

Which commercial sectors coagglomerate with the accommodation industry? Evidence from Barcelona

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ABSTRACT

The expansion of accommodation establishments in an urban area might bring about a transformation to its commercial structure to meet tourists' needs. This can result in the loss of the area's identity, jeopardize its authenticity, and worsen the residents' quality of life. Yet, beyond some anecdotes which currently dominate the policy debate, no empirical evidence exists identifying which specific businesses abound around accommodation establishments. This paper proposes to fill this gap by estimating in Barcelona the degree to which each commercial sector appears to be geographically coagglomerated with the accommodation industry. Barcelona seems to be an appropriate case of study since it has already shown signs of the touristification of the commercial sector in neighborhoods that comprise most of the tourist accommodation offer. The results of this study allow identifying the particular commercial sectors that most and least coagglomerate with accommodation establishments; and show that tourism-oriented sectors tend to collocate with accommodation establishments, whereas residential-oriented ones do not follow this pattern. These results might help design policies aimed to preserve neighborhoods' identities and community resilience in tourist cities.

1. Introduction

Tourism is a key global economic sector with a total contribution of 10.4% to world GDP and 10.0% to global employment (World Travel & Tourism Council, 2019). The world counts more tourists than ever before. In 2018, 1.4 billion people traveled abroad (The World Tourism Organization, 2019). This represents 965 million more than in 1990 (World Tourism Organization, 2017). The evolution of tourism in urban destinations is of even bigger importance. Nowadays, urban tourism makes up almost half of all international tourism, and, in the past decade, it has shown faster growth than non-urban tourism (World Travel & Tourism Council, 2018). Despite these positive figures, there has been a backlash against the exponential increase of tourism in some cities. Recent demonstrations and protest movements against the tourism industry in highly tourism-dense urban destinations, such as Barcelona, Berlin or Venice, are just some symptoms of this increasing civil unrest (Coldwell, 2017; Novy & Colomb, 2016, 2019).

Apart from the standard community concern about pollution and the excessive congestion of public space and services, tourism gentrification has become the cornerstone of the protests against mass tourism in many urban destinations. Tourism gentrification in an urban destination is

defined as a process in which a part of the city formerly intended for residents becomes a tourist enclave (Gotham, 2005), and is claimed to endanger the residents' right to "stay put" (Cocola-Gant, 2018) due to its associated economic and socio-cultural impacts. On the one hand, it is usually related to an increase in the number of tourist accommodation establishments, which leads to an increase in the price of housing and a displacement of some low-income residents to more affordable areas (Herrera et al., 2007; Kesar et al., 2015; López-Gay & Cocola-Gant, 2016). On the other hand, the surroundings of the accommodation establishments might adapt to satisfy the demand of tourists, and, eventually, there can be a substitution of residential-oriented facilities for tourism-oriented ones (Aall & Koens, 2019; Blanco-Romero et al., 2018). That is, the expansion of tourist accommodations might not only be associated to an increase in the price of housing, but it can also trigger a transformation of the commercial structure. This touristification of the commercial facilities is perceived by residents as negatively affecting their quality of life (Martín et al., 2018), since they experience increasing difficulties to satisfy ordinary needs (Ananian et al., 2018; Blanco-Romero et al., 2018), it contributes to the erosion of social networks and it affects the place identity (Pinkster & Boterman, 2017). Ultimately, the commercial transformation becomes a motive for further

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displacement of long-term residents (Cócola-Gant, 2015).

Due to its disruptive potential for local communities, a wide variety of methods have been applied to analyze socio-cultural effects and dynamics associated with the displacement of resident-oriented commercial activities. Such phenomenon has been approached mainly through the lens of residents' perceptions (Ananian et al., 2018; Antunes et al., 2020; Freytag & Bauder, 2018; Pinkster & Boterman, 2017) and, in a minor extent, through the combination of subjective perceptions with socio-demographic indicators (Hernández, 2016; Herrera et al., 2007). Nevertheless, to the best of the authors' knowledge, there is no empirical evidence identifying which particular commercial sectors tend to be located in the neighboring of accommodation establishments, beyond some specific examples and approximations through subjective perceptions that currently dominate the policy debate.

As claimed by a recent study for the European Parliament, such lack of empirical evidence on the socio-cultural impacts linked to the touristification of destinations represents a challenge for governments, which aim to design policies focused on guaranteeing the sustainability of the tourism activity (Peeters et al., 2018). Hence, the objective identification of commercial sectors at risk might help design urban policies targeting a desirable balance between residential-oriented and tourism-oriented businesses and allowing community resilience in tourist cities.

Accordingly, this paper wishes to contribute to the academic and policy debate by empirically establishing in a tourism-dense urban destination, such as Barcelona, which are the businesses that tend to collocate with accommodation establishments such as hotels, hostels, serviced apartments, or vacation rentals. To be clear, the objective of this study is not to identify the transformation in the commercial structure triggered by an increase in the tourist accommodation industry from a dynamic perspective. Alternatively, the goal is to establish, from a static point of view, which specific commercial sectors are most and least coagglomerated with the accommodation industry in a city that already accumulates a large number of tourist accommodations and presents signs of tourism-related social unrest. To this end, this paper uses data from the 2014 Barcelona Commercial Census and from Inside Airbnb to estimate the Ellison and Glaeser (1997) coagglomeration index between the accommodation industry and each commercial sector in Barcelona. This index allows assessing the degree to which each economic sector appears to be geographically collocated with the accommodation industry. Furthermore, this paper demonstrates the potential applicability of commercial census open databases as sources of information for directly monitoring tourism-driven functional changes in urban spaces.

Barcelona seems to be an appropriate area of study since it has become a global touristic destination which was ranked as the 15th most visited city in the world during 2017 (World Travel & Tourism Council, 2018). From 1990 to 2018, Barcelona witnessed increases in the numbers of hotels and overnight stays in hotels by 262% and 408%, respectively (Consortium of Turisme de Barcelona, 2017, 2018, 2019). In parallel with this finding, there have been increasing concerns about the disadvantages generated by the accommodation and the tourism industry in the quality of life of Barcelona residents. For example, more than 50% of residents living in major tourist areas believe that there are too many accommodation establishments in their neighborhood. This percentage rises to more than 70% for some specific inner-city neighborhoods (Barcelona City Council, 2017). Along the same line, one in three residents thinks that tourism is not compatible with the preservation of the cultural identity of the city and this proportion rises to one in two in certain neighborhoods (Barcelona City Council, 2016). Likewise, during the last decade, some areas of Barcelona have shown signs of a tourist-oriented transformation of its commercial structure (Hernández, 2016).

2. Related literature

Urban tourism has been growing since the 1980s (Law, 1993) to the extent that it has become a popular mode of traveling (Ashworth, 1992; Ashworth & Page, 2011; Bouchon & Rauscher, 2019). At the same time, since residents and urban tourists make use of the same space and services, urban tourism may affect the quality of residents' lives (Edwards et al., 2008). Accordingly, studies on the impacts of urban tourism, and particularly about its social impacts, have been particularly prolific. Among the extensively reviewed impacts, aspects related to tourism gentrification stands out as a core concern (Arias-Sans & Quagliari, 2015; Carvalho et al., 2019; Fuller & Michel, 2014; Herrera et al., 2007; Kesar et al., 2015; López-Gay & Cócola-Gant, 2016; Peeters et al., 2018).

Tourism gentrification is related to the original term "gentrification" coined by Glass (1964) to explain the changes she witnessed in some neighborhoods of London, that entailed the displacement of the indigenous residents (Hamnett, 2003). Classic explanatory theories for understanding this phenomenon are grouped between the ones based on the seminal Smith's (1979) rent gap interpretation and the Ley's (1986) identification of demand factors. On the one hand, Smith (1979) argued that after a long period of devaluation of an area, a rent gap is generated attracting several actors such as real estate agents or mortgage lenders, among others. Moreover, this interest is usually channeled and promoted by the government in order to regenerate these areas. On the other hand, Ley (1986) pointed out that the demographic and economic transformations experienced by Canada and United States societies during the 70s, fuelled the interest of white-collar workers for city centers. According to his study, urban lifestyle's cultural offer and amenities, and changes in occupations represented by the rise of post-industrial "white-collar" professionals, highly correlate with gentrification processes. These two explanations have been later referred to as production- and consumption-sides theories of gentrification, respectively (Cócola-Gant, 2019). Smith's (1979) considers gentrification to be led by the supply side of the market, whereas Ley's (1986) views gentrification to be driven by the demand side. In any case, both theories seem to complement each other and gentrification processes are indeed a market result where all producers, consumers and governments interact.

Since then, the word "gentrification" has been used to describe a process of neighborhood transformation in which the settlement of a new group of individuals, more affluent than the existing residents, contributes to the displacement of the original neighbors. In the case that this process is triggered by a rapid spread of the tourism industry, the literature talks about tourism gentrification, a process conceptualized by Gotham (2005). The theoretical conceptualization of tourism gentrification is also nourished by the two aforementioned classical pillars of gentrification theories according to which both supply and demand motives are plausible explanations of the phenomenon. First, Smith's (1979) rent gap-based interpretation is reflected in tourism private sector developers benefiting from lucrative profit opportunities generated by low real estate prices in depreciated areas of tourism cities. In this sense, the private sector decides to develop tourism businesses grounded on the attractiveness and historical value of such areas and the created rent gap. This phenomenon has recently been exemplified by the way in which house-sharing platforms have made advantage of the rent gap existing between the residential use of housing and its tourism commoditization (Wachsmuth & Weisler, 2018). Furthermore, and as Smith's (1996) also brings up, gentrification processes may be also initiated by the government. The entwining of tourism in urban regeneration (or *beautification*) policies and plans has traditionally been seen as a way to boost the regeneration of formerly industrial run-down urban spaces (Mordue, 2017; Page & Hall, 2003; Pearce, 2001). For example, Prytherch et al. (2009) exhaustively discuss how transforming a city like Valencia into a major tourism destination has been the focus of the local government. Second, Ley's (1986) view of gentrification can also be mirrored in the tourism arena. Tourists might feel attracted to

the same areas such as the new creative and middle class, increasing the demand for the space in these areas and interacting with existing and non-tourism specific gentrification processes (Cocola-Gant, 2018).

Regarding the aforementioned tourism-specific forces, the literature tended to attach a higher weight to supply and government reasons or to a combination of them. For instance, the tourism industry has traditionally been presented as a tool for urban regeneration strategies in which the government's agenda is aligned with the promoters' one (Ananian et al., 2018; Antunes et al., 2020; Bertocchi & Visentin, 2019; Blanco-Romero et al., 2018; Carvalho et al., 2019; Prytherch et al., 2009). This implies that less attention has been paid to analyze tourism gentrification as a more spontaneous and demand-driven process. Nevertheless, this should not be interpreted as demand motives being not important. In fact, demand, supply, and government considerations are all excellent candidates to understand how the tourism industry can impact the residential housing market, increasing the real estate price, and become a reason for expelling neighborhood residents.

In any case, it has also been argued that, in tourism gentrification processes, original residents tend to be displaced from their neighborhoods not only as a response to an increase in the real estate price but also to a change in the commercial structure (Carvalho et al., 2019; Cocola-Gant, 2018; Sequera & Nofre, 2018). Thus, presenting tourism gentrification as a process mainly impacting real estate markets is problematic because it encompasses more phenomena. While it is true that, as stated, there are studies that have established that a change in the commercial structure is one of the reasons why some residents decide to leave their neighborhoods, most articles have focused on the other facet. For instance, several studies focus, from the housing gentrification perspective, on how the irruption of Airbnb is related to the displacement of former residents (e.g., Arias-Sans and Quagliari (2015), Blanco-Romero et al. (2018)).

The change in the commercial structure is especially relevant in the case of urban destinations, as they are characterized by the spatial and functional integration of the tourism activity (Aall & Koens, 2019; Sequera & Nofre, 2018). In any case, it has been argued that the capacity of large cities to absorb tourism impacts, together with their inherent multifunctionality, would prevent the loss of other functions (Ashworth & Page, 2011; Bouchon & Rauscher, 2019), including the ones oriented to the residents' daily life. Yet, previous studies analyzing residents' perceptions have concluded that, in areas of intense tourism activity, the commercial structure shifts towards a more tourism-oriented offer (Carvalho et al., 2019; Cocola-Gant, 2018). This change is perceived as having a negative impact on residents' quality of life in several ways: by causing a lack of consumption facilities and services frequented by long-term residents (Ananian et al., 2018; Bertocchi & Visentin, 2019; Postma & Schmuecker, 2017), by eroding the social bonds between local commerce and the community (Zukin et al., 2009), and by degrading the place identity (Özdemir & Selçuk, 2017).

Regarding the importance of local commerce to satisfy daily needs, previous literature shows that this transformation constitutes a central concern for residents. For example, Cocola-Gant (2015) finds that residents of Barcelona's Gòtic neighborhood claim that a shortage of resident-oriented commercial businesses is a key factor to explain the gentrification process that the neighborhood experiences, and that it can become one of the reasons why original residents decide to move off the neighborhood. Specifically, he finds that the shortage of shops needed for daily needs, such as supermarkets or grocery stores, erodes the quality of life of Barcelona Gòtic neighborhood's residents. Similarly, Bertocchi and Visentin (2019) show the relevance of the lack of resident-oriented services as a reason for residents to move out from Venice. Along the same lines, Nofre et al. (2018) point out that the expansion of tourism-oriented nightlife businesses in one of the beachfront neighborhoods of Barcelona has deteriorated the community livability. Thus, the analysis of neighbors' perceptions suggests that the touristification of the commercial sector impacts on the likelihood of residents' displacement.

At the same time, local facilities are also places of encounter and vectors that shape the local community network (Cocola-Gant, 2015; García et al., 2016; Zukin et al., 2009). Moreover, identity concerns have aroused since traditional businesses, local shopping streets and local markets constitute spaces for social interaction and reproduction (Cocola-Gant, 2018; Gonzalez & Waley, 2013; Zukin, 2012). Furthermore, the touristification of the commercial structure of a neighborhood usually yields the growth of global franchises (Cocola-Gant, 2018; Prytherch et al., 2009) and a standardization of the urban landscape. These changes convert the neighborhood in a copy of any other global tourist area (García-Hernández et al., 2017), and leads to a loss of the neighborhood's identity and sense of place (Blázquez-Salom et al., 2019; Özdemir & Selçuk, 2017). In fact, Pinkster and Boterman (2017) note that Amsterdam Canal district's residents believe that the tourism-led commercial transformation undermines their neighborhood and contributes to losing the authenticity of the area.

The combination of these consequences indicate that the transformation of the commercial structure erodes the social capital of affected areas (Cocola-Gant, 2015; Gotham, 2005; Tan et al., 2018; Zukin et al., 2009), in terms of reducing residents' access to network-based resources and relationships that would allow them to prosper (Mauerhofer, 2013; Moscardo et al., 2017). Since social capital contributes to the ability of a community to adapt to changes and crisis, and hence it reduces its vulnerability against external phenomenon, such erosion will directly impact on the community resilience (Erdmenger, 2019; Fernandes & Chamusca, 2014). Thus, a displacement of commerce caused by tourism leading to an erosion of social capital, and a consequent loss of resilience, will directly impinge the social sustainability of the destination. Given these implications, it becomes essential to better understand this phenomenon.

In such a process, it is likely that tourist accommodation plays a decisive role. The presence of tourist accommodations might affect the type of commerce that surrounds them. Indeed, Shoval et al. (2011) demonstrate that the location of accommodation establishments is a strong predictor of tourist movements by finding that tourists spend most of their time in the neighboring of their accommodation. This behavior of tourists can provoke a commercial metamorphosis in these areas, as their commercial offer might adapt to satisfy tourists' tastes which potentially differ from residents' ones (Chen & Ting, 2019). In fact, the influence of accommodation establishments on the commercial structure has been previously described in terms of specific examples in some qualitative studies. For example, when Gotham (2005) describes the transformation process that took place in the New Orleans' neighborhood of Vieux Carre, he notes that "the construction of upscale hotels (...) has increased foot traffic within the Vieux Carre and encouraged investors to renovate properties (...) and turn old bars on Bourbon Street into upscale themed music clubs" (p. 1109). Similarly, when Füller and Michel (2014) discuss tourism-related conflicts in Berlin's district of Kreuzberg, which has seen an increase in the number of vacation rentals, they note that there has been a "transformation of working-class pubs and mom-and-pop grocery stores into high-priced coffee shops" (p. 11). This phenomenon might be intensified in a context in which vacation rentals do not only concentrate with the existing hotel offer in tourist cities, but tend to amplify the tourism pressure in residential areas (Gutiérrez et al., 2017).

Actually, the increase in the number of tourist accommodation establishments and the substitution of traditional commerce for businesses geared towards tourism are two of the key factors explaining residents' conflicts with tourism across many urban destinations (Martín et al., 2018; Novy & Colomb, 2016; Postma & Schmuecker, 2017). In fact, both factors can be related, as the presence of tourist accommodation can strengthen the tourist specialization of the commercial structure. However, in relation to the businesses that appear around accommodation establishments, previous studies have not systematically examined and identified which are these businesses. In this sense, it is essential to identify, from an objective perspective and non-dependent on residents'

perceptions, which commercial sectors coagglomerate with accommodation establishments. This could be used by policymakers to keep an adequate balance between tourism-oriented and residential-oriented businesses, which is key to preserve neighborhoods' identities and allow community resilience in tourist cities (Crespi-Vallbona & Mas-carilla-Miró, 2018; Litvin & Rosene, 2017; Pinkster & Boterman, 2017).

Despite the importance of the problem, the measurement of commercial changes has been hindered by the lack of data and measurement difficulties (Kosta, 2019). Beyond the above discussed observations and a few other anecdotes supported by qualitative research, there is no empirical evidence identifying the specific commercial sectors that tend to be located in the surroundings of the accommodation establishments. Consequently, this paper aims to extend the literature and contribute to the policy debate by identifying the commercial sectors that most and least geographically coagglomerate with the accommodation industry in a tourism dense destination such as Barcelona.

In parallel with the tourism literature, this paper is also connected to the urban economics studies because it uses one of its seminal indexes. Specifically, the Ellison and Glaeser (1997) coagglomeration index is estimated to assess the degree to which each economic sector is geographically collocated with the accommodation industry. This index, which is discussed in the following section, has traditionally been employed to study coagglomeration patterns for groups of manufacturing industries (e.g., Barrios et al. (2006); Howard et al. (2016)), and in a lesser extent for service ones (e.g., Kolko (2010)). Therefore, this paper also aims to span the literature by bringing a well-known and used methodology from urban economics to the tourism arena, responding to the call for linking tourism studies with a wider domain of social sciences (Ashworth & Page, 2011).

Indeed, the motives for why firms agglomerate are extensively discussed in the economics literature, at least since Marshall's (1920) publication. Businesses from two different industries coagglomerate because they might receive direct benefits of being close one to the other. That is, using the economics' language, these firms might enjoy positive cross-industry spillovers, such as cross-industry flow of ideas or benefits from sharing customers or input providers between the two industries (Marshall, 1920). For example, restaurants and accommodation establishments might cluster due to the fact that both industries supply complementary services and share the same type of customers. However, two industries might also collocate due to the existence of location-specific natural advantages that attract both of them (Ellison & Glaeser, 1997). For instance, restaurants and accommodation establishments might cluster due to the fact that firms in both industries decide to position themselves near to tourist attractions such as monuments or the beach. Therefore, coagglomeration patterns can emerge as a combination of both types of cross-industry agglomerative forces, spillovers and natural advantages, and it is challenging to tell them apart (Ellison & Glaeser, 1997).

3. Methodology

3.1. Coagglomeration index

Ellison and Glaeser (1997) propose a coagglomeration index that can be used to study whether groups of industries are geographically clustered or dispersed across the different geographic partitions of a larger entity (for example, the different administrative regions of a country or the different neighborhoods of a city). Ellison et al. (2010) show that this index takes a reduced form when it is applied to pairs of industries. Specifically, the Ellison and Glaeser coagglomeration index (C_{AB}^{EG}) between two economic sectors A and B takes the following form:

$$C_{AB}^{EG} = \frac{\sum_{m=1}^M (s_{mA} - x_m)(s_{mB} - x_m)}{\left(1 - \sum_{m=1}^M x_m^2\right)} \quad (1)$$

where m indexes geographic areas (that is, the geographic partitions); s_{mA} and s_{mB} stand, respectively, for the share of industries A and B 's employment contained in area m ; and x_m equals area m 's share of overall employment (that is, x_m is a proxy for the aggregate size of economic activity in area m). Ellison and Glaeser (1997) and Ellison et al. (2010) demonstrate that this index measures the strength of cross-industry agglomerative forces, that is, spillovers and natural advantages between the two considered industries, and therefore, it evaluates the tendency for these two industries to geographically collocate in a same geographic area. Intuitively, this index compares the levels of industries A and B 's simultaneous geographical concentration beyond the one that would be expected to arise in the absence of coagglomeration forces between these two industries. Specifically, it contrasts the actual concentration of firms from both industries with the concentration that would result if firms would locate in a random manner, but that would reproduce the aggregate spatial distribution of the economic activity.

Guimarães et al. (2007) review the Ellison and Glaeser (1997) index and show that using employment shares to study agglomeration patterns might lead to odd results when firms in a particular industry are characterized by being small in terms of employee number. This is likely to be the case in the context of this study as many commercial businesses in a city might employ few people or even a single worker. In these cases, Guimarães et al. (2007) suggest that using firm count data is more intuitive. This issue is also noted by Howard et al. (2016) who propose to simply replace employment shares for firms shares in Eq. (1). Accordingly, this paper estimates the Ellison and Glaeser (1997) coagglomeration index of Eq. (1) between the accommodation industry (denoted by A) and a commercial sector B by using the following notation: m indexes geographic areas; s_{mA} and s_{mB} stand, respectively, for the share of accommodation establishments and commercial sector B 's businesses contained in area m ; and x_m equals area m 's share of overall businesses in the city. As regards to the geographic area, this paper defines areas as neighborhoods since coagglomeration is studied in the context of urban tourism and it makes sense to study the collocation patterns that arise at this level. Note that although neighborhoods are used as geographic areas, the coagglomeration index of Eq. (1) between the accommodation industry A and a given commercial sector B is a single number for the whole city.

This index can take values between -1 and 1 . Following Ellison and Glaeser (1997), the index should be interpreted as follows. A positive estimated index must be interpreted as indicating that there is more coagglomeration between accommodation establishments and commercial sector B 's businesses than that attributable to the tendencies of businesses in each of these two economic sectors to locate near to other businesses in their same sector and where aggregate economic activity is high. Conversely, a negative estimated index must be interpreted as indicating that commercial sector B 's businesses are more geographically dispersed with the accommodation industry than what would be expected. Finally, an estimated index equal to zero implies that there does not exist any collocation pattern between the accommodation sector and the commercial sector B .

Therefore, this index measures the coagglomeration pattern that arises after taking into account the tendency that businesses of a specific economic sector might have to geographically locate near to other businesses in their same sector or to concentrate in economically active neighborhoods. This index's ability makes this methodology an adequate option to identify the specific sectors that tend to be located around accommodation establishments. If, on the contrary, conclusions were drawn from a hypothetical positive relationship across neighborhoods between the number of stores of a specific commercial sector and the number of accommodation establishments, this could result in a biased diagnosis since the relationship could be measuring tendencies different from the coagglomeration forces between that specific commercial sector and the accommodation one. Thus, the estimates of Eq. (1) allow identifying whether or not a commercial sector

coagglomerates with the accommodation industry and ordering the different commercial sectors depending on the extent that they coagglomerate with the accommodation industry.

3.2. Statistical significance of the coagglomeration index

The original [Ellison and Glaeser \(1997\)](#) index does not come with any measure of statistical significance. Thus, although the estimations of the coagglomeration index are informative, it is necessary to construct a measure that allows determining if these estimations are statistically significant. To this aim, this study follows [Cassey and Smith \(2014\)](#) who propose obtaining a measure of statistical significance through bootstrapping methods for another index also proposed by [Ellison and Glaeser \(1997\)](#), which measures the geographical agglomeration of firms of the same industry. Specifically, they propose to repeatedly and randomly simulate the location of firms assuming that agglomeration forces are nonexistent, reestimate the index in each simulation, and compare these simulated estimates to the actual one.

Nevertheless, when coagglomeration patterns and not just agglomeration ones are studied, [Coll-Martínez et al. \(2019\)](#) and [Moreno-Monroy and García Cruz \(2016\)](#) note that two industries might end up being colocated due to the presence of cross-industry agglomeration forces between both sectors and due to the individual patterns of each of the sectors. Consequently, to take these forces into account, two types of random simulations need to be done for each commercial sector in this study. First, to control for the pattern of the accommodation industry, all accommodation establishments are kept constant and only the businesses in a given commercial sector are randomly distributed across the different neighborhoods. Second, to control for the pattern of the commercial sector, the businesses in this sector are kept constant and the accommodation establishments are randomly distributed. In both cases, in order to control for the general tendency to concentrate in economically active neighborhoods, the probability of being assigned to a particular neighborhood is set to equal that neighborhood's share of overall businesses in the city.

These two processes are followed for each commercial sector 1000 times. Next, the coagglomeration index is estimated for each of these simulated distributions. Note that the expected value for the index in these simulations is zero since no coagglomeration forces were assumed. Then, for each sector, the 1000 estimations of the index in each of the two types of simulations are ordered and used to obtain the critical values for the interval containing a percentage of observations equal to the desired confidence level. Finally, it can be concluded that there exists significant coagglomeration between the accommodation industry and a commercial sector whenever the actual estimated index falls outside each of the two estimated confidence intervals. Consequently, the estimations of the coagglomeration index jointly with its respective measure of statistical significance allow identifying which specific commercial sectors tend to be coagglomerated or geographically dispersed with the accommodation industry.

3.3. Relevance of the estimates

The identification of the commercial sectors that most and least coagglomerate with the accommodation industry might be useful to design policy aimed to preserve the identity of neighborhoods and allow community resilience. To verify the relevance of this identification, this study proposes to examine if there exists any relationship between the share of businesses in an area belonging to the commercial sectors that tend to positively coagglomerate with the accommodation industry and the perceptions that residents of this area have towards the tourism activity. Analogously, this analysis is repeated for the share of businesses that are negatively coagglomerated with the accommodation industry. Correspondingly, the following two shares are constructed:

$$y_{m+} = \frac{n_{m+}}{n_m} \text{ and } y_{m-} = \frac{n_{m-}}{n_m}, \quad (2)$$

where y_{m+} and y_{m-} stand for the shares of businesses in an area m that are positively or negatively coagglomerated with the accommodation industry, respectively; n_{m+} and n_{m-} equal the number of businesses in an area m that belong to a commercial sector that displays a statistically significant positive or negative coagglomeration index, respectively; and n_m equals the total number of businesses in an area m . That is, y_{m+} and y_{m-} respectively measure the extent to which the commercial structure of an area m is coagglomerated or dispersed with the accommodation industry.

3.4. Data

To estimate this coagglomeration index in any tourist city, it is only necessary to have information on the location of each accommodation establishment and information on the location and economic classification of each other business in the city. This study applies this index for the case of Barcelona and uses the 2014 Barcelona Commercial Census, provided by the Barcelona City Council. This is an open source database that is appropriate to estimate this index as it contains detailed information on the type of business that is settled (if any) in each of the ground floor business premises of the city ([Barcelona City Council, 2014](#)). However, the methodology proposed could be also carried out using other data sources containing the same type of information such as Open Street Map or Google Places databases.

Among the 67,433 observations in the used census, this paper only uses those for which a business was active during 2014. In the final sample, similar economic sectors, such as cafeterias and other food facilities, are merged. The final database includes 45,605 business units that belong to 56 commercial sectors, including the tourist accommodation one, and which are located across the 73 different neighborhoods of the city. [Table 1](#) shows the distribution of these businesses across the different commercial sectors. In its turn, [Fig. 1](#) depicts the spatial distribution of these businesses across the city, where each dot represents a different business. It is important to mention that a newer version of this census was conducted in 2016; however, this latter version aggregates some key tourist sectors in a same category which would prevent the disentanglement of some interesting coagglomeration patterns that might arise. Therefore, the former version is considered to better suit the goals of this paper.

In regard to the accommodation industry, the commercial census only contains traditional establishments such as hotels, hostels, and serviced apartments. That is, it excludes vacation rentals. Nevertheless, the latter also plays a key role in the global accommodation industry since the irruption of Airbnb back in 2008. In fact, Barcelona is the eighth city with more Airbnb listings in the world ([Canales & Gal, 2018](#)). Accordingly, this paper also studies the coagglomeration patterns that arise between vacation rentals advertised on Airbnb and the different commercial sectors. To this end, the census data is supplemented with the [Inside Airbnb \(2015\)](#) database for Barcelona. Specifically, all Airbnb advertisements that were available in Barcelona in September 2015 and that could be assigned to a neighborhood are taken into account. This time period is chosen because it is the closest available to 2014 which is the year in which the census was conducted. This includes 12,035 advertisements.

Finally, this paper also uses data from a survey conducted by the local government in which they assess the perceptions that residents have towards the tourism activity and its impacts ([Barcelona City Council, 2016](#)).

Table 1
Distribution of firms across economic sectors.

Sector	Freq.	Sector	Freq.
Art dealers and antique stores	613	Health and personal care stores	2927
Automotive repair and maintenance	1284	Internet cafes	329
Baked goods and confectionery stores	1707	Jewelry and watch stores	729
Banking and financial services	1553	Meat markets	706
Beer, wine, and liquor stores	199	Motor vehicle dealers	360
Building material and supplies dealers	263	Movie theaters and theatres	62
Cafeterias and other eating and drinking places	6362	Municipal markets	40
Car rental	101	Music, movies and video games stores	345
Car washes	40	News dealers and newsstands	131
Caterers	30	Nightclubs	296
Cell phone stores	459	Notions and lingerie	281
Children's stores	517	Office supplies, stationery and book stores	995
Clothes and footwear repairs	556	Offices of real estate agents	605
Clothing stores	3490	Optical goods stores	331
Construction	2454	Other miscellaneous store retailers	367
Convenience stores	1138	Pet and pet supplies stores	398
Dollar stores	553	Photographic services	264
Driving schools	179	Print shops	136
Drycleaning and laundry services	311	Restaurants	2997
Electronics and appliance stores	773	Shoe stores	616
Fish and seafood markets	170	Shopping malls	20
Fitness and recreational sports centers	268	Sporting goods stores	341
Florists	302	State lotteries and gambling	186
Fruit and vegetable stores	850	Supermarkets and other grocery stores	1298
Furniture and home furnishings stores	1640	Tobacco stores	496
Gift and souvenir stores	360	Transportation and warehousing	295
Hair, nail, and skin care services	2641	Travel agencies	351
Hardware stores	293	Tourist accommodation	597

4. Results

4.1. Index estimates

Table 2 presents the estimates of the Ellison and Glaeser (1997) coagglomeration index between the accommodation industry and each commercial sector (C_{AB}^{EG}) with their corresponding significance level (Sig.). Among the 56 commercial sectors used in this study, 78% of them exhibit some sort of coagglomeration pattern with the accommodation industry. Specifically, 14 sectors display a positive and statistically significant index, meaning that they are coagglomerated with the accommodation industry. Likewise, 29 sectors have a negative and statistically significant index, meaning that they are geographically dispersed with the accommodation industry. The remaining 12 sectors do not have a statistically significant index and they must be interpreted as not being coagglomerated nor geographically dispersed with the accommodation industry. Sectors are organized in a decreasing order depending on their degree of coagglomeration. The commercial sector with the highest index estimate is car rentals with an estimate equal to 0.034. The next most colocated sectors with the accommodation industry are art dealers and antique stores, gift and souvenir stores, theaters, shopping malls, jewelry and watch stores, clothing stores, shoe stores, cell phone stores, nightclubs, and restaurants. Most of these sectors could be considered as tourism-oriented ones and not essential for the day-to-day groceries of residents. Conversely, some commercial sectors that might be seen as residential oriented like fish and seafood markets, fruit and vegetable stores or supermarkets and other grocery stores display a negative index.

The mean of the estimates in Table 2 across all commercial sectors is -0.001 and the standard deviation is 0.011 . These statistics are aligned with the ones obtained in previous studies that also estimate the Ellison and Glaeser (1997) coagglomeration index. For instance, Ellison et al. (2010) find that the mean and the standard deviation of their estimates for manufacturing industries at the county level in the United States equal 0.000 and 0.003 , respectively. Likewise, Kolko (2010) finds that the mean and the standard deviation of his estimates for service industries in the United States at the zip code level equal -0.000 and 0.000 , respectively. In their turn, Howard et al. (2016) find that the mean and the standard deviation of their estimates for manufacturing industries in Vietnam at the commune level (a subdivision subordinated to cities and towns) when using firm count data, as in the present study, equal 0.000 and 0.001 , respectively. Furthermore, their maximum and minimum estimated values equal 0.002 and -0.004 , respectively.

To take into account the vacation rental industry, this paper estimates the degree to which each commercial sector colocates with vacation rentals. To this end, the Ellison and Glaeser (1997) coagglomeration index is reestimated between vacation rentals advertised in Airbnb and each business sector, including the conventional accommodation industry. The estimates are reported in Table 3 and, although they show slightly smaller numbers than the previous estimates, are aligned with the previous ones. On the one hand, it is natural that the estimates show slightly smaller numbers since vacation rentals are usually more scattered throughout the city than conventional accommodation establishments. On the other hand, 79% of the sectors that are positively coagglomerated with the conventional accommodation industry are also coagglomerated with vacation rentals. For instance, car rentals, art dealers and antique stores, gift and souvenir stores, nightclubs and restaurants are all economic sectors that coagglomerate with both the conventional accommodation and the vacation rentals industries. Indeed, the second most coagglomerated sector with vacation rentals is the traditional accommodation industry, and the correlation between the estimates of Tables 2 and 3 equals 0.838 .

4.2. Spatial distribution of coagglomerated and not coagglomerated sectors

To ease the interpretation of the above estimates, this subsection shows the spatial distribution of some sectors and the conventional accommodation establishments. At the city level, Figs. 2 and 3 present, respectively, the distribution across Barcelona of all traditional accommodation establishments and all businesses belonging to one sector with a positive estimated index, nightclubs, and to a sector with a negative estimated index, fish markets. If the two maps are compared, it can be seen how nightclubs seem to be concentrated around accommodations, while fish markets tend to concentrate where there are no accommodation establishments.

Second, Figs. 4 and 5 zoom in on the Gòtic and the Sant Andreu neighborhoods, respectively. The first is the neighborhood of Barcelona in which a greater percentage of its residents think that there are too many tourist accommodations, while the second is one of the neighborhoods with the lowest percentage of neighbors who believe that there is an excess of tourist accommodations (Barcelona City Council, 2016). In both figures, the maps on the left-hand side display the spatial distribution of accommodation establishments and businesses belonging to four sectors with a positively estimated index in Table 2. The selected sectors are (1) car rentals, (2) art dealers and antique stores, (3) gift and souvenir stores, and (4) nightclubs. All these sectors are likely to be more frequented by tourists than by residents. Alternatively, the maps on the right-hand side display the spatial distribution of accommodation establishments and businesses belonging to four sectors with a negatively estimated index in Table 2. The selected sectors are (1) supermarkets and other grocery stores, (2) meat markets, (3) fruit and vegetable stores, and (4) fish and seafood markets. All these sectors are likely to be used for the daily groceries of residents. Fig. 4 shows that in the Gòtic

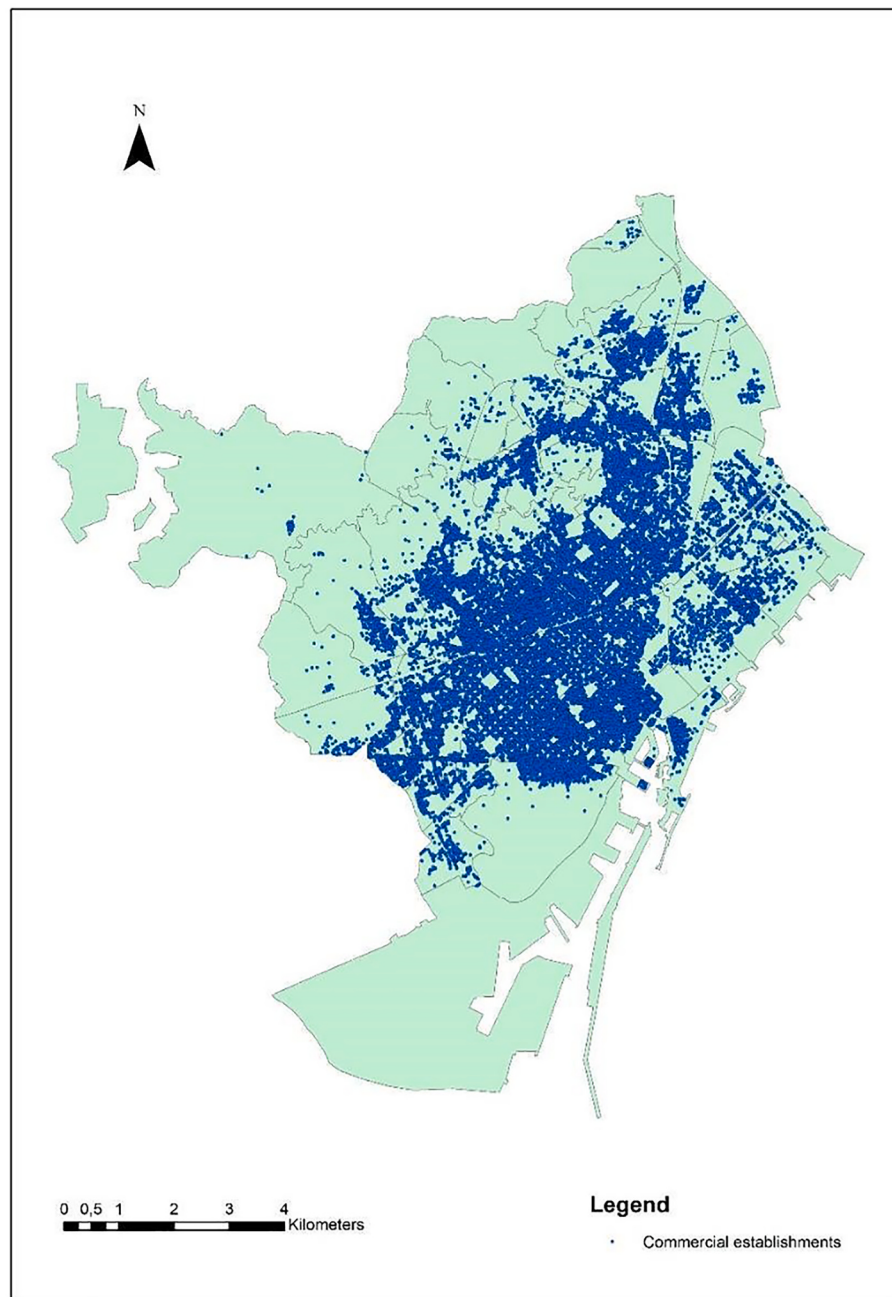


Fig. 1. Spatial distribution of businesses across Barcelona.

neighborhood, where there is a high concentration of accommodation establishments, there is a bigger concentration of the selected businesses with a positive coagglomeration index than of businesses with a negative one. Conversely, Fig. 5 exhibits that in the Sant Andreu neighborhood, where there is a single accommodation establishment, there is a bigger agglomeration of the selected businesses with a negative coagglomeration index than businesses with a positive one.

4.3. Relation of the estimates with residents' perceptions towards tourism

Figs. 6 displays a panel of graphs showing the relationship between various residents' perceptions towards the tourism activity and the proportion of businesses in a given area that belong to the sectors that positively coagglomerate with the traditional accommodation industry (y_{m+}). Similarly, Fig. 7 shows the analogous graphs for the proportion of businesses that are negatively coagglomerated with the traditional

accommodation industry (y_{m-}). Each point in these graphs represents an area of the city. Ideally, all these points should represent areas of the same category, such as neighborhoods or any other subdivision of the city. However, the used perceptions survey presents the results aggregating some residents at the neighborhood level and some others at the district one (Barcelona City Council, 2016). In any case, this does not compromise the analysis since the union of all the reported areas in the survey makes up the whole city, and y_{m+} and y_{m-} can be also computed for the exact same partitions using the estimates of Table 2. The different variables measuring perceptions are reported on the vertical axis and correspond to the share of residents of each area who (1) believe that tourism activity does not support the preservation of the city's cultural identity, (2) consider that they live in a tourist neighborhood, (3) believe that the presence of tourists causes prices in their neighborhood to rise, (4) would like fewer tourists in their neighborhood, and (5) think that in their neighborhood there are too many accommodation establishments.

Table 2

The Ellison and Glaeser (1997) coagglomeration index estimates between the accommodation industry and each commercial sector.

Sector	C_{AB}^{EG}	Sig.	Sector	C_{AB}^{EG}	Sig.
Car rental	0.034	***	Photographic services	-0.005	*
Art dealers and antique stores	0.025	***	Electronics and appliance stores	-0.005	***
Gift and souvenir stores	0.022	***	Supermarkets and other grocery stores	-0.005	***
Movie theaters and theatres	0.021	***	Health and personal care stores	-0.005	***
Shopping malls	0.018	**	Children's stores	-0.005	***
Jewelry and watch stores	0.013	***	Florists	-0.005	**
Clothing stores	0.013	***	Meat markets	-0.006	***
Shoe stores	0.013	***	Hair, nail, and skin care services	-0.006	***
Cell phone stores	0.010	***	Beer, wine, and liquor stores	-0.006	**
Nightclubs	0.007	***	Notions and lingerie	-0.007	***
Restaurants	0.006	***	News dealers and newsstands	-0.008	**
Convenience stores	0.005	***	Pet and pet supplies stores	-0.008	***
Dollar stores	0.003	**	Motor vehicle dealers	-0.008	***
Travel agencies	0.001		Clothes and footwear repairs	-0.009	***
Cafeterias and other eating and drinking places	0.001	***	Municipal markets	-0.009	
Office supplies, stationery and book stores	0.001		Fitness and recreational sports centers	-0.009	***
Music, movies and video games stores	0.001		Fruit and vegetable stores	-0.009	***
Banking and financial services	0.000		Offices of real estate agents	-0.009	***
Optical goods stores	-0.001		Print shops	-0.010	***
State lotteries and gambling	-0.002		Driving schools	-0.010	***
Drycleaning and laundry services	-0.002		Other miscellaneous store retailers	-0.011	***
Baked goods and confectionery stores	-0.002	*	Construction	-0.011	***
Sporting goods stores	-0.002		Automotive repair and maintenance	-0.012	***
Furniture and home furnishings stores	-0.002	**	Transportation and warehousing	-0.013	***
Tobacco stores	-0.003		Building material and supplies dealers	-0.013	***
Hardware stores	-0.004		Fish and seafood markets	-0.014	***
Internet cafes	-0.004	*	Caterers	-0.015	**
Car washes	-0.004				

Note: Coefficients are statistically different from zero at the following levels:

- * $p < 0.1$.
- ** $p < 0.05$.
- *** $p < 0.01$.

Fig. 6 shows a positive relationship between the extent to which the commercial structure is coagglomerated with the accommodation industry and each of the considered perceptions towards tourism across the different areas in the city. Conversely, all graphs in Fig. 7 illustrate the opposite pattern; that is, there exists a negative relationship between the extent to which the commercial structure is geographically dispersed with the accommodation industry and each of the considered perceptions towards tourism.

Table 3

The Ellison and Glaeser (1997) coagglomeration index estimates between vacation rentals and each sector.

Sector	C_{AB}^{EG}	Sig.	Sector	C_{AB}^{EG}	Sig.
Car rental	0.006	***	Meat markets	-0.002	
Tourist accommodation	0.005	***	Optical goods stores	-0.002	
Movie theaters and theatres	0.004	***	State lotteries and gambling	-0.002	
Cell phone stores	0.004	***	Beer, wine, and liquor stores	-0.002	
Gift and souvenir stores	0.004	***	Offices of real estate agents	-0.002	*
Art dealers and antique stores	0.003	***	Furniture and home furnishings stores	-0.002	***
Dollar stores	0.001	***	Hair, nail, and skin care services	-0.002	***
Convenience stores	0.001	***	Fruit and vegetable stores	-0.002	**
Sporting goods stores	0.001	***	Photographic services	-0.002	
Restaurants	0.001	***	Florists	-0.002	
Electronics and appliance stores	0.000	***	Clothes and footwear repairs	-0.002	**
Jewelry and watch stores	0.000	*	Health and personal care stores	-0.002	***
Nightclubs	0.000	*	News dealers and newsstands	-0.003	
Travel Agencies	0.000	*	Fish and seafood markets	-0.003	*
Clothing stores	-0.000		Driving schools	-0.003	**
Cafeterias and other eating and drinking places	-0.000	*	Pet and pet supplies stores	-0.003	***
Music, movies and video games stores	-0.000		Motor vehicle dealers	-0.003	***
Shoe stores	-0.000		Car washes	-0.004	
Internet cafes	-0.001		Municipal markets	-0.004	
Drycleaning and laundry services	-0.001		Children's stores	-0.004	***
Hardware stores	-0.001		Construction	-0.004	***
Office supplies, stationery and book stores	-0.001		Automotive repair and maintenance	-0.004	***
Supermarkets and other grocery stores	-0.001		Building material and supplies dealers	-0.004	***
Tobacco stores	-0.001		Other miscellaneous store retailers	-0.005	***
Shopping malls	-0.001		Transportation and warehousing	-0.006	***
Notions and lingerie	-0.001		Fitness and recreational sports centers	-0.006	***
Baked goods and confectionery stores	-0.001		Print shops	-0.007	***
Banking and financial services	-0.002		Caterers	-0.008	***

Note: Coefficients are statistically different from zero at the following levels:

- * $p < 0.1$.
- ** $p < 0.05$.
- *** $p < 0.01$.

5. Discussion, conclusion and limitations

5.1. Discussion

The main results of this study show that there is a relationship between the geographical location of accommodation establishments and the presence or absence of specific commercial sectors. Table 2 shows that sectors such as car rentals, gift and souvenir stores, nightclubs or restaurants tend to be found around hotels, hostels and serviced apartments; whereas sectors such as fish and seafood markets, fruit and vegetable stores, clothes and footwear repairs or supermarkets and other grocery stores are not usually in the surrounding of the aforementioned

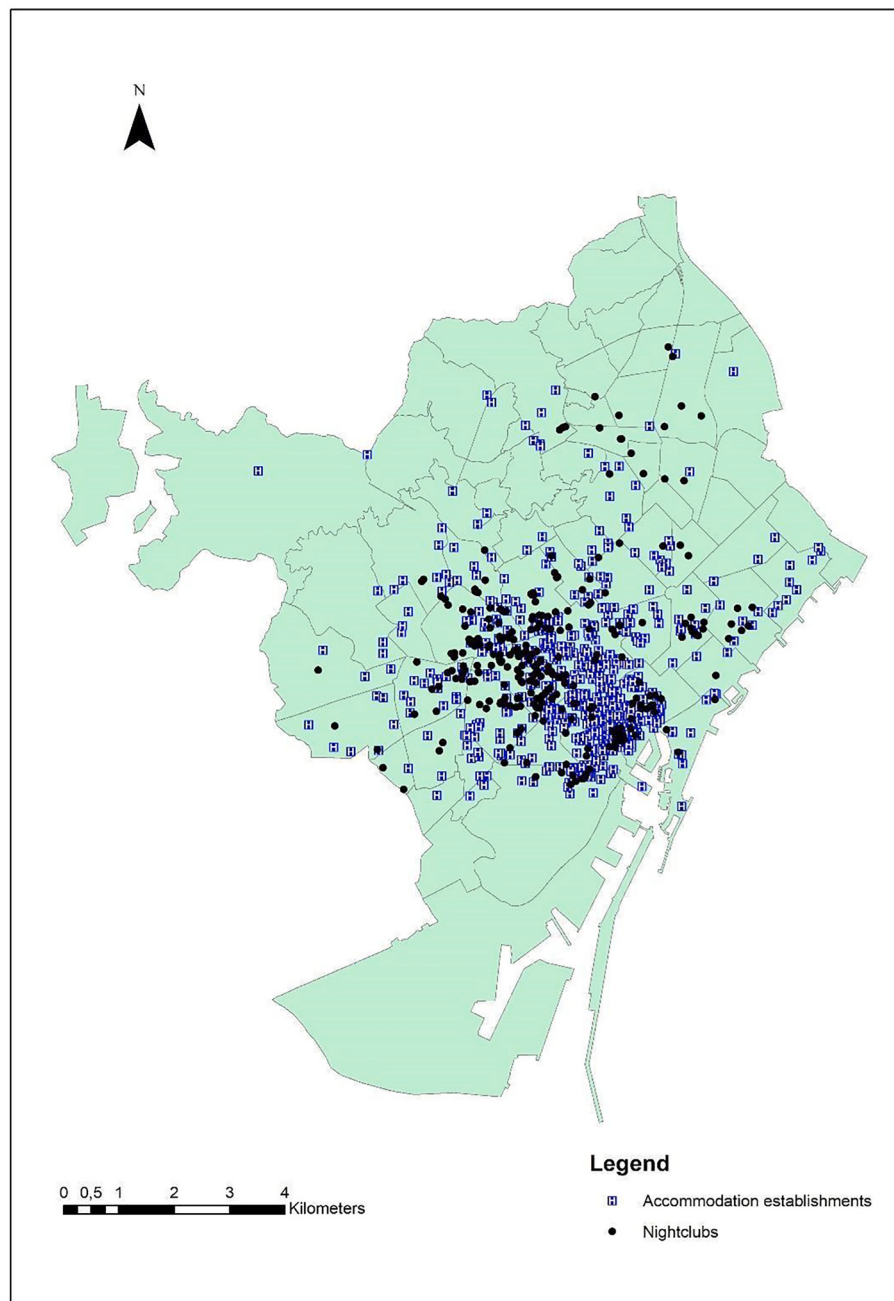


Fig. 2. Spatial distribution of accommodation establishments and nightclubs across Barcelona.

accommodation establishments. Table 3 displays a similar pattern between vacation rentals and the commercial sectors. These results are connected to previous qualitative studies arguing that some tourist and urban areas do not only accumulate a large number of accommodation establishments, but also a large number of tourism-oriented commercial businesses (Cócola-Gant, 2015; Füller & Michel, 2014; Gotham, 2005). Based on residents' perceptions or direct observation, previous studies had signalled the relation between tourism and the increase of shops selling souvenirs, sunglasses and clothes, art-galleries or renting bicycles, together with the appearance of "hipster" and take-away restaurants, cafés and pubs (Antunes et al., 2020; Bertocchi & Visentin, 2019; Carvalho et al., 2019; Cócola-Gant, 2015; Hernández, 2016). At the same time, they have reported the disappearance of local grocery shops and food-markets (or traditional food products), carpentries, bookshops, butchers, and the transformation of shoe-repair services into trolley-repair ones (Ananian et al., 2018; Antunes et al., 2020; Carvalho

et al., 2019). Nevertheless, the current article differs from previous studies, mostly qualitative or based on small and non-representative samples, as it is based on a complete census, and it establishes a spatial relationship between accommodation establishments and the commercial structure.

In these circumstances, this study is also related to the tourism gentrification phenomenon by studying a market outcome at a particular point in time. The authors analyze, from a static perspective, an environment highly oriented towards tourism, both in terms of numerous accommodation establishments and a commercial structure with a certain degree of tourism specialization. Furthermore, resident displacement indicators linked to tourism gentrification in Barcelona are already well established by a broad corpus of research. In this context, the present research builds on this base to draw the relationship among gentrification theories, tourism development and commercial gentrification. Indeed, the identification of commercial sectors coagglomerating

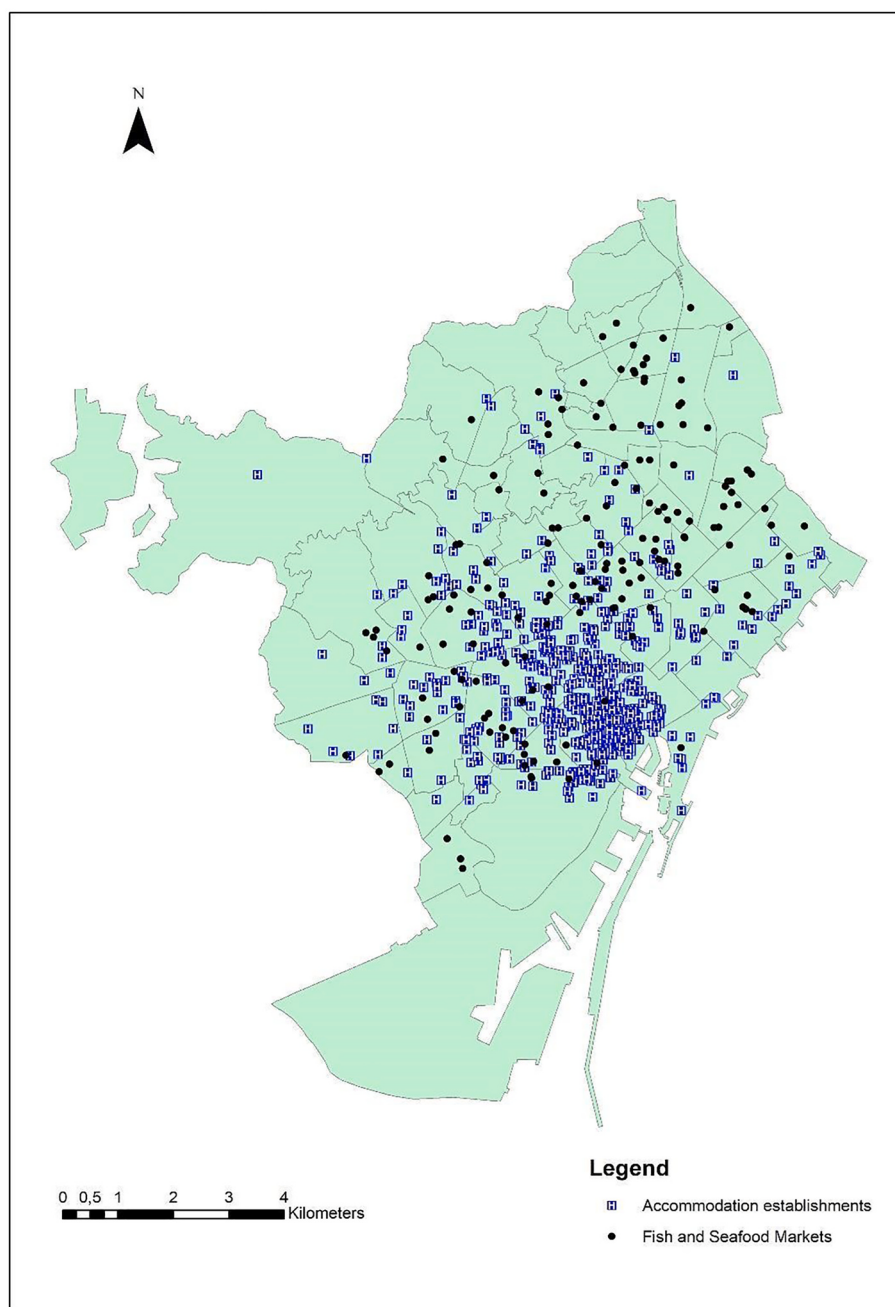


Fig. 3. Spatial distribution of accommodation establishments and fish markets across Barcelona.

with tourist accommodation suggests what type of commercial structure becomes another explanatory factor when accounting for the displacement of residents in tourism gentrification processes. The observed phenomena can be rationalized using classical gentrifying theories. On the one hand, the [Smith's \(1979\)](#) rent-gap based interpretation can explain both the expansion of hotels and tourism-focused shops in some particular and previously depreciated areas of Barcelona. This explanation may have been complemented by the government's interests in the tourism development in those areas. On the other hand, the [Ley's \(1986\)](#) demand view may be also a plausible reason to account for the established phenomena. Commercial structure in the surrounding of accommodation establishments may have adapted to meet tourists' needs as tourist accommodations and tourist-oriented shops are complementary services.

Smith's (1996) rent gap theory is very present in the gentrification literature, namely focusing on the impacts on real estate and

highlighting the government's role in promoting policies that are partially responsible for this impact. This theory can explain why certain areas in Barcelona, such as the historic neighborhoods, may have been transformed with the complicity of public institutions, and part of the private sector, to tourism-oriented areas as a means to regenerate them. That regeneration may have brought about an increase in rental prices of the housing market, and also the commerce's ones, thus contributing not only to the expulsion of residents but also of shop tenants. From this perspective, supply-side theories would explain how tourism development has contributed to the expansion of tourist accommodations and tourist-oriented shops as part of urban regeneration strategies. However, [Ley's \(1986\)](#) demand-side theory of gentrification processes might also explain the observed phenomena. From this point of view, the rent gap might not be as important as the fact that commerce ends up responding to the new gentrifiers' needs. Since tourists' needs are not the same as the neighbors' ones, this reorientation leaves a gap in which the former

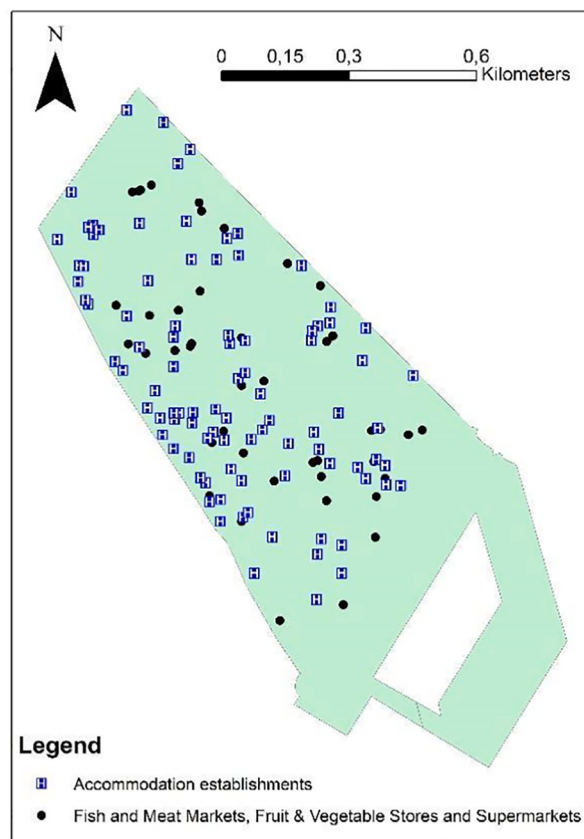


Fig. 4. Spatial distribution of accommodation establishments and some sectors in Gòtic neighborhood.

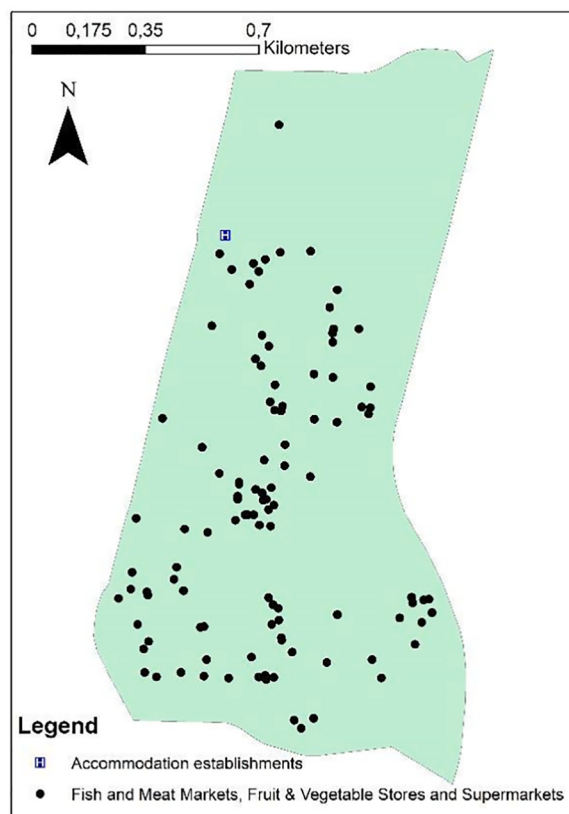
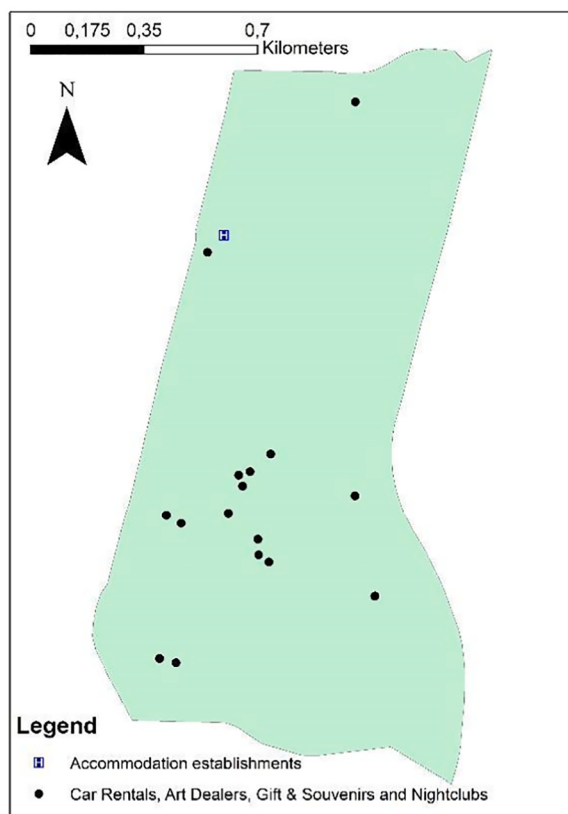


Fig. 5. Spatial distribution of accommodation establishments and some sectors in Sant Andreu neighborhood.

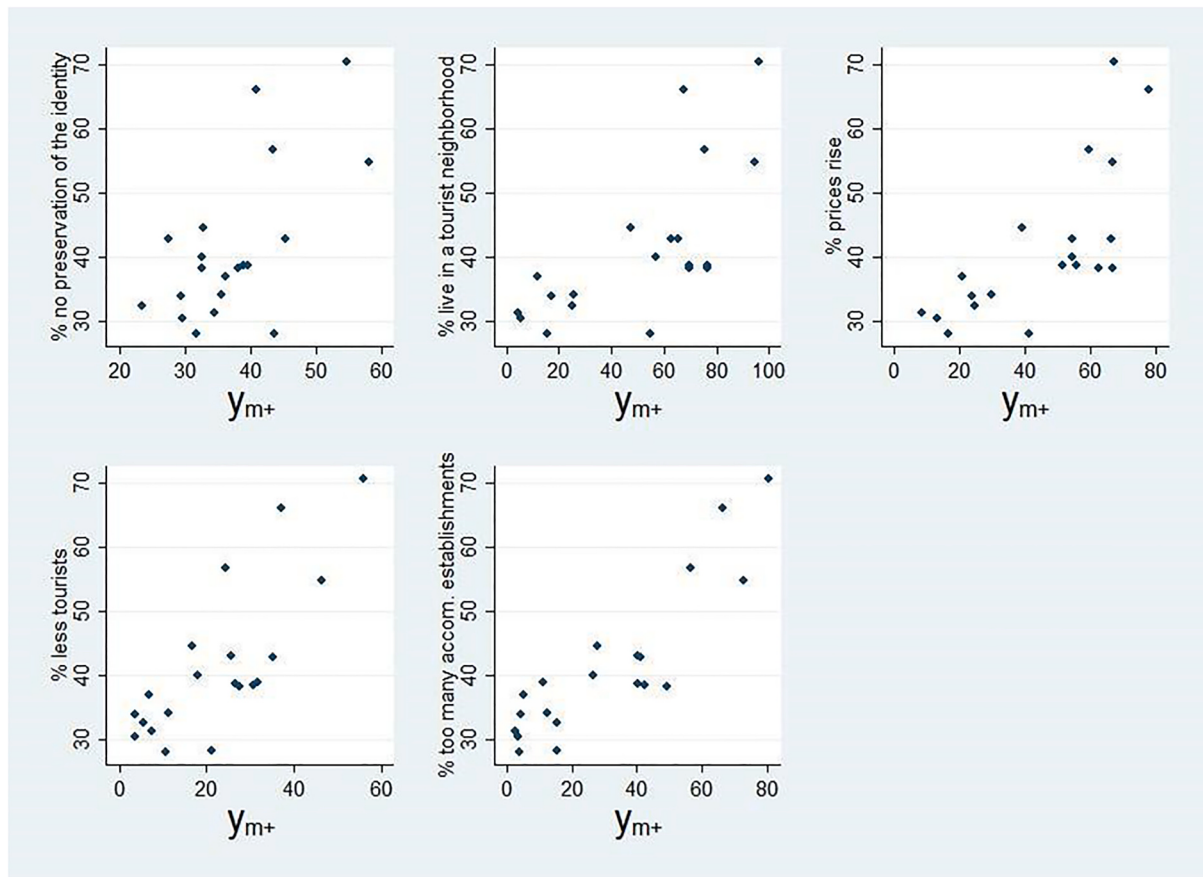


Fig. 6. Relationship at the neighborhood/district level between the share of businesses that are positively coagglomerated with the accommodation industry and different residents' perceptions towards tourism.

residents cannot fulfill their basic needs, therefore affecting their quality of life. Thus, although much attention for explaining gentrification processes has been paid to the supply side, it can be argued that the identified coagglomeration patterns in this study also reflect the other side of the process.

Furthermore, the identified coagglomeration patterns between tourist accommodations and some commercial sectors should be also interpreted from the lens of Urban Economics' coagglomerating forces. In this sense, there are two potential forces that should be discussed. First, certain commercial sectors might receive direct benefits of being close to accommodation establishments. That is, they might enjoy positive cross-industry spillover benefits. Second, both tourist-oriented sectors and accommodation establishments may coagglomerate just because of the existence of location-specific natural advantages attracting them such as tourist hotspots. In fact, both forces are likely to coexist and may be responsible for the observed phenomena (Ellison & Glaeser, 1997).

These main results have then been cross-analyzed with residents' perceptions in Figs. 6 and 7. It has been found a positive correlation between how much tourism-oriented the residents feel that their neighborhood is and the percentage of commercial facilities that have proved to abound in the surroundings of tourist accommodations. Specifically, those neighborhoods whose shops and businesses tend to belong to economic sectors coagglomerated with the accommodation industry are also those areas in which residents claim that tourism might have detrimental effects for the preservation of the city's identity and for their own quality of life. Given that these commercial sectors are also those that are likely to be more tourism oriented than resident oriented, this paper also goes in line with previous studies sustaining that a touristification of the commercial structure constitutes a central concern

for residents (Cocola-Gant, 2015; Gotham, 2005; Nofre et al., 2018; Novy & Colomb, 2016; Pinkster & Boterman, 2017). Yet, this study provides new insight by establishing a geographic correlation that suggests a bond between the loss of community resilience and the commercial structure linked to the presence of tourist accommodations. The businesses that tend to be less coagglomerated with accommodations may also be the ones that are key for residents' quality of life and, therefore, essential for maintaining social capital over time.

Finally, it should be noted that, until now, the potential displacement of the residential function of urban destinations has been analyzed either directly from residents' perceptions, either indirectly by signaling the decrease of inhabitants of highly frequented tourist areas (Bertocchi & Visentin, 2019; Cocola-Gant, 2015; Herrera et al., 2007; Sequera & Nofre, 2018). Thus, this paper also spans this literature by proposing the use of a well-established methodology in urban economics that applied over objective longitudinal data could significantly contribute to the academic debate. In fact, the theoretical implications would imply significant contributions to the classic discussion regarding the potential loss of function in urban tourism destinations (Ashworth & Page, 2011; Bouchon & Rauscher, 2019).

5.2. Conclusions

The objective of this research was to empirically identify which commercial sectors tend to abound in the surroundings of tourist accommodation establishments in a tourist city. To this aim, this paper has applied the seminal Ellison and Glaeser (1997) index to the Barcelona Commercial Census. The conducted analysis has allowed the identification of the commercial sectors coagglomerating with the accommodation industry in a first-tier urban tourist destination. It was found that

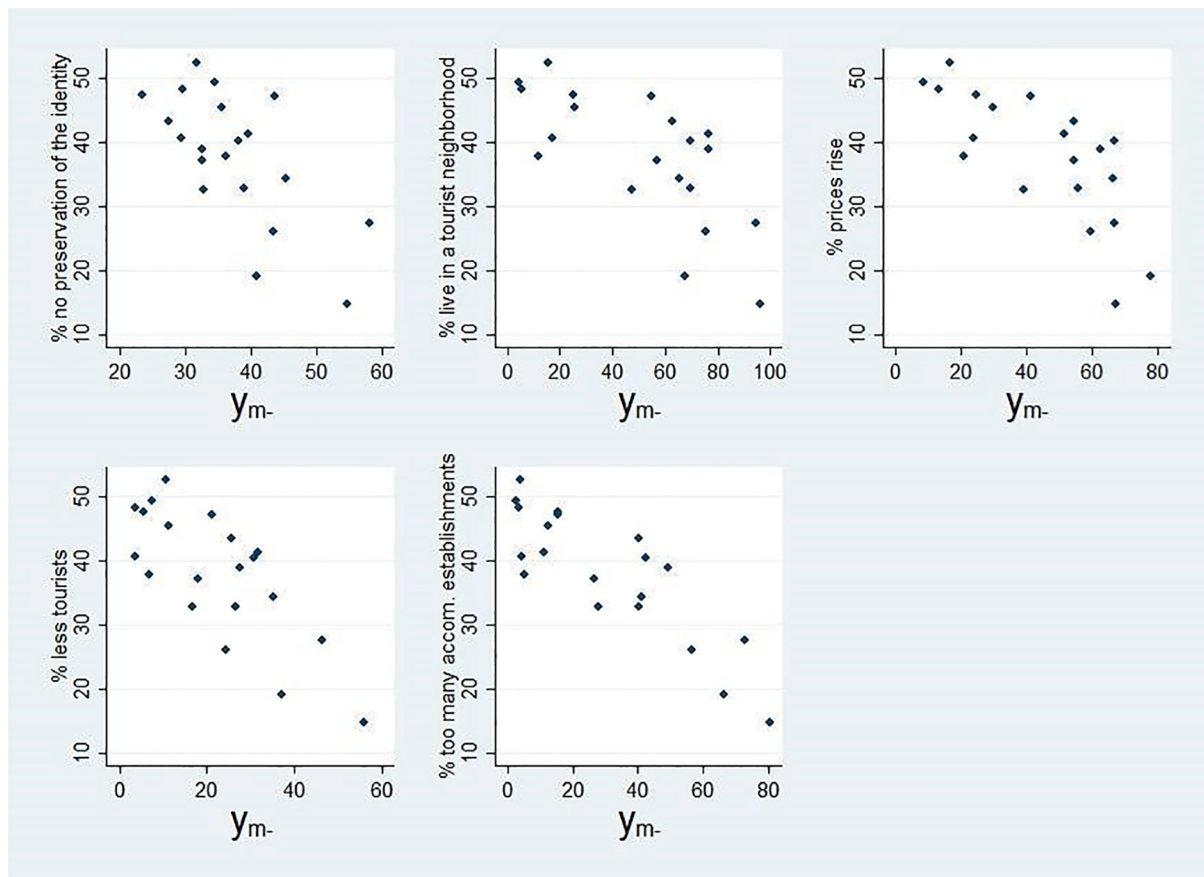


Fig. 7. Relationship at the neighborhood/district level between the share of businesses that are negatively coagglomerated with the accommodation industry and different residents' perceptions towards tourism.

tourist-oriented sectors are prone to be in the neighboring of accommodation establishments; whereas resident-oriented sectors tend to be geographically dispersed with the accommodation industry. These results suggest that in neighborhoods with a wide presence of accommodation establishments might not be convenient for the day-to-day life of their residents, representing a threat to the residents' quality of life. Indeed, in those neighborhoods in which a higher share of the commercial offer belongs to sectors coagglomerated with accommodation establishments are also those neighborhoods where residents have more negative opinions about tourism.

From a practical perspective, the identification of potentially vulnerable commercial sectors to the urban tourism development entails several implications in terms of informing policymaking. Given that the literature suggests that tourism-led commercial transformations standardize the urban landscapes across tourist cities (García-Hernández et al., 2017), the results of this paper are informative for other important urban tourist destinations such as Barcelona. Hence, this research contributes to a more integral and sustainable urban and tourism planning which would take retail and commercial structure into consideration. By focusing on resident-oriented sectors, plans and policies should help in maintaining local community social capital by foreseeing vulnerabilities to touristification. The results of this study can undoubtedly become a tool to develop urban policies aimed at promoting a balance between the daily needs of residents and those of tourists. The results may allow, for example, a heterogeneous tax system that promotes or discourages certain commercial sectors in neighborhoods with a high presence of tourist accommodation establishments. In parallel, these findings can also contribute to inform social collectives and retailers' associations, helping to sharpen their demands and to frame their interactions with policymakers.

Moreover, this study also opens the door to a new possible systematized and objective monitoring of tourism-led changes in the commercial structure, and hence to the possibility of its use as an urban tourism sustainability indicator. The replication of these index's estimates across time and their comparison with the development of the accommodation industry can be very informative about tourism commercial gentrification processes. Thus, it is also suggested establishing a periodical census of urban commercial structures as a management good practice.

The problem addressed in this study is specially relevant in the actual paradigm of urban tourism development which is expanding both in absolute numbers and spatially. Considering that this growth involves residential areas that until now have not had to face tourism-led gentrification processes, the results of this paper might be informative in forecasting the touristification of the commercial sector in these areas and can help promote community resilience.

5.3. Limitations and future work

This study is not exempt from limitations. First and due to the current lack of previous and comparative data, this paper only offers a static photo of the situation in Barcelona. A follow-up study would be necessary to analyze possible diachronic changes both in the expansion of the tourist accommodation industry and in the possible changes of the commercial offer that develops around accommodation establishments. Second, the vacation rentals' data corresponds to 2015 while the commercial census one refers to the situation in Barcelona in 2014. This discrepancy might constitute a limitation in a dynamic city such as Barcelona. However, these databases have been taken as a starting point to apply this methodology and establish an identification strategy for

urban tourism investigations. Future studies can use other databases, such as Open Street Map or Google Places, to apply the proposed methodology in this research with different information sources, or to other destinations to verify if the phenomenon replicates elsewhere. Finally, the data used does not distinguish within the same sector if the businesses are mostly frequented by tourists or residents. This can also be analyzed in future studies that use Google Places or user-generated content data as it also offers reviews' information that can be used to better profile a particular business.

CRedit authorship contribution statement

Oriol Anguera-Torrell: conceptualization, investigation, methodology, formal analysis, writing – original draft, writing -review & editing.

Aurélien Cerdan: conceptualization, investigation, writing - review & editing.

Declaration of competing interest

We have no conflicts of interest to disclose.

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