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## Conference Paper

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# **Tourism usage of digital collaborative economy platforms in Europe: situation, behaviours and implication for the digital policies.**

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# **Tourism usage of digital collaborative economy platforms in Europe: situation, behaviours and implication for the digital policies.**

## **Abstract**

This research analyses how tourists using digital sharing economy platforms have behaved in the European Union, whether there are differences between European regions and how they have evolved with the pandemic. Using spatial econometric techniques, this study provides a comparative analysis, in space and time, that identifies regional inequalities in terms of the intensity of demand for accommodation offered on digital sharing economy platforms. In particular, different clusters of high intensity of collaborative tourism have been detected, and spatial spillover effects and interdependencies of European regions in collaborative tourism have been recognised, finding a positive spatial autocorrelation in the intensity rate of collaborative tourism. An effect of tourist destination saturation on the use of accommodation offered on digital sharing economy platforms has also been observed. Several digital public policy implications have been discussed, promoting regulatory coordination at the interregional and pan-European levels to avoid inequalities and imbalances across Europe.

## **Keywords:**

Digital tourism, platforms' economy, digital policies, European regions, sharing, ESDA, spatial models.

## 1. INTRODUCTION

The collaborative economy (sharing economy, digital platform economy) is impacting more and more sectors and is growing rapidly across Europe, also in the tourism sector, where it provides exciting opportunities for citizens as consumers, as well as for SMEs and entrepreneurs. Moreover, its accelerated development has introduced challenges, especially in popular tourist destinations. Digital sharing economy platforms are having a transformative effect on the traditional tourism model and are generating exponential growth in the global economy (Dredge & Gyimóthy, 2017; Presenza, Panniello & Messeni Petruzzelli, 2021). In particular, these digital platforms are altering the way the tourism sector is managed, impacting the processes of tourism product development, data gathering, market access and tourist attraction (World Bank Group, 2018).

Although the European Commission continues to talk about the sharing economy and collaborative economy platforms, the business model is moving closer to capitalist forms of for-profit management, with short-term rental generation and investors who use housing as an asset to store capital (Cocola-Gant & Gago, 2021). Similar to Mody, Cheng and Hanks (2021), we follow the definition of Wirtz et al. (2019) of collaborative economy in tourism as a business model that enables peer-to-peer (P2P) sharing of assets and resources with constrained capacity, including mainly accommodation and transport tourism services.

There is an emerging academic interest in investigating the evolution of the collaborative economy and P2P accommodation (Dann et al., 2019, for a systematic review; Andreu, Bigne, Amaro & Palomo, 2020, for a bibliometric analysis). Recently, the literature indicates that the post-pandemic tourism context needs the tourism sector to examine alternative ways based on the collaborative economy to improve tourist trust, innovate, seek authenticity and experiences, understand sustainability tourism motivations, use big data and manage over-tourism (Vila-López & Küster-Boluda, 2022).

The topic of analysis also has relevant implications for public policy in the digital sphere, given the current regulatory situation and the proliferation of digital platforms for collaborative purposes, which entails numerous tensions with hotel chains and traditional establishments, as well as with cities where their growth impacts on neighbourhood life, making it an increasingly politicised issue with diverse polemical debates. Despite the fact that policy responses differ depending on the cities, there is still a small number of

comparative research that justifies this heterogeneity (Aguilera, Artioli, & Colomb, 2021). In their bibliometric study on Airbnb, Andreu et al. (2020) indicate that sharing economy is an emerging research area, and there are still underexplored topics such as ethics and sustainability, legal and regulatory issues and socially excluded consumers.

To date, research has focused on the cases of the main tourist cities, but there is a lack of analysis that provides a regional and transnational overview of the European Union and that allows geographical and temporal comparisons (especially due to the impact of the pandemic, establishing pre- and post-COVID19 differences). Therefore, as a research question, we asked ourselves how the tourist using these tools has behaved in Europe, whether there are differences across the different European regions and how it has evolved with the pandemic.

Specifically, this main objective can be broken down into four intermediate research objectives: (i) analyse the evolution of the sharing tourism intensity distribution in the regions of the EU-27 in recent years; (ii) explore whether there are interregional relationships concerning the intensity of collaborative digital tourism in neighbouring regions; (iii) model the evolution of the intensity of collaborative tourism in the European regions (iv) delve into the implications that this type of tourist activity has for the digital public policies of the sector.

The rest of the document is structured as follows: Section 2 briefly reviews the literature on collaborative economy research in tourism. Section 3 shows the empirical analysis, referring to the database and methodology used, as well as the results and discussion. Finally, section 4 contains the main implications for digital policies and the conclusions of the study.

## **2. BRIEF LITERATURE REVIEW**

There is growing academic research that addresses the phenomenon of the irruption of P2P platforms in tourism, and this growing literature has already been systematically reviewed (Cheng, 2016; Prayag & Ozanne, 2018; Kuhzady, Seyfi, & Béal, 2022; Song, 2023).

Approaches are varied, with many being focused on drivers and user profiles (Pesonen & Tussyadiah, 2017), platforms themselves, among which the many works dedicated to Airbnb stand out (Guttentag, 2019, for a specific literature review on this platform), the

perceptions of residents in tourist areas with respect to the impacts that the intense growth on tourist rental accommodations (Martín-Martín et al., 2020), impacts on the performance, occupancy levels and revenue of hotels (Sigala 2017), responses from the "traditional" accommodations (Zhu et al. 2019), overcrowding effect from the influx of tourists in residential areas, pollution and rent price increases (Ioannides, Röslmaier, & Van Der Zee, 2019; Gurran & Phibbs 2017). Its "dark side" has also been identified, that is, its undesirable social, environmental, and economic impacts and its change of focus from altruistic purposes to profits (Buhalis, Andreu & Gnoth, 2020).

However, the Covid-19 pandemic has changed everything. Regulatory restrictions have drastically reduced the number of travellers during 2020 (Farmaki & Miguel, 2022). The pandemic has magnified and complicated this relevant stream of investigation, requiring more research on urban-rural dynamics, housing market change, community impacts, and regulatory response across Europe (Colomb, & Gallent, 2022). These authors consider important areas for further research the regionally focused and comparative.

Particularly noteworthy are the geographical and political implications that the P2P phenomenon in tourism brings with it, even though analysing spatiotemporal patterns of tourism in Europe are scarce (e Silva et al., 2018). These authors consider that regions with both high tourism intensity and high seasonality are deemed to be more vulnerable to the tourism sector and any shocks. As Mody, Hanks and Cheng (2021) affirm, there is still a great deal to be known about how a sudden influx of tourism, made possible by the availability of additional lodging in the form of home-sharing,

It is important to note the geographical and political considerations that the issue introduces. At the municipal level, there has been a heated debate for and against it in cities and towns such as Barcelona, Paris and Milan (Aguilera, Artioli & Colomb, 2021). The local level is particularly well-researched, with European cities such as Barcelona (Álvarez-Sousa, 2020; Mazzamuto & Picone, 2022), Sevilla (Hernandez-Maskivker et al., 2019), Budapest (Pinke-Sziva et al., 2019), Berlin (Schäfer and Braun, 2016) or Santorini (Smith, Olt, & Berezvai, 2019). Some territories have also been studied as islands and, in very exceptional cases, regions (Morales-Pérez, Garay-Tamajón & Troyano-Gontá, 2022). Phenomena such as over-tourism, the impact of short-term rentals or the reactions of neighbours to this type of tourism are analysed with special interest.

In its study on Airbnb in Athens, Lisbon, and Milan, Amore, de Bernardi, and Arvanitis (2022) consider that this phenomenon is fostering a new form of urban displacement at a faster rate than traditional housing gentrification, with the renting of prime residential areas to tourists. Similarly, Guttentag (2019) studies the spatial patterns of Airbnb and indicates that housing effects are likely in areas with a high density of accommodation offered on digital platforms such as Airbnb. The volume of supply of platforms is related to the size of the city and its status as a leisure destination (Adamiak, 2018).

### **3. EMPIRICAL ANALYSIS AND RESULTS**

#### **3.1. Sample and Methodology**

Our research uses information from Eurostat's experimental statistics, which are compiled using new data sources. The experimental statistics have the advantage of bringing novelty, as there is little public information on the subject. Moreover, these data sources are a pioneering initiative by Eurostat to produce reliable data consistently covering the whole EU, based on direct cooperation with industry.

This research is based on the analysis of data from four international digital tourism platforms, such as Airbnb, Booking, Tripadvisor and Expedia. The information has been provided to Eurostat through data exchange agreements and is therefore official and guarantees the representativeness of the information. Specifically, these data provide information on the number of overnight stays in tourist accommodation offered on any of the above-mentioned digital sharing economy platforms in EU regions.

Although this Eurostat dataset provides information on the different NUTS classifications (Nomenclature of territorial units for statistics), as in most EU spatiotemporal research (Boschma et al., 2023; Capello & Caragliu, 2021; Szeles, 2018), we have focused on the NUTS 2 level because these are the basic regions for the application of regional policies (Eurostat, 2022). This study applies the latest NUTS classification established in 2021, which lists 242 regions at NUTS level 2 (more information on the classification of NUTS2 regions and coding in Eurostat (2022)).

According to Belotti et al. (2017), this study uses balanced panel data to be able to perform preliminary statistical tests and estimate with spatial panel data. Therefore, we used a set of 224 regions with available information from 2018 to 2021. In addition, this

period allows us to understand the behaviour patterns of the demand for accommodation in the collaborative economy before, during, and after the COVID-19 pandemic.

We measure the demand for accommodation in the collaborative economy based on the number of overnight stays. Similar to Gutiérrez et al. (2017), to eliminate the effect of different ranges of total tourism demand in the different European regions, we define the collaborative tourism intensity rate as an indicator that relates collaborative tourism demand and total tourism demand. Thus, the collaborative tourism intensity rate (CTIR) is calculated as follows:

$$CTIR = \frac{\text{collaborative tourism}_i}{\text{total tourism}_i} \times 100 \quad (1)$$

where *collaborative tourism<sub>i</sub>* is measured by the number of overnight stays of resident and non-resident tourists in accommodation offered via collaborative economy platforms in region *i*, and *total tourism<sub>i</sub>* is measured by the total nights spent of resident and non-resident tourists in any tourist accommodation establishment<sup>1</sup>.

In this research, we use mapping techniques and exploratory spatial data analysis (ESDA) to study the differences between European regions and how the intensity of the collaborative tourism sector has evolved with the pandemic. We also identify the different regional clusters of collaborative tourism in Europe and model the collaborative tourism demand.

We use the well-known measure of disparity, the Gini coefficient, to analyse regional inequalities in demand for collaborative economy accommodation across EU regions. It is calculated as follows:

$$G = \frac{2}{m^2 \bar{y}} \sum_{i=1}^m i(y_i - \bar{y}) \quad (2)$$

The Gini coefficient has been used in tourism mainly in terms of seasonal demand, analysing inequalities between months of the year (Duro, 2016), but it has also been used

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<sup>1</sup> This class includes the provision of short-term accommodation provided by: hotels, resort hotels, suite / apartment hotels, motels, motor hotels, guesthouses, pensions, bed and breakfast units, visitor flats and bungalows, time-share units, holiday homes, chalets, housekeeping cottages and cabins, youth hostels and mountain refuges



to measure inequalities in tourism development between different cities (Ji & Wang, 2022). However, this index does not consider the spatial distribution of the observation units (in our case, the regions) nor their possible spatial interactions. Therefore, this study is complemented by ESDA and visualisation techniques to analyse the situation and patterns using collaborative economy digital platforms in Europe.

ESDA allows us to analyse whether the spatial distribution of collaborative economy accommodation demand in Europe is random or whether there is spatial autocorrelation, as well as to discover spatial association schemes, hotspots, and spatial clusters (Anselin, 1999; Grubestic & Murray, 2005; Sarrión-Gavilán et al., 2015).

According to Tobler's First Law of Geography, "*everything is related to everything else, but near things are more related than distant things.*" A key step in spatial analysis is the specification of the spatial weight matrix, since it captures the distance between the neighbours. Depending on the interpretation of distance, different spatial weight matrices can be employed, such as a geographic adjacency matrix, a geographic distance weight matrix, or an economic distance weight matrix (Haibo et al., 2020). This article employs a geographic adjacency weight matrix to capture the contiguity interactions between spatial entities. In particular, we use the first-order contiguity spatial weight matrix with the queen grid ( $W_{ij}$ ) and is defined as:

$$w_{ij} = \begin{cases} 1, & i \text{ and } j \text{ have common border} \\ 0, & \text{otherwise} \end{cases} \quad (3)$$

$W$  is a  $N \times N$  contiguity spatial weight matrix, where  $N$  is the number of regions. Other studies that use first-order contiguity spatial weight matrix are Rodríguez Rangel & Sánchez Rivero (2020) and Zeenat Fouzia et al. (2019)

The mapping tools intuitively present the inequalities studied for the case of the European Union. However, this representation is not statistically objective and must be supplemented by statistical tests. Global spatial autocorrelation can measure the global correlation and disparity degree of some spatial geographical phenomena (Xie et al., 2012). We use the Moran's I to evaluate the global spatial autocorrelation of collaborative tourism intensity in the NUTS2 regions of the EU-27. Moran's I can be calculated as:

$$I = \frac{N}{S_0} \frac{\sum_{ij} w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^N (x_i - \bar{x})^2} \quad i \neq j \quad (4)$$

$$S_0 = \sum_i \sum_j W_{ij} \quad (5)$$

where  $x_i$  is the observed value of the variable studied in the NUTS2 region  $i$ ,  $x_j$  is the observed value of the variable studied in the NUTS2 region  $j$ ,  $W_{ij}$  is the spatial weight matrix value.

Global Moran's I measures spatial autocorrelation based on entities locations and values simultaneously (Xiaobin et al., 2021). That is, it examines whether location patterns exist between the regions according to the values of the variable studied and determines its type in global terms.

Global Moran's I can determine the existence of global autocorrelation: (i) Positive: regions with high values tend to be surrounded by regions with high values, or regions with low values tend to be surrounded by regions with low values. (iii) Negative: regions with high values tend to be surrounded by regions with low values and vice versa. Next, we estimate the Moran Scatterplot plot that visually complements the Moran's I test.

In order to detect significant local clusters around an individual location, that is, to identify both local instabilities, local deviations from global behaviour or spatial outliers, as well as representing the existence of different clusters in all the European regions, we use hot and cold spot analyses. According to Kondo (2016), the standard method for hot and cold spot analyses in spatial statistics is the Getis–Ord  $G_i^*(d)$  statistic, which tests whether a region and its neighboring regions form a spatial cluster. The statistic proposed by Getis and Ord (1992) is calculated as follows:

$$G_i^*(d) = \frac{\sum_{j=1}^N w_{ij}(d)x_j}{\sum_{j=1}^N x_j} \quad (6)$$

Where  $w_{ij}(d)$  is the  $ij^{\text{th}}$  element of the spatial weight matrix defined as:

$$w_{ij}(d) = \begin{cases} 1, & \text{if } d_{ij} < d, \text{ for all } i, j \\ 0, & \text{otherwise} \end{cases} \quad (7)$$

And  $d$  denotes the threshold distance for the spatial weight matrix.

According to Kondo (2016), the  $G_i^*(d)$  statistic evaluates the relationship between the local sum of variable  $x$  at radius  $(d)$  from the centroid of region  $i$ , and the total sum of the

variable  $x$  for all regions. Therefore, those regions with higher (lower) shares of variable  $x$  are detected as hot (cold) spots. The null hypothesis is complete spatial randomness, and the rejection of the null hypothesis indicates an outlier in the geographical space (more details about the statistic and its application in Kondo (2016)).

Following Cook et al. (2019), we compare and evaluate different non-spatial and spatial models to determine the effects of regional interactions on collaborative tourism intensity and analyse the impact of tourism saturation and income in the destination region. Tourism saturation has been measured by the hotel occupancy rate of the regions, and the Gross Domestic Product has measured the income level of the destination in per capita terms (GDP pc) at current prices, both variables obtained from Eurostat. According to Elhorst (2010), Table 1 denotes the specification of the different models used in this research.

**Table 1. Model non-spatial and spatial specification**

<b>Model Name</b>	<b>Model specification</b>
Non-Spatial Linear Model (NS)	$Y = X\beta + \varepsilon$
Spatial Autoregressive Model (SAR)	$Y = X\beta + \rho WY + \varepsilon$
Spatial Error Model (SEM)	$Y = X\beta + u$ $u = \lambda Wu + \varepsilon$
Spatial Autoregressive Combined Model (SAC)	$Y = X\beta + \rho WY + u$ $u = \lambda Wu + \varepsilon$

### 3.2. Results and Discussion

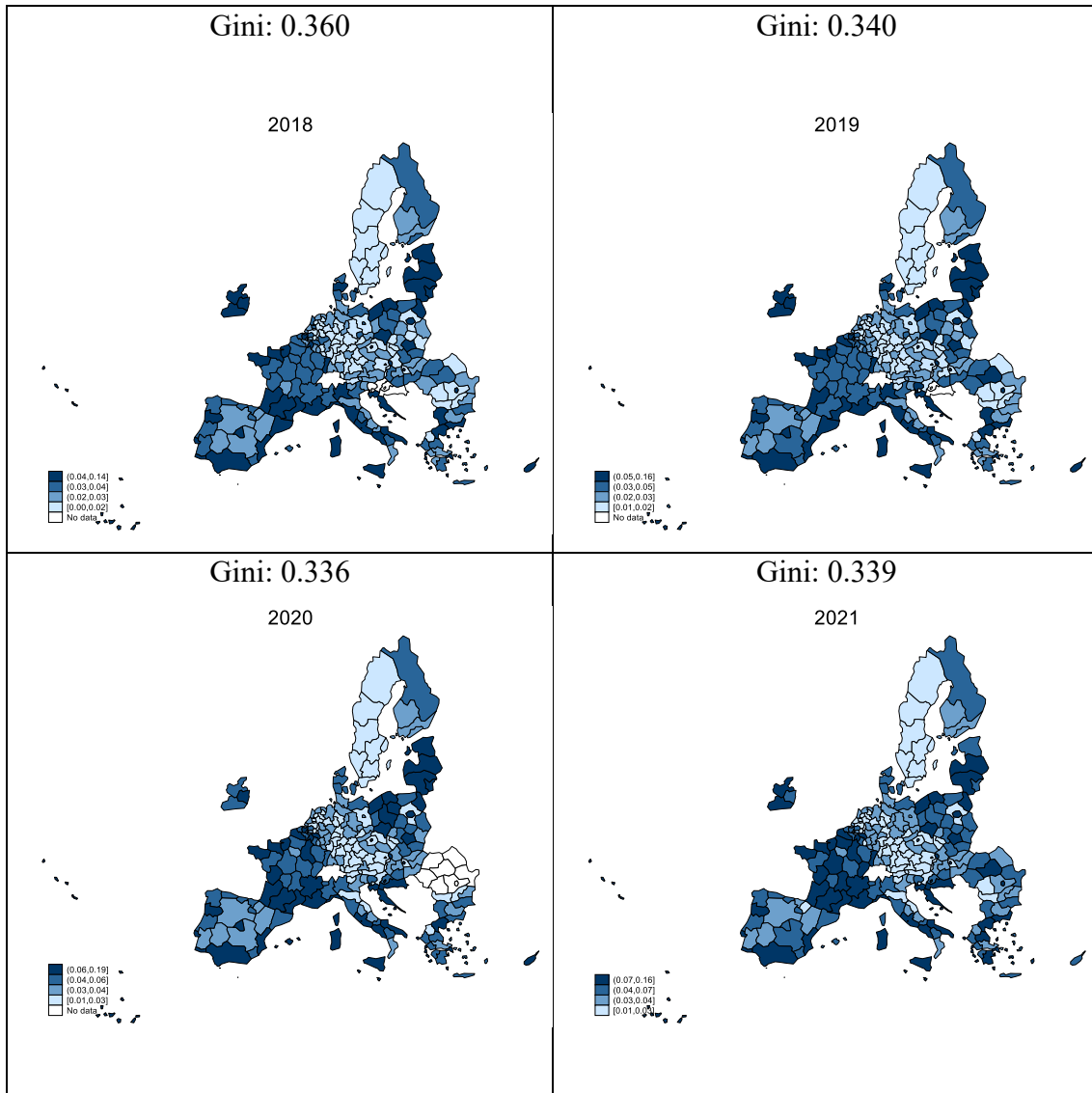
#### 3.2.1. *Spatiotemporal patterns and interregional relationships of collaborative tourism intensity in Europe*

Tourists do not act in isolation from other economic agents, that is, tourists do not make their decisions independently from other agents, but there is a set of interactions that can affect their decision-making. If individuals in regions interact with each other, territories are also interacting with each other. Therefore, what follows will be an attempt to collect regional inequalities in adopting collaborative economy tourism in the EU-27 and the spatial interdependencies of its regions at a NUTS-2 level through an ESDA.

In order to illustrate the degree of inequality in the tourist use of collaborative economy digital platforms in Europe, Figure 1 presents the evolution of regional disparities in the

intensity of collaborative tourism using the Gini index and their distribution by graphic maps.

**Figure 1. Evolution of Collaborative Tourism Intensity in EU-27 per NUTS2 (2018-2021)**



The results reveal a dynamic and significant degree of inequality in the intensity of collaborative hosting across European regions at the NUTS2 level. Specifically, in the years prior to the pandemic, the regions with a high intensity of collaborative tourism were concentrated especially on the Mediterranean coast (Languedoc-Roussillon, Provence-Alpes-Cote d'Azur and Corsica in France, Catalonia, the Valencian Community and Balearic Islands in Spain or Liguria, Tuscany, Friuli-Venezia Giulia, Sardinia and Sicily in Italy) and the regions of the Baltic countries of Estonia, Latvia, and Lithuania.

On the other hand, a pattern of low-intensity of collaborative hosting is observed in the regions of central Europe (including the regions of Germany, Austria, the Czech Republic and Hungary). However, after the start of the pandemic in 2020, a trend of expansion and concentration of the highest rates of use of collaborative tourist accommodation is observed in the French regions (Rhône-Alpes, Poitou-Charentes, Center — Loire Valley or Auvergne, among others). These results show that the intensity of the demand for P2P accommodation in Europe is not distributed randomly but by spatial clusters, indicating that there could be a significant correlation between European regions concerning the use of collaborative tourism platforms.

In order to statistically verify the existence of spatial autocorrelation in the intensity of collaborative tourism between European regions, we use the global Moran's I index from 2018 to 2021 (see Table 2).

The results show that the global Moran's I of CTIR was positive during the study period, and all p-values showed significance at the 0.01 level. These results confirm the existence of spatial interrelationships between European regions. In addition, the global Moran's I index rose from 2018 to 2021, and the Z significance level increased from 3.661 to 6.937, indicating that the spatial agglomeration effect of collaborative tourism gradually became the dominant trend.

**Table 2. Global Moran's I index of CTIR**

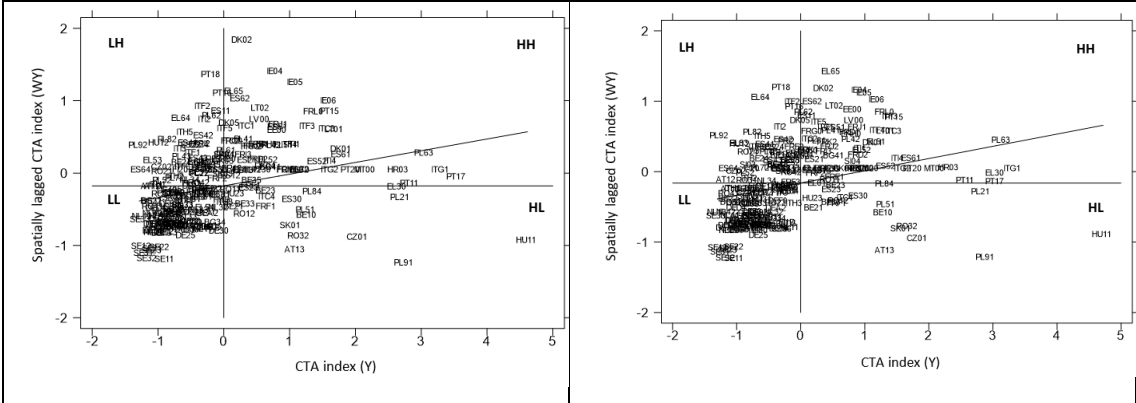
Year	Global Moran's I	Z-value	p-value
2018	0.175	3.661	0.000 ***
2019	0.186	3.929	0.000 ***
2020	0.225	4.677	0.000 ***
2021	0.331	6.937	0.000 ***

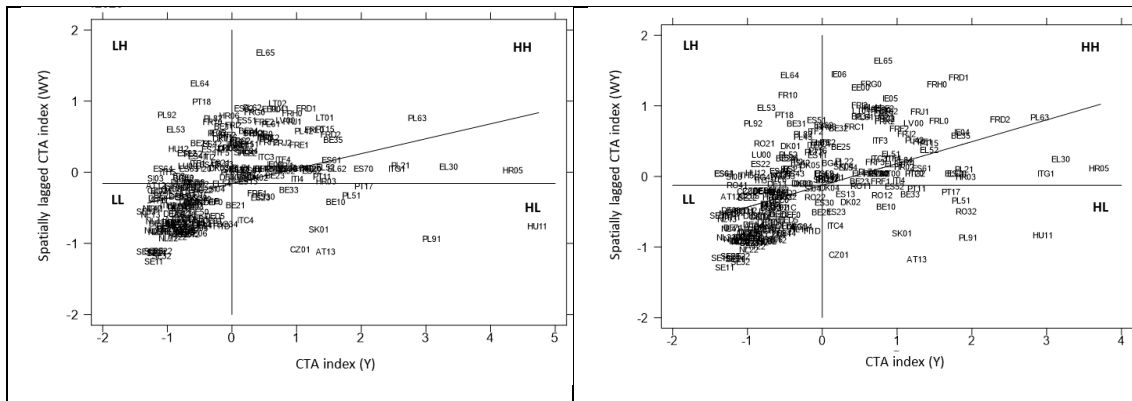
This research uses the Moran scatterplot to complement the results of the global spatial autocorrelation analysis and to identify the behaviour of the different European regions. Figure 1 is focused on representing where in the four quadrants are the analysed regions represented by the NUTS2 codes offered by Eurostat. The regions located in the High-High (HH) and Low-Low (LL) quadrants present a positive spatial association. Specifically, the HH quadrant shows that regions with high intensity of sharing economy hosting demand are mostly surrounded by regions with also high rates of sharing hosting

intensity. In the case of the regions located in the LL quadrant, the value of the collaborative accommodation intensity rate will be low, and they will be surrounded by regions with low intensity of demand for collaborative tourist accommodation. The results confirm the positive spatial autocorrelation identified by the global Moran's I index and also reveal a higher concentration of regions in the LL quadrant. That is, regions with low collaborative tourism intensity that are surrounded by regions with low collaborative tourism intensity predominate.

On the other hand, it is observed that regions located in quadrant HH are French regions Lower Normandy, Upper Normandy, Languedoc-Roussillon, and Brittany, among others, which could indicate the existence of a cluster of high values in this country. On the contrary, the regions located in the HL and LH quadrants present a negative spatial association. The HL quadrant denotes regions with high intensity values of P2P tourist accommodation demand surrounded by neighbours with low values, including (Vienna, Lombardia, Madrid, or Brussels). In contrast, the LH quadrant contains regions with low intensity values of collaborative accommodation demand that are surrounded by neighbours with high values. According to Lutz (2019), these types of regions are exceptional cases that can be diamonds in the rough, such as Central Greece, Alentejo in Portugal, or Navarre in Spain, or represent regions with restrictive regulations regarding shared economy accommodation, such as Ile-de-France or Catalonia.

**Figure 2. CTIR index Moran's scatterplot**



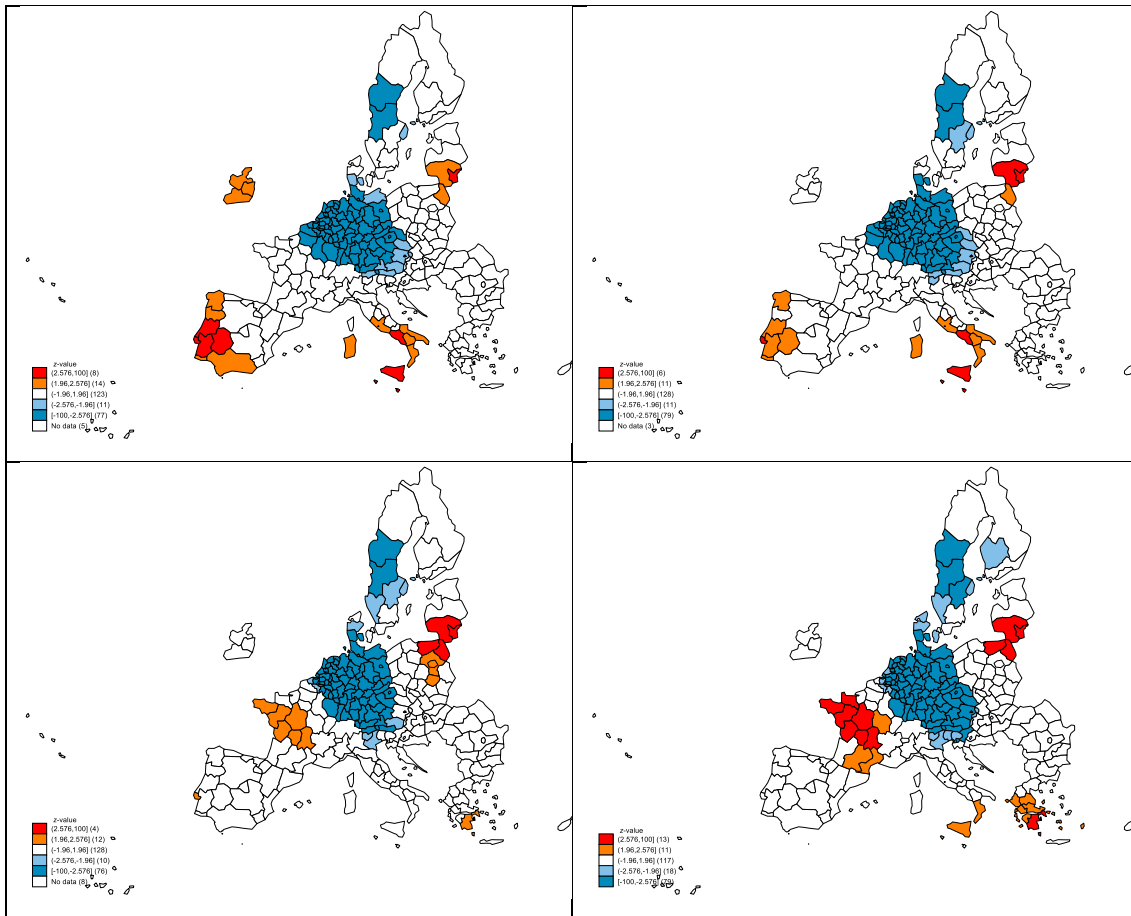


### 3.2.2. Collaborative tourism intensity cluster in Europe

We use hot and cold spot analysis for the defined collaborative tourism intensity rate to understand the geographical distribution of collaborative tourism in Europe. The hot and cold spot analysis is implemented using the `gestiord` command in Stata v.17. developed by Kondo (2016).

Figure 3 reveals the persistent trend identified in Central European regions that have maintained a clustering trend of cold spots with respect to the intensity of sharing economy accommodation demand. In contrast, the Southern European regions tend to show hot spots. Especially after the COVID-19 pandemic, Figure 3 visually clarifies the dynamism of collaborative tourism intensity with the growing formation of a high-intensity cluster of collaborative tourism in the regions of France. The empirical results of this study show relevant implications since they suggest that policies to promote collaborative economy platforms should be carried out in the Central European regions. As data availability on sharing economy platforms increases, it is crucial to continuously monitor dynamic changes in demand for this type of accommodation.

**Figure 3. Hot and cold spots in collaborative tourism agglomeration**



### 3.2.3. Modelling Collaborative Tourism Intensity

Preliminarily, we used the Breusch-Pagan (BP) test (Breusch & Pagan, 1980) to determine whether the panel data fit the OLS model or the random effects model. Subsequently, the Hausman test is employed to determine the choice between the fixed and random effects models. According to the results obtained for the BP and Hausman test, we reject the null hypothesis in both tests, therefore, this research uses fixed effects to model collaborative tourism intensity and to analyse interregional interdependencies between European regions.

In Table 3, the non-spatial fixed effects model (Model 2) shows evidence of the influence of factors such as GDP pc and the hotel occupancy rate, as well as the increased sensitivity of the intensity of collaborative tourism to changes in the hotel occupancy rate after the emergence of the COVID-19 pandemic. However, according to the results of the previous sections, we know that there is a spatial autocorrelation in the intensity distribution of



collaborative tourism demand in Europe. Therefore, in line with Cook et al. (2019), this specification is insufficient, and the results could be inefficient and biased. Therefore, we estimate the following spatial models: Spatial Autoregressive Regression model (Model 3), Spatial Error Model (Model 4), and Spatial Autoregressive Combined model (Model 5).

The Wald tests of spatial terms also present strong and significant evidence of spatial interdependence of regions in all the spatial models. The significance of the spatial coefficients indicates the impact of regional relations on the growth of collaborative tourism intensity of European tourist destinations. All the models present the same relationship between the dependent and independent variables, which is a sign of the robustness of the results. Specifically, GDP pc shows an indirect relationship with the intensity of collaborative tourism, that is, when GDP pc increases in the destination region, the intensity of collaborative tourism decreases.

**Table 3. Model estimates**

DV: CTIR	MODEL 1		MODEL 2		MODEL 3	MODEL 4		MODEL 5		
	Non-Spatial Random Effect		Non-Spatial Fixed Effect		SAR	SEM		SAC		
ln_GDP_pc	-1.25	***	-2.27	***	-3.24	***	-4.92	***	-4.89	***
Hotel occupancy rate	-10.32	***	-9.85	***	-6.18	***	-9.33	***	-9.20	***
Hotel occupancy rate <sup>2</sup>	12.06	***	11.43	***	7.32	***	10.35	***	10.22	***
Hotel occupancy rate * Year										
2019	1.17	***	1.23	***	0.89	***	1.34	***	1.33	***
2020	4.29	***	4.23	***	2.69	***	4.10	***	4.04	***
2021	4.41	***	4.53	***	3.12	***	4.38	***	4.34	***
$\lambda$							0.71	***	0.05	
$\rho$					0.53	***			0.68	***
Constant	18.05	***	28.33	***						
Wald $\chi^2$ test	585.86	***			870.83	***	282.18	***	290.36	***
Hausman test	58.74	***								
Wald test of spatial terms					128.52	***	231.49	***	212.52	***
AIC					1491.9		1450.045		1451.873	
BIC					1530.283		1488.429		1495.054	
N. Observation	896		896		896		896		896	

Note: \*\*\*p < 0.01; W = geographic binary contiguity matrix.

Regarding the hotel occupancy rate, significant parameters are found for both linear and quadratic terms, suggesting a non-linear effect on the hotel occupancy rate and the intensity of collaborative tourism. Thus, the negative impact of an increase in the hotel occupancy rate, as an alternative accommodation service, becomes positive when the hotel occupancy rate is higher. In other words, given high levels of saturation in hotel demand, the intensity of the use of digital platforms for contracting the tourist accommodation service increases. Furthermore, the results show that the sensitivity to the hotel occupancy rate has increased significantly in the years following the outbreak of the COVID-19 pandemic. This may be explained by the increased aversion to the risk of contagion among tourists in the face of the saturation of tourist destinations since tourists sought to escape from very crowded destinations (Mody et al., 2022).

Following Agiakloglou and Tsimpanos (2023), we use the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) to select the best-fitting spatial econometric model. In the SEM model, the AIC (1450.045) and BIC (1488.429) are less than the rest of the spatial models. Consequently, the SEM (Model 4) can be considered the best-fitting spatial panel regression model; therefore, we interpret the spatial effect based on the SEM model estimates. The SEM presents evidence of positive spatial autocorrelation in the disturbances since the coefficient of the spatial autoregressive parameter for the error ( $\lambda$ ) is 0.71 and highly significant ( $p < .01$ ). The  $\lambda$  coefficient measures the magnitude of the interdependence through the disturbance term. Our results confirmed that the regional interrelation in the intensity of collaborative tourism presents a direct relationship, indicating that the shocks that may occur in adjacent regions positively impact the intensity of collaborative tourism in European regions.

According to Elhorst (2010), the estimated coefficients of the independent variables cannot be directly interpreted as the effect on the dependent variable since spatial predictors can cause direct and indirect effects. Therefore, Table 4 presents the estimates of the direct and indirect marginal effects of each of the explanatory variables using the Stata v.17 software<sup>2</sup>.

Comparing the direct and indirect effects from spatial models, the total effects of destination GDP per capita have a negatively significant effect on the intensity of

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<sup>2</sup> More detail on the calculation of marginal effects in LeSage (2008)

collaborative tourism. On the other hand, one of the most relevant findings is the positive total effect of tourism saturation in the intensity of demand for accommodation contracted through shared economy digital platforms. Specifically, in line with Ginindza and Tichaawa (2019), the results of the SEM model (best-fitting model) indicate that, in total terms, a 1 per cent increase in the hotel occupancy rate has a positive effect of 2.35 per cent on the collaborative tourism intensity rate.

**Table 4. Marginal effects: direct, indirect, and total effects**

	MODEL 3	MODEL 4	MODEL 5
	SEM	SAR	SAC
<b>Direct</b>			
ln_GDP_pc	-4.92 ***	-3.39 ***	-4.89 ***
Hotel occupancy rate	2.35 ***	2.11 ***	2.34 ***
<b>Indirect or Spillover</b>			
ln_GDP_pc	-	-2.28 ***	-0.17
Hotel occupancy rate	-	1.39 ***	0.08
<b>Total</b>			
ln_GDP_pc	-4.92 ***	-5.66 ***	-5.07 ***
Hotel occupancy rate	2.35 ***	3.49 ***	2.42 ***

#### 4. IMPLICATIONS FOR THE DIGITAL POLICIES AND CONCLUSIONS

As mentioned above, the regulatory aspects of these types of digital platforms are one of the emerging issues for research on for-profit digital platforms and cities (Artioli, 2018; Aguilera, Artioli, & Colomb, 2021; Prayag & Ozanne, 2018). This phenomenon allows numerous individuals to become micro-entrepreneurs in the hospitality industry, making tourist accommodation one of the main policy issues around the world (Guttentag, 2017).

Legislation in this regard should consider that regulatory intervention may be necessary to deal with market failures caused by short-term rentals (Edelman and Geradin, 2015), labour and employment issues (Poon & Ng, 2017), and managing social unrest with resistance movements reclaiming residents' 'right to the city' (Gil & Sequera, 2018). The digital nature of short-term rentals defies conventional modes of regulation, forcing public authorities to deal with hard-to-quantify activities and new transnational companies (Colomb & Moreira de Souza, 2021). We agree with Interian (2016), who considers that the European regulatory approach is more developed and focuses on reducing negative externalities from short-term rentals than in the US.

The extra pressure induced on residential neighbourhoods by the growth in the supply of tourist accommodation through digital platforms may jeopardise the social sustainability of tourism (Martín-Martín et al., 2023). Moreover, residents may see it as a case of gentrification and a process of social injustice (Cocola-Gant & Gago, 2021). Sectoral regulation must be sensitive to these perceptions of digital tourism.

Some authors (see Afilipoaie, Donders & Ballon, 2022) suggest that digital platform markets are debatable and, in line with Baumol's theory (1982), the existence of power asymmetries allows powerful actors to exploit unfair trading practices. The European Commission (EC) has promoted regulation impacting the tourism P2P market. In concrete, the EC, after launching proposals in December 2020 and on 25 March 2022, reached a political agreement on the Digital Market Act (DMA) and on 23 April 2022 on the Digital Service Act (DSA).

The DSA applies to gatekeepers of different platform services such as online marketplaces, operating systems, cloud services or online search engines. These gatekeepers will be subject to a number of clearly defined obligations and prohibitions. These are established mainly to avoid unfair market practices. On the other hand, the Digital Services Act contains obligations that will apply to all digital services that connect consumers to goods, services, or content and includes new procedures for extensive protection of the fundamental rights of online users. Therefore, supervision for tourism platforms has started to be encouraged in Europe, and European user protection in the digital marketplaces is gradually promoted.

On the other hand, the geographical space is relevant to the public policy intervention. Our knowledge is very limited regarding ICT participation and uses at the subnational level (Blank, Graham and Calvino, 2018) because a "consolidated" national analysis hides territorial inequalities (Vicente and López, 2011). Regional digital inequality exists (Lutz, 2019), but its study in the European Union (EU) is still very infrequent due to limited access to comparable regional statistics (Vicente and López, 2011; Szeles, 2018; Lucendo-Monedero, Ruiz-Rodríguez & González-Relaño, 2019). In any case, European regional studies are beginning to boom, given the dynamics of the drive towards regionalisation processes in the EU (Grasse, 2001). It is, therefore, particularly relevant to deepen the knowledge of the regional perspective on business and policy related to P2P tourism from digital platforms.

Using spatial econometric techniques, this study has identified regional inequalities in terms of the intensity of demand for accommodation offered on digital sharing economy platforms. In particular, different clusters of high intensity of collaborative tourism have been detected in the regions of the Mediterranean coast and the Baltic countries. In contrast, the regions of Central-Eastern Europe continue to show low rates of the intensity of demand for accommodation offered on digital P2P platforms. We agree with Yang (2012) that spatial clusters could play a crucial role in knowledge spillovers and innovation diffusion, and spillovers from increased demand for P2P accommodation are expected to be especially more common in adjacent regions as a result of spatial proximity and social interactions between tourists and residents of one region and another. When there are regional interactions, knowledge diffuses rapidly and promotes innovations in tourism, contributing to tourism development.

Furthermore, using different spatial models, the spatial spillover effects and the effects of interdependencies of European regions in terms of collaborative tourism have been recognised, finding a positive spatial autocorrelation in the intensity rate of collaborative tourism. Another relevant finding has been the effect of tourist destination saturation on the use of accommodation offered on digital sharing economy platforms. In line with Ginindza and Tichaawa (2019), this study highlights the direct relationship between tourist destination saturation and the intensity rate of collaborative tourism demand. Furthermore, we have also detected a change in the sensitivity of tourism saturation after the onset of the COVID-19 pandemic. This fact confirms, in line with Mody et al. (2022), a shift in consumer behaviour in the choice of tourist accommodation services towards the use of digital collaborative economy platforms since the outbreak of the pandemic, especially in the regions of France.

It is clear that in the face of a possible "contagion" effect between neighbouring regions of situations and problems due to the effects of tourism via online platforms, regulatory coordination at the interregional and pan-European level is necessary to avoid inequalities and imbalances across Europe.

Despite the contributions of this research, it is not exempt from limitations. The main limitation has been the availability of data at the NUTS2 level, for example, a variable that could affect the intensity of collaborative tourism could be the price level of hotels and P2P accommodation. However, Eurostat does not provide information on price indices for goods and services at the NUTS2 level. In addition, as an experimental

Eurostat survey, the information on collaborative economy platforms is still scarce, and it does not collect information on the price of P2P accommodation either. For these reasons, the use of panel data has been chosen since it makes it possible to control the impact of omitted variables (Hsiao, 2003). Likewise, new avenues are opened to understand the regional interactions of the demand for collaborative tourism in the EU-27. In the face of negative visions, online platforms have generated relevant tourists' benefits and have promoted a more efficient EU internal market. This is an area to be explored in future research. The platforms have also boosted cross-border tourism within and outside the Union in a phenomenon that is also worth investigating,

More emphasis, coordination, and consistency in territorial cohesion are required at a time when the European Commission is announcing more locally oriented policies. Furthermore, we hope that the academic and political reflection raised on the "territorial dimension" linked to regional inequalities will promote a growing sensitivity to the relevance of policy analysis with a geographical component and, thus, a better understanding of the territorial impact of public bodies' interventions. This regional perspective should be strongly encouraged, given the importance for Europeans to continue building a real Union in the digital world.

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