation. That issue is a sensitive one not only conceptually but also methodologically given the clear interdependency between both variables. In previous studies, such interdependency has prompted researchers to implement modeling strategies able to account for that bidirectional relationship (Le-Klähn et al., 2015; Masiero and Zoltan, 2013).

2.2. The impact of the COVID-19 pandemic on public transportation use

The COVID-19 pandemic has significant disrupted population mobility due to overall reductions in day-to-day activities, often in light of travel restrictions and social distancing policies issued by national, regional, and local governments worldwide (De Vos, 2020). Although such restrictions explained the steep decline in the use of all modes of transportation in the first phase of the pandemic (Gutiérrez, Miravet, and Domènech, 2020), the recovery of transit ridership has since lagged behind the use of individual ways of getting around, including private vehicles, walking, and cycling (Anke et al., 2021; Beck, Hensher, and Wei, 2020; Eisenmann et al., 2021; Jenelius and Cebecauer, 2020; Mogaji, 2020).

The particular association between the pandemic and public transportation ridership seems to mostly derive from a higher perceived risk of infection among users of public transportation compared with other modes (Barbieri et al., 2021). Although some studies conducted in the early phase of the pandemic found an association between public transportation use and SARS-CoV-2 infection (Harris, 2020; Shen et al., 2020), that association has since been deemed inconclusive (Hu et al., 2021; Moreno et al., 2021; Severo, Ribeiro, Lucas, Leão, and Barros, 2021). That discrepancy is likely due to the rapid, widespread implementation of non-pharmaceutical measures aimed at reducing virus transmission (Chen et al., 2021; Hanaei and Rezaei, 2020; Pradhan, Biswasroy, Kumar Naik, Ghosh, and Rath, 2020), together with the fact that well-ventilated environments where individuals wear face coverings and remain silent can generally be regarded as posing a low risk of infection, even when crowded (Jones et al., 2020). However, studies have also shown how travelers, regardless of the inconclusive evidence, continue to perceive public transportation as being a high-risk environment, which has significant potential to alter travel behavior and, in turn, reduce the use of public transportation (Abdullah, Ali, Dias, Campisi, and Javid, 2021; Tan and Ma, 2020).

Despite the COVID-19 pandemic's evident impact on long-range travel (Abu-Rayash and Dincer, 2020; Korinth, 2020), little is known

about its impact on transit use among tourists at destinations. In that context, the study of how the COVID-19 pandemic may have impacted tourists' use of public transportation and its determinants can be valuable. In our study, we hypothesized that compared with everyday mobility, individuals' mobility while on vacation is highly flexible and not as constrained in space or time by the need to access key services. By extension, tourists' use of public transportation may have also been affected by the pandemic and may present significant differences in terms of traditional determinants of such use. Therefore, understanding tourists' patterns of travel behavior adopted during the pandemic, particularly concerning their use of public transportation, is crucial for both the tourism and recreation sectors, not only for planning services offered to visitors but also for local urban and transportation authorities that need to manage tourist flows in urban areas into the post-pandemic era.

3. Study design

3.1. Setting and background data

Our study was set in the Costa Daurada, a coastal area in Catalonia approximately 100 km to the southwest of Barcelona (see Fig. 1). Characterized by a mild Mediterranean climate, the region ranks among Spain's main summer tourist destinations and receives >5 million visitors each year (Patronat de Turisme de la Diputació de Tarragona, 2018). Although mostly a beach destination, the Costa Daurada is also located close to several UNESCO World Heritage sites and other places of cultural interest, as well as PortAventura World, one of Europe's premier theme parks (Clavé, 2010). In our study, we focused on Central Costa Daurada (CCD), home to the three municipalities of Cambrils, Salou, and Vila-seca–La Pineda. In 2019, the CCD had a combined year-round population of 83,561 residents, which has been shown to grow by approximately 40% when seasonal visitors are accounted for (Institut d'Estadística de Catalunya, 2019). The CCD is located between two of Catalonia's major midsized cities—Tarragona (pop. 134,515) and Reus (pop. 104,373)—and it is well-connected both regionally and internationally by road, by conventional and high-speed rail, and by plane, namely via Reus Airport. Meanwhile, Tarragona is the region's primary port, one that has recently begun to receive international cruise ships (Domènech, Gutiérrez, Clavé, Gutiérrez, and Clavé, 2019).

The CCD is traditionally characterized as having a high level of public transportation use among visitors. According to data from the Consortium of Public Transportation of Camp de Tarragona, in August 2019 public transportation ridership in the area's three municipalities amounted to 600,226 monthly ticket validations, which was 736.7% greater than the minimum ridership recorded in January that year (81,473 validations; see Fig. 2). That result is mostly explained by the area's compact, urban nature, which justifies the high provision of interurban bus services with lines that connect the three municipalities among themselves as well as with Reus, Tarragona, and other relevant points of interest in the region. However, the impact of the COVID-19 pandemic resulted in a massive reduction in transit ridership by April 2020, which recovered only 20.23% of its normal volume during the summer months (121,452 monthly ticket validations in August).

3.2. Data and variables

In our study, we used data from a survey of tourists conducted annually by the Eurecat Tourism Observatory in the Costa Daurada. Conducted every summer since 2006, the survey seeks to collect information about visitors' demographic and socioeconomic profiles, about the characteristics of their visits, and about their perceptions and valuations of the destination (see **Supplemental File 1** for the questionnaire). Such information is collected to characterize tourist demand in the area and thus to inform regional authorities as well as key local public and private actors in the tourism sector. During the survey, traditionally conducted at different times throughout the day and throughout the week, professional surveyors are placed at strategic locations in areas where the primary accommodation facilities for tourists (e.g., hotels, hostels, and campsites) are located and where visitor flows tend to concentrate (e.g., waterfronts, shopping areas, leisure areas, and beaches). At each location, surveyors randomly select individuals to be surveyed and ask for their informed consent to be surveyed. After the surveyors check whether willing respondents are residents or visitors, they conduct the interviews orally and record tourists' responses on a tablet.

With access to the microdata granted under a research cooperation agreement with Eurecat, we used data from the 2019 and 2020 surveys

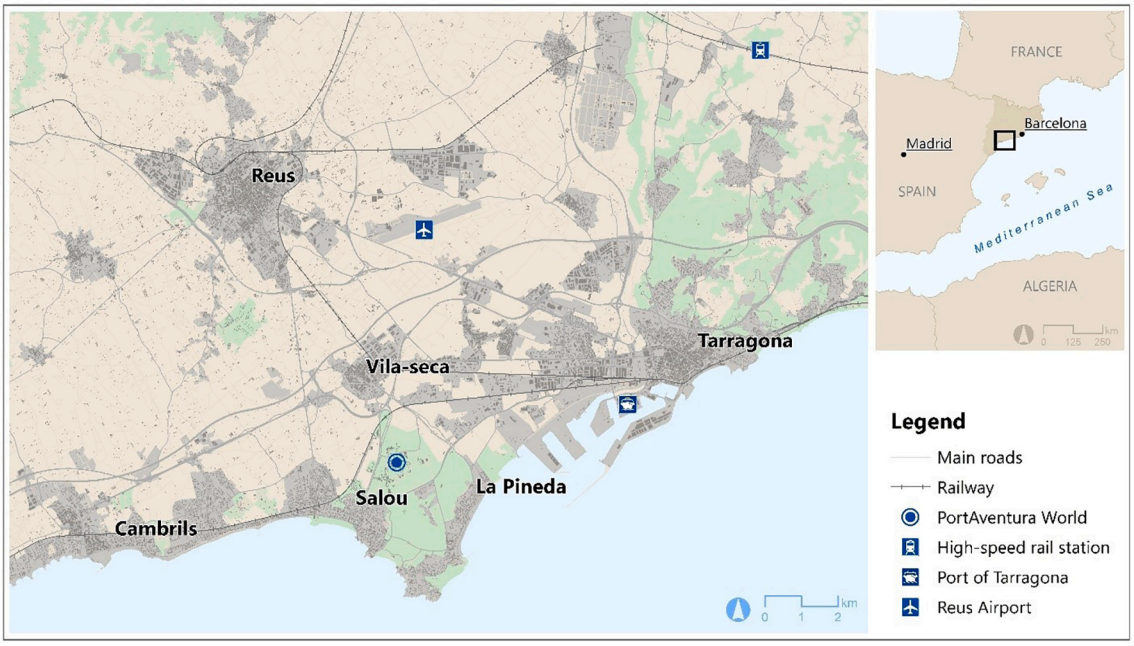

Fig. 1. Map of Central Costa Daurada (CCD). Source: Own production.

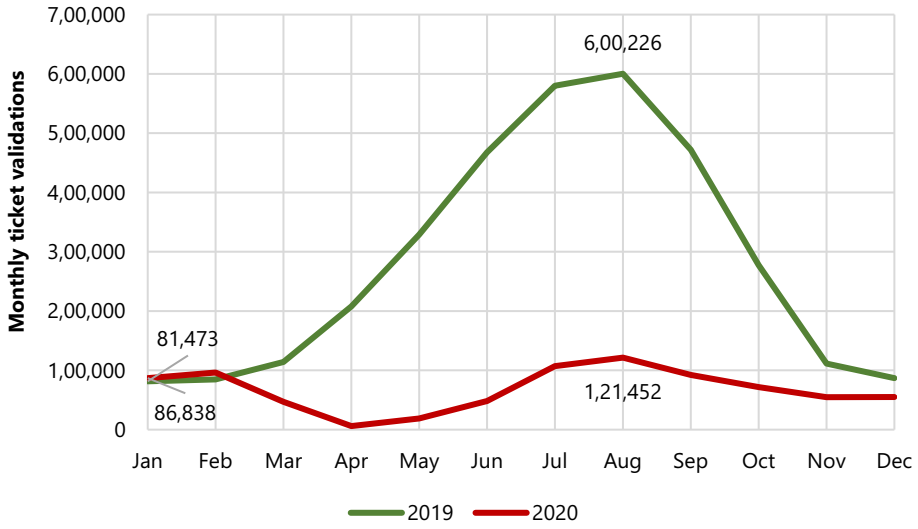

Fig. 2. Evolution of monthly public transportation ticket validations in Central Costa Daurada (CCD), in 2019 and 2020. Source: Own production with data provided by the Consortium of Public Transportation of Camp de Tarragona.

from samples consisting of 1493 respondents in 2019 and 1465 in 2020. Considering the number of visitors who arrived at the three analyzed municipalities during the summer months in 2019 and 2020 (i.e., approx. 1.3 million in 2019 and 500,000 in 2020), both samples are representative at a 99% confidence level with a 3.5% margin of error.

The summer of 2020 can be regarded as a key moment in the evolution of the COVID-19 pandemic in Spain, given the overlap between the primary vacation period and the relative relaxation of government-issued limitations on activities and population mobility after the stay-at-home order in place from March 14 to May 2, 2020. During summer 2020, Spain reported a relatively low incidence of the virus compared with other moments in the pandemic, with under 200 confirmed cases per 100,000 inhabitants (Instituto Nacional de Estadística, 2021), and there were no effective nationwide restrictions on the movement of the population.

The primary outcome in our study was a dichotomous variable that captured public transportation use while at the destination (0 = *no use of public transportation*, 1 = *use of public transportation*). We also considered a second outcome—the spatial behavior of visitors at the destination—given its relevant reciprocal relationship with tourists' use of public transportation, as explained in Section 3.3. To that purpose, we additionally created a dichotomous variable indicating whether a respondent took any excursions in or around the area studied (0 = *did not take any excursions*, 1 = *took at least one excursion*).

For independent variables, we considered relevant characteristics of the individual tourists and their visits as well as factors related to the COVID-19 pandemic. In terms of individual characteristics, we included gender, age, nationality, level of education, and employment status. As for characteristics of their visits, we included mode of transportation used to arrive at the destination, whether it was the tourist's first time visiting the location, the number of nights spent at the destination, the type of accommodation, the total expenditure during the visit, and the type of traveling party. Last, we also considered two variables specifically related to the pandemic. To be specific, we created an indicator reflecting whether the pandemic had changed any characteristic of the tourist's visit (i.e., by summarizing a list of characteristics including choice of destination, duration of the visit, mode of transportation used to access the destination, activities engaged in at the destination, and type of accommodation) and how the tourists had evaluated the COVID-19 prevention measures (e.g., social distancing, hygiene measures, limits on occupancy) at the destination on in a Likert-type scale from 1 (*low*) to 5 (*high*).

3.3. Analysis

The econometric strategy of our analysis was conditioned by several potential biases. First, the mode of transportation used to access the study was liable to become endogenous because it could relate to the tourists' profile. In that event, the correlation of unobserved heterogeneity associated with the use of public transportation within the destination and the mode used to arrive to the destination would result in an endogeneity bias (Gutiérrez and Miravet, 2016). Thus, we considered that the decisions related to the modes of transportation could not be modeled linearly and that using traditional instrumental variable techniques would result in inconsistent results (Wooldridge, 2014). Given the multinomial nature of the transportation options for traveling to the destination, along with the dichotomous nature of the use of public transportation at the destination, we considered that an endogeneity-corrected logit model should be applied if evidence of endogeneity were found (Deb and Trivedi, 2006a). The exogeneity test suggested by Deb and Trivedi (2006b) resolves whether the null hypothesis of endogeneity can be rejected. In our study, the probability of the null hypothesis of exogeneity was $p = 0.777$ and thus could not be rejected. For a robustness check, the model and the test were replicated with the samples of 2019 and 2020 separately, and the conclusion was the same.

A second potential source of bias, as mentioned, stems from the reciprocal relationship between tourists' decision to undertake visits during their stay and the mode of transportation that they chose to use within the destination (Le-Klähn et al., 2015; Masiero and Zoltan, 2013). The decision of undertaking visits relates to the range of attractions that can be accessed by a given set of transportation alternatives. At the same time, visitors can decide which mode of transportation to use depending on the attraction that they have decided to visit. Thus, considering that the correlation between the errors of both variables was highly likely, we modeled the probabilities of using public transportation during stays and undertaking excursions jointly by means of a bivariate probit model, as expressed in the following equations:

$$y_{i1}^{*} = \beta_1' X_{i1} + \varepsilon_{i1}, y_{i1} = 1 \; if \; y_{i1}^{*} > 0, 0 \; otherwise$$

$$y_{i2}^{*} = \beta_2' X_{i2} + \varepsilon_{i2}, y_{i2} = 1 \; if \; y_{i2}^{*} > 0, 0 \; otherwise$$

$$[\varepsilon_{i1}, \varepsilon_{i2}] \sim N_2 \, (0, 0, 1, 1, \rho), \; -1 < \rho < 1 \qquad (1)$$

in which y_{i1}represents individual observations of whether subject i is categorized as a public transportation user during their stay, y_{i2}

represents the observation of excursions, y_{i1}^* and y_{i2}^* respectively represent their associated latent variables, β_1' and β_2' denote the vectors of coefficients, X_{i1} and X_{i2} express the set of the observed explanatory variables, and ε_{i1} and ε_{i2} represent the unobserved heterogeneities of each equation.

The correlation between ε_{i1} and ε_{i2}, represented by ρ, was assessed by means of the Wald test. Because the probability that $\rho = 0.0$ was nil, the null hypothesis, which implies the lack of correlation between the error terms, was discarded, and the estimation of the bivariate probit was considered to be the appropriate approach to estimation.

In a second step, we ran a set of bivariate probabilistic models that included an interaction term between each independent variable and the survey year. The objective of the second step was twofold. First, although both sample sizes had a similar number of observations, the number of total visitors to the CCD in 2020 was significantly lower than in previous years, which could have led to the lack of representativeness of the whole sample containing the data from both 2019 and 2020 because data from 2020 would be overrepresented. Thus, using the interactions was expected to solve the problem because they would separate the effect of each year and prevent the model from assigning excessive preponderance to the effect attached to the sample from 2020. Second, including the interactions allowed addressing whether the effect attached to each of the explanatory variables on the probabilities of using public transportation services as well as undertaking excursions was modified in the context of the pandemic, without losing the dichotomous variable referring to the survey year. All of the explanatory variables were thus interacted with the same variable (i.e., year 2020), which required estimating as many models as interactions to avoid distorting the results of the coefficients.

Last, we also ran separate bivariate probabilistic models with interactions for the variables related to the COVID-19 pandemic, which were present in the 2020 survey only.

4. Results

4.1. The impact of the COVID-19 pandemic on tourists' use of public transportation and excursions

We analyzed data representing 2958 survey respondents—1493 from 2019 and 1465 from 2020—the characteristics of whom are presented in Table 1 (see **Supplemental File 2** for additional indicators of skewness and kurtosis). In general, we observed that 54% of travelers to the CCD used public transportation during their visit and that 71% conducted at least one excursion within or around the destination under normal circumstances (i.e., in 2019). The impact of the COVID-19 pandemic on both outcomes was clear: in 2020, the use of public transportation among visitors dropped by approximately 20 percentage points (i.e., only 35% of visitors used public transportation in 2020), while excursions dropped by approximately 16 (i.e., 55% of visitors took at least one excursion in 2020).

Even so, the drop in the use of public transportation in 2020 may have been related to the fact that certain key characteristics of visitors to the area changed significantly while others remained consistent. On the one hand, aspects such as gender and age remained similar between 2019 and 2020: men were slightly overrepresented in both years (53–54%), and the average age was approximately 50 years old. On the other, whereas 45% of visitors to the CCD would normally be Spanish (i.e., in 2019), followed by French or British (18% and 17%, respectively), with other nationalities accounting for the remaining 20%, in 2020 a whopping 90% of respondents were Spanish due to travel restrictions and the consequent reduction of foreign visitors in the region.

Another significant change in terms of the characteristics of the respondents' visits was the mode of transportation that they used to access the CCD. Although private transport was the primary option used (56%) in 2019, followed by plane (34%) and public transportation (11%), in 2020 the share of respondents who arrived to the CCD via private

Table 1
Description of the outcome variables and the characteristics of the sample.

	Total sample	2019	2020
Total (n, %)	2958 (100)	1493 (100)	1465 (100)
Outcomes			
Public transportation use at the destination (n, %)			
Yes	1320 (44.62)	813 (54.45)	507 (34.61)
No	1638 (55.38)	680 (45.55)	958 (65.39)
Conducted excursions during their visit (n, %)			
Yes	1861 (62.91)	1055 (70.66)	806 (55.02)
No	1097 (37.09)	438 (29.34)	659 (44.98)
Individual characteristics			
Gender (n, %)			
Men	1585 (53.58)	792 (53.05)	793 (54.13)
Women	1373 (46.42)	701 (46.95)	672 (45.87)
Age (mean, SD)	50.78 (16.04)	49.88 (16.11)	51.70 (15.93)
Nationality (n, %)			
Spain	1994 (67.41)	672 (45.01)	1322 (90.24)
France	360 (12.17)	267 (17.88)	93 (6.35)
United Kingdom	269 (9.09)	258 (17.28)	11 (0.75)
Others	335 (11.33)	296 (19.83)	39 (2.66)
Educational attainment (n, %)			
Basic education	713 (24.10)	330 (22.10)	383 (26.14)
Secondary education	1140 (38.54)	548 (36.70)	592 (40.41)
College education	1025 (34.75)	568 (38.04)	460 (31.40)
No data	77 (2.60)	47 (3.15)	30 (2.05)
Employment status (n, %)			
Salaried employee	1533 (51.83)	771 (51.64)	762 (52.01)
Self-employed	475 (16.06)	273 (18.29)	202 (13.79)
Unemployed	91 (3.08)	23 (1.54)	68 (4.64)
Retired or inactive	859 (29.04)	426 (28.53)	433 (29.56)
Visit characteristics			
Travel mode to the destination (n, %)			
Private vehicle	2148 (72.62)	829 (55.53)	1319 (90.03)
Public transportation	267 (9.03)	157 (10.52)	110 (7.51)
Plain	543 (18.36)	507 (33.96)	36 (2.46)
First time visiting the location (n, %)			
Yes	574 (19.41)	445 (29.81)	129 (8.81)
No	2384 (80.59)	1048 (70.19)	1336 (91.19)
Number of nights (mean, SD)	17.06 (27.37)	12.89 (22.76)	21.22 (30.83)
Accommodation (n, %)			
Second residence	1092 (36.92)	346 (23.17)	746 (50.92)
Residence of family or friends	169 (5.71)	67 (4.49)	102 (6.96)
Apartment	438 (14.81)	265 (17.75)	173 (11.81)

(*continued on next page*)

Table 1 (*continued*)

	Total sample	2019	2020
Total (n, %)	2958 (100)	1493 (100)	1465 (100)
Hotel	1046 (35.36)	715 (47.89)	331 (22.59)
Camping	188 (6.36)	89 (5.96)	99 (6.76)
Others	25 (0.85)	11 (0.74)	14 (0.96)
Expenditure level (n, %)			
<200 €	555 (18.76)	140 (9.38)	415 (28.33)
Between 200 and 500 €	726 (24.54)	331 (22.17)	395 (26.96)
Between 500 and 1000 €	510 (17.24)	262 (17.55)	248 (16.93)
Between 1000 and 5000 €	420 (14.20)	171 (11.45)	249 (17.00)
>5000 €	24 (0.81)	6 (0.40)	18 (1.23)
No data	723 (24.44)	583 (39.05)	140 (9.56)
Type of travel party (n, %)			
Alone	170 (5.72)	61 (4.09)	109 (7.44)
As a couple	1210 (40.91)	568 (38.04)	642 (43.82)
With children	1106 (37.39)	626 (41.93)	480 (32.76)
With friends	163 (5.51)	106 (7.10)	57 (3.89)
Others	309 (10.45)	132 (8.84)	177 (12.08)
COVID-19 related perceptions (only 2020)			
Has any characteristic of the visit changed due to the COVID-19 pandemic? (n, %)			
Yes	471 (32.15)		471 (32.15)
No	994 (67.85)		994 (67.85)
Valuation of COVID-19 prevention measures (mean, SD)	3.72 (1.05)		3.72 (1.05)

transport rose to 90%, followed by public transportation (8%) and plane (2%). Such shifts relate to the mentioned drop in international visitors and the result that most visitors in 2020 were Spanish and especially from neighboring regions accessible by car. In turn, the shifts also explain why the average duration of visits changed from 13 nights in 2019 to 21 in 2020 and why the percentage of visitors lodging in hotels dropped from 38% in 2019 to 23% in 2020, while the use of second residences increased from 23% to 51%. The shifts similarly impacted respondents' expenditure at the destination. In 2020, the proportion of visitors who spent less than €500 and especially less than €200 increased considerably.

Such changes, especially the change in the origin of visitors, were likely the primary drivers of the significant drop in the use of public transportation in 2020, because foreign visitors traditionally account for higher levels of transit ridership. However, the use of public transportation may have also decreased generally. To test that possibility, we compared the use of public transportation between Spanish and foreign visitors, and among our results, we observed that the use among Spanish visitors changed from 46.7% in 2019 to 33.2% in 2020 but varied from 60.8% to 47.6% among foreign visitors (values not reported in Table 1).

Regarding the factors related to the COVID-19 pandemic included in the 2020 survey, we observed that 32% of visitors in 2020 indicated that the pandemic had modified at least one characteristic of their visit, while the average evaluation of prevention measures at the destination was 3.72 out of 5.0.

The pandemic's impact on visitors' use of public transportation and whether they took excursions was confirmed by the results of the bivariate probabilistic models presented in Table 2. Those models were used to estimate the probability of using public transportation (**Model 1**) and of taking excursions within or around the destination (**Model 2**) in relation to an indicator for the survey year and considering the characteristics of visitors and their visits. The first notable result regarding the models was the high correlation between the two equations. As stated in the previous section, the high significance of the likelihood test for the rho parameter indicated a high correlation between the two equations and thus confirmed the need for a bivariate probabilistic model. Another major result revealed by the models was the effect of the survey year on both the probability of using public transportation and of taking excursions. On the one hand, we observed a significant negative association between the survey year (2020) and the use of public transportation within the destination (Coef. $= -0.334$, $p \leq 0.01$). On the other, we observed a similarly strong, significant negative association between the year 2020 and the probability of taking excursions (Coef. $= -0.374$, $p \leq 0.01$).

4.2. The impact of the COVID-19 pandemic on the determinants of public transportation use and excursions

In this section, we present the results of the bivariate probabilistic models that included an interaction term between each independent variable and the survey year. To ease the comprehension and comparability of the results, in Table 3 we include the coefficients associated with the survey year 2020 and each of the independent variables shown in Table 2 (i.e., in the column labeled "Without interaction") and present the coefficient of the interaction term together with the two previous variables (i.e., in the column labeled "With interaction").

After considering the interactions, we observed how the association between most factors and the use of public transportation remained unaltered from 2019 to 2020. We thus concluded that the effects associated with the great majority of variables remained stable despite the impact of the pandemic. Regarding the use of public transportation in particular, most variables remained significant after the interaction terms were included and showed no significant association between the interaction itself and the outcome. Such was the case, for instance, of both arriving at the destination via public transportation and plane, which showed consistently significant positive associations with the use of public transportation at the destination despite the pandemic's effects. Similarly, traveling from foreign countries other than France and the United Kingdom, staying at a second residence, traveling with friends, and reporting a midrange expenditure were also consistently associated with higher probabilities of using public transportation. Conversely, being a first-time visitor had a consistent significant negative association with transit use even after the pandemic.

We did, however, observe changes in some variables. First, when we included an interaction term between secondary level of education and the year 2020, we observed that the association between level of education and tourists' use of public transportation was not significant for 2019 (i.e., variable without the interaction), while the interaction showed a significant negative association. We thus concluded that the observed negative association found initially was significant in 2020 only. The second change identified refers to the duration of the visit and its impact on the use of public transportation. After including the interaction term, we observed how the number of nights spent at the destination continued to have a positive association with the probability of using public transportation, whereas the magnitude of the effect decreased in 2020 due to the pandemic. We also observed that reporting a low to midrange level of expenditure (i.e., €200–500) during the visit had a significant positive association with public transportation use in 2019 and a significant negative association in 2020. Last, in terms of public transportation use at the destination, we found that the interaction term of coming with children and the survey year had a significant positive association, which suggests that the variable had a positive association with transit use in 2020.

Table 2
Estimation of the bivariate probabilistic model for public transportation use and excursions associated with characteristics of individuals and of their visit, and with the impact of the COVID-19 pandemic.

Independent variables	Model 1: Public transportation use	Model 2: Excursions
	Coef. (Std. Error)	Coef. (Std. Error)
Impact of COVID-19		
Survey year (2020)	−0.334 (0.061)***	−0.374 (0.062)***
Individual characteristics		
Gender (Women)	−0.016 (0.049)	−0.126 (0.049)**
Age (10 years)	0.016 (0.096)	0.215 (0.096)**
Age (10 years) (squared)	0 (0)	−0.002 (0.001)***
Salaried or self-employed (Yes)	−0.123 (0.072)*	0.012 (0.073)
Education (Secondary) (Ref = Basic education)	−0.197 (0.064)***	0.085 (0.064)
Education (College) (Ref = Basic education)	−0.160 (0.069)**	0.154 (0.069)**
Origin (France) (Ref = Spain)	0.085 (0.082)	0.510 (0.088)***
Origin (United Kingdom) (Ref = Spain)	0.030 (0.140)	−0.095 (0.148)
Origin (Others) (Ref = Spain)	0.281 (0.115)**	0.628 (0.126)***
Visit characteristics		
Arriving by public transportation (Ref = Private veh.)	0.905 (0.094)***	−0.003 (0.092)
Arriving by plain (Ref = Private veh.)	0.852 (0.117)***	0.161 (0.129)
Frist time visiting the location (Yes)	−0.211 (0.074)***	0.093 (0.073)
Number of nights (10 nights)	0.035 (0.020)*	0.139 (0.021)***
Number of nights squared (10 nights)	0 (0)	0 (0)
Staying in a second home (Ref = Hotel)	0.304 (0.075)***	0.054 (0.073)
Staying in an apartment (Ref = Hotel)	0.080 (0.079)	0.256 (0.081)***
Staying at family's/friend's (Ref = Hotel)	0.073 (0.115)	0.184 (0.115)
Staying in a camping (Ref = Hotel)	−0.196 (0.115)*	0.179 (0.112)
Staying in other accommodation (Ref = Hotel)	0.387 (0.263)	0.216 (0.270)
Expenditure (200–500 €) (Ref = <200 €)	0.096 (0.078)	0.250 (0.078)***
Expenditure (500–1000 €) (Ref = <200 €)	0.271 (0.087)***	0.045 (0.086)
Expenditure (1000–5000 €) (Ref = <200 €)	0.507 (0.098)***	0.004 (0.098)
Expenditure (>5000 €) (Ref = <200 €)	0.163 (0.278)	0.221 (0.311)
Traveling as a couple (Ref = Traveling alone)	0.061 (0.111)	0.111 (0.112)
Traveling with children (Ref = Traveling alone)	−0.005 (0.116)	−0.029 (0.117)
Traveling with friends (Ref = Traveling alone)	0.271 (0.149)*	0.244 (0.152)
Traveling with others (Ref = Traveling alone)	0.003 (0.129)	0.224 (0.130)*
Model performance indicators		
Observations	2958	
rho	0.11 (0.031)	
Wald test for zero slopes	709.57***	
Likelihood ratio test for rho equal to zero	13.214***	

The outcomes in the bivariate probabilistic models can take two values, 0 or 1. The model is used to estimate two binary correlated outcomes, the use of public transportation at the destination and conducting at least one excursion during the visit. The significance test of the model has a positive outcome providing a $\alpha \leq 0.01$ probability of wrongly rejecting the null hypothesis. The likelihood ratio test for rho provides a significant result at $\alpha \leq 0.01$, indicating a strong correlation between the two equations. * p-value $\leq$0.1, ** $p \leq 0.05$, *** $p \leq 0.01$.

Regarding the probability of taking excursions, some determinants also remained unaltered during the pandemic. Such was the case of the positive association between the probability of taking excursions and having a college education, coming from France or foreign countries other than the United Kingdom, and staying exclusively in apartments. However, after including the interaction terms, we also observed a set of relevant changes in the associations previously observed for other variables. First, the association initially detected between gender and taking excursions vanished once the interaction was introduced. Second, the association between age and the probability of taking excursions remained significant even after the interaction with the survey year was included, although the magnitude of the effect slightly decreased in 2020 due to the pandemic. In the model, the effect of the survey year was also no longer significant, which suggests that the overall reduction in the probability of taking excursions in 2020 was mostly captured by the effect of age during the pandemic. Third, the association initially detected between staying in accommodations other than hotels, apartments, second residences, or family or friends' residences with the probability of taking excursions was significant during 2020 only, as indicated by the significant association of the interaction term. Last, we observed two significant changes in terms of expenditure. On the one hand, the association between having reported a low to midrange expenditure (i.e., €200–500) and the probability of taking excursions was statistically significant in 2020 only. On the other, whereas respondents who reported a midrange to high expenditure (i.e., €500–1000) were more likely to take excursions in 2019, that association was reversed in 2020.

4.3. Pandemic-related factors' associations with public transportation use and excursions

In this final subsection, we present the results of including perceptions of the COVID-19 pandemic as interaction terms in two additional models for each outcome (Table 4). First, we ran the model including the indicator reflecting a change in any characteristic of tourists' visits, including changes in their choice of destination, the duration of their visits, the mode of transportation that they used to access the CCD, the activities that they engaged in at the destination, and the type of accommodation (**Model 1**). Second, we adjusted the model by including an interaction term capturing the evaluation of COVID-19 prevention measures—for example, social distancing, hygiene measures, and limits on occupancy—at the destination (**Model 2**). In terms of public transportation use, respondents who reported that the pandemic had resulted in at least one change in the characteristics of their visit and who had higher evaluations of COVID-19 prevention measures were significantly less likely to use public transportation at the destination. Regarding excursions, whereas their likelihood was significantly higher for respondents who reported a higher evaluation of the prevention measures, no significant association related to changes in the characteristics of their stays arose. Additionally, whereas the coefficient attached to year 2020 did not substantially vary when the changes regarding the characteristics of their visits were added to the models, it dramatically changed when the evaluation of the prevention measures was included in Model 2. Indeed, the significant impact of the year 2020 on public transportation use was swept out, while the effect on excursions increased.

5. Discussion

In our study, we examined the impact of the COVID-19 pandemic on

Table 3
Comparison of the bivariate probabilistic estimation models with and without interactions between each independent variable and survey year.

	Public transportation use		Excursions	
	Without interaction	With interaction	Without interaction	With interaction
Model 1				
Survey year (2020)	−0.334 (0.061)***	−0.302 (0.075)***	−0.374 (0.062)***	−0.338 (0.076)***
Gender (Woman)	−0.016 (0.049)	0.019 (0.068)	−0.126 (0.049)**	−0.085 (0.072)
Interaction		−0.072 (0.098)		−0.078 (0.098)
Model 2				
Survey year (2020)	−0.334 (0.061)***	−0.552 (0.174)***	−0.374 (0.062)***	−0.023 (0.174)
Age (10 years)	0.016 (0.096)	−0.005 (0.097)	0.215 (0.096)**	0.256 (0.099)***
Interaction		0.050 (0.031)		−0.069 (0.032)**
Model 3				
Survey year (2020)	−0.334 (0.061)***	−0.452 (0.108)***	−0.374 (0.062)***	−0.192 (0.108)*
Age (10 years) (squared)	0 (0)	0 (0)	−0.002 (0.001)***	−0.002 (0.001)**
Interaction		0 (0)		0 (0)
Model 4				
Survey year (2020)	−0.334 (0.061)***	−0.228 (0.096)**	−0.374 (0.062)***	−0.408 (0.098)***
Salaried or self-employed (Yes)	−0.123 (0.072)*	−0.035 (0.094)	0.012 (0.073)	−0.016 (0.096)
Interaction		−0.156 (0.108)		0.048 (0.109)
Model 5				
Survey year (2020)	−0.334 (0.061)***	−0.254 (0.071)***	−0.374 (0.062)***	−0.411 (0.072)***
Education (Sec.) (Ref = Basic)	−0.197 (0.064)***	−0.082 (0.083)	0.085 (0.064)	0.029 (0.085)
Interaction		−0.222 (0.102)**		0.101 (0.101)
Model 6				
Survey year (2020)	−0.334 (0.061)***	−0.287 (0.070)***	−0.374 (0.062)***	−0.378 (0.071)***
Education (College) (Ref = Basic)	−0.160 (0.069)**	−0.089 (0.086)	0.154 (0.069)**	0.148 (0.089)*
Interaction		−0.144 (0.105)		0.011 (0.105)
Model 7				
Survey year (2020)	−0.334 (0.061)***	−0.367 (0.065)***	−0.374 (0.062)***	−0.378 (0.065)***
Origin (France) (Ref = Spain)	0.085 (0.082)	−0.009 (0.096)	0.510 (0.088)***	0.503 (0.105)***
Interaction		0.253 (0.169)		0.033 (0.181)
Model 8				
Survey year (2020))	−0.334 (0.061)***	−0.348 (0.062)***	−0.374 (0.062)***	−0.383 (0.062)***
Origin (UK) (Ref = Spain)	0.030 (0.140)	−0.022 (0.143)	−0.095 (0.148)	−0.131 (0.152)
Interaction		0.700 (0.413)*		0.490 (0.419)
Model 9				
Survey year (2020)	−0.334 (0.061)***	−0.321 (0.062)***	−0.374 (0.062)***	−0.368 (0.063)***
Origin (Rest) (Ref = Spain)	0.281 (0.115)**	0.335 (0.126)***	0.628 (0.126)***	0.656 (0.140)***
Interaction		−0.251 (0.240)		−0.124 (0.256)
Model 10				
Survey year (2020)	−0.334 (0.061)***	−0.347 (0.064)***	−0.374 (0.062)***	−0.355 (0.064)***
Arriving by PT (Ref = P. veh.)	0.905 (0.094)***	0.851 (0.123)***	−0.003 (0.092)	0.083 (0.123)
Interaction		0.121 (0.179)		−0.190 (0.177)
Model 11				
Survey year (2020)	−0.334 (0.061)***	−0.344 (0.062)***	−0.374 (0.062)***	−0.362 (0.063)***
Arriving by plain (Ref = P. veh.)	0.852 (0.117)***	0.823 (0.123)***	0.161 (0.129)	0.204 (0.136)
Inter		0.188 (0.246)		−0.243 (0.250)
Model 12				
Survey year (2020)	−0.334 (0.061)***	−0.335 (0.064)***	−0.374 (0.062)***	−0.372 (0.065)***
Frist time visitors (Yes)	−0.211 (0.074)***	−0.212 (0.083)**	0.093 (0.073)	0.099 (0.087)
Interaction		0.007 (0.154)		−0.017 (0.146)
Model 13				
Survey year (2020)	−0.334 (0.061)***	−0.267 (0.070)***	−0.374 (0.062)***	−0.363 (0.070)***
Number of nights (10 nights)	0.035 (0.020)*	0.079 (0.031)**	0.139 (0.021)***	0.143 (0.032)***
Interaction		−0.043 (0.022)**		−0.007 (0.023)
Model 15				
Survey year (2020)	−0.334 (0.061)***	−0.308 (0.062)***	−0.374 (0.062)***	−0.359 (0.063)***
Num. of nights (10) (Squared)	0 (0)	0 (0)	0 (0)	0 (0)
Interaction		0 (0)		0 (0)
Model 14				
Survey year (2020)	−0.334 (0.061)***	−0.341 (0.076)***	−0.374 (0.062)***	−0.443 (0.076)***
Staying in Sec. res. (Ref = Hotel)	0.304 (0.075)***	0.295 (0.097)***	0.054 (0.073)	−0.049 (0.098)
Interaction		0.015 (0.112)		0.175 (0.112)
Model 15				
Survey year (2020)	−0.334 (0.061)***	−0.364 (0.065)***	−0.374 (0.062)***	−0.380 (0.066)***
Staying in apart. (Ref = Hotel)	0.080 (0.079)	−0.013 (0.096)	0.256 (0.081)***	0.240 (0.103)**
Interaction		0.178 (0.143)		0.037 (0.145)
Model 16				
Survey year (2020)	−0.334 (0.061)***	−0.343 (0.063)***	−0.374 (0.062)***	−0.376 (0.064)***
Stay. at fam./fri. (Ref = Hotel)	0.073 (0.115)	0.010 (0.170)	0.184 (0.115)	0.165 (0.180)

(*continued on next page*)

Table 3 (*continued*)

	Public transportation use		Excursions	
	Without interaction	With interaction	Without interaction	With interaction
Interaction		0.107 (0.215)		0.030 (0.220)
Model 17				
Survey year (2020)	−0.334 (0.061)***	−0.336 (0.063)***	−0.374 (0.062)***	−0.373 (0.063)***
Stay.in camping (Ref = Hotel)	−0.196 (0.115)*	−0.205 (0.154)	0.179 (0.112)	0.192 (0.164)
Interaction		−0.021 (0.213)		−0.021 (0.209)
Model 18				
Survey year (2020)	−0.334 (0.061)***	−0.337 (0.061)***	−0.374 (0.062)***	−0.387 (0.062)***
Stay. in other (Ref = Hotel)	0.387 (0.263)	0.275 (0.404)	0.216 (0.270)	−0.524 (0.397)
Interaction		0.194 (0.524)		1.336 (0.550)**
Model 19				
Survey year (2020)	−0.334 (0.061)***	−0.226 (0.070)***	−0.374 (0.062)***	−0.476 (0.071)***
Exp. (200–500€) (Ref ≤200 €)	0.096 (0.078)	0.311 (0.104)***	0.250 (0.078)***	0.031 (0.106)
Interaction		−0.376 (0.119)***		0.345 (0.119)***
Model 20				
Survey year (2020)	−0.334 (0.061)***	−0.332 (0.066)***	−0.374 (0.062)***	−0.415 (0.067)***
Exp. (500–1000€) (Ref ≤200 €)	0.271 (0.087)***	0.277 (0.112)**	0.045 (0.086)	−0.077 (0.115)
Interaction		−0.011 (0.131)		0.211 (0.133)
Model 21				
Survey year (Ref = 2019)	−0.334 (0.061)***	−0.371 (0.064)***	−0.374 (0.062)***	−0.297 (0.065)***
Exp. (1 k–5 k€) (Ref ≤200 €)	0.507 (0.098)***	0.351 (0.132)***	0.004 (0.098)	0.426 (0.148)***
Interaction		0.259 (0.147)*		−0.651 (0.165)***
Model 22				
Survey year (2020)	−0.334 (0.061)***	−0.338 (0.061)***	−0.374 (0.062)***	−0.371 (0.062)***
Exp. (5000€<) (Ref ≤200 €)	0.163 (0.278)	−0.260 (0.533)	0.221 (0.311)	5.454 (5658.479)
Interaction		0.567 (0.610)		−5.35 (5658.479)
Model 23				
Survey year (2020)	−0.334 (0.061)***	−0.295 (0.074)***	−0.374 (0.062)***	−0.327 (0.074)***
Couple (Ref = Alone)	0.061 (0.111)	0.118 (0.126)	0.111 (0.112)	0.182 (0.128)
Interaction		−0.097 (0.101)		−0.116 (0.102)
Model 24				
Survey year (2020)	−0.334 (0.061)***	−0.412 (0.072)***	−0.374 (0.062)***	−0.389 (0.074)***
With children (Ref = Alone)	−0.005 (0.116)	−0.107 (0.128)	−0.029 (0.117)	−0.048 (0.130)
Interaction		0.205 (0.103)**		0.037 (0.103)
Model 25				
Survey year (2020)	−0.334 (0.061)***	−0.326 (0.062)***	−0.374 (0.062)***	−0.374 (0.063)***
With friends (Ref = Alone)	0.271 (0.149)*	0.323 (0.170)*	0.244 (0.152)	0.224 (0.178)
Interaction		−0.144 (0.224)		−0.002 (0.225)
Model 26				
Survey year (2020)	−0.334 (0.061)***	−0.314 (0.063)***	−0.374 (0.062)***	−0.397 (0.064)***
With others (Ref = Alone)	0.003 (0.129)	0.129 (0.158)	0.224 (0.130)*	0.075 (0.163)
Interaction		−0.224 (0.163)		0.244 (0.165)

All models are adjusted by all other independent variables. * p-value ≤0.1, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table 4
Estimation of bivariate probabilistic models including interactions between COVID-19 related factors and survey year.

	Public transportation use	Excursions
	Coef. (Std. Error)	Coef. (Std. Error)
Model 1		
Survey year (2020)	−0.288 (0.065)***	−0.394 (0.065)***
Changes due to COVID-19	−0.156 (0.077)**	0.070 (0.074)
Model 2		
Survey year (2020)	0.137 (0.140)	−0.964 (0.139)***
Valuation of COVID-19 prevention measures	−0.125 (0.033)***	0.155 (0.033)***

The variable 'changes due to COVID-19' can take two values 0 or 1. The variable 'valuation of the COVID-19 prevention measures' can take ordered values in the interval 1–5.

tourists' use of public transportation at a tourist destination, specifically the CCD, a coastal urban destination in Spain, and the determinants of such use. We compared the likelihood of being a public transportation user in 2019 and in 2020 in the area and explored how the pandemic may have modified the determinants of transit use among visitors. Among our results, we observed a clear drop in the use of public transportation associated with a similar reduction in visitors' mobility within the destination, analyzed in our study as the probability of taking excursions. We also observed how, with very few exceptions, the traditional determinants of tourists' use of public transportation at the destination generally remained unaltered during the pandemic. However, we did identify significant associations between a set of pandemic-related variables and visitors' transit use and spatial behavior.

The first major result of our study was that the share of public transportation use among surveyed visitors declined from 54.5% in 2019 to 34.6% in 2020—that is, by approximately 20 percentage points or a reduction of −36.5%. The COVID-19 pandemic's impact was confirmed when we included the year 2020 as a variable in bivariate probabilistic models examining the probability of being a public transportation user and of taking excursions, which revealed a significant negative association between the pandemic and both outcomes. The observed reductions in mobility and the use of public transportation were expected considering the reported behavioral intentions of visitors in relation to the pandemic in a recent study (Sánchez-Pérez, Terán-Yépez, Marín-Carrillo, Marín-Carrillo, and Illescas-Manzano, 2021).

Similarly, the relative decline that we observed in public transportation use (−36.5%) was within the range of reductions observed in studies on overall public transportation use in different contexts (i.e., 20–60%; Anke et al., 2021; Eisenmann et al., 2021; Jenelius and Cebecauer, 2020). In any case, whereas the reduction in transit use reported in the literature capturing everyday mobility may be explained by the overall reduction in population mobility together with the perceived risk of infection (Abdullah et al., 2021), the explanations for the reduced use of public transportation while on vacation may be significantly different. On the one hand, a possible explanation could relate to the reduction of international and especially long-range visitors, who in 2019 were more likely to use transit than domestic or short-range visitors, who mostly access and travel within the CCD via private transport (Miravet et al., 2021). On the other, mobility while on vacation may be more flexible in space and time than everyday mobility, meaning that contrary to day-to-day travel undertaken to access basic needs and services, mobility on vacation can be more easily modified. In that sense, visitors could not only have been likely to use alternative modes of transportation when possible but also to engage in activities that required less traveling or to avoid traveling to relatively distant locations. That outcome clearly aligns with the observed reduction in the probability of taking excursions during the pandemic, which had a significant reciprocal association with the likelihood of using public transportation.

Our study's second aim was to explore whether the determinants of tourists' use of public transportation had been altered during the pandemic. Overall, most of the individual- and visit-related factors associated with transit use at the destination in 2020 remained similar to those observed in 2019 and in previous years (Gutiérrez and Miravet, 2016; Miravet et al., 2021). For example, we observed how arriving at the destination via public transportation continued to be the chief factor of transit use at the destination and that long-range visitors, albeit few in number in 2020, continued to be more likely to use public transportation than domestic tourists and visitors from relatively nearby countries. The exceptions that we observed regarding changes during the pandemic concerned level of education, length of stay, midrange incomes, and traveling with children. Although interpreting each of those changes separately is challenging, it seems plausible that the alterations in the observed associations could be explained by the effect of the pandemic and by the change in the profile of visitors in 2020, who were more often local or regional and generally had a lower socioeconomic status and expenditure level than their counterparts in previous years. Concerning changes in the determinants of visitors' spatial behavior at the destination, the results observed for visitors' age are especially noteworthy. The likelihood of taking excursions in 2019 increased significantly as age increased; however, in 2020 the magnitude of the association was less, and the relationship between the survey year and the outcome lost its statistical significance in that iteration of the model. Those two results suggest that the overall reduced probability of taking excursions in 2020 could largely be explained by the reduced effect of visitors' age, which in relation to the probability of taking excursions in 2020 could be explained by a higher fear among older adults of contracting COVID-19 given their higher risk of developing severe COVID-19-related complications (Esai Selvan, 2020). We also observed similar changes in the likelihood of taking excursions in terms of visitors' expenditure compared with those observed for public transportation use, which again highlights their strong correlation.

Last, we observed how changes made in visitors' trips due to the COVID-19 pandemic and their evaluation of COVID-19 prevention measures at the destination negatively affected their use of public transportation. Moreover, in that iteration of the model, the association between survey year and the outcome was no longer significant, which suggests that most of the decline observed in the likelihood of using public transportation in 2020 can be explained by visitors' perceptions of COVID-19 prevention measures. A possible interpretation of that result is that respondents who reported a higher evaluation of such preventive measures were also ones who were generally more concerned with the spread of the virus. In turn, the result would imply that the previously reported association between fear of infection from airborne viruses and the reduced use of public transportation (Hotle, Murray-Tuite, and Singh, 2020) has also applied to tourists during the COVID-19 pandemic. Beyond that, we also found that the pandemic's negative impact on excursions was less among tourists who reported higher evaluations of the preventive measures. That result suggests that the pandemic's negative impact on excursions, although still relevant, was slightly lower among tourists who were more concerned with the spread of the virus (i.e., those who reported a higher evaluation of prevention measures). It is possible that those same respondents could have switched to using other modes of transportation for their excursions and thus been slightly less impacted by the pandemic in terms of their overall spatial behavior. A final consideration regarding the perception of risk of infection is that visitors who traveled at all during the first summer of the pandemic (i.e., 2020) are arguably less averse to risk of infection in general and thus had greater mobility and used public transportation more during their visit than individuals who perceived a greater risk of infection. However, that aspect could not be tested due to our study's design.

Our study is not exempt from considerations that can inform future examinations of the impact of the current and future pandemics on tourists' mobility. First, although we used survey results from two years, ours was a cross-sectional study and therefore no time-dependent causality can be directly interpreted from the associations found in the results. Second, the sample size for 2019 was smaller than expected, meaning that the estimations of Model 1 could have been biased. However, after including interaction terms between each independent variable and the survey year in a set of iterations of the model, we observed how the changes in the model's coefficients and their statistical significance generally remained unaltered. Last, a final particularity to highlight is that our study was conducted in the summer of 2020, a specific moment in the pandemic's evolution in Spain characterized by a lower but increasing incidence of the virus together with the first generalized vacation period in the country, which might limit its comparability to other stages of the pandemic.

6. Conclusion

We found that the COVID-19 pandemic has resulted in a significant decrease in tourists' mobility and use of public transportation at a summer coastal destination in Spain. We argue that the observed changes derive from the combination of a relative change in visitors' profile, the flexible nature of mobility while on vacation, and the perceived risk of contagion in enclosed spaces. However, aside from a few exceptions and pandemic-specific factors, most of the traditional determinants of mobility and public transportation use remained unaltered. That finding again highlights the relevance of the means of transportation used to access destinations in determining how visitors travel within destinations. Our results imply that the progress made by public transportation observed in urban tourist destinations in the past decade has likely been partially undone due to the COVID-19 pandemic. That development poses a significant challenge for local and regional authorities, considering not only the climate emergency that requires the promotion of sustainable tourism and mobility models but also the financial conditions needed to provide an efficient, reliable transit service.

In that light, the evidence generated by our study can inform the tourism sector as well as local authorities and transit agencies. On the one hand, the tourist sector, especially in urban areas, needs to put forth particular effort toward regaining tourists' trust in public transportation, especially because providing reliable public transit services benefits the overall attractiveness of destinations and helps to reduce the environmental impact of tourist activity there. That consideration is particularly relevant given that COVID-19 prevention measures aimed at promoting social distancing may have caused a spike in tourists' use of

private transport. On the other hand, the results have clear implications not only for tourist managers in preparation for future pandemics but also for transit agencies and local and regional authorities in urban areas, where visitors traditionally constitute a critical portion of the overall annual transit ridership and thus help to financially sustain the provision of transit options for visitors and residents alike. In turn, promoting public transportation both to access tourist enclaves and to travel within and around destinations needs to begin accounting for both the traditional sociodemographic and visit-related determinants of transit use and subjective factors such as the perceived safety of public transportation and potential changes in visitors' behavioral patterns due to the pandemic (Li, Zhang, Liu, Kozak, and Wen, 2020).

Given the results of our study, the agenda for future studies is also clear. More research is needed to assess the impact of the COVID-19 pandemic on tourists' use of public transportation in other geographic contexts, especially ones with different levels of transit services on offer and/or that have experienced different degrees of and changes in COVID-19 incidence. Future studies should also pay particular attention to the relationship between the perception of risk among visitors and their use of public transport, which we could not entirely capture in our study. In that sense, qualitative methods such as in-depth interviews and focus groups would be particularly suitable to exploring transit use and the perceived risk of infection among both travelers and people who did not travel in 2020 due to the fear of contagion, as well as to evaluate the overall experience of traveling during the pandemic in general. Last, the results of our analysis suggest two new areas for research. For one, studies conducted in the midterm should evaluate the effectiveness of measures implemented during the pandemic to mitigate the decline in public transport use in tourist destinations and urban areas overall. As for the other, researchers need to evaluate the extent to which the observed changes in mobility patterns and public transportation use among visitors persist into the post-pandemic era, as well as assess what actions are taken in the mid- and long term to return to pre-pandemic levels of public transportation use.

CRediT authorship contribution statement

Xavier Delclòs-Alió: Conceptualization, Writing – original draft. **Aaron Gutiérrez:** Conceptualization, Writing – review & editing. **Daniel Miravet:** Methodology, Formal analysis, Writing – review & editing. **Josep Tomàs-Porres:** Formal analysis, Writing – review & editing. **Guillem Vich:** Conceptualization, Writing – review & editing. **Salvador Anton Clavé:** Supervision, Writing – review & editing.

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Appendix A. Supplementary data

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