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Impact of COVID-19 on tourism demand in European regions - An analysis of the factors affecting loss in number of guest nights

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A R T I C L E I N F O

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A B S T R A C T

The outbreak of COVID-19 in 2020 had a major impact on the European tourism sector, with substantial variations recorded between regions. To build a more resilient tourism ecosystem, a deeper knowledge of the factors underscoring tourism demand loss is necessary. However, research is still limited to country-specific case studies. In this paper, we investigate COVID-19's impact on tourism demand in EU-27 and EFTA countries at the NUTS2 level during the pandemic's first year. Through a fractional response model we find (1) higher losses of tourism demand in urban destinations and in destinations highly dependent on foreign tourism, (2) lower losses in domestic destinations, in proximity, or that have natural assets. Recommendations to build a more resilient tourism ecosystem are outlined.

1. Introduction

The outbreak of COVID-19 interrupted a long period of sustained tourism growth worldwide. In Europe, one of the most popular tourist destinations (UNWTO, 2018), the spread of the virus started on 21 February 2020, with the first documented positive case detected in Italy (Cerqua & Di Stefano, 2022). In response, European governments adopted restrictive travel and health measures to contain its spread. These measures ranged from personal health protections such as social distancing, contact tracing, travel and mobility restrictions, to full-blown lockdowns (Burns et al., 2020; Collins-Kreiner & Ram, 2021; Seyfi, Hall, & Shabani, 2020). The tourism sector experienced immediate and unprecedented disruption. According to Eurostat data, the percentage of guest-nights fell by 50% overall in the EU-27 in 2020, although with important country variations (e.g., Cyprus: −79%, Netherlands: −31%).

Fig. 1 shows the average trend in terms of the strictness of the various government policies adopted in relation to COVID-19 in the EU-27 Member States during 2020. The trend is based on the stringency index, developed by the Oxford Coronavirus Government Response Tracker project: a composite measure of nine response metrics ranging from 0 to 100, where a higher score indicates a stricter response (Hale et al., 2021). The curve increased rapidly and reached a peak of 80 in April 2020, implying an almost immediate and complete halt in tourism activity during the pandemic's first phase. From April onwards, the measures started to gradually ease to levels below 50 in the summer season, followed by an increase in the last quarter of the year. Despite the overall strong impact of the COVID-19 restrictions in the tourism activity, their effect was temporally and spatially heterogeneous, with marked differences across countries and regions (European Commission, 2020).

Research about the impact on tourism demand at the regional level in the EU-27 is emerging, but, at the time of writing, it remains limited to a handful of case studies, namely for Croatia (Mikulić, Keček, & Žajdela Hrustek, 2022; Payne, Gil-Alana, Mervar, & Goenechea, 2022), Czech Republic (Vaishar & Šťastná, 2022), France (Falk, Hagsten, & Lin, 2022a), Spain (Duro, Perez-Laborda, Turrion-Prats, & Fernández-Fernández, 2021), Poland (Gierczak-Korzeniowska, Szpara, & Stopac, 2021) and Portugal (Carvalho, Peralta, & Pereira dos Santos, 2022). These studies indicate that urban destinations, and those relying on a high share of international tourists, were exposed to stronger demand losses. Nevertheless, the applicability of the findings from those studies to other countries is potentially constrained by country-specific travel restrictions.

There is a dearth of research to provide a deeper understanding of the complex dynamics underlying demand loss due to the COVID-19 shock at the regional level in a comprehensive, multi-country context. Filling this gap in the literature would support the formulation of adequate

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policies at international level, such as in the European Union (EU), where the importance of increasing the resilience of the tourism ecosystem was highlighted in the Transition Pathway for Tourism (European Commission, 2022) and in the European Agenda for Tourism 2030 (Council of the European Union, 2022). This agenda acknowledges the growing need for research and knowledge about tourism dynamics in the EU.

This study contributes to understanding the interplay between various factors on the impact of the pandemic on tourism demand in Europe, at regional level, to identify vulnerabilities and support future decision and policy-making, towards a more resilient tourism. In particular, we (i) explore the geographical distribution of loss in number of guest-nights at the height of the COVID-19 crisis in 2020 at the regional level in 31 countries, covering EU-27 and the 4 countries from the European Free Trade Association (EFTA), (ii) assess the determinants of demand loss in the sub-set of EU-27 regions and (iii) provide recommendations for tourism management. Although the pandemic continued beyond 2020, the analysis is limited to 2020 to focus on the impact of the shock and avoid confusion with the recovery phase.

The article is structured as follows: In section 2, we provide a review of studies related to the impact of disasters and, specifically, the COVID-19 pandemic on the tourism sector at the regional level. In section 3, we describe the materials and methods employed in this study. In section 4, we analyse the results with a focus on the spatio-temporal distribution of loss in number of guest-nights and their determinants. In sections 5 and 6, we discuss the results and conclude with implications for tourism management and directions for future research.

2. Literature review

Tourism demand is sensitive to environmental and socio-economic events (Sharpley, 2005), from natural disasters (e.g., earthquakes, tsunamis, flood, volcanic eruptions) (Rosselló, Becken, & Santana-Gallego, 2020), to terrorism (Hanon & Wang, 2020) to economic, financial (Prideaux, Laws, & Faulkner, 2007), political (Hanon & Wang, 2020), and epidemiological crises (Kuo, Chen, Tseng, Ju, & Huang, 2008; McAleer, Huang, Kuo, Chen, & Chang, 2010; Miller & Ritchie, 2003; Tarlow, 2009). The best known pre-COVID-19 health crises in the recent years were relatively localized events. Nonetheless, crises related to SARS, MERS, and Ebola recorded substantial impacts on tourism demand in the affected countries (Kuo et al., 2008; McAleer et al., 2010), where higher number of cases lead to a stronger impact on international tourist arrivals in the short and long run (McAleer et al., 2010).

COVID-19, with its high infection rates implied immediate consequences for both European tourism demand and supply (Burns et al., 2020; Collins-Kreiner & Ram, 2021; Uğur & Akbıyık, 2020; Zheng, Luo, & Ritchie, 2021). On the demand side, the fear of contagion led to a significant decrease in tourist activity. A text mining analysis of TripAdvisor's platform revealed that 40% of the comments in the period between December 30, 2019 and March 15, 2020 referred to trip cancellations, with many cancellations occurring on the same day that news of the outbreak was reported (Uğur & Akbıyık, 2020). On the supply side, mobility restrictions and border closures imposed by national authorities made it difficult for destinations to welcome tourists (Burns et al., 2020; Collins-Kreiner & Ram, 2021).

At the regional level, the impact of COVID-19 on tourism was assessed mostly in single countries, whereas Falk, Hagsten, and Lin (2022b) investigated the regional dimension in a multi-country setting, comparing Austria, Germany, Switzerland and the Czech Republic. All studies indicate a general tendency towards higher losses for regions with a high dependence on foreign tourism, a rediscovery of rural areas and predominance of domestic tourism during the pandemic.

Specifically, in Portugal, Carvalho et al. (2022) showed that COVID-19 hit urban and central municipalities more severely than rural destinations. In Spain, studies by Duro et al. aimed at identifying factors influencing regional vulnerability and resilience in the context of COVID-19. They found that tourism dependency, market structure, the supply of rural accommodation, and the health incidence of the pandemic were factors affecting tourism vulnerability (Duro et al., 2021; Duro, Perez-Laborda, & Fernandez, 2022). In Croatia, the results from Mikulić et al. (2022) and Payne et al. (2022) demonstrated that the decrease in foreign tourist arrivals, due to COVID-19 travel restrictions, resulted in a significant decline in economic activity for the Adriatic region as compared to the more industrial-oriented, continental Croatia. In the Czech Republic, destinations focused on foreign tourism

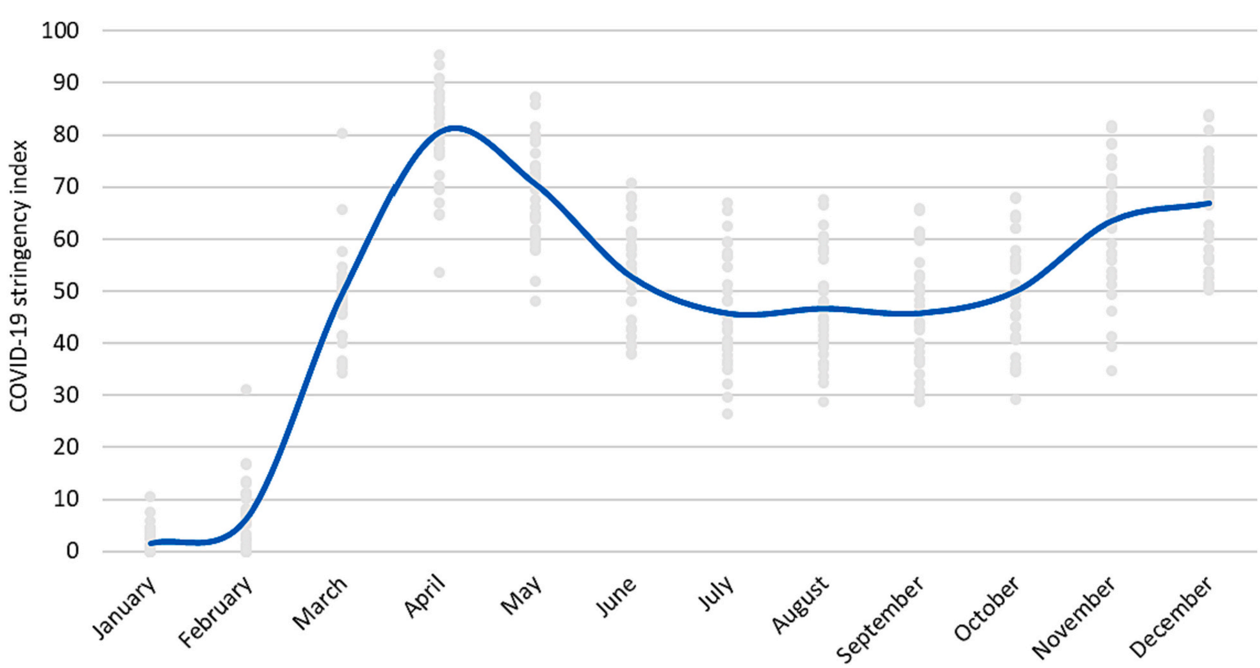

Fig. 1. Average stringency index in 2020 for EU-27 Member States (grey dots) and EU-27 average (blue line), by month. Data from https://ourworldindata.org/grapher/covid-stringency-index?time=2022-04-12&region=Europe, authors' elaboration. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

underperformed compared to rural regions, which represented a valid alternative for tourism, owing to natural, gastronomic and local attractions (Vaishar & Šťastná, 2022). In France, regions with lower economic activity were attractive for domestic tourism, at odds with previous trends, with coastal regions and regions surrounded by national parks recording a larger growth in domestic overnight stays (Falk et al., 2022a). A survey conducted in Poland showed high preferences for nature-related travel, active tourism, and trips aimed at health recovery (Gierczak-Korzeniowska et al., 2021). Consequently, higher tourism demand was recorded in rural areas, which are usually not associated with tourism, in contrast to higher losses in cities. In Slovakia, an increase in tourism interest was registered in alpine areas (Šambronska, Mrkvova, Matušíková, Dudić, & Parajka, 2021). The multi-country study conducted in 65 regions in Austria, Germany, Switzerland and the Czech Republic showed a decrease in the number of domestic overnight stays in densely populated regions. This contrasted with a surge in interest and demand for sparsely populated areas compared with the previous year (Falk et al., 2022).

While these studies deliver valuable insights about region-specific characteristics associated with tourism demand loss variability, the country-specific travel restrictions prevent the extrapolation and inference of these results to the other European countries. The absence of a study adopting a consistent methodology at the EU level limits confidence on common approaches for policy intervention with regard to future preparedness and for building tourism resilience. An in-depth understanding of the factors affecting regional tourism vulnerability to COVID-19 in a multi-country context is proposed and attempted herein.

3. Materials and methods

Research was conducted in the EU-27 and 4 EFTA countries. We described, mapped the impact of COVID-19 on tourism demand on 31 countries, while conducted an econometric analysis to estimate the impact of different regional factors on tourism demand loss. The econometric analysis was only conducted on the 27 EU countries due to data limitations.

The units of analysis were the NUTS2 regions (version 2016).[1] The NUTS2 level of classification offers the most granular geographic scale unit with available data on tourism demand in the covered countries. The dependent variable is the relative loss in the number of guest-nights in 2020 vs 2019. We selected relative loss instead of relative changes due to (1) our interest in the formulation of policies aimed at reducing the impact of demand shocks and their economic consequences and (2) the very limited number of regions with overall gains in tourism demand in 2020 and their small tourism sector.

3.1. Econometric model

Relative losses are expressed as a continuous variable in the interval from 0 to 1, where 0 identifies destinations without loss in number of guest-nights, with the maximum value of 1 reflecting a loss in tourism demand of 100%, as per Eq. (1).

$$y_i \in [0,1] = \begin{cases} 0 \; for \; NS_{i,2020} \geq NS_{i,2019} \\ 1 - \dfrac{NS_{i,2020}}{NS_{i,2019}} \; for \; NS_{i,2020} < NS_{i,2019} \end{cases} \tag{1}$$

Here, y_i, relative loss hereafter, represents the loss in number of guest-nights for a tourism destination i (i.e., NUTS2 region) and NS denotes the nights spent, measured for each destination i for the years 2019 and 2020.

To analyse the determinants of the relative loss, we used a two-part fractional response model (frm) (Ramalho, Ramalho, & Murteira, 2011), which allows conducting econometric analysis for response variable in the [0,1] interval. Other generalised non-linear models were used, with the final choice being the fractional response model due to higher model fit (see Table A.1 in Appendix). The parts of the two-part fractional response model consisted of a first binary component (B in Eq. (2)) indicating if a region recorded a loss in number of guest-nights (y_i>0) or not (y_i=0), and a subsequent fractional component (F), capturing the heterogeneity in the relative loss ($y_i \in (0,1]$). The expected value of the relative loss was defined in Eq. (2).

$$E(y_i|X_i) = B(X_{Bi}\beta_B)\cdot F(X_{Fi}\beta_F) \tag{2}$$

The first part B involved the use of a binary logit model (Eq. (3)), with a dichotomous dependent variable where "0" identifies destinations without loss in nights spent, and "1" destinations recording a loss. The probability of being "0" or "1" depends on a linearly addictive function based on a set of variables X_{Bi} whose impact is defined by the parameters β_B. This is estimated by maximum likelihood.

$$B(X_{Bi}\beta_B) = \frac{e^{X_{Bi}\beta_B}}{1 + e^{X_{Bi}\beta_B}} \tag{3}$$

The second, fractional part F is estimated through a Generalised Linear Model (GLM). The expected value of the fractional component ∈ (0,1] depends on a linearly addictive function based on a set of variables X_{Fi} whose effect on the relative loss is defined by the parameters β_F. In our model, a loglog link function (Eq. (4)) has been used for the fractional part F, according to the best fit (see Table A.1 in Appendix). This is estimated by Bernoulli-based quasi-maximum likelihood.

$$F(X_{Fi}\beta_F) = e^{-e^{-X_{Fi}\beta_F}} \tag{4}$$

Note that the estimates obtained in modelling the component F would be the same obtained by a one-part model, or a Generalised Linear Model (GLM) conducted only on the regions with a relative loss higher than 0. We considered a two-part approach to obtain further information on the systematic differences between regions recording losses or gains.

3.2. Variable selection and data sources

3.2.1. Dependent variable

The dependent variable was calculated as in Eq. (1) using data retrieved from Eurostat's experimental dataset on "Collaborative economy platforms".[2] This dataset records the number of nights spent in holiday and short-stay accommodations booked via four different platforms: Airbnb, Booking.com, TripAdvisor, and Expedia. This dataset was considered as an alternative to official data on nights spent in accommodations, which were unavailable at NUTS2 level at the time of writing. A comparison of nights spent reported in both datasets at country level shows a Pearson correlation of 0.91 and 0.86 for 2019 and 2020, respectively, indicating a good approximation of the experimental dataset to the official data on accommodations.

3.2.2. Independent variables

In the specification of the components B and F in Eq. (2), we considered five categories variables: socio-economic control variables, COVID-19 restriction, territorial typology, tourism characteristics and geographic controls. The selection of the explanatory variables was governed by three main criteria: evidence from related studies; the inclusion of a control variable for the travel restrictions; the exploration of

[1] NUTS (Nomenclature of Territorial Units for Statistics) is the Eurostat's official regional subdivision for collection and reporting of statistical data. It is structured in four hierarchical levels, from NUTS-0 (countries) to NUTS-3 (subregions).

[2] https://ec.europa.eu/eurostat/web/experimental-statistics/collaborative-economy-platforms

additional variables characterising tourism demand that could be correlated with travel demand loss. The full list of variables is provided in Table 1, followed by a detailed description and reason for their inclusion. We did not include more specific epidemiological variables (e.g., number of reported COVID-19 cases and deaths) due to inconsistent reporting across countries (Simon, 2021). However, indirect information regarding the epidemiological situation is included through the restriction control variable.

Table 1
Independent variables and data sources.

Variable name	Type	Description	Year	Source
Socio economic control				
Population	Continuous	Total population in the region	2020	Eurostat
Population density	Continuous	Population per sq. km in the region	2020	Eurostat
GDP per capita	Continuous	GDP per capita in the region	2020	Eurostat
COVID-19 restriction control				
Weighted stringency index	Continuous	COVID-19 stringency index	2020	Own calculation (Eq. (5))
Territorial typology				
Destination type	Categorical	Indicates if a region is classified as Coastal, Rural, City, Urban Mix or Nature/Mountain.	2019	Own calculation based on Batista e Silva, Barranco, Proietti, Pigaiani, and Lavalle (2021)
Tourism characteristics				
Tourism density	Continuous	Tourists per sq. km in the region	2019	Own calculation based on Eurostat data
Tourism demand catchment	Continuous	Potential demand with land accessibility to the region	2019	Own calculation (Eq. (6))
Share of foreign tourists	Continuous	Percentage of foreign arrivals in the region	2019	Eurostat
Tourism diversity	Continuous	Indicate the diversity of the tourism typologies within a region	2019	Own calculation (Eq. (7))
Tourism intensity	Continuous	Number of tourists per resident	2019	Eurostat
Seasonality	Continuous	Coefficient of seasonal variation, higher coefficient, higher seasonality in the region.	2019	(Bender, Schumacher, & Stein, 2005)
Intensity x Seasonality	Continuous	Tourism intensity by month weighted per the share of annual demand in the specific month.	2019	Own calculation based on Batista e Silva et al. (2018) (Eq. (8))
Geographic control				
Country	Categorical	Control for systematic country effect	2020	
Geographic macro areas (East, West, South, North)	Categorical	Indicates if a region belongs to Northern, Western, Southern or Eastern Europe.	2020	EuroVoc definition (Publications Office of the European Union, 2022)

Socio-economic controls:

- **Population** is a control variable retrieved from Eurostat used as control for the demographic size of the regions.
- **Population density** is a control variable retrieved from Eurostat. From previous studies, people tried to avoid congested places (Carvalho et al., 2022; Duro et al., 2021; Park, Kim, Kim, Lee, & Giroux, 2021; Santos & Oliveira Moreira, 2021), so that population density and tourism density are used as proxies to determine the level of expected congestion.
- **GDP per capita** is a control variable retrieved from Eurostat used as a proxy of economic conditions of the destination. It is an attempt to control for price, a relevant variable for destination choice for which there is no information at the NUTS2 level.

COVID-19 restriction control:

- The **weighted stringency index** is a control variable for travel restrictions constructed by weighting the monthly average Oxford stringency index at country level (Hale et al., 2021) by the monthly proportion of tourist demand at NUTS2 level in 2019 (Eq. (5)). Having no regional control for travel restrictions, this variable is proposed to regionalise country-level travel restrictions.

$$WSI_i = \sum_{t=1}^{12} SI_{ct,2020} * \frac{NS_{it,2019}}{NS_{i,2019}} \quad (5)$$

where.
WSI_i = weighted stringency index of tourism destination i;
$SI_{ct,2020}$ = monthly average of Oxford stringency index in the country c of tourism destination i in month t of the year 2020;
$NS_{it,2019}$ = nights spent in tourism destination i in month t of 2019;
$NS_{i,2019}$ = nights spent in tourism destination i in 2019.
Typology control:

- **Destination typology** is a categorical variable, used to investigate if the relative loss depends on the predominant type of tourism of each region. EU regions are classified according to the predominant type of tourism, including: city tourism, coastal tourism, mountains and nature tourism, rural tourism and mixed tourism. The classification of regions is based on the location of tourism accommodation establishments in relation to geographic features inside regions such as cities, coast, mountains or protected areas (Batista e Silva et al., 2021).

Tourism characteristics:

The destination-specific tourism characteristics are indicators used to describe the tourism demand in regions. They are calculated on 2019 data, the closest available year before the pandemic hit, to better capture the initial conditions just prior to COVID-19. Data of nights spent used to calculate some indicators are retrieved from Eurostat.

- **Tourism density** is calculated by dividing the number of nights spent at tourist accommodations by the surface area of the region. From previous studies, people tried to avoid congested places (Carvalho et al., 2022; Duro et al., 2021; Park et al., 2021; Santos & Oliveira Moreira, 2021), so that population density and tourism density are used as proxies to determine the level of expected congestion.
- **Tourism demand catchment** is an indicator of proximity tourism potential for each destination. As a consequence of restrictions on airline companies, this variable was included in order to measure the potential tourism demand in a distance range that is attractive in the absence of flights (Yin, Bertolini, & Duan, 2015). The indicator is

expressed in millions of inhabitants and is calculated as an inverse distance weighted of the number of inhabitants within a radius of 800 km from the border of each NUTS2 region,[3] as follows in Eq. (6).

$$Q_i = \sum_j \frac{Q_{ij}}{(d_{ij}+1)} \tag{6}$$

where.

Q_i = tourism demand catchment for tourism destination region i.

Q_{ij} = no. of inhabitants found at a distance band j from region i (distance bands from 0 to 800 km, spaced in 50 km). This was done using GIS overlays between buffer bands and the JRC-GEOSTAT population grid 2018 at 1 km resolution.[4] Cross-country border population is included.

d_{ij} = distance between region i and band j, measured in hundred km. When $i = j$, d is set to 0. This permits that the whole population of region i be counted as part of the tourism demand catchment.

- **Share of foreign tourists** is the percentage of nights spent by foreign tourists in relation to total nights spent in each tourism destination. It has been included given the higher than expected impact of air-travel restrictions and border controls on foreign tourism compared to domestic, as shown also in previous studies (Falk et al., 2022; Falk et al., 2022a; Vaishar & Šťastná, 2022).
- **Tourism diversity** is an indicator of the diversity of the tourism supply, based on the relative presence of tourism accommodations across four geographical zones within a NUTS2 region: cities, coastal areas, natural or mountainous areas, and rural areas. It is calculated by the inverted ratio between the standard deviation of the accommodation distribution across geographical zones within each region and a constant, k, corresponding to the theoretical maximum standard deviation (assuming tourist accommodations are all located in one single geographical zone), as expressed in Eq. (7).

$$TD_i = 1 - \frac{std.dev\ (share\ of\ tourism\ accommodation\ in\ geographical\ zones)_i}{k} \tag{7}$$

- **Tourism intensity** is a proxy for the region's economic dependence on tourism (Batista e Silva et al., 2018) as well as an indicator of a destination's attractiveness (Pavković, Karabašević, Jević, & Jević, 2021). It is calculated by dividing the number of nights spent at tourist accommodations by the resident population.
- **Seasonality** is an indicator of concentration of tourism demand during the course of a year (Bender et al., 2005), which might strongly affect the relative loss in case of a health crisis during peak demand. It is calculated as the coefficient of variation of monthly nights spent in each region (Bender et al., 2005).
- **Intensity x Seasonality** is an indicator of the susceptibility of a region in case of shocks or disruptions in the tourism sector (Batista e Silva et al., 2018). It is calculated by weighting the monthly tourism intensity using the share of annual tourism demand generated in the specific month as the weighting coefficient as in Eq. (8).

$$IxS_i = \sum_{t=1}^{12} TI_{it,2019} * \frac{NS_{it,2019}}{NS_{i,2019}} \tag{8}$$

where:

IxS_i = intensity per seasonality index of tourism destination i;

$TI_{it,2019}$ = tourism intensity of tourism destination i in month t of 2019;

$NS_{it,2019}$ = nights spent in tourism destination i in month t of 2019;

$NS_{i,2019}$ = nights spent in tourism destination i in 2019.

Geographic controls:

- **Country** is a control for the systematic country effect.
- **Macro areas** is a control for the geographical macro-regions based on EuroVoc classifications (Publications Office of the European Union, 2022). The EuroVoc classification includes Northern countries (Sweden, Finland, Denmark, Estonia, Latvia, and Lithuania), Southern countries (Italy, Spain, Portugal, Malta, Cyprus, and Greece), Eastern countries (Poland, Romania, Slovenia, Slovakia, Czech Republic, Bulgaria, Croatia and Hungary) and Western countries (Austria, France, Germany, Netherlands, Belgium, Luxembourg and Ireland).

All the variables were included in the component F. In the final specification of the component B, a subset of variables was used, due to the impossibility of estimating a number of parameters higher than the degrees of freedom (corresponding to regions not recording losses). A forward selection of significant variables has been applied to obtain the final specification, which comprehends destination typology, share of foreign tourists and tourism diversity (Table A.3 in Appendix).

4. Results

4.1. Loss of guest-nights: descriptive statistics and geographical distribution

The number of guest-nights decreased in 2020 in relation to 2019 in 93% of the NUTS2 regions of the EU-27 and EFTA countries, with an average relative loss of 0.34 (i.e., 34% drop in nights spent) and a maximum of 0.79 (Table 2, Table A.1 in Appendix, Fig. 2).

Fig. 2 shows the geographical distribution of the relative loss. The few regions coloured in yellow witnessed no loss in guest-nights. The relative loss (regions in red tones) has a marked spatial dependence, with the highest relative loss being recorded on islands (e.g., Iceland, Cyprus, Azores and Balearic islands), capital city regions (e.g., Madrid, Lisbon, Dublin and Rome) and regions in southern countries (e.g., Campania and Veneto in Italy, Cataluña in Spain, Macedonia and Western Thrace in Greece).

The statistical distribution of the relative loss is asymmetric and moderately left skewed, indicating a higher frequency of relative loss below 0.5 (Fig. A.1 in Appendix). The relative loss presents a heterogeneous distribution over the four quarters (Table 2, Fig. 3, Fig. A.2), following the waves of contagion of COVID-19.

Regions of countries first hit by the pandemic (e.g., Italy, Spain), and islands, had the highest loss in guest-nights in Q1. In Q2 all the countries

Table 2
Descriptive statistics of the dependent variable in the NUTS2 regions.

	2020	2020. Q1	2020. Q2	2020. Q3	2020. Q4
Ratio of annual demand in 2019	100%	12%	25%	45%	17%
Regions with demand loss	217	72	232	152	222
Percentage of regions with demand loss	93%	31%	99%	65%	95%
Relative loss					
Mean	0.34	0.03	0.69	0.23	0.47
Median	0.33	0.00	0.71	0.17	0.50
Max.	0.79	0.43	0.97	0.81	0.94
Total number of regions	233				

[3] The 800 km distance is considered as the limit threshold of short-haul flights (Gössling, Humpe, & Bausch, 2020) in which there are attractive alternative means of transport compared to flights (Yin et al., 2015).

[4] https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/population-distribution-demography/geostat

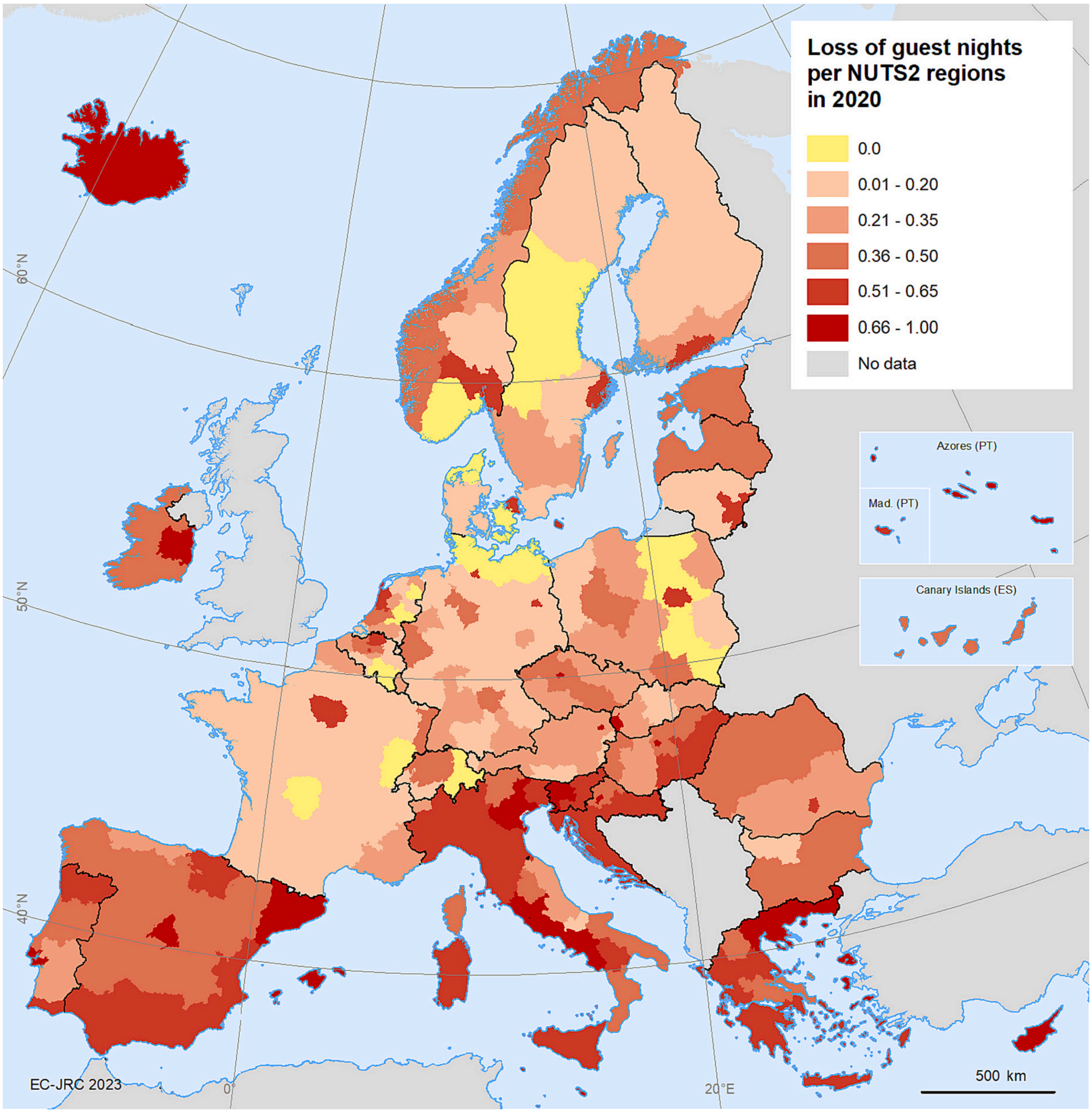

Fig. 2. Relative loss in guest-nights in 2020 vs 2019, by NUTS2 (from 0 = no loss in guest-nights, to 1 = 100% of guest-nights lost in 2020 vs 2019.

were hit strongly, with a moderate loss in guest-nights recorded only in some regions in Finland, Germany, Poland and Sweden. In Q3, regions from southern and eastern countries presented a higher loss in guest-nights, while in Q4 (second COVID-19 wave), a higher loss in guest-nights was registered in several regions, except for most of Sweden. Notably, the regions of some capital cities (e.g. Paris, Madrid, Dublin, etc.) presented the highest relative loss of the respective country for all the quarters.

4.2. Econometric analysis

Before conducting the econometric estimation, we analysed the correlations across independent variables and carried multi-collinearity tests. Analyses of correlations across the independent variables is shown in Table A.2 in Appendix. The highest correlation is between tourism density and population density. The highest variance inflation factor (VIF) value in the multi-collinearity tests is 7.5, which indicates the absence of collinearity issues. Therefore, all the proposed variables were included in the model. We tested different estimations methods (OLS, GLM, one-part frm and two-part frm), link functions (logit, probit, loglog, cloglog) and specifications to obtain the final model. The best fit was obtained using a logit link function for the binary component, and a loglog link function for the fractional component. Results of other models are reported in Table A.1 in Appendix. The final two-part fractional response model was obtained through the *frm package* in R (Ramalho, 2015), with the binary component separating the regions with relative losses higher than 0 from those without losses in guest-nights, and the fractional component identifying the factors explaining the heterogeneity of the relative loss.

The binary component of the model highlights that a low share of foreign tourists, low tourism diversity and destination type rural are common factors across the regions without loss in guest-nights (Table A.3 in Appendix). As for the fractional component, the results of four different specifications are shown in Table 3. In model 1 we conducted the analysis using COVID-19 restrictions, socio-economic controls and country fixed effects. In model 2, we added destination typology and tourism indicators as regressors. The normal distribution of the errors was rejected by the Shapiro-Wilk test, indicating a

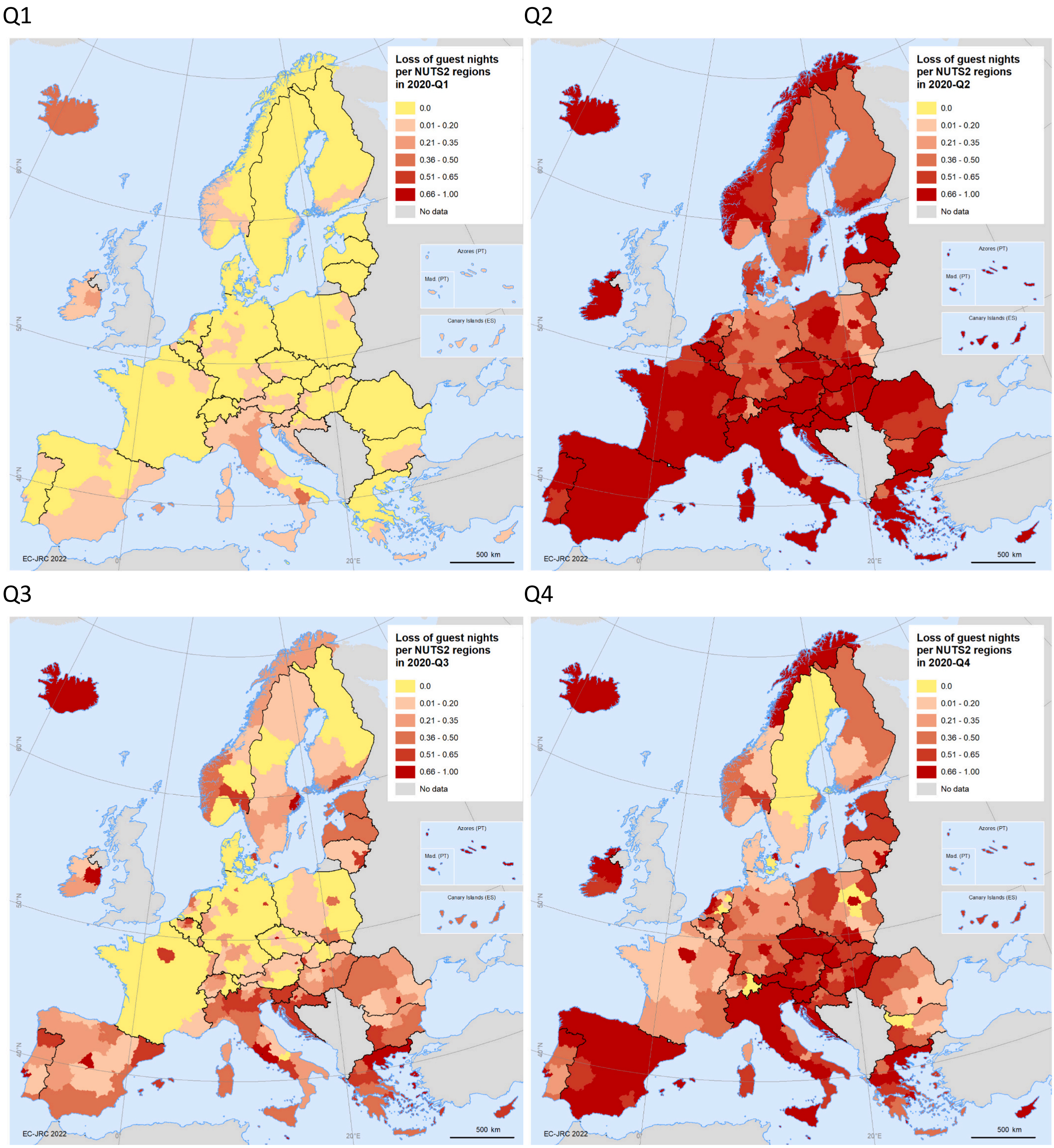

Fig. 3. Relative loss in guest-nights in 2020 vs 2019, by NUTS2 and per quarter.

misspecification of the model. Therefore, in model 3, we replaced the country fixed effect with geographic controls for Eastern, Southern and Northern Europe, taking Western Europe as the reference, which resulted in a normal distribution of the error terms. Finally, in model 4, we added the Intensity x Seasonality indicator.

The results show that the weighted stringency index, the economic control variables and country fixed effects explain 76.1% of the variation in the regions' relative loss in guest-nights. The addition of tourism indicators and destination type increase the R-square by 5.5 percentage points, for a total of 81.6%. Higher weighted stringency index, population and GDP per capita are associated with a stronger impact on tourism demand (i.e., higher relative loss). Geographic controls show that the demand shock in Southern and Eastern Europe was stronger too.

Regarding destination typology, cities and urban mix destinations recorded a stronger loss in guest-nights compared to coastal areas. Coastal and nature/mountain are the typologies with the lowest relative loss. Rural destinations had a higher relative loss than that of coastal areas, but this is significant only in the model without country dummies, suggesting the effect of rural typology across countries, but not within. Therefore, countries with predominance of rural regions recorded a

Table 3
Estimation results of the fractional response model (fractional component). Effect on the relative guest-night loss in 2020.

	Model 1		Model 2		Model 3		Model 4	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
Socio-economic control								
Population	0.007***	(0.002)	0.005***	(0.001)	0.004***	(0.001)	0.004***	(0.001)
Population density	<0.001***	(<0.001)	<0.001**	(<0.001)	<0.001	(<0.001)	<0.001	(<0.001)
GDP per capita	0.023***	(0.003)	0.014***	(0.003)	0.009***	(0.003)	0.010***	(0.003)
COVID restrictions control								
Weighted stringency index	0.015***	(0.003)	0.013***	(0.003)	0.006***	(0.002)	0.006***	(0.002)
Destination typology (ref.=Coastal)								
Cities			0.066**	(0.029)	0.104***	(0.029)	0.111***	(0.029)
Rural			0.03	(0.029)	0.081***	(0.03)	0.087***	(0.031)
Nature/Mountain			-0.033	(0.027)	-0.001	(0.024)	0.008	(0.024)
Urban Mix			0.06**	(0.025)	0.086***	(0.026)	0.092***	(0.026)
Tourism characteristics								
Tourism density			<0.001	(<0.001)	<0.001	(<0.001)	<0.001	(<0.001)
Tourism demand catchment			-0.002***	(0.001)	-0.002***	(0.001)	-0.003***	(0.001)
Share of foreign tourists			0.004***	(0.001)	0.005***	(<0.001)	0.004***	(<0.001)
Tourism diversity			0.001	(<0.001)	<0.001	(<0.001)	0.001	(<0.001)
Tourism intensity			-0.001*	(0.001)	-0.002**	(0.001)	-0.003***	(0.001)
Seasonality			-0.001	(<0.001)	<0.001	(<0.001)	-0.001	(0.001)
Intensity x Seasonality							0.001*	(<0.001)
Geographic control (ref.= West Europe)								
Eastern Europe					0.145***	(0.021)	0.153***	(0.022)
Southern Europe					0.115***	(0.028)	0.122***	(0.026)
Northern Europe					-0.035	(0.029)	-0.032	(0.028)
Other control variables								
Intercept	YES		YES		YES		YES	
Country dummies	YES		YES		NO		NO	
Link function - binary	Logit		Logit		Logit		Logit	
Link function - fractional	Loglog		Loglog		Loglog		Loglog	
Observations	233		233		233		233	
Regions with loss	217		217		217		217	
R^2	0.761		0.863		0.811		0.816	
Shapiro Wilk test (p.value)	0.065		0.016¤		0.821		0.630	

Note: * = p.value<0.10, ** = $p < 0.05$, *** = $p < 0.01$, ¤ = Normality distribution of residuals rejected.

higher relative loss compared with less rural countries, but within the same country there seems to be no significant difference in relative loss when comparing rural and coastal regions.

As for tourism characteristics, relative losses increase with the share of foreign tourists. This is in accordance with expectations and results from previous country-specific studies in Europe (Duro et al., 2022; Payne et al., 2022; Vaishar & Šťastná, 2022). Conversely, larger tourism demand catchment contributes to mitigating guest-night losses. This result was statistically significant in all models. Regions with high tourism intensity recorded on average a lower demand loss. Conversely, the indicator capturing the interaction between tourism intensity and seasonality was associated with a higher relative loss. This suggests that high tourism intensity reflects a high tourism attractiveness, but in regions where intensity is combined with seasonality, the relative loss was higher. Finally, high seasonality did not present a correlation with the relative loss during the 2020 shock (see insignificant coefficient for seasonality in Table 3). This could be related to the low restrictions during Q3, which represented the high season in coastal areas which tend to be the most seasonal too.

The spread of COVID-19 and associated restrictions were not even throughout the year, as shown in Fig. 1 and Table 2. Therefore, to dig more deeply into the intra-year variability, we estimated four different *frm*, one for each quarter, to explain quarter-specific relative loss (Table 4). Due to different statistical distributions of the relative loss (Fig. A.2), we adapted the functional form to each quarter using a cloglog in Q1 and loglog in quarters Q2 to Q4 accordingly to the best fit. Instead, the variables of the specification remained the same for comparison purposes.

The results corroborate those from the model for the whole year and provide additional information regarding the impact of typologies, tourists' density and tourism demand catchment. In Q2, when the strongest restrictions were imposed with hard lockdowns, there was no difference in relative loss between the typologies, indicating that restrictions outweighed any regional difference attributable to their characteristics. From Q2 onwards, tourist density was found to be an additional factor contributing to relative losses, possibly indicating a reduced preference for crowded tourism destinations. A high pool of potential tourism demand within a reachable geographic distance was especially important in Q3.

The partial effect of the final model for the entire year and the different quarters are displayed in Table 5, which offer a comparable interpretation across models with different functional forms.

5. Discussion

5.1. Interpretation of the results

The impact of the COVID-19 crisis on tourism demand was strong overall in Europe but marked with substantial national and regional variation. We identified different factors explaining the heterogeneity in the relative loss of guest-nights in 2020, from travel restrictions to region-specific, geographical, socio-economic and tourism demand characteristics. Top-down restrictions imposed by countries in an attempt to contain the spread of the virus were the main driver for a reduction in tourist demand, which was consistent with the findings of Okafor and Yan (2022). This evidence highlights the powerful role of government in the management of a health crisis and the imposition of travel restrictions.

Urban destinations were impacted more compared to coastal and nature/mountain. This is consistent with evidence from the Czech Republic (Vaishar & Šťastná, 2022), Poland (Gierczak-Korzeniowska et al., 2021), Slovakia (Šambronska et al., 2021) and Portugal, where low density non-urban destinations leaning towards nature tourism suffered a less severe impact (Carvalho et al., 2022; Santos & Oliveira Moreira,

Table 4
Estimation of results of the fractional response model (fractional component). Effect on the relative loss, by quarter.

	2020.Q1		2020.Q2		2020.Q3		2020.Q4	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
Socio-economic control								
Population	-0.007	(0.005)	0.006	(<0.001)	0.005***	(0.001)	<-0.001	(0.002)
Population density	0.001*	(<0.001)	-0.001	(<0.001)	-0.001***	(<0.001)	<-0.001**	(<0.001)
GDP per capita	0.017***	(0.006)	0.023*	(0.001)	0.006***	(0.004)	0.021***	(0.006)
COVID restrictions control								
Weighted stringency index	0.005***	(0.002)	0.004***	(0.002)	0.006***	(0.002)	0.01***	(0.003)
Destination typology (ref.=Coastal)								
Cities	-0.02	(0.029)	0.008	(0.032)	0.121***	(0.041)	0.152***	(0.041)
Rural	-0.025	(0.032)	-0.015	(0.038)	0.041	(0.044)	0.101**	(0.041)
Nature/Mountain	-0.127***	(0.038)	0.001	(0.024)	-0.028	(0.04)	0.102***	(0.033)
Urban Mix	-0.075*	(0.041)	0.01	(0.028)	0.1***	(0.036)	0.058	(0.04)
Tourism indicators								
Tourist density	<0.001	(<0.001)	<0.001***	(<0.001)	<0.001***	(<0.001)	<0.001***	(<0.001)
Tourism demand catchment	-0.001*	(0.001)	-0.001	(0.001)	-0.003***	(0.001)	0.001	(0.001)
Share of foreign tourists	0.001	(0.001)	0.005***	(0.001)	0.006***	(0.001)	0.004***	(0.001)
Diversity	0.001*	(0.001)	0.001***	(0.001)	-0.001	(0.001)	0.002***	(0.001)
Intensity	0.002**	(0.001)	-0.006***	(0.002)	-0.006***	(0.001)	-0.005**	(0.002)
Seasonality	-0.001	(0.001)	<0.001	(<0.001)	<0.001	(0.001)	-0.001	(0.001)
Intensity x Seasonality	<0.001	(<0.001)	0.001*	(0.001)	0.001***	(<0.001)	0.001	(0.001)
Control variables								
Eastern	0.014	(0.032)	0.094***	(0.027)	0.159***	(0.032)	0.28***	(0.034)
Southern	-0.052*	(0.03)	0.173***	(0.037)	0.042	(0.045)	0.267***	(0.055)
Northern	-0.059	(0.048)	-0.099***	(0.038)	0.041	(0.043)	0.101*	(0.059)
Intercept	YES		YES		YES		YES	
Link function - binary	Logit		-		Logit		Logit	
Link function - fractional	Cloglog		Loglog		Loglog		Loglog	
Observations	233		233		233		233	
Regions with loss	72		232		152		222	
R^2 - fractional	0.474		0.675		0.749		0.671	
Shapiro Wilk test (p.value)	0.411		<0.001¤		0.887		0.019¤	

Note: * = p.value<0.10, ** = $p < 0.05$, *** = p < 0.01, ¤ = Normality distribution of residuals rejected.

2021). Different reasons could explain the higher relative losses in urban destinations compared to coastal and nature/mountain, including the seasonality of restrictions, the reduction in business tourism, the increased attractiveness of natural settings and lower preference for regions with a high tourism density in the context of the pandemic, and, finally, the dynamics of domestic tourism (Aburumman, 2020; Batista e Silva et al., 2021; Duro et al., 2021; Kaplan Mintz, Ayalon, Nathan, & Eshet, 2021; Park et al., 2021; Pouso et al., 2020), as further detailed below.

(1) Seasonality of restrictions: The travel and leisure activity restrictions were lower during the summer, when tourism in coastal regions was at its peak (Batista e Silva et al., 2021) and in the first two months of the year, which together with the summer represent periods of high demand for nature/mountain destinations. (2) The sharp reduction in business tourism, including meetings, incentives, conferences and events, affected mainly cities with a high travel demand (Aburumman, 2020). (3) Natural assets and landscapes such as the seaside, lakes or mountains provide opportunities for improving the

Table 5
Partial effect on the relative loss, for the entire year and by quarter.

	2020	2020.Q1	2020.Q2	2020.Q3	2020.Q4
Socio-economic control					
Population	0.001***	−0.001	0.001	0.002***	<0.001
Population density	<0.001	<0.001*	<0.001	<0.001***	<0.001**
GDP per capita	0.003***	0.002***	0.003***	0.002***	0.007***
COVID restrictions control					
Weighted stringency index	0.005***	0.005***	0.005***	0.006***	0.009***
Destination typology (ref. = Coastal)					
Cities	0.101***	−0.020	0.019	0.109***	0.178***
Rural	0.078***	−0.042	−0.016	0.044	0.093**
Nature/Mountain	−0.003	−0.152***	−0.012	−0.020	0.083***
Urban Mix	0.086***	−0.077*	0.013	0.103***	0.056
Tourism indicators					
Tourist density	0.001	<0.001	<0.001***	<0.001***	<0.001***
Tourism demand catchment	−0.002***	−0.001*	−0.001	−0.003***	0.001
Share of foreign tourists	0.004***	0.001	0.005***	0.006***	0.005***
Diversity	−0.004	0.002*	−0.006***	−0.007	−0.004***
Intensity	−0.004***	−0.063**	−0.068***	−0.103***	−0.173**
Seasonality	<0.001	−0.001	<0.001	<0.001	−0.001
Intensity x Seasonality	0.001*	<0.001	0.001*	0.001***	0.001
Control variables					
Eastern	0.147***	0.011	0.098***	0.156***	0.286***
Southern	0.131***	−0.045*	0.175***	0.044	0.279***
Northern	−0.020	−0.045	−0.093***	0.042	0.096*

Note: * = p.value<0.10, ** = p < 0.05, *** = $p < 0.01$.

well-being and relief from the tough restrictions and lockdowns which were detrimental to mental health (Buckley & Westaway, 2020; Gierczak-Korzeniowska et al., 2021; Kaplan Mintz et al., 2021; Pouso et al., 2020). (4) The lower preference for regions with a high tourism density: Tourists avoided destinations with expected crowding, preferring destinations or types of tourism allowing greater social distancing (e.g., camping, glamping) (Craig, 2021; Duro et al., 2021; Park et al., 2021). (5) The dynamics of domestic tourism: the higher relative loss of demand in regions with a predominance of urban tourism, especially capital city regions, might indicate an outflow of travellers from these regions to other domestic destinations, but not vice versa.

The geography of tourist flows was reshuffled in 2020, with tourists preferring closer destinations reachable by land (Li, Gong, Gao, & Yuan, 2021), as shown by lower relative loss in destinations with higher tourism demand catchment. This finding confirms the expectations of Romagosa (2020) and evidence from Spain (Duro et al., 2021). It highlights the relevance of accessibility by land for tourism destinations.

Regions characterized by higher tourism intensity held a relative advantage even during the pandemic. The lower relative loss associated with tourism intensity might be explained by the positive relationship between tourism intensity and the destinations' attractiveness and reputation (Pavković et al., 2021). Nevertheless, in destinations where tourism intensity is combined with high seasonality, relative losses have been higher.

The share of foreign tourism associated with higher relative losses confirms the results from Spain (Duro et al., 2022), Croatia (Payne et al., 2022) and the Czech Republic (Vaishar & Šťastná, 2022), and highlights the vulnerability of regions with a high dependence on international tourism in the event of extreme shocks (Canh & Thanh, 2020; Santos & Oliveira Moreira, 2021).

5.2. Avenues for a more resilient tourism

While the COVID-19 outbreak caught European tourist destinations mostly unprepared, the crisis represented an opportunity to understand the factors that aggravate the vulnerabilities of tourism destinations during crises. The lessons learned can be useful to build more resilient tourist destinations, capable of withstanding future pandemics or other shocks. Nevertheless, each tourism destination is different, facing specific challenges (Calgaro, Lloyd, & Dominey-Howes, 2014). Because the vulnerability of each tourism destination may be the result of a combination of different factors, a one-size-fits-all strategy cannot be formulated. This paper highlights a series of vulnerability factors that apply differently to different destinations in the context of future pandemics or similar crises. Below we highlight implications from our findings for stakeholders from local, regional and national destination management organizations and policymakers to the industry players, to support a more resilient tourism.

Destination management organizations should be ready, in case of shocks, to compensate for losses in tourism demand and be able to preserve the attractiveness of a destination. A high dependency on inbound tourism stands out as a factor that exposes destinations to higher tourism demand loss in case of extreme shocks like a pandemic. Reducing the dependency on a particular market and diversifying tourism demand by focusing on a nearby touristic offer would reduce exposure in case of shocks involving travel restrictions (Boto-García & Mayor, 2022; Romagosa, 2020). This could be achieved, for instance, by offering a higher diversity of tourism products, for which product innovation and access to funding and resources are key (Böhme et al., 2021).

Nevertheless, reducing dependency on inbound tourism may imply a sizeable economic cost, with 56% of total tourism expenditure in Europe linked to foreign arrivals (Barranco et al., 2020). Destinations aiming at reducing the exposure to tourism demand loss, but not willing to give up expected revenues to achieve that, should consider innovative strategies to offset revenue loss from international tourists, and diversify risk by reaching out to new markets.

A complementary diversification strategy is to offer digital tourism opportunities (Akhtar et al., 2021). This innovative type of tourism received a positive sentiment from travellers during COVID-19 (Zhang, Li, Ruan, & Liu, 2022) and may be suitable for people suffering from travel anxiety and who are willing to experience travels in the metaverse (Zaman, Koo, Abbasi, Raza, & Qureshi, 2022).

The loss in travel demand was higher in urban destinations, due also to the reduction of business tourism. Such disruptions to the demand structure may be minimised by attracting other work-related segments, such as digital nomads with multi-locality lifestyles (Barranco et al., 2021), or the promotion of workations (Voll, Gauger, & Pfnür, 2022) as a way to increase the average length of stay of tourists. The impact of these phenomena depends, to some extent, on the availability of a high-speed internet and other amenities (Proietti et al., 2022).

European funding such as from the European Regional Development Fund (ERDF) and Cohesion Fund may be used to support investments to render regional tourism destinations more resilient (European Commission, 2021; European Court of Auditors, 2021). For example, these instruments could support investments in transport networks in regions with an economy heavily dependent on tourism and that suffer from low accessibility and lower tourism demand catchment. Additionally, small regions with limited financial capacity, cross-regional and -national partnerships with actors along the value chain may be helpful to create strategies towards higher tourism capacity sustainably (Böhme et al., 2021).

The EU and its Member States are responsible for developing national recovery and resilience plans and have some capacity to drive the negative consequences of health crises on the tourism sector. Although adaption is the preferred path towards resilience, policymakers cannot change structural geographical characteristics that make some destinations inherently more vulnerable to shocks (e.g., being an island, or having limited natural assets and offerings). Specific support instruments designed to mitigate the economic effects of shocks may still be necessary in regions that remain heavily dependent on tourism.

And, ultimately, given that travel restrictions represent the main factor for the loss in guest-nights during the COVID-19, as confirmed in our study, similar measures in the future should be carefully equated, weighing the known negative social and economic consequences against the expected benefits.

6. Conclusions

The COVID-19 pandemic highlighted the need to develop a more resilient tourism sector in Europe, taking into account differences between and within countries. This calls for the identification of factors that make tourism destinations more vulnerable to shocks at regional level and in a multi-country context.

Using the example of COVID-19 outbreak in 2020, and controlling for the stringency of COVID-19 restrictions enacted in each region, we investigated a series of factors underscoring the shock on the tourism sector measured in terms of the loss of guest-nights at regional level. While the travel and mobility restrictions explain the bulk of the loss in tourism demand in 2020, we identified other significant factors. Concretely, regions characterized by urban tourism, with a high dependence in foreign arrivals, or with a combination of high tourism intensity and high seasonality appeared to have had stronger losses in tourism demand. Conversely, regions with large tourism demand catchments, with low density and natural assets (e.g., coast, mountain, nature) had lower reduction in guest-nights.

The findings from this first, comprehensive, EU-wide assessment, confirm preliminary research conducted for single countries, adding to the body of evidence with potential implications for destination management organizations across the EU. Destination management organizations at different territorial scales should consider the specific factors that made their regions especially vulnerable during the COVID-19 crisis, and work out adaptation strategies to make them more resilient in view of future shocks.

We singled out various avenues to increase tourism destination resilience, which can be summarised in diversification of the tourism offer and demand. Strategies and policies leading to higher diversification may result as well in the reduction of the seasonality of tourist destinations, contributing to a higher resilience and sustainability of tourism activity overall. EU funding and investments to improve tourism capacity and attractiveness can be sought by tourist destinations, individually or in wider strategic partnerships. When tourist destinations remain particularly vulnerable due to, for example, fixed geographical characteristics and constraints, emergency support instruments may remain necessary. Ultimately, extreme travel restrictions such as the ones observed during 2020, must be carefully consider the known negative impacts and the expected benefits.

This study presents limitations regarding the spatial scale of the analysis and the variable set used in the econometric study. As for the of scale, it was only possible to conduct the study at the NUTS2 level due to a lack of dependent and independent variables at a higher spatial granularity with European coverage. An analysis at NUTS3 level may add precision, but we are confident the main trends are already evident at NUTS2 level. Coherence between our findings at EU level and earlier country-specific studies support this assumption. Finally, additional variables related to travellers' origin, or the dynamic epidemiological context in the destinations could not be tested due to missing consistent data at EU level. Yet, the high explanatory power of the presented models indicate that the key factors were captured.

The impact of the COVID-19 outbreak in 2020 on regional tourist destinations and their determinants is by now well established. Future research should focus primarily on the recovery of tourist destinations from years 2021–2022 onward, also with a sub-national perspective.

Declaration of Competing Interest

The authors declare no conflict of interests.

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Appendix A. Appendix

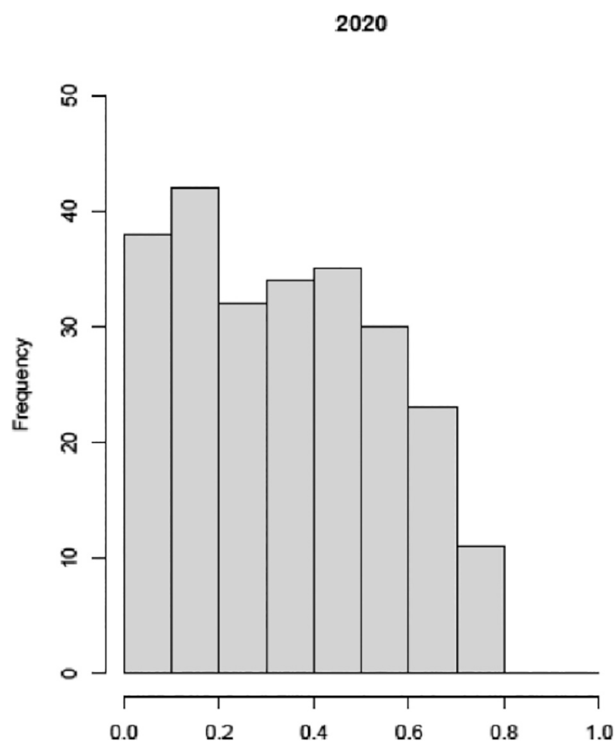

Fig. A.1. Statistical distribution of relative loss in 2020.

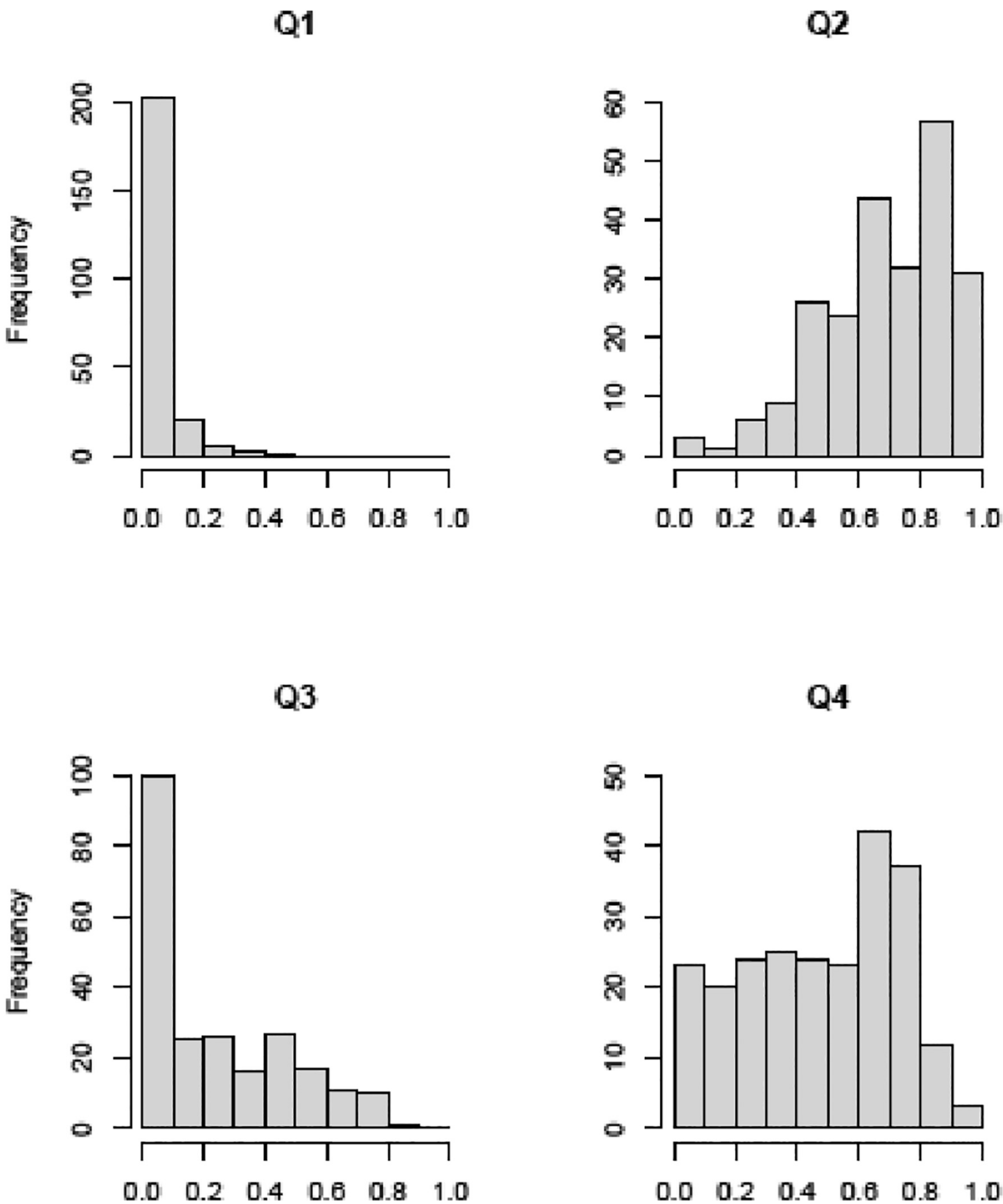

Fig. A.2. Statistical distribution of relative loss in 2020, by quarter.

Table A.1
Comparison of model fit across different models and link functions.

Model	Link function	N.obs	Rˆ2
OLS	–	233	0.783
GLM	binomial	233	0.705
GLM	gaussian	233	0.783
GLM	poisson	233	0.622
FRM - 1 part	logit	233	0.771
FRM - 1 part	probit	233	0.774
FRM - 1 part	loglog	233	0.792
FRM - 1 part	cloglog	233	0.747
FRM - 2 parts*	logit	233	0.800
FRM - 2 parts*	probit	233	0.802
FRM - 2 parts*	loglog	233	0.816
FRM - 2 parts*	cloglog	233	0.779

Note: * = the link function is referred to the fractional component. Models have been tested with the complete specification, including all the listed variables.

Table A.2
Correlation matrix of independent variables.

Variable		Correlations																
		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17
Population	X1																	
Population density	X2	0.03																
GDP pro capite	X3	0.15	0.33															
Weighted stringency index	X4	0.22	0.00	0.00														
Cities	X5	0.19	0.52	0.40	−0.05													
Rural	X6	0.00	−0.08	−0.06	−0.05	−0.15												
Nature/Mountain	X7	−0.07	−0.13	0.05	−0.19	−0.26	−0.18											
Urban Mix	X8	−0.08	−0.10	−0.07	−0.14	−0.21	−0.15	−0.26										
Tourist density	X9	0.00	0.81	0.36	−0.01	0.39	−0.10	−0.13	−0.13									
Tourism demand catchment	X10	0.20	0.01	0.37	−0.05	−0.05	0.11	0.39	0.05	−0.03								
Share of foreign tourists	X11	−0.02	0.22	0.21	−0.02	0.23	−0.05	−0.16	−0.28	0.41	−0.31							
Diversity	X12	0.27	−0.35	−0.05	0.07	−0.06	0.08	−0.20	0.25	−0.39	0.15	−0.37						
Intensity	X13	−0.19	−0.05	0.05	0.07	−0.13	−0.10	0.02	−0.18	0.22	−0.20	0.55	−0.39					
Seasonality	X14	−0.24	−0.28	−0.48	0.17	−0.37	−0.07	−0.18	−0.18	−0.20	−0.48	0.13	−0.14	0.26				
Intensity X Seasonality	X15	−0.12	−0.04	−0.09	0.07	−0.09	−0.09	−0.12	−0.15	0.16	−0.27	0.46	−0.35	0.80	0.38			
East	X16	−0.07	−0.07	−0.35	−0.49	−0.08	0.05	0.08	0.24	−0.07	−0.04	−0.12	0.00	−0.16	0.03	−0.04		
South	X17	0.05	−0.01	−0.24	0.67	−0.08	−0.03	−0.25	−0.16	0.03	−0.54	0.32	−0.11	0.27	0.34	0.24	−0.35	
North	X18	−0.10	−0.09	0.11	−0.31	0.13	0.02	−0.17	−0.01	−0.09	−0.30	0.00	0.16	−0.07	0.09	−0.07	−0.16	−0.19

Table A.3
Estimation results. Impact on relative loss (binary component), entire year.

	Est.	S.E.
Destination type (ref. = Coastal)		
Rural	−2.225***	(0.696)
Tourism indicators		
Share of foreign tourists	0.082***	(0.025)
Diversity	0.064***	(0.021)
Control variables		
Intercept	YES	
Link function - binary	Logit	
Observations	233	
Regions with loss	217	
R^2	0.174	

Note: * = p.value<0.10, ** = p < 0.05, *** = p < 0.01.

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