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# Spatial influence of attractions on tourism development<sup>1</sup>

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# Spatial influence of attractions on tourism development

## Abstract (243 words)

Destination planning raises questions relative to spatial organization within the destination and to the spatial extent of the gains generated by attractions. Thus, it is important to increase understanding and knowledge of the mechanisms by which attractions generate tourism development. The aim of this study is to analyze how tourist attractions influence tourism development within destination and what the spatial extent of this influence is. It is argued that both the appeal of tourist attractions and their spatial characteristics are determining factors. Thus distinguishing local, spread and diffuse attractions is essential and specific indicators were created to that purpose. Using count data models, an econometric analysis was conducted in order to test the effect of attractions on the number of hotel rooms in 2015 on the one hand, and on the number of employees in the tourism sector in 2014 on the other, in French municipalities. The study brings several original results. First, as in the case of green areas, some attractions may trigger the emergence of tourism development but may also have a depressive effect on the level of tourism development when they exceed a certain threshold. Second, the influence of sport and leisure facilities is more limited in space than for ski slopes, beaches and tourist sites, which confirms that the appeal of attractions determine the spatial extent of tourism development. Third, beyond a distance threshold, some attractions can generate negative spatial spillovers and have a depressive effect on tourism development.

**Keywords:** Attraction; Tourism development; Amenities, Location; Econometrics, Count data model.

**Word count:** 8823 (Abstract: 243; Keywords: 10; Main text: 6095; References: 911; Tables: 1470, Appendix: 94).

## Introduction

Attractions are central in destination place planning (Dredge, 1999; Leask, 2010). Indeed, enhancing tourist attractions or building new ones are the main vehicles by which regional and local governments promote tourism development. As a consequence, over the last thirty years, a number of regions and municipalities have made substantial investments in tourist attractions, such as sports facilities, theme parks or museums, sometimes without significant gains (Rosentraub & Joo, 2009). The design and the implementation of an attraction-based policy raise questions relative to spatial organization within the destination. First, the location of new amenities must be chosen, taking into account the location of other attractions in order to reduce spatial competition and generate positive spatial spillovers. Second, the level of jurisdiction in charge of the management or financing of an attraction should depend on its size and its costs, but also on the spatial extent of the gains generated by this attraction in terms of arrivals, employment and services created. Thus, destination planning and attraction-based policy design involve understanding the mechanisms by which attractions generate tourism development, how several attractions interact, and how they influence tourist services within a destination.

Tourist attractions are the subject of extensive literature. Many works have defined the notion of attraction and have characterized the different types of attractions (Wall, 1997; Sternberg, 1997; Pearce, 1991). Several models have been developed that deal with the mechanism of tourist attractions and highlight the different components of attractions (MacCannell, 1976; Leiper, 1979, 1990; Gunn & Var, 2002). But in these works, spatial aspects are seldom integrated in the literature on attractions (Leask, 2010). Moreover, empirical analyses on the spatial influence of attractions are relatively rare. Recently important literature has been developed, both theoretical and empirical, that deal with the spatial relation between tourist and attraction (Lew & McKercher, 2006; Orellana, Bregt, Ligtenberg, & Wachowicz, 2012). But there is a general dearth in this literature concerning the influence of attractions on tourist services.

This paper aims to contribute to the existing literature on the nature and effects of attractions. In this work, we ascertain whether different attractions, such as sports and leisure facilities or tourist sites, pull tourist development and we investigate the spatial extent of their influence. First, the proposed theoretical framework gives an insight into how the spatial influence of an attraction depends on the spatial extent of this attraction. Consequently, analyzing empirically the spatial influence of attractions on tourist development requires that the attractions be treated differently if they are local, spread or diffuse. Second, we apply this framework to an empirical analysis. We put forward original measures that take into account the different spatial forms of attractions. Using count data econometric models, we test the effect of these different types of attractions on the number of hotel rooms in 2015 on the one hand, and on the number of employees in tourism sector in 2014 on the other, in French municipalities. In order to analyze the spatial extent of this influence, we estimate the effect of attractions in the municipalities where they are located but also in the neighboring municipalities.

This work leads to several interesting results. Beyond the impact of emblematic tourism attractions (ski slopes and beaches), it confirms the positive influence of heritage attractions (e.g. tourist sites), natural attractions (e.g. lakes, watercourses, environmental quality) and sports and leisure facilities on tourism development. As expected, it also shows that the influence of local attractions exceeds the municipal borders. Nevertheless, the spatial extent of the influence of local attractions is more or less significant according to the type of attraction. Indeed, tourist sites, beaches and ski slopes influence tourism development over a longer distance than sports and leisure facilities. Finally, facilities seem to have a positive effect on tourism development in a municipality but a depressive effect in the neighboring municipalities. This could mean that these attractions generate negative spatial spillovers and contribute to more agglomerated forms of tourism.

This paper is structured as follows. We first present our conceptual framework. The next section is dedicated to the data and the attraction variables we have created. We then set out our econometric model followed by the results of our estimations, a discussion of these results, and our final conclusions.

## **Theoretical background**

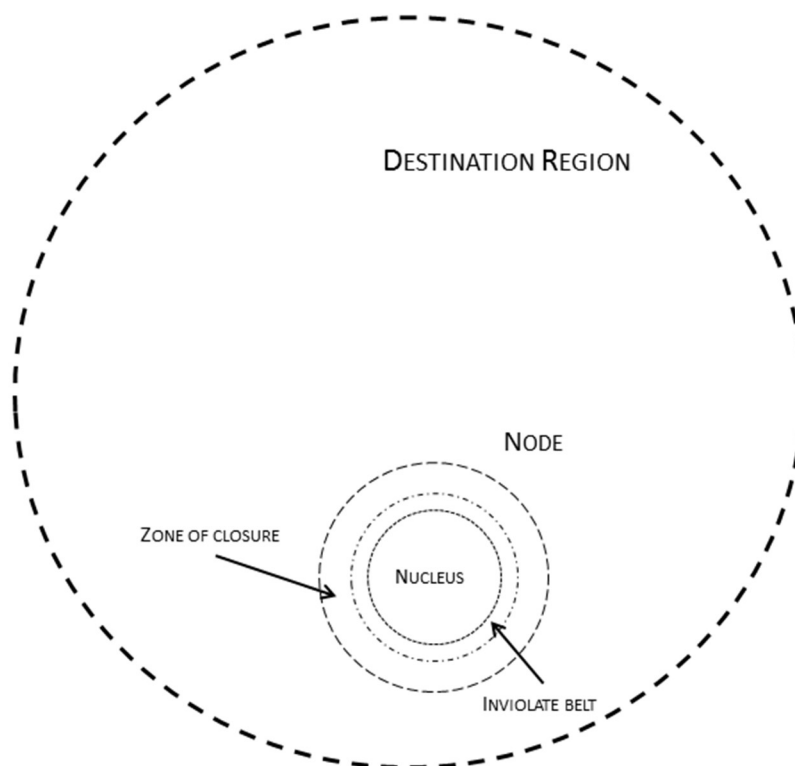
### ***Spatial models of attractions***

In their seminal works, Gunn and Var (2002) and MacCannell (1976) laid the foundation of the tourism attraction system models. According to them, an attraction is a system comprising three different elements: a tourist, a sight (also called nucleus or attraction) and a marker, which refers to the information that encourages the tourist's decision to visit the attraction.

In these models, the nucleus is the central element of the attraction system. The nucleus (or attraction) is a feature or characteristic of a place that a tourist contemplates visiting or actually visits (Leiper, 1990). It might be a sight, an object, an event or any kind of tourist amenities.

According to Lew (1987), the studies on tourist attraction systems can be classified into three general perspectives: the ideographic perspective which consists in describing each specific site, the cognitive perspective which focuses on tourist experiences and perceptions, and the organizational perspective which looks at the spatial, capacity or temporal nature of attractions. From this latter perspective, several works have proposed spatial models of attraction. They have introduced key concepts and have especially helped in describing and understanding the spatial structure of destinations.

From a spatial point of view, a destination region is a location which attracts tourists and that a tourist chooses to visit for a least one night in order to experience some characteristics perceived as satisfying a leisure time experience (Leiper, 1979, 1995). A destination region may be large or small and can exist on different scales (Dredge, 1999). In their model, Gunn and Var (2002) identify three key elements within a destination region: “attraction complexes”, “circulation corridors” that provide tourist access to attraction complexes, and a “non-attraction hinterland”. Each attraction complex, also called “node” by Dredge (1999), contains attractions and services which together form a local sub-destination within the destination region. Gunn and Var (2002) suggest that the spatial structure of the nodes consists of three concentric rings (Figure 1). The nucleus is the center of the structure. It is then surrounded by an “involute belt”, which provides the immediate physical and psychological setting for a tourist experience. The involute belt is then surrounded by a “zone of closure”, defined as the outer area of the attraction influence and which includes services and facilities supporting tourism.



**Figure 1.** Spatial structure of a node in destination region

Many works have investigated the relation between the nucleus of the attraction system and the tourist. Following Rugg (1973), an important literature has analyzed how attractions influence the tourists' destination choice (Papatheodorou, 2001; Seddighi & Teocharous, 2002; Nicolau & Mas, 2006). Another strand of literature has looked at the interaction between the nuclei and the tourists within the destination, focusing on the tourists' movements. Lew and McKercher (2006) propose different linear path models of tourist behavior in local destinations. Following them, several empirical studies have been conducted to explore tourist movement patterns (Smallwood, Beckley & Moore, 2012; Orellana et al., 2012, Zoltan & McKercher, 2015). To a certain extent, these works help to define the boundaries of nodes and the links between them. But these analyses fail to highlight how a nucleus influences the level of development of tourist services, what the spatial extent of its influence is, and what the dimension of the zone of closure surrounding the nucleus is. In the present work, a different stance is adopted. Our aim is to contribute to the study of nodes by analyzing how an attraction influences the development of tourism services within a destination region and by investigating the extent of this spatial influence.

### ***Influence of spatial types of attractions***

Following Dredge (1999), we consider that the configuration of nodes, and in particular of their service component, depends on the level of attractiveness of nuclei. Indeed, price and demand level are key drivers for the firms' performance and hence for the development of tourism services (Papatheodorou, 2003). And many studies have shown the influence of attractions on both of these (Morley, 1992; Lee & Jang, 2011; Peña, Jamilena, Molina, & Olmo, 2015). The appeal of tourist attractions and their influence on the development of tourism services are mainly determined by their own characteristics. Attractions can be very different in nature (Rosentraub & Joo, 2009). In some cases, tourism attractions may be public goods provided by nature (e.g. rivers), public facilities supplied by local authorities (e.g. a swimming pool), services provided by firms (e.g. restaurants) or positive externalities generated by an economic activity (e.g. the influence of agriculture on landscape). In spite of this considerable heterogeneity, from a spatial point of view, the attractions can be divided into three types based on their spatial characteristics: the local attractions, the spread attractions and the diffuse attractions.

Local attractions correspond to what Wall (1997) calls "point attractions". Among others, this category includes monuments, parks, infrastructures like theaters, swimming pools and other local public goods. In this case, the development of tourist services in a node depends on the level of tourist interest of the local attraction. As there can be several local attractions in a node, the overall appeal of a node may increase with the number of local attractions because of the tourists' preference for diversity. Therefore, we assume that:

*H1: The development of tourist services in a node increases with the number of local attractions.*

Spread attractions include what Wall (1997) calls linear attractions (e.g. rivers, coastlines) and areal attractions (e.g. lakes, protected areas). Like the local attractions, spread attractions are localized. But they differ in the fact that their physical dimension is significant. Indeed spread attractions are sometimes large enough to extend over several municipalities. Given the physical dimension of this type of attraction, the tourist appeal may increase insofar as the spread attraction is large. Thus, we assume that:

*H2: The development of tourist services in a node increases with the surface area of the spread attractions.*

The attractiveness of these first two types of attractions can be strengthened by a third type of attraction. Diffuse attractions concern attractions that are not localized and cannot be clearly delimited in space (e.g. climate, landscape diversity). Therefore we assume that:

*H3: The development of tourist services in a node depends mainly on the magnitude of the diffuse attraction.*

#### ***Distance decay and delimitation of the zone of closure***

Within a destination region, the appeal of tourist attractions is not constant in space. And, as a consequence, their influence on both the tourists' willingness to pay for tourist services and on the demand level may decrease with distance from the nucleus. Two different branches of empirical literature have highlighted these relations.

The first branch has ascertained the influence of the distance to attractions on the price of tourist services. Using the hedonic prices approach, Espinet, Saez, Coenders and Fluvia (2003) and Kaidou, Moore and Charles-Soverall (2014) have thus shown that the proximity to the beach has a significant and positive effect on both hotel prices and rental prices for villas and cottages. Dealing with the concept of distance decay at a macro-scale, a second branch of empirical works has shown that tourism demand varies with the distance traveled between the origin and the destination of tourists (Paul & Rimmawi, 1992; McKercher, Chan & Lam, 2008). McKercher and Lew (2003) have identified three types of distance decay curves: a standard curve suggesting that demand peaks close to the origin and then declines exponentially with distance; a plateauing curve where the demand plateaus and decreases only after a certain distance threshold; a third curve with a secondary peak located at some large distance from the origin. Recent works have revealed that this relation also holds within a destination region and suggest that the three types of distance decay curves should be observed on a local scale (Shoval, McKercher, Ng & Birenboim, 2011). Among these works, Smallwood, Beckley and Moore (2012) have shown that most tourists do not travel a long distance between their accommodation and the recreational services (*i.e.* less than 20 km). But they have also ascertained that the distance traveled depends on the attractiveness of the sites.

Thus, the level of development of tourist services in a node depends mainly on the tourist appeal of the nucleus, and decreases with the distance from the nucleus until a certain distance. This distance corresponds to a profitability threshold beyond which no tourist services are present and marks the outer limit of the zone of closure. Therefore, we assume that:

*H4: The spatial extent of the influence of attractions on tourism services depends on the attraction considered and on its tourist appeal.*

In order to test these assumptions, we have conducted an econometric analysis on French data at the municipal level.

## Data and variables

### *Sample and dependent variables*

Applied to France, our empirical work aims to test the spatial influence of attractions on tourist services. The French case is of particular interest because it offers insight into very different forms of tourism and enables us to analyze the influence of a wide range and a high-density of attractions (such as coast or heritage). In order to identify the spatial extent of the influence of attractions, we have made the decision to stay on a scale of analysis that is as precise as possible. Indeed, an analysis conducted on too large a scale could jeopardize this approach. Since the databases used to create our variables were available at best at the municipal level, it is on this scale that we have made our estimations. Small islands (Ponant Islands) have been excluded because we had no data on time distances for them but the municipalities located in big islands like Corsica are kept in the analysis. The estimations were finally conducted on a sample of 36,554 French municipalities.

Two different dependent variables have been created at the municipal level. The first dependent variable  $N_i$  is the number of hotel rooms in a municipality  $i$  in 2015 (Table 1). The second dependent variable  $E_i$  is the number of employees in the tourism sector, as defined by the French Ministry in charge of tourism (Appendix 1), in a municipality  $i$  in 2014.

### *Measuring the different types of attractions*

The theoretical background leads us to assume that the influence of attractions on the development of tourism services is partly determined by their spatial characteristics. As a consequence, we have introduced measures relating to local attractions, spread attractions and diffuse attractions.

In this study, we have taken into account four types of local attractions. The first two variables concern emblematic tourism resources: ski resorts and beaches. The variables **ski** and **beach** correspond respectively to the number of ski slopes and the number of beaches in the municipality. The third variable on local attractions, called **sites**, indicates the number of major tourist sites, i.e. that are visited by more than 10,000 people a year (e.g. castles, caves, museums). Furthermore, Rosentraub and Joo (2009) have shown that amusement and sports attractions were associated with a high level of tourist employment. Thus, a specific variable **facilities** evaluates the level of municipal resources for eight types of sports and leisure facilities: cinemas, riding schools, swimming pools, tennis courts, sites of water-based recreational services, outdoor fields for small team games, outdoor sports, and hiking trails. For each type of facility, we have calculated a standardized score by dividing the number of facilities present in municipality  $i$  by the maximum number obtained in a municipality, so that we obtain a score between zero and one. The variable facilities corresponds to the sum of the eight scores obtained.

The influence of spread attractions cannot be grasped using measurements developed at the municipal level (e.g. the proportion of the municipal area occupied by lakes). Indeed, as they may extend over several municipalities, these measurements would not have been relevant. We have therefore chosen to create our variables for spread attractions by focusing on the boundaries of the spread attractions themselves.



**Table 1.** Statistical summary.

Variable	Description	Source	Mean	Std. dev.	Minimum	Maximum
<i>Dependent variables</i>						
$N_i$	Number of hotel rooms of 01/01/2015	INSEE, Tourist accommodation capacity	17.552	434.954	0.000	78,605
$E_i$	Number of employees in the tourism sector of 12/31/2014	ACOSS, Firms and jobs of the private sector	24.101	803.605	0.000	149,234
<i>Tourist attractions variables</i>						
Ski	Number of ski slopes in 2007	Ministry of Youth and Sports, Inventory of sports facilities	0.010	0.176	0.000	15.000
W-ski			0.008	0.039	0.000	1.198
Wctg-ski	Weighted average number of ski slopes over the neighboring municipalities using row-standardized matrices		0.010	0.107	0.000	5.876
W25-ski			0.008	0.053	0.000	3.157
W50-ski			0.008	0.033	0.000	0.889
Beach	Number of beaches in 2012	Ministry of Health, Bathing waters	0.049	0.540	0.000	27.000
W-beach			0.037	0.150	0.000	2.376
Wctg-beach	Weighted average number of beaches over the neighboring municipalities using row-standardized matrices		0.045	0.365	0.000	12.000
W25-beach			0.037	0.200	0.000	7.963
W50-beach			0.037	0.134	0.000	2.060
Sites	Number of major tourist sites in 2007	Atout-France, Frequentation of tourist sites	0.091	0.609	0.000	27.000
W-sites			0.084	0.067	0.000	0.862
Wctg-sites	Weighted average number of sites over the neighboring municipalities using row-standardized matrices		0.104	0.308	0.000	8.930
W25-sites			0.082	0.087	0.000	1.433
W50-sites			0.086	0.064	0.000	0.908
Facilities	Composite index on the level of sports and leisure facilities in 2007	Ministry of Youth and Sports, Inventory of sports facilities & INSEE, Permanent Equipment Database	0.033	0.076	0.000	5.017
W-facilities			0.031	0.023	0.004	0.285
Wctg-facilities	Weighted average number of facilities over the neighboring municipalities using row-standardized matrices		0.035	0.048	0.000	1.311
W25-facilities			0.031	0.027	0.000	0.383
W50-facilities			0.032	0.022	0.004	0.240

Variable	Description	Source	Mean	Std. dev.	Minimum	Maximum
Lake	Surface area of lakes	Sandre, BD Carthage	0.585	12.655	0.000	576.747
Watercourse	Watercourse width index	Sandre, BD Carthage	1.096	0.967	0.022	3.000
Ecology	Indicator of the environmental quality	MEDDE, environmental zonings	19.149	31.273	0.000	100.000
Green-area	Share of the surface area covered by green areas in 2006	MEDDE, Corine Land Cover	56.682	27.929	0.000	100.000
<i>Control variables and dummies</i>						
Log(pop)	Log of the number of inhabitants in 2007	INSEE, National Census	6.153	1.337	0.000	14.601
Log(nontour-emp)	Log of the number of employees in the sectors other than tourism in 2008	ACOSS, Firms and jobs of the private sector	2.877	2.544	-1.000	13.927
Mountain	Municipality included in a mountain zone	Ministry of Agriculture, compensation for natural handicaps	0.170	0.376	0.000	1.000
Border	Municipality located along the border with Belgium, Luxembourg or Germany	Own construction based on IGN, BD CARTO	0.007	0.083	0.000	1.000
<i>Interaction variables</i>						
Ski*sites			0.004	0.220	0.000	36.000
Ski*Facilities			0.002	0.107	0.000	19.091
Beach*sites			0.082	3.717	0.000	459.000
Beach*facilities			0.012	0.440	0.000	70.200
Sites*facilities			0.023	0.540	0.000	70.200

Two different spread attractions have been considered: lakes and watercourses. For both variables, we have considered their size. Thus, the variable **lake** corresponds to the surface area of lakes in municipality  $i$  if at least one lake is present in this municipality or, in other cases, the surface area of the nearest lake weighted by the inverse time-distance spent to get from municipality  $i$  to the municipality in which the lake is located. All the travel times used in this empirical analysis have been calculated using Odomatrix software (Hilal, 2010). These are travel times in off-peak hours and are expressed in minutes. Concerning watercourses, we have first evaluated the width of the watercourses using the available ranges of values: the width index takes one if the watercourse's width is less than 15 m, two if it is between 15 and 50 m, three if it is over 50 m. Then, as with lakes, we have given the variable **watercourse** the value concerning the watercourses in municipality  $i$  if at least one watercourse is present in this municipality or, in other cases, the value of the nearest watercourse weighted by the inverse time-distance to get to the municipality in which it is located.

In order to better integrate the fact that the third type of attraction is diffuse in space and that its level varies gradually, the variables relating to diffuse attractions have been smoothed. Thus, those variables have been calculated over a larger area  $i'$  than that of the municipality, which includes municipality  $i$  and its neighboring municipalities located within a five kilometer radius. Two different diffuse attraction variables have been introduced in our estimations. The first variable of diffuse attraction, **ecology**, is an indicator of the environmental quality. It corresponds to the proportion of the surface area included in at least one protected area or area of natural interest. Seven different types of environmental zoning have been used to create our indicator of environmental quality, defined within the framework of different national, European or international environmental policies: national parks, nature reserves, coastal protection areas, Ramsar convention on wetlands of international importance (especially as waterfowl habitats), European special protection areas and important bird areas, European special areas of conservation and regional nature parks. The second diffuse attraction variable, called **green-area**, corresponds to the proportion of the surface area covered by green areas such as parks, grassland, forests or scrub.

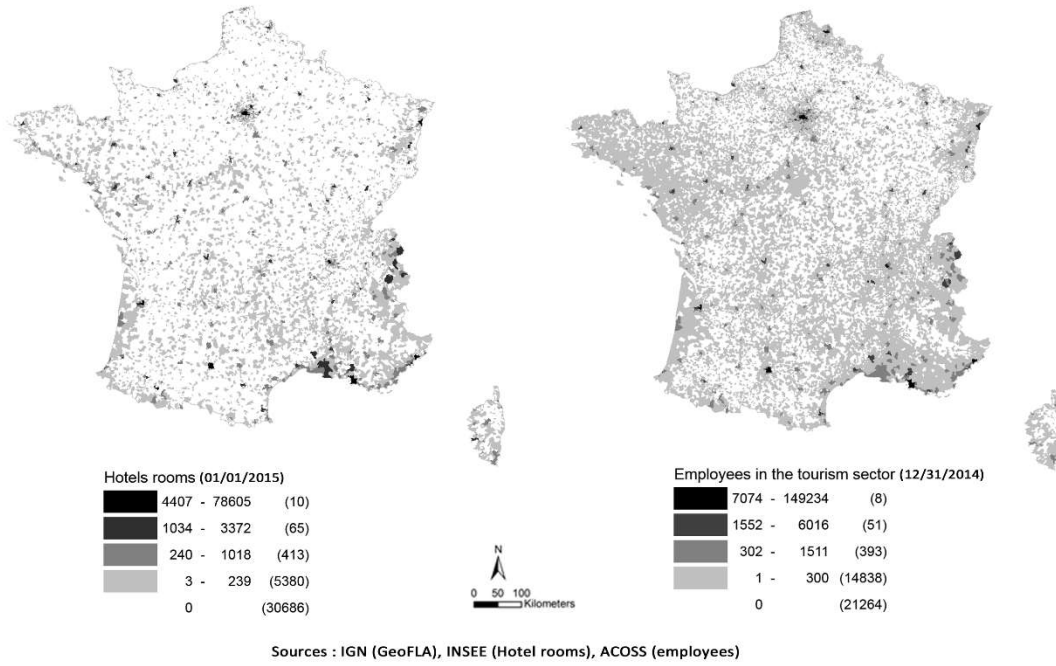
### *Control variables and dummies.*

In order to control for the size effect, we have introduced the log of municipality **population** as a control variable. Moreover, the development of tourist services is mainly linked to leisure trips but may also be due to professional stays. Thus, we have introduced the log of the number of **employees in the sectors other than the tourism sector** to control for business tourism. Finally, we also have considered the influence of geographical features by introducing dummy variables. The variable **mountain** indicates whether municipality  $i$  is included in a mountain zone as defined within the framework of the European policy on rural development and less favored areas. In order to control for a 'frontier effect', we have also introduced the variable **border** which takes one if municipality  $i$  is located along a non-mountainous border area, that is to say along the border with Belgium, Luxembourg or Germany.

## **Econometric model**

### *Zero inflated negative binomial model*

In France, tourism services are geographically concentrated especially along the coastline and in the mountainous areas (Figure 2). And many French municipalities present neither hotel rooms nor employees in the tourism sector.



**Figure 2.** Spatial distribution of the dependent variables

As a consequence, our two dependent variables  $N_i$  and  $E_i$  are characterized by a low number of distinct positive values and count data models are the most appropriate. The Poisson model is usually the first choice but it has a restrictive equidispersion assumption. As the variances of  $N_i$  and  $E_i$  are more than a thousand times higher than their means (Table 1), the equality of the conditional mean and variance is rather unrealistic. The Negative Binomial (NB) model is able to deal with the problem of the over-dispersion of the data by introducing an individual unobserved effect in the conventional Poisson model.

Then, there is a debate about the excess of zero and the need to implement a two regime model like the zero inflated negative binomial (ZINB) model (Allison, 2012). In that case, two latent groups are treated differently by combining a binary process with a count process as in the following equation (Winkelmann, 2008; Long and Freese, 2014):

$$\Pr(Y = y|x) = p(1 - \min(y, 1)) + (1 - p)G(x\beta_2, \alpha) \quad y = 0, 1, 2, \dots$$

The probability function of the outcome  $y$  in the ZINB model is a mixture of  $p = F(x\beta_1)$  the probability of belonging to the Always 0-Group from a logit specification, 1 the probability of the 0 outcome in the Always 0-Group, and  $G(x\beta_2, \alpha)$  the probability of each count (including zeros) in the Not Always 0-Group from a NB model with the over-dispersion parameter  $\alpha$  (i.e. with conditional mean  $\mu = \exp(x\beta_2)$  and conditional variance  $\mu(1 + \alpha\mu)$ ).

The Vuong test comparing ZINB and NB models is used to choose between both specifications (Vuong, 1989; Greene, 2008). This statistic has a standard normal distribution. A value higher than 1.96 for the Vuong statistic favors the ZINB, while a value less than -1.96 favors the Negative Binomial distribution (the test is inconclusive for values between -1.96 and 1.96). In our case with 84% and 58% of the municipalities having respectively no hotel rooms and no employees in the tourism sector, this test suggests that the ZINB model fits better the data and is a significant improvement over a standard NB model.

### ***Introduction of spatial lagged variables***

Firstly, a base model has been estimated to analyze the influence of the different types of attractions on both dependent variables. Then, in order to measure the spatial extent of the influence of local attractions, we have introduced spatial lagged variables in two steps. In a first step, we have analyzed if hotel capacity and tourist employment in the municipality  $i$  were influenced by the attractions located in the neighboring municipalities, taking into account the effect of distance. The spatial weight matrix used here is a time-based weight matrix, in which the weight corresponds to the inverse travel time in off-peak hours ( $t_{ij}$ ) between the city hall of municipality  $i$  and the city hall of municipality  $j$  if  $j$  is less than 50 km from  $i$ , and equals zero if there are 50 km or more between  $i$  and  $j$ . Then, the weight is such that:

$$W_{ij} = \begin{cases} \frac{1}{t_{ij}} & \text{if } d_{ij} < 50 \text{ km} \\ 0 & \text{if } d_{ij} \geq 50 \text{ km} \end{cases}$$

All the spatial weights are row-standardized so that the elements in each row sum to 1. Thus, four other variables, **W-ski**, **W-beach**, **W-sites** and **W-facilities** have been added to our econometric model, which correspond respectively to the average number of ski slopes, the average number of beaches, the average number of tourist sites and the average number of facilities, and the average number of tourist sites over the neighboring municipalities of  $i$  in a radius of 50 km weighted by the travel-time needed to reach them.

In a second step, we have investigated the geographical scope of influence of local attractions. Instead of the spatial lagged variables **W-ski**, **W-beach**, **W-sites** and **W-facilities**, we have introduced for each local attraction different variables computed within different distance thresholds and calculated from different spatial weight matrices. In all the matrices, the weight  $W_{ij}$  is the inverse travel time in off-peak hours between the municipalities  $i$  and  $j$  if they are neighbors, and zero in the other cases. The difference between the matrices lies in the definition of neighbors. In their work on distance decay function within a marine park, Smallwood, Beckley and Moore (2012) have shown that most of the tourists traveled by vehicle less than seven kilometers to reach the beach access points and less than two kilometers for the boat launching sites. In both cases, they observed a secondary peak in the histograms of distance at about 70 km for the beach access points and 40 km for the boat launching sites. Considering these results and after having tested different distance thresholds, we have chosen three different spatial weight matrices. The matrix used to create the spatial lagged variables **Wctg** considers  $i$  and  $j$  as neighbors if these municipalities have common borders. The spatial weight matrix used for the variables **W25** takes into account the municipalities that are not contiguous but are separated by less than 25 km, and the one used for the variables **W50** considers the municipalities that are separated by more than 25 km but less than 50 km. Thus we get:

$$W_{ctg_{ij}} = \begin{cases} 1 & \text{if } i \text{ and } j \text{ share a common border} \\ 0 & \text{if } i \text{ and } j \text{ do not share a common border} \end{cases}$$

$$W_{25_{ij}} = \begin{cases} \frac{1}{t_{ij}} & \text{if } d_{ij} < 25 \text{ km and } i \text{ and } j \text{ do not share a common border} \\ 0 & \text{if } d_{ij} \geq 25 \text{ km} \end{cases}$$

$$W_{50_{ij}} = \begin{cases} \frac{1}{t_{ij}} & \text{if } 25 \leq d_{ij} < 50 \text{ km} \\ 0 & \text{otherwise} \end{cases}$$

## Results

### *Identifying the effect of attractions*

The base model shows, as expected, that most of the attractions have a positive effect on the development of tourism services in a municipality (Table 2). Indeed, the first regime of the ZINB models (Logit columns) shows that the probability of a municipality having no hotel room or no employee in the tourism sector decreases when the number of ski slopes, beaches, tourist sites and facilities increase. This probability also decreases when the access to water-based resources (lakes and watercourses) or the environmental quality level increases. The second regime of the ZINB models (Negative binomial columns) also shows that ski slopes, beaches, sites, facilities, lakes and environmental quality levels have a positive and significant effect on the number of hotel rooms and the number of employees in the tourism sector. Thus, these results confirm those obtained by Rosentraub and Joo (2009) concerning the influence of sports and amusements on the tourism industry. They also confirm the positive effect of natural amenities and, amongst others, of water-based resources already observed by Marcouiller, Kim and Deller (2004) and Dissart, Aubert and Truchet (2009).

**Table 2.** Estimated results: effects of attractions.

Variable	ZINB Number of hotel rooms in 2015		ZINB Number of employees in the tourism sector in 2014	
	Logit	Negative binomial	Logit	Negative binomial
Intercept	7.0244***	1.7862***	8.4356***	-1.0978***
Ski	-1.8276***	0.2808***	-4.4313	1.1782***
Beach	-0.7058***	0.1330***	-2.6247***	0.2483***
Sites	-0.8766***	0.1593***	-1.5949***	0.2271***
Facilities	-3.7823***	1.2677***	-5.6253***	3.0148***
Lake	-0.0030***	0.0013**	-0.3038***	0.0023***
Watercourse	-0.1328***	-0.0243	-0.1469***	-0.0127
Ecology	-0.0056***	0.0030***	-0.0035***	0.0027***
Green-area	-0.0089***	-0.0063***	-0.0101***	-0.0041***
Log(pop)	-0.3997***	0.1102***	-1.1693***	0.2686***
Log(nontour-emp)	-0.3853***	0.2336***	-0.1910***	0.3197***
Mountain	-0.5686***	0.2222***	-0.3575***	0.1299*
Border	0.3102	-0.2992*	-0.7704***	-0.1655
Regional fixed effects	Yes	Yes	Yes	Yes
Log( $\alpha$ )		-0.1636***		-.4819***
Observations		36 554		36 554
LL		-38 858		-69 088
Vuong(z)		60.82		34.51
AIC		77 854		138 314
BIC		78 441		138 901

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01 and robust standard errors

Note: For one unit augmentation in an explanatory variable, say ski, the probability of having no hotel rooms decreases (significant negative parameter of -1.83) whereas the number of hotel rooms increases (significant positive parameter of 0.28).

Results related to green areas are more surprising. Indeed, access to green areas has a positive and significant effect on the presence of hotel capacity and tourist employment but has a negative and significant effect on their level. This result can be interpreted as a consequence of a threshold effect. We can suppose that an increase in the surface of green areas up to a certain threshold can generate tourism development. But above this threshold, increasing green areas does not foster tourism development and will rather be associated with more diffuse and less dense forms of tourism.

Further estimations have been made in order to investigate the relation between the different local attractions and to identify substitution effects or complementarities (Tables 3a and 3b). The results of the second regime of the ZINB models show a substitution effect between the local attractions, and especially between the sport and leisure facilities and the other local attractions. Thus, it seems that the tourism development is fostered either by ski, beach and tourist sites or by facilities. Nevertheless, the first regime of the ZINB model on the number of employees in the tourism sector shows that tourist sites can be complementary to ski slopes and beaches and that these attractions can contribute together to the emergence of tourism.

### *Analyzing the spatial extent of the influence of local attractions*

Table 4 presents the results of the models with the spatial lagged variables. For both dependent variables, we have first introduced the variables related to the local attractions located in the neighboring municipalities (Models 1). The estimates reveal that the spatial influence of leisure and sports facilities on the one hand, and of tourist sites and ski slopes on the other, are different. Indeed, the level of tourism development in a municipality increases with the number of tourist sites and ski slopes present in this municipality, but also nearby. On the contrary, leisure and sports facilities have a positive effect on tourism development only in the municipalities in which they are located, while they have a negative effect on tourism development in the neighboring municipalities.

In Models 2, we have introduced the spatial lagged variables created from the spatial weight matrix  $W_{ctg}$ ,  $W_{25}$  and  $W_{50}$  in order to further investigate the geographical scope of the influence of local attractions. The obtained results reinforce the previous ones and confirm that the spatial extent of the influence of the attractions varies according to the type of attraction. They add new information insofar as they reveal that leisure and sports facilities have a positive and significant effect on the tourism development level in the contiguous municipalities but have a negative and significant effect on the presence and the number of hotel rooms beyond the contiguous municipalities and within a 25 km radius. By contrast, the other local attractions seem to have a more extended positive effect on tourism development, within a 25 km radius for beaches and tourist sites and beyond 25 km for ski slopes.

Linked to the literature on attractions, these results suggest that the dimension of the node and the zone of closure depend on the type of attraction, which is in the nucleus. Two reasons could explain this difference in the spatial extent of the influence of local attractions. First, we can suppose that tourists are more likely to travel a considerable distance for ski slopes, beaches or major tourist sites than for leisure and sports facilities and that the distance they are willing to travel for facilities does not exceed a few kilometers. Second, we can assume that tourist sites act upon tourism development as a source of recreation, which requires tourist movements, but also as a source of other benefits such as scenic views. And we can suppose that in the latter case, the spatial influence of tourist sites may extend further. Consequently, we can suppose that ski slopes, beaches and tourist sites have an effect on the overall attractiveness of the area whereas leisure and sports facilities act upon the location of tourists and consequently upon the development of tourism services on a smaller scale.

**Table 3a.** Estimated results: substitution effects or complementarities between attractions.

Variable	ZINB Number of hotel rooms in 2015									
	(1)		(2)		(3)		(4)		(5)	
	Logit	NB	Logit	NB	Logit	NB	Logit	NB	Logit	NB
Intercept	7.0235***	1.7889***	7.0222***	1.7919***	7.0292***	1.8024***	7.0254***	1.8194***	7.0306***	1.8515***
Ski	-1.8585***	0.3079***	-1.8630***	0.3256***	-1.8251***	0.2826***	-1.8270***	0.2733***	-1.8260***	0.2675***
Beach	-0.7055***	0.1329***	-0.7056***	0.1327***	-0.6425***	0.1617***	-0.7134***	0.1712***	-0.7062***	0.1298***
Sites	-0.8805***	0.1610***	-0.8764***	0.1588***	-0.8534***	0.1728***	-0.8765***	0.1598***	-0.9058***	0.2203***
Facilities	-3.7810***	1.2725***	-3.7948***	1.2968***	-3.7818***	1.2311***	-3.7862***	1.4251***	-3.8377***	1.5705***
Ski*sites	0.4935	-0.0646*								
Ski*facilities			0.5175	-0.1521**						
Beach*sites					-0.3701	-0.0120***				
Beach*facilities							0.2098	-0.1359***		
Sites*facilities									0.4809	-0.1460***
Lake	-0.0030***	0.0013**	-0.0030***	0.0013**	-0.0030***	0.0013**	-0.0030***	0.0013**	-0.0030***	0.0012**
Watercourse	-0.1328***	-0.0244	-0.1328***	-0.0244	-0.1331***	-0.0224	-0.1325***	-0.0230	-0.1326***	-0.0255
Ecology	-0.0056***	0.0030***	-0.0056***	0.0030***	-0.0055***	0.0030***	-0.0056***	0.0030***	-0.0056***	0.0028***
Green-area	-0.0089***	-0.0063***	-0.0089***	-0.0063***	-0.0089***	-0.0064***	-0.0089***	-0.0063***	-0.0089***	-0.0065***
Log(pop)	-0.3996***	0.1098***	-0.3994***	0.1095***	-0.4003***	0.1069***	-0.3999***	0.1035***	-0.4002***	0.1017***
Log(nontour-emp)	-0.3853***	0.2336***	-0.3854***	0.2335***	-0.3854***	0.2342***	-0.3853***	0.2339***	-0.3853***	0.2312***
Mountain	-0.5687***	0.2207***	-0.5688***	0.2186***	-0.5684***	0.2269***	-0.5688***	0.2158***	-0.5692***	0.2125***
Border	0.3105	-0.3006*	0.3100	-0.3002*	0.3072	-0.2972*	0.3099	-0.3056*	0.3107	-0.2816*
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log( $\alpha$ )	-0.1644***		-0.1642***		-0.1691***		-0.1711***		-0.1732***	
Observations	36 554		36 554		36 554		36 554		36 554	
LL	-38 856		-38 857		-38 843		-38 839		-38 832	
Vuong(z)	60.84		60.82		60.90		60.88		60.95	
AIC	77 854		77 856		77 827		77 820		77 805	
BIC	78 458		78 460		78 431		78 424		78 409	

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01 and robust standard errors.



**Table 3b.** Estimated results: substitution effects or complementarities between attractions.

Variable	ZINB Number of employees in the tourism sector in 2014									
	(1)		(2)		(3)		(4)		(5)	
	Logit	NB	Logit	NB	Logit	NB	Logit	NB	Logit	NB
Intercept	8.4347***	-1.0980***	8.4398***	-1.0898***	8.4339***	-1.0905***	8.4290***	-1.0762***	8.4274***	-1.0690***
Ski	-4.0564*	1.2534***	-3.9973**	1.3341***	-4.4025	1.1787***	-4.4181	1.1670***	-4.4525	1.1595***
Beach	-2.6264***	0.2473***	-2.6267***	0.2465***	-2.5145***	0.2900***	-1.4738***	0.3047***	-2.6414***	0.2539***
Sites	-1.5838***	0.2362***	-1.5961***	0.2263***	-1.5606***	0.2481***	-1.5887***	0.2327***	-1.3144***	0.3153***
Facilities	-5.6251***	3.0075***	-5.5449***	3.1032***	-5.6434***	2.9873***	-5.4440***	3.1895***	-5.1819***	3.4050***
Ski*sites	-15.0128***	-0.2692***								
Ski*facilities			2.7270***	-0.8432***						
Beach*sites					-19.0323***	-0.0267***				
Beach*facilities							-534.6676	-0.2852***		
Sites*facilities									-10.2934	-0.3103***
Lake	-0.3039***	0.0023***	-0.3044***	0.0023***	-0.3036***	0.0023***	-0.3045***	0.0023***	-0.3015***	0.0022***
Watercourse	-0.1469***	-0.0130	-0.1468***	-0.0129	-0.1462***	-0.0117	-0.1461***	-0.0123	-0.1474***	-0.0142
Ecology	-0.0035***	0.0028***	-0.0035***	0.0027***	-0.0036***	0.0027***	-0.0036***	0.0027***	-0.0037***	0.0025***
Green-area	-0.0102***	-0.0041***	-0.0102***	-0.0041***	-0.0101***	-0.0041***	-0.0102***	-0.0041***	-0.0102***	-0.0042***
Log(pop)	-1.1690***	0.2688***	-1.1697***	0.2676***	-1.1691***	0.2667***	-1.1679***	0.2644***	-1.1673***	0.2652***
Log(nontour-emp)	-0.1912***	0.3194***	-0.1912***	0.3193***	-0.1910***	0.3197***	-0.1920***	0.3193***	-0.1925***	0.3160***
Mountain	-0.3591***	0.1284*	-0.3637***	0.1230*	-0.3546***	0.1327**	-0.3573***	0.1254*	-0.3626***	0.1217*
Border	-0.7705***	-0.1662	-0.7714***	-0.1669	-0.7697***	-0.1666	-0.7737***	-0.1695	-0.7735***	-0.1667
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log( $\alpha$ )	0.4808***		0.4797***		0.4779***		0.4764***		0.4711***	
Observations	36 554		36 554		36 554		36 554		36 554	
LL	-69 081		-69 074		-69 062		-69 052		-69 017	
Vuong(z)	34.50		34.46		34.51		34.40		34.38	
AIC	138 304		138 290		138 265		138 247		138 177	
BIC	138 907		138 894		138 869		138 851		138 781	

\* p&lt;0.1; \*\* p&lt;0.05; \*\*\* p&lt;0.01 and robust standard errors.

**Table 4.** Estimated results: spatial extent of the influence of local attractions.

Variable	ZINB : Number of hotel rooms in 2015				ZINB : Number of employees in the tourism sector in 2014			
	Model 1		Model 2		Model 1		Model 2	
	Logit	Negatif binomial	Logit	Negatif binomial	Logit	Negatif binomial	Logit	Negatif binomial
Intercept	6.9705***	1.6739***	7.0408***	1.7947***	8.4402***	-1.2477***	8.4377***	-1.0598***
Ski	-1.5647***	0.1361***	-1.4127***	0.1871***	-6.3233	0.8334***	-4.8358	0.8474***
W-ski	-3.4210***	2.4000***			-0.6853	4.3611***		
Wctg-ski			-0.9822***	-0.0453			-7.6166**	0.4666*
W25-ski			-1.5457***	-0.1241			-2.5279	0.5037**
W50-ski			-0.2516	3.5023***			5.2550***	3.3278***
Beach	-0.6512***	0.1025***	-0.5660***	0.1075***	-2.4379***	0.1714***	-2.1900***	0.1488***
W-beach	0.1914	0.0864			0.1184	0.1149		
Wctg-beach			-0.0691	-0.0262			-0.4250*	0.0504*
W25-beach			-0.3346**	0.2438***			-0.2373	0.1929***
W50-beach			0.8003***	-0.0766			0.5513	-0.0069
Sites	-0.8602***	0.1653***	-0.8556***	0.1795***	-1.4944***	0.2344***	-1.4728***	0.2502***
W-sites	-3.1830***	1.1234***			-5.8561***	2.3426***		
Wctg-sites			-0.2974***	0.1643***			-0.8227***	0.3096***
W25-sites			-1.0705***	0.3924**			-2.3862***	0.5969***
W50-sites			-1.3806***	-0.5706*			-2.3064***	0.0124
Facilities	-4.1372***	1.2281***	-4.1471***	1.1945***	-5.7186***	2.9173***	-5.2776***	2.8649***
W-facilities	7.9534***	-1.6354*			3.2780	-2.0904**		
Wctg-facilities			0.5729	1.3954***			-0.7529	1.0448***
W25-facilities			5.5141***	-3.3785***			1.6620	-1.3467
W50-facilities			-0.1662	-0.0399			1.3493	-2.2296
Lake	-0.0022**	0.0007	-0.0028**	-0.0004	-0.3113***	0.0011**	-0.2990***	0.0007
Watercourse	-0.1307***	-0.0186	-0.1324***	-0.0197	-0.1434***	-0.0079	-0.1408***	-0.0048
Ecology	-0.0052***	0.0025***	-0.0050***	0.0025***	-0.0031***	0.0018***	-0.0026***	0.0017***
Green-area	-0.0093***	-0.0054***	-0.0097***	-0.0043***	-0.0090***	-0.0028**	-0.0088***	-0.0020*
Log(pop)	-0.3816***	0.1139***	-0.3893***	0.1015***	-1.1184***	0.2616***	-1.1247***	0.2474***
Log(nontour-emp)	-0.3883***	0.2283***	-0.3848***	0.2255***	-0.1963***	0.3147***	-0.1973***	0.3104***
Mountain	-0.5380***	0.1359**	-0.5309***	0.0851	-0.4301***	-0.0236	-0.3420***	-0.0660
Border	0.2924	-0.2935*	0.2823	-0.2896**	-0.7068**	-0.1574	-0.6588**	-0.1588
Regional fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log( $\alpha$ )		-0.1844***		-0.2136***		0.4538***		0.4434***
Observations		36 554		36 554		36 554		36 554
LL		-38 747		-38 643		-68 813		-68 679
Vuong(z)		60.92		61.10		34.67		35.21

AIC	77 648	77 472	137 781	137 543
BIC	78 303	78 263	138 436	138 334

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\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$  and robust standard errors.

Moreover, the negative effect of the facilities on municipal tourism development which occurs beyond a distance threshold suggests the possible existence of a “shadow zone” between nodes, which could remind the agglomeration shadow between cities (Krugman, 1994). Indeed, other things being equal, the presence of facilities in a municipality seems to have a depressive effect on tourism development in the neighboring municipalities. This could mean that if they want to take advantage of the facilities, tourists locate very near them and that these attractions contribute to more agglomerated forms of tourism.

### ***Treatment of possible bias***

In order to check the robustness of our estimates, different tests have been conducted. First, we have tested the absence of multicollinearity between the different spatial weight variables by introducing these different covariates successively. The comparison of our previous models and these ones show that our estimates remain stable, and confirm the robustness of our results. Second, we assumed that tourism development is pulled by attractions. But to a certain extent, accommodation and other tourist services could also bring more modern attractions. Thus, our results could face a simultaneity bias. To handle this issue, we have lagged all explanatory variables: covariates are built using 2006, 2007 or 2008 data (according to data availability) while dependent variables are evaluated for years 2014 and 2015. Third, our econometric models may also be concerned by a specification bias. Indeed, some of the attractions measured by our covariates are clearly man-made attributes. Thus, if a policy in favor of tourism is implemented in a municipality, this policy could simultaneously have an effect on the level of attractions (e.g. patrimonial sites, facilities) and on the number of hotels. As French regional councils have a major role in the implementation of tourism development policy, we have tried to capture this effect by controlling regional fixed effects. Consequently, we have introduced 22 regional dummies in all of the regressions. Finally, heteroskedasticity is modelled as a simple function of the mean for the negative binomial process and for the logit process. We have used the sandwich estimator of the variance to produce robust standard errors (Huber, 1967). However, for logit models as well as for negative binomial models, Cameron and Trivedi (2010) stressed that there are usually little differences between standard errors and robust standard errors except in presence of misspecified functional form. In our application, the results are similar whatever the specification of the variance.

### **Conclusion**

This paper has investigated the influence of attractions on tourist development at the municipal level. Our main contribution to attractions literature is twofold. On a conceptual level, we have seen that distinguishing local, spread and diffuse attractions is necessary to correctly analyze the spatial influence of attractions. Empirically, we have proposed measures for each category of attraction and spatial lagged variables enabling us to analyze the spatial extent of the influence of local attractions. Using count data, we have then measured the spatial influence of several attractions on the number of hotel rooms and on the number of employees in the tourism sector in French municipalities in 2015 and 2014 respectively.

Our study confirms the influence of natural, heritage and recreational attractions on tourism development. But it also brings three original results. First, it shows that the surface of green areas impact positively the presence of tourism development but negatively its level. This result may be due to a threshold effect and could be linked with more diffuse and less dense forms of tourism, such as rural tourism particularly marked by outdoor activities and experiencing nature (Bel, Lacroix, Lyser, Rambonilaza & Turpin, 2015). Second, the results show that spatial influence depends on the attraction considered and that the spatial extent of their influence is

higher in the case of ski slopes, beaches and tourist sites than in that of facilities. Third, as a depressive effect of the facilities on tourism development is observed beyond a distance threshold, it suggests that these attractions generate negative spatial spillovers and contribute to more agglomerated forms of tourism.

The original aspect of this work is that it considers the influence of space in the relation between attractions and tourism services and that it provides food for thought about mechanisms of tourism development within destinations. Since many attractions are public goods, these results also have implications in terms of public policy. They stress the need to adapt policies to the local context and to design tourism policies at the level of territories large enough to integrate spatial spillovers generated by attractions. Indeed, our results suggest that the supply of local attractions, and especially tourist sites and ski slopes, should be funded and organized by inter-municipal cooperation rather than by isolated municipalities. Moreover, if confirmed by further studies, the possible existence of negative spatial spillovers generated by facilities and the possibility of substitution effects between local attractions should be integrated in tourism planning and in the establishment of new tourist attractions. Indeed, these findings suggest that it would be more efficient to locate new attractions elsewhere than within already developed tourist nodes or than in their close neighborhood.

Despite these findings, our study has some limitations and calls for future research. First, we have tried to take into account a broad spectrum of attractions. Nevertheless, we have been sometimes limited by the data available. Thus, we have failed to integrate tourist events or forests, while some studies have determined their positive effects on tourism (Getz, 2008; Le Goffe, 2000). Second, we have been able to propose spatial variables related to the spatial extent of the influence of attractions only in the case of local attractions. Indeed, creating such variables for spread attractions would have required examining each attraction on a case-by-case basis, which is not compatible with a study based on national data. As many studies have shown the positive effect of natural amenities (Marcouiller, Kim and Deller, 2004; Rambonilaza, 2012) and as these attractions are very often wide attractions, this point remains an important issue. Thus, future research conducted on a more limited scale could allow for the measurement of the spatial extent of the influence of spread attractions. Finally, our empirical work has been conducted on the specific case of France. Studies carried out on other countries and regions would be needed to confirm our results.

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## **Appendix 1. Classification of the tourism activities according to the French Activity Nomenclature (NAF rev.2)**

<b>Lodging</b>	
55.10 Z	Tourism hotel and similar tourism lodging (with room service)
55.20 Z	Tourism lodging (without room service) and other short-stay accommodation
55.30 Z	Campgrounds and trailer parks
<b>Restaurants &amp; coffee shops</b>	
56.10 A	Traditional restaurants
56.10 B	Cafeterias and self-service restaurants
56.10 Cp	Fast-food restaurants
56.30 Z	Bars
<b>Other tourism activities</b>	
49.39 C	Cable cars and ski lifts
79.11 Z	Travel agencies
79.12 Z	Tour operators
79.90 Z	Reservation service and related activities
96.04 Z	Body care