ORIGINAL ARTICLE

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Dynamics of agglomeration and competition in the hotel industry: A geographically weighted regression analysis based on an analytical hierarchy process and geographic information systems (GIS) data

JEL Classification: *M31; M21; Z33*

Abstract

Research background: The effects of locating next to other establishments of equivalent activity is a decision with serious and far-reaching implications, not only from the point of view of location decisions but also with regard to competitive strategy, pricing, or promotion decisions. The literature provides evidence of the negative effects of being proximate to competitors (erosion of market share), but there are also benefits associated with the increased attraction of demand (attraction effect). This phenomenon is of particular interest in the case of hospitality, where hotel concentrations can be found around certain tourism resources, and is a crucial factor in hoteliers' decisions as they evaluate these contradictory effects.
Purpose of the article: Drawing from the relevance that the confrontation between agglomeration and competition has in the hotel industry, our study aims to examine if this confrontation can be driven by geographical location and how both vertical and horizontal differentiation factors can unbalance it.
Methods: Based on the use of geographical information systems and the estimation of a geographically weighted regression model with a wide dataset that includes 3,153 European hotels located in Spain, France and the United Kingdom.
Findings & value added: We extend agglomeration and competition theoretical bodies related to location decisions by providing new findings about their simultaneous effect. Specifically, this study contributes to filling the gap regarding their combined effects on pricing and the conditions under which one prevails over the other. Results show that the role of geographical location and a hotel's online reputation are more decisive differentiation factors than hotel category when explaining the asymmetry of the effects of agglomeration and competition.

Introduction

In the lodging sector, as in many other industries, geographical location is a relevant factor in achieving success (Fang *et al.*, 2019). A good location can influence consumer hotel selection (Masiero *et al.*, 2019), allowing hotels to benefit from higher income, profitability, and occupation (Luo & Yang, 2016). The identification of factors that determine better locations and hotel location patterns constitutes valuable information for investors, since it allows them to achieve a better understanding of the market and to avoid areas with excess hotel supply. The economic relevance of these decisions is evident as is revealed by new hotel construction projects activity in Europe. In Europe this reached an all-time high at the end of 2022 with new hotel opening projects numbering 1,660 among which London with 79 stands out as the city with the most projects, Paris has 34, and Madrid has 36 projects (Horwath HTL, 2022; Lodging Econometrics, 2022).

Location-related models have emphasized the complexity of hotel location decisions, in particular, the tourist-historic city model, the monocentric model and agglomeration models (Yang *et al.*, 2014). The tourist-historic city model shows different hotel distribution patterns associated with different zones within the tourist-historic cities. The monocentric model describes the distribution of land use patterns as several monocentric rings as a function of distance from the city centre and highlights the possible location of urban hotels. Finally, agglomeration models argue that hotels tend to cluster with other hotels to benefit from the externalities derived from this concentration (providing greater access to resources, leading suppliers, special services, or special relationships, and reducing consumers' search costs) (Yang *et al.*, 2014). Among the explanatory factors, transportation networks (Li *et al.*, 2015), tourist attractions (Fang *et al.*, 2019), commercial centres (Cró & Martins, 2018), the recreation business (Lee *et al.*, 2018), the public service infrastructure and the economic environment (Yang *et al.*, 2014), all stand out and the role of geographical competition environment in locations decisions has been highlighted, since the latter may affect hotel pricing (Becerra *et al.*, 2013; Silva, 2016), hotel performance (Lee & Jang, 2015; Urtasun & Gutiérrez, 2017), and the survival of hotels (Baum & Mezias, 1992; Kalnins, 2016).

However, extant literature shows partial and divergent results, without a consensus on the final consequences of physical hotel competition, that is, competition arising from the physical location or physical distance between hotels (Tsang & Yip, 2009). Indeed, previous studies have shown that a competitive environment plays a fundamental role in the choice of hotel location (Kim *et al.*, 2020; Luo & Yang, 2016), either seeking advantages of agglomeration, that is, the advantages that a hotel can obtain from clustering or softening competition (Freedman & Kosová, 2012; Yang *et al.*, 2014). On the one hand, hotels can achieve some benefits by co-locating next to their competitors, such as achieving higher performance (Kim *et al.*, 2020; Lee & Jang, 2015; Li & Du, 2018), growth in hotel efficiency due to the positive spillover effect from their neighbours (Barros, 2005), increased demand because of a reduction in consumers' search costs or exclusive access to resources (Canina *et al.*, 2005), or acquisition of local knowledge from the incumbent firms in that market (Woo & Mun, 2020). Additionally, co-location next to other hotels may encourage price competition/erode benefits (Balaguer & Pernías, 2013; Becerra *et al.*, 2013; Lee, 2015; Rezvani & Rojas, 2020), thereby increasing performance risk (Kim *et al.*, 2020) and

failure rates (Baum & Mezias, 1992; Kalnins, 2016). This debate has been fuelled lately because of the role establishment concentration plays in enhancing social media communication (Liu *et al.*, 2018).

Due to the coexistence of these two opposing effects, hoteliers tend to actively seek the benefits of agglomeration effects in their location decision process (Adam & Mensah, 2014; Kalnins & Chung, 2004). Moreover, the achievement of an agglomeration effect can even influence the internationalization decision-making of hotel chains (Marco-Lajara *et al.*, 2017; Woo & Mun, 2020). Thus, hotel location research has recently been using agglomeration models that unlike other absolute models such as the tourist-historic city model and mono-centric model, try to explain the relative hotel location patterns of new hotels and can explore hotel location on intra-metropolitan, intra-regional and regional scales (Yang *et al.*, 2014).

Based on agglomeration theories (e.g., McCann & Folta, 2008) authors have approached the problem from different perspectives, with the differentiation approach being the most widely considered. Under this approach, the prevalence of one effect over the other may depend on vertical differentiation factors such as hotel category (Canina *et al.*, 2005; Freedman & Kosová, 2012), or horizontal differentiation factors such as chain membership (Chung & Kalnins, 2001; Becerra *et al.*, 2013) or services assortment (Urtasun & Gutiérrez, 2006, 2017). Additionally, from a dynamic perspective, market demand also allows this confrontation to be unbalanced (Silva, 2016).

From the conclusions of the ongoing debates, some contradictions may arise. First, some studies advocate vertically differentiated agglomerations (Canina *et al.*, 2005; Freedman & Kosová, 2012) as opposed to vertically undifferentiated agglomerations (Lee & Jang, 2015), since hotels of similar quality can cooperate when they are geographically proximate to one another (Lee, 2015; Silva, 2016). Second, there are also contradictions about the asymmetry of the agglomeration versus competition debate. Thus, there is empirical evidence in favour of economy and unbranded hotels benefiting most from agglomeration (Canina *et al.*, 2005; Kalnins & Chung, 2004), but agglomeration can intensify the positive effect of vertical differentiation on hotel price (Sánchez-Pérez *et al.*, 2020), and the higher category hotels and branded hotels are less pressured to reduce price when competition increases (Becerra *et al.*, 2013; Lee & Jang, 2013).

However, some limitations from previous contributions can be identified. First, studies usually consider vertical differentiation based only on

hotel category (Canina *et al.*, 2005; Freedman & Kosová, 2012; Lee, 2015; Lee & Jang, 2013; Lee & Jang, 2015). Although the lodging industry uses the hotel category extensively as an indicator of quality (Becerra *et al.*, 2013; Silva, 2016), this has been questioned as it is based mainly on the physical standards of the hotel (Abrate *et al.*, 2011), and does not take into account the quality perceived by the client through their online reviews (Blomberg-Nygard & Anderson, 2016), and the finding of divergences between them (Núñez-Serrano *et al.*, 2014). Recently, hotel research has begun to consider the online reputation achieved by a hotel through online reviews as a vertical differentiation factor (Sánchez-Pérez *et al.*, 2020; Rezvani & Rojas, 2020), as well as a measure of the quality perceived by consumers (Ghose *et al.*, 2012; Liu *et al.*, 2020) and even as an essential factor in the evaluation and identification of competitors (Ye *et al.*, 2022), an issue that, to the best our knowledge, has not been considered by previous studies on hotel agglomeration.

Second, the measurement of hotel agglomeration has been carried out in an inaccurate way, mainly through the number of establishments or available hotel rooms (Becerra *et al.*, 2013; Canina *et al.*, 2005; Freedman & Kosová, 2012; Lee & Jang, 2015; Park *et al.*, 2022), considering the geographical distance between the nearest competitors (Baum & Haveman, 1997; Park *et al.*, 2022; Silva, 2016) or the set of the geographically nearest competitors (Becerra *et al.*, 2013; Lee, 2015; Park *et al.*, 2022), but hotels can compete beyond geographical barriers with hotels that are less differentiated in quality (Lee, 2015) and the set of competitors can be identified through the quality perceived by consumers (Ye *et al.*, 2022) making alternative approaches necessary in the agglomeration measurement (McCann & Folta, 2008).

Third, previous literature has analysed the role of vertical differentiation on hotel agglomeration whereas horizontal differentiation based on services has scarcely been considered (Urtasun & Gutiérrez, 2017). However, hotels not only compete vertically but also horizontally with geographically proximate competitors through a differentiated service offer (Liu *et al.*, 2020). According to the theory of strategic balance (Deephouse, 1999), the establishment of the right differentiation strategy in relation to the competition can be a challenge for hotel managers (Kim *et al.*, 2020) given the great diversity of hotel services that can drive the customer's purchase decision (Dubé & Renaghan, 2000), new emerging services that respond to the increasingly demanding needs of guests (Kim *et al.*, 2017), and the diffi-

culty of capturing the consumer's value perceptions regarding the services offered (Liu *et al*., 2020). As a consequence, an effective measure of hotel service differentiation with respect to competitors is needed to clarify if conformity or differentiation encourages the agglomeration effect.

Finally, regarding the asymmetry of the effect of agglomeration and competition, the models considered in previous studies establish a static relationship between the dependent variable and explanatory variables throughout the study framework failing to account for spatial heterogeneity and spatial dependence. For this reason, the increased use of techniques such as Geographically Weighted Regression (GWR) has recently been championed in tourism and hospitality research (Nicholls & Kim, 2022). GWR can model a spatially varying relationship between the dependent and explanatory variables (Fotheringham *et al*., 2003) which allows us to analyse locally which hotels have benefited the most from the effect of agglomeration or have been more affected by the effect of competition. Although previous literature has applied GWR to analyse how the effect of hotel attributes on price can vary spatially (Zhang *et al*., 2011b), to the best of our knowledge, GWR has not been used to analyse how agglomeration vs. competition can vary spatially.

To overcome the limitations of previous studies, and framed on performance implications associated with specialized agglomeration (McCann & Folta, 2008), the present work tests the effects of hotel agglomeration on hotel price by building a GWR model on each hotel's differentiation strategy and environmental features through a multi-criteria approach to measuring hotel competition. Specifically, this research develops an attractiveness index based on a modified analytical hierarchy process (AHP) that takes into account the hoteliers' perspective as well as the opinion of consumers through online reviews. We rely on geographical information systems (GIS) to capture both the hotel geographical location and the quality perceived by the customer.

Our approach endeavours to provide some contributions. First, our study tries to extend the results on the confrontation agglomeration vs. competition through the application of GIS and GWR as a more advanced methodology to link the asymmetry of the effect of agglomeration or competition to the geographical location of the hotel. Second, our proposal attempts to provide useful tools in the competition assessment for hotel managers, facilitating the search for the benefits of agglomeration with others, supporting promotion decisions (e.g., social media), and assisting in

their location decisions when opening a new establishment (Adam & Mensah, 2014; Woo & Mun, 2020) and in their differentiation decisions when managing an existing one (Kim *et al.*, 2020; Liu *et al.*, 2020). Third, through the competition index, and given the dynamic nature of online reviews, our research permits the continuous evaluation of the strengths, weaknesses, and competitive advantages over competitors. Finally, this study provides a new proposal for the assessment of competitors based on perceptive quality through the online reviews of consumers, which has scarcely been considered in previous studies (Ye *et al.*, 2022) overcoming the limitations of these since it also considers the geographical distance between competitors.

The paper is structured as follows. Section 2 introduces the theoretical background and reviews hotel agglomeration and hotel differentiation literature. Section 3 establish the methodology. Section 4 shows the empirical findings. Section 5 introduces discussion with previous studies, and finally Section 6 concludes with implications and contributions.

Literature review

Hotel location and competition: the agglomeration view

Previous studies on hotel location have revealed that a critical factor in the geographical location of a hotel is competition (Fang *et al.*, 2019, Kim *et al.*, 2020; Luo & Yang, 2016). On the one hand, through the geographical hotel location, hoteliers can seek to co-locate with other hotels and benefit from agglomeration effects (Lee & Jang, 2015; McCann & Folta, 2008). On the other hand, hoteliers can avoid pressure from competitors by locating away from them (Lee, 2015). Therefore, the directions taken by each research stream are completely opposite.

Agglomeration theories postulate that companies tend to agglomerate based on obtaining access to specialized labour, exclusive resources, positive spillovers, greater demand and on facilitating the transfer of tacit knowledge (McCann & Folta, 2008). Agglomeration refers to the geographical concentration of economic activity and it can be defined as the concentration or number of firms in a well-defined physical space (Gardiner *et al.*, 2010). Hospitality research has provided empirical support for these theories (Canina *et al.*, 2005; Chung & Kalnins, 2001; Kim *et al.*, 2020; Lee & Jang, 2015; Marco-Lajara *et al.*, 2016) and has found that co-location with other

hotels can provide benefits through the generation of externalities and facilitating access to resources (Canina *et al.*, 2005). Further, positive spillover benefits may also be provided by geographically proximate retailers (Barros, 2005). Through hotel agglomeration, hotels can strengthen and grow demand (Canina *et al.*, 2005; Chung & Kalnins, 2001), improve performance (Kim *et al.*, 2020; Lee & Jang, 2015; Li & Du, 2018), increase their profitability (Marco-Lajara *et al.*, 2016), and can acquire local knowledge from existing hotels (Woo & Mun, 2020). Thus, the search for the agglomeration effect can strongly condition both the hotel location decisions (Adam & Mensah, 2014; Kalnins & Chung, 2004) and the internationalization decisions of global chains (Marco-Lajara *et al.*, 2017; Woo & Mun, 2020) that can benefit from local knowledge to mitigate the drawbacks of foreignness, the collective challenge that global firms must face when they decide to expand into a new foreign market (Woo & Mun, 2020). Nevertheless, greater hotel agglomeration does not always provide beneficial outcomes (Becerra *et al.*, 2013; Kim *et al.*, 2020; Lee, 2015; Liu *et al.*, 2020; Marco-Lajara *et al.*, 2014), and thus hospitality literature has also provided support for the assumption from Industrial Organization that establishes the existence of a negative effect on hotel performance associated with increased competition (Shaked & Sutton, 1982). A high degree of competition can outweigh the benefits associated with agglomeration and lead to lower prices (Becerra *et al.*, 2013; Lee, 2015; Liu *et al.*, 2020) and a loss of profits (Marco-Lajara *et al.*, 2014), which can negatively affect hotel performance, increasing risk (Kim *et al.*, 2020) and raising failure rates in agglomerated areas (Baum & Mezias, 1992; Kalnins, 2016). Thus, agglomeration and competition are two factors that interact through hotel location (Freedman & Kosová, 2012). This confrontation of two opposing effects has been extensively analyzed by previous hospitality research, highlighting two research streams. One stream, based on agglomeration models (Yang *et al.*, 2014), has focused on analysing whether the hotel industry tends towards agglomeration and the factors that favour this trend (Adam & Mensah, 2014; Baum & Haveman, 1997; Cró & Martins, 2018; Fang *et al.*, 2019; Fang *et al.*, 2021; Freedman & Kosová, 2012; Kalnins & Chung, 2004; Lee *et al.*, 2018; Li *et al.*, 2015; Luo & Yang, 2016; Qin *et al.*, 2021; Urtasun & Gutiérrez, 2006; Yang *et al.*, 2014) while another stream has analyzed the impact of hotel agglomeration on hotel economic results and the factors that unbalance the confrontation between agglomeration and competition (Balaguer & Pernías, 2013; Becerra *et al.*, 2013; Canina *et al.*, 2005; Chung & Kalnins, 2001; Enz *et al.*, 2008;

Kalnins, 2016; Kim *et al.*, 2020; Lee, 2015; Lee & Jang, 2013; Lee & Jang, 2015; Li & Du, 2018; Marco-Lajara *et al.*, 2014; Marco-Lajara *et al.*, 2016; McCann & Vroom, 2010; Park *et al.*, 2022; Rezvani & Rojas, 2020; Silva 2016; Tsang & Yip, 2009; Urtasun & Gutiérrez, 2017).

Results from the first stream show that agglomeration benefits influence hotel location decisions (Adam & Mensah, 2014; Fang *et al.*, 2021), although there is a threshold above which hoteliers avoid co-locating in highly agglomerated areas (Baum & Haveman, 1997; Luo & Yang, 2016). Arguments favouring agglomeration can be underpinned by land use (Fang *et al.*, 2019; Li *et al.*, 2015); amenities (Lee *et al.*, 2018; Luo & Jang 2016), and access to transportation or urban population density (Fang *et al.*, 2019) although the effect of these factors may be heterogeneous according to spatial location (Fang *et al.*, 2019; Fang *et al.*, 2021), hotel category (Fang *et al.*, 2021) or chain (Qin *et al.*, 2021). A contradiction can be observed about the role of differentiation, since both differentiation (Cró & Martins, 2018; Freedman & Kosová, 2012; Kalnins & Chung, 2004; Urtasun & Gutiérrez, 2006) and conformity (Adam & Mensah, 2014; Baum & Haveman, 1997) can encourage hotel agglomeration, so that hotels seek a trade-off between conformity and differentiation with the competition (Baum & Haveman, 1997).

The second stream established that agglomeration increases failure rate (Baum & Mezias, 1992; Kalnins, 2016), and hotel performance is more sensitive to the agglomeration effect than the competition effect (Li & Du, 2018). Thus, agglomeration can provide higher performance (Kim *et al.*, 2020; Lee & Jang, 2015), but it can also increase performance risk (Kim *et al.*, 2020) being unclear which hotels benefit the most. Thus, Tsang and Yip (2009) established that the benefit is similar for all categories, Canina *et al.* (2005) concluded that lower category hotels benefit the most, while Chung and Kalnins (2001) claimed that smaller hotels did, and finally Kim *et al.* (2020) suggested that hotels with a degree of trade-off between differentiation and conformity in size, quality and geographical location are those that obtain more benefits. Additionally, agglomeration can increase hotel profits if a certain threshold is reached below which agglomeration erodes profits (Marco-Lajara *et al.*, 2016).

Regarding pricing, agglomeration can encourage price competition (Balaguer & Pernías, 2013; Becerra *et al.*, 2013; Lee, 2015; Lee & Jang, 2013; Rezvani & Rojas, 2020) with higher category hotels and branded hotels being less pressured to reduce the price (Becerra *et al.*, 2013; Lee & Jang, 2013), but also agglomeration is associated with price premium (Sánchez-

Pérez *et al*., 2020; Enz *et al*., 2008; McCann & Vroom, 2010) without an agreement about which hotels benefit the most as both lower category hotels and unbranded hotels (Enz *et al*., 2008) as well as higher category hotels (Sánchez-Pérez *et al*., 2020) can attain greater benefits. This confrontation between agglomeration and competition can be influenced by factors such as demand (Silva, 2016), geographical distance from competitors (Silva, 2016, Park *et al*., 2020; Rezvani & Rojas, 2020), new hotel attributes (McCann & Vroom, 2010), online reputation (Rezvani & Rojas, 2020) or vertical differentiation (Lee & Jang, 2015).

Previously, agglomeration was measured by the number of hotels within a certain radius from a specific hotel, the number of hotels in some geographical areas or alternatively by geographical distance to competitors, but it remains a challenge how to measure the degree of agglomeration intensity since it must include both the number and the quality of the competitors (McCann & Folta, 2008). Additionally, although a spatial variation in factors that promote hotel agglomeration has been confirmed (Fang *et al*., 2019; Fang *et al*., 2021), only the first stream (Fang *et al*., 2021; Lee *et al*., 2018; Qin *et al*., 2021) has recently considered the application of techniques that take into account spatial autocorrelation and spatial heterogeneity (Getis, 2007; Nicholls & Kim, 2022). However, although there may be a dependency between observations within a geographical area or cluster (Canina *et al*., 2005; Chung & Kalnins, 2001), in the second stream this issue has scarcely been considered (Urtasun & Gutiérrez, 2017) as effective methods that control for any impact of a specific location are necessary due to the physical conditions (McCann & Folta, 2008). GWR methodology has been used to analyse the influence of hotel attributes on price (Zhang *et al*., 2011b). Furthermore, regarding the asymmetry of agglomeration benefits, GWR allows a spatial model to be estimated and a local analysis of which hotels benefit more from agglomeration compared to the global model contained in previous literature. Thus, our proposal is framed in the second research stream and tries to expand the results on the effect of the confrontation between agglomeration and competition in the hotel price by incorporating GIS and an estimation by GWR of a local spatial model.

Hotel agglomeration and differentiation

Agglomeration and vertical differentiation

Hotels can compete on price by employing vertical differentiation strategies (i.e., competing along a product dimension valued similarly by all customers, such as overall hotel quality (Becerra *et al.*, 2013)). Thus, given the existence of customers with low price sensitivity, this would allow them to attract customers willing to pay a premium price for higher quality services (Liu *et al.*, 2020).

Given the existence of customers with low price sensitivity, hotels can compete vertically to attract those customers who are willing to pay a premium price for higher-quality services (Liu *et al.*, 2020). Previous literature has highlighted the essential role played by vertical differentiation as a factor that influences both the formation of hotel agglomerations (Adam & Mensah, 2014; Freedman & Kosová, 2012; Kalnins & Chung, 2004) as well as the moderating role in the influence of hotel geographic concentration or agglomeration on economic results (Lee & Jang, 2015; Park *et al.*, 2022; Rezvani & Rojas, 2020). Thus, in addition to the results already commented on asymmetric agglomeration benefits based on vertical differentiation, there is also contradictory evidence both in favour of differentiated agglomerations (Freedman & Kosová, 2012; Kalnins & Chung, 2004; Park *et al.*, 2022; Rezvani & Rojas, 2020) and vertically undifferentiated agglomerations (Adam & Mensah, 2014; Lee, 2015; Lee & Jang, 2015; Tsang & Yip, 2009) based on the premise that similar hotels can cooperate when they are located in the same area (Lee, 2015; Silva 2016).

The vertical differentiation index par excellence that has been widely used in hotel agglomeration research is hotel categorization or a similar classification (Becerra *et al.*, 2013; Lee, 20015; Lee & Jang, 2015; Silva, 2016). However, hotel category is mainly based on the physical standards of the hotel and one of its limitations is that it does not take into account the quality perceived by consumers expressed through online reviews (Blomberg-Nygard & Anderson, 2016) in which divergence between hotels has been empirically verified (Núñez-Serrano *et al.*, 2014). Consequently, the validity of the hotel category as a vertical measurement of differentiation has recently been questioned (Abrate *et al.*, 2011) due to the challenge of measuring a high-quality service (Mankad *et al.*, 2016) whereas, by comparison, the

customer opinions in online reviews provide more information (Ye *et al.*, 2022).

Hospitality research has highlighted the role that online reviews play in the current lodging industry landscape. Thus, in the era of e-commerce, a better online reputation allows hotels to achieve premium prices (Sánchez-Pérez *et al.*, 2020; Zhang *et al.*, 2011a), since online reviews are a decisive factor in customer search patterns in the tourism industry (Lu *et al.*, 2016) and in subsequent hotel selection (Zhao *et al.*, 2015).

Recently, online reputation has been considered by hospitality research as a measure of quality perceived by consumers (Ghose *et al.*, 2012; Liu *et al.*, 2020) and hence as a factor of vertical differentiation that allows the positive effects of agglomeration to be enhanced and which also reduces price competition in (Rezvani & Rojas, 2020; Sánchez-Pérez *et al.*, 2020) so that hotels perceived by customers to be of similar quality can compete without the need to be geographically proximate (Rezvani & Rojas, 2020) and therefore this constitutes a useful tool for the identification of competitors (Ye *et al.*, 2022).

Nonetheless, previous agglomeration research has neglected online reputation as a factor of vertical differentiation in the assessment of the competitive environment, requiring an alternative approach that accounts for the quality perceived by consumers, thus responding to a challenge in agglomeration research regarding the classification into good and bad hotels to measure the asymmetric effect of agglomeration benefits (McCann & Folta, 2008). Given the relevance of geographical distance and online reputation in price competition (Rezvani & Rojas, 2020), our approach combines both factors using GIS, a tool which is widely considered in agglomeration studies (Park *et al.*, 2022; Rezvani & Rojas, 2020; Urtasun & Gutiérrez, 2017) for competitor assessment.

Agglomeration and horizontal differentiation

Although hoteliers can compete with hotels that are geographically proximate by offering services that are differentiated both vertically and horizontally (Liu *et al.*, 2020), the agglomeration research has extensively focused on the impact of vertical differentiation on hotel agglomeration whereas the impact of horizontal differentiation has scarcely been considered (Urtasun & Gutiérrez, 2017), to the extent that previous agglomeration studies that took horizontal differentiation into consideration mainly used

chain membership as a differentiating index (Chung & Kalnins, 2001; Kalnins & Chung, 2004; Qin *et al*., 2021). However, recently the chain has begun to lose its relevance (Hollenbeck, 2018) and consequently, it does not protect against price competition with nearby hotels (Becerra *et al*., 2013). Additionally, chain affiliation is an absolute measurement that does not allow graduation in differentiation strategies, and therefore does not allow the assumptions of the theory of strategic balance to be incorporated, which establish that in markets such as the hotel industry with strong competition (Liu *et al*., 2020), a trade-off between differentiation and conformity in a company's strategy can soften competition while allowing it to capture agglomeration benefits (Deephouse, 1999).

Although the theory of strategic balance has been confirmed empirically by some agglomeration studies, these have mainly considered a limited number of dimensions such as distance, quality, and size (Baum & Haveman, 1997; Kim *et al*., 2020; Urtasun & Gutiérrez, 2006) instead of the different services offered (Urtasun & Gutiérrez, 2017).

However, establishing the appropriate degree of differentiation can pose a serious challenge for hoteliers, since differentiation strategies in services cannot always provide benefits to the hotels with greater differentiation (Urtasun & Gutiérrez, 2017) as competition can weaken the competitive advantage achieved by a hotel through its offer of services if some geographically proximate competitors incorporate the same services for free or at a minimum price (Liu *et al*., 2020). In fact, undifferentiated high-priced hotel agglomerations with a differentiated services offer lead to higher performance (Urtasun & Gutiérrez, 2017) thus an appropriate degree of mixture of conformity and differentiation strategies can promote a more stable performance (Kim *et al*., 2020). Finally, the wide variety of services in the hotel sector (Dubé & Renaghan, 2000) with the emergence of newly demanded services responding to new guest needs (Kim *et al*., 2017) and the difficulty of capturing consumers' value perceptions of services (Liu *et al*., 2020), make it even more difficult to find a balance in the trade-off between conformity and differentiation. Thus, an adequate differentiation measurement of service offer with respect to competitors can make it easier to determine if conformity or differentiation encourage the agglomeration effect.

Research methods

To analyse the effect of hotel agglomeration and differentiation strategies on hotel price, a sample of hotels was collected. An international wholesaler, Veturis, which clusters several travel agencies was used to collect the sample and the information about hotel attributes through web analysis techniques. Veturis is a relevant company (London Stock Exchange Group, 2017) that works in a similar way to Online Travel Agencies (OTAs), which provide an information source widely considered in hospitality research (Cró & Martins, 2018; Liu *et al*., 2020; Zhang *et al*., 2011a). Regarding online reviews information, Veturis is a reliable source since it only posts online reviews from real guests after their hotel stay. An initial sample of 3648 hotels geolocated in Spain, France, Italy and the UK to analyse different competitive contexts was obtained during the year 2017 when these countries were the top European countries both in international tourism revenues and tourist arrivals (UNWTO, 2018). For those hotels with missing data, an attempt was made to complete the information from the hotel websites. After missing data removal, the final sample included 3514 hotels located in 177 cities, organized in 866 commercial zones. Due to the small sample size for Italy, we excluded this country from the empirical analysis.

Following previous studies on confrontation agglomeration vs. competition that consider hotel price as the dependent variable (Becerra *et al*., 2013; Lee, 2015; Park *et al*., 2022; Zhang *et al*., 2011a), we accounted for the yearly average room rate for a standard double room in euros during the year 2017 as the dependent variable for each hotel included in the sample, due to it being invariant to seasonal effects and special events (Lee, 2015). Following Rosen (1974) and several previous studies in hotel price determinants (see a review of previous studies that considered this model in Zhang et al., 2011b for more details), this variable was log-transformed to facilitate the effect interpretation. Consequently, the percentage impact on room price for a continuous variable is computed with the coefficient multiplied by 100 (Kennedy, 2008).

Among independent variables, we considered both control variables and explanatory variables. Firstly, we considered the following control variables:

– *Size*=Hotel rooms number. The pricing policy can be affected by the hotel size so following Becerra *et al*. (2013), we controlled for the hotel size by the number of rooms.

- *LAge*=log(Hotel construction year). Based on Zhang *et al.* (2011b), hotel age can condition hotel pricing behaviour. To account for this possible difference, we measured the hotel age by the logarithm of the number of years of hotel operations.
- *Online_Reputation*. To control for the effect of hotel online reputation on room price, following Zhang *et al.* (2011a), this variable measures the yearly average customer rating of each hotel from reviews posted in Veturis during 2017 with a 0–10 scale.

Secondly, the explanatory variables included in the model were:

- A competition index *CI*
- *Hotel_Category*
- A horizontal differentiation index *HD*

Regarding the explanatory variables, a competition index *CI* that allows the evaluation of different hotel characteristics through online consumer ratings (Ghose *et al.*, 2012) was considered to assess the competitive environment of a hotel. Although the competition area can be delimited by a radius around the hotel (Park *et al.*, 2020), our sample includes cities of different geographic sizes with a non-homogeneous hotel distribution, from which it is difficult to unify a common radius that works satisfactorily. Following previous studies (Balaguer & Pernías, 2013; Kalnins, 2016), to homogeneously assesses hotel competition, we considered the commercial areas defined by Veturis to establish the set of competitors of each hotel.

Following Tierno *et al.* (2018), we calculated the competition of hotel *i* in its area of competition B_i with *n* competing hotels as follows:

$$CI_i = \frac{\sum_{h=1}^{n}(1-A_h)\cdot D_{ih}}{n} \qquad (1)$$

where A_h denotes the attractiveness of competitor *h* and D_{ih} denotes the distance in meters between hotel *i* and hotel *h*. The *CI* value considers both the distance to competitors as well as the attractiveness of these and enables us to evaluate the competition facing a hotel. The higher the *CI* value for a hotel, the lower the degree of competition that the hotel has to face.

The attractiveness (A_h) for each hotel was measured through the analytical hierarchy process (AHP) (Saaty & Tran, 2007) with a dimensionless value between 0 and 1 which reflects a mixture between the evaluations of experts and consumers. The higher the A_h value, the more attractive the hotel *h* is. Figure 1 shows the hierarchical scheme considered in AHP, with three main criteria, hotel infrastructure, perceived hotel quality and hotel

cost, divided into different sub-criteria. Thus, infrastructure covers the hotel location and its facilities and perceived hotel quality encompasses the hotel's cleanliness and the service provided. Finally, cost consists of a single factor, the perceived price of the hotel. A set of 10 experts in the hotel industry (including hotel managers, hotel sales promotion managers, tourism technicians in official organizations or managers from tourism event companies) scored these criteria and subcriteria separately with personal interviews through the pairwise comparison and the nine-point scale for AHP (Saaty & Tran, 2007). Those scores for which the consistency ratio was greater than 10% were discarded to avoid inconsistency in the evaluation (Saaty & Tran, 2007). To obtain the weights of each criterion and subcriteria, we considered the arithmetic mean technique to join individual scores for each expert. Table 1 shows the final weights for each criterion and subcriteria.

Next, the pairwise comparison between the competitors of a hotel was carried out through the online assessment of each of the subcriteria that the hotel had received. The evaluations made by the customers for each hotel in each one of the subcriteria included in AHP were provided by Veturis again. This online evaluation of each subcriterion ranges between 0 to 10 and the comparison of a hotel i versus a hotel h for a specific subcriterion was carried out by the ratio of its evaluations x_i/x_h, making it necessary to rescale the pairwise comparison to the nine-point scale. Thus, our proposal mixes the evaluation of experts that compare the subcriteria and the evaluation of the customers for the comparison of hotels and it incorporates multiple criteria through online consumer reviews in the evaluation of a hotel's competition and incorporates attractiveness as a vertical differentiation factor in the assessment of competitors.

Additionally, we considered supplementary explanatory variables to measure both vertical differentiation and horizontal differentiation (Becerra *et al.*, 2013). Concerning vertical differentiation, as in most previous studies, we considered the *Hotel_Category* in the usual range from one to five stars (Becerra *et al.*, 2013; Silva, 2016).

For horizontal differentiation, following similar approaches in hospitality research to measure differentiation in the service space (Liu *et al.*, 2020; Silva, 2015; Urtasun & Gutiérrez, 2006; Urtasun & Gutiérrez, 2017), a distance from product differentiation literature (Chisholm *et al.*, 2010) was considered. Specifically, the services offered by a hotel i are compared with hotels located in the same commercial area B_i as follows:

$$HD_i = sum(V_i) \cdot \underset{\substack{h \in B_i \\ h \neq i}}{mean}\big(d(V_i, V_h)\big) \tag{2}$$

where V_i is a vector that indicates the availability of a service with the value 1 and absence of said service with the value 0 and includes hotel style, available sports activities and meal services. The value $d(V_i, V_h)$ is the differentiation of hotel i with respect to hotel h. If hotel h offers all the services included in hotel i then $d(V_i, V_h)=0$. Otherwise, its value is defined as follows:

$$d(V_i, V_h) = \left(\cos^{-1} \frac{V_i \cdot V_h}{\|V_i\| \cdot \|V_h\|}\right) / \left(\frac{\pi}{2}\right) \tag{3}$$

Thus, the higher the value of *HD*, the greater the horizontal differentiation degree with respect to competitors.

Finally, Table 2 provides the main descriptive statistics for all variables in the sample.

Analysis and results

A semi-logarithmic model was employed to examine the relationship between the dependent variable and independent variables. First, we considered ordinary least squares (OLS), but hotels in the same area share externalities such as services, amenities and attractions which can produce autocorrelation in price (Zhang *et al.*, 2011b). Additionally, the model includes spatial features based on commercial areas that can exhibit local homogeneity against the no-autocorrelation assumption of OLS and cause biases in the estimation of the regression coefficients (Zhang *et al.*, 2011b). Finally, the effect of competition on price can vary geographically (Park *et al.*, 2022). Thus, for model estimation, we employed geographically weighted regression (GWR), a recent estimation technique to account for spatial autocorrelation (Fotheringham *et al.*, 2003). Under GWR, the relationship between the dependent variable and the explanatory variables is non-static and therefore it is necessary to estimate a different set of regression parameters for each unit included in the sample.

To this end, the GWR method, based on the geographical location of each unit, considers spatial weights for all observations. Specifically, the

model considered for each sample unit with a vector of location coordinates u, is given by:

$$LPrice_i(u) = \beta_0(u) + \beta_1(u)Size_i + \beta_2(u)LAge_i +$$
$$+\beta_3(u)Online_{Reputation_i} + \beta_4(u)CI_i + \qquad (4)$$
$$+\beta_5(u)Hotel\_Category_i + \beta_6(u)HD_i + \varepsilon_i$$

where regression coefficients are estimated by:

$$\beta(u) = (X^T W(u) X)^{-1} X^T W(u) \cdot \log(Price_i)(u) \qquad (5)$$

W(u) denotes the weighting matrix of each observation for the model estimation of the sample unit u and X is the matrix of the explanatory variables. W(u) contains the weights for each sample unit according to the distance with respect to the point with coordinates u, the higher the distance with respect to point u, the smaller the weight. There are some ways to specify W(u) through three key elements, the distance, the kernel function, and its bandwidth. In this case, W(u) is obtained with a Gaussian kernel function based on Euclidean distance. Since our sample covers global cities such as Madrid, Paris or London with a higher hotel concentration, an adaptive kernel is preferable to a fixed kernel since the spatial distribution is non-homogeneous. The adaptive kernel bandwidth was established as a fixed number of 101 nearest neighbours based on their spatial location through the minimization of AICc (Gollini *et al.*, 2015).

To analyse the role of the hotel category as a vertical differentiation strategy with respect to competition, we considered ANOVA, Welch's ANOVA and Kruskal-Wallis tests to analyse if there are significant differences in the effect of the variable *CI* on price among the different levels of hotel category. All statistical procedures were performed with R software, version 4.2.1 whereas the results representation in maps were performed with QGIS softwar, version 3.22.3.

First, we analysed both global (OLS specification) and local multicollinearity (GWR specification) by variance inflation factor values (VIF) (Table 3) since multicollinearity could be a relevant issue in GWR even when global multicollinearity is not detected (Wheeler & Tiefelsdorf, 2005). The maximum value is 1.193 for global VIFs and 1.775 for local VIFs, so VIFs values are below the usual threshold of 5 (Kennedy, 2008). Thus, the independent variables from the proposed model do not show multicollinearity problems and all of them are included in the model estimation.

Next, we estimated both global and local models with OLS and GWR respectively. Table 4 reports the estimation results for OLS, the measures of AIC, AICc, R² value, adjusted R² (Fotheringham *et al*., 2003), the joint F-test, the joint Wald test, the Koenker (BP) test and the Jarque-Bera test. Since the result of the Koenker test shows statistically significant heteroscedasticity and/or nonstationarity, the model significance was checked with the Joint Wald Statistic that confirms the overall model significance. Similarly, the robust p-values confirm the significance of each independent variable at the 0.01 level. *Hotel Category*, *Size* and *Online Reputation* have a positive impact on room price whereas *LAge*, *CI* and *HD* have a negative impact. The negative effect of *CI* implies that there is an agglomeration effect, that is, a positive effect of the concentration of competitors. This agglomeration effect together with the negative effect of *HD*, suggests that differentiated agglomerations are the most beneficial for hotel prices.

The results from OLS diagnostics show that in addition to heteroscedasticity and nonstationary, the OLS model shows a lack of normality (Jarque-Bera test), and therefore the OLS estimation can lead to misleading results.

To analyse spatial autocorrelation of residuals from the OSL model, a Moran's I test was performed (Zhang *et al*., 2011b). The statistical value for the OLS residual is 0.334 (Z-score = 62.264), thus there is a significant positive spatial autocorrelation for OLS residuals (Table 5). Therefore, the estimated local model may be more appropriate than the global model to account for the spatial autocorrelation.

From Table 6, the GWR model shows better values of R², adj-R² and AICc. Additionally, the global R² value is less than all R² values from the local model so there is no sample unit for which the global model has a better fit than the local one. To compare the local and global goodness of fit, a F1-test (Leung *et al*., 2000) and an F-test (Fotheringham *et al*., 2003, p. 92) were performed (Table 7). Results from both test shows that the GWR specification attain a significant better goodness of fit than the OLS specification. Additionally, Table 5 shows that although the residuals from GWR are spatially autocorrelated (Moran's I Statistic=0.081; Z-score=15.229), the local estimation reduced the spatial autocorrelation considerably. For all the above reasons, the local model can be recommended over the global model.

From Table 6, coefficients for *Hotel Category* range from 0.090 to 0.416 whereas the rest of the variables include both positive and negative values in their range. The variability in the GWR parameters of all variables sug-

gests that GWR coefficients could be non-stationary. To test spatial variation in local coefficients, F3-tests were performed for each variable (Leung *et al.*, 2000). Results from F3 tests (Table 7) confirm a significant spatial variation in the coefficients for explanatory variables so coefficients can be considered non-stationary and GWR coefficients may be more appropriate than OLS coefficients that can lead to misleading conclusions for some hotels.

Regarding the confrontation agglomeration vs. competition, the results of the GWR model suggest that this depends on the hotel's geographical location. Similarly, confrontation conformity vs. differentiation is also linked to the hotel. To analyse how both agglomeration vs. competition and conformity vs. differentiation can vary geographically, we will illustrate three examples of global cities, Madrid, Paris, and London. Previous studies on hotel agglomeration have considered global cities as a study framework because they have some advantages (better quality infrastructure, skilled employees) that can encourage hotel agglomeration and are more attractive destinations for international tourists (Woo & Mun, 2020).

In the case of Madrid, we have broken down the city into administrative neighbourhoods (Ayuntamiento de Madrid, 2018). Figures 2 and 3 show the distribution by neighbourhoods of the effect of *CI* and *HD* respectively. Figure 2 shows that the valence of the *CI* effect can vary geographically. Thus, in the neighbourhoods of the Central district (Palacio, Sol, Embajadores, Cortes, Justicia, and Universidad) *CI* has a positive effect on the price, and therefore in these neighbourhoods there is a competition effect that also exists in some adjacent neighbourhoods of other districts such as Trafalgar, Almagro or Arguelles (dark dots). In this case, hoteliers should avoid a highly competitive environment, either by avoiding locating in the proximity of other competitors, especially if they are very attractive or by differentiating themselves vertically with greater attractiveness based mainly on the quality perceived by the customer. Thus, vertical differentiation based on attractiveness alleviates the negative effect of competition.

Concerning the role played by vertical differentiation based on the hotel category in neighbourhoods where there is a competition effect (positive *CI* effect), ANOVA, Welch's ANOVA and Kruskal-Wallis tests rejected the hypothesis that the positive effect of *CI* is similar in all categories. Figure 8a shows the distribution of the competition effect by hotel category and shows that there is a downward trend in the intensity of the effect as the category increases, so the category allows significant softening of the nega-

tive effect of competition but in a modest way, since the difference in the value means of the effect (solid black lines) is very similar to the global mean value (dashed line) for all except 5-star categories.

As the location of the neighbourhood begins to distance itself from the central district, the effect of *CI* turns from positive to negative, that is, as the distance from the central districts increases, an agglomeration effect begins to emerge, the intensity of which also increases with the distance to the central district. Thus, in neighbourhoods proximate to the city centre such as Castellana, Goya or Recoletos, a low-intensity agglomeration effect is observed (white dots) while in neighbourhoods such as Lista, Ibiza or Estrella the effect is intensified. The highest effect of *CI* occurs in neigh-bourhoods such as Simancas, Piovera or Corralejo. In these locations, hotel-iers should look for a highly competitive environment, that is, they should be located next to the competitors, especially if competitors are more attrac-tive. Hotel agglomeration is beneficial for hotels located in these neigh-bourhoods regardless of the degree of attractiveness. However, hotels with greater attractiveness face a lower competitive environment and benefit less from co-location so that hotels with less vertical differentiation capture differentiation from the most attractive hotels.

Regarding the hotel category, Figure 8b shows the distribution of the agglomeration effect (negative *CI* effect) by category. ANOVA, Welch's ANOVA and Kruskal-Wallis tests confirmed that category significantly influences the intensity of the agglomeration effect. Figure 8b shows a growing trend, which implies that category reduces the agglomeration effect in a deeper way than the competition effect since the differences be-tween categories are greater in general than in the case of the competition effect. Thus, in the neighbourhoods of Madrid where there is an agglomer-ation effect, hotels with lower category capture this effect with the greatest intensity.

Concerning the effect of *HD*, Figure 3 shows that in most Madrid neigh-bourhoods the effect is positive with variable intensity. The greatest inten-sity is in neighbourhoods of the central district such as Sol, Universidad, Palacios, and some adjacent neighbourhoods such as Argüelles (dark dots). Given that there is a competition effect in these neighbourhoods, through a differentiated service offer, hotels can protect themselves from competi-tive rivalry. On the contrary, there are a few hotels located in neighbour-hoods such as Rejas or Aeropuerto where the *HD* effect is negative (red dots) which, together with the existing agglomeration effect in these areas,

suggests that the undifferentiated agglomeration is more beneficial in these neighbourhoods. Finally, in the rest of the neighbourhoods (blue dots), the effect of *HD* is positive with low intensity and since in these areas there is an agglomeration effect, this suggests that horizontally differentiated agglomerations are more beneficial in these locations.

Regarding Paris, the organization of the city is based on 'arrondissements or districts (Open platform for French public data, 2018). Figures 4 and 5 respectively depict the effect of *CI* and *HD* by districts. Figure 4 shows that there is a hotel agglomeration effect in all districts of Paris, the intensity of which depends on geographical location. Thus, in Paris, being close to the competition allows hotels to attain price premiums. The highest intensity occurs in districts 9, and 2 and some hotels in district 10 and the lowest intensity in districts 11, 12, 13 and 20. Consequently, regardless of the district, hotel agglomeration is beneficial for hotels throughout Paris, and therefore they should choose locations close to the most attractive competition since the agglomeration effect is asymmetric and is more beneficial to less attractive hotels. Regarding the role played by the category as a vertical differentiation strategy, Figure 8c shows that the agglomeration effect decreases when the category increases, but ANOVA, Welch's ANOVA and Kruskal-Wallis ruled out that the differences were significant. Thus, in the case of Paris, the hotel category does not moderate the agglomeration effect and hotels from all categories benefit similarly from it.

Regarding horizontal differentiation, Figure 5 shows that the valence of the effect is linked to geographical location. Thus, in districts 3, 4, 9, 13 and 14 and some hotels in districts 10 and 12, the effect is negative (blue dots), which suggests that in these districts the agglomeration of hotels with an undifferentiated service offer allows higher prices to be set and therefore it is more advisable to opt for conformity strategies. On the contrary, in the peripheral districts of Paris, the *HD* effect is positive (red dots) and consequently it is more advisable to opt for differentiation strategies, which suggests that differentiated agglomerations are more beneficial in these districts.

Finally, the city organization for London is based on wards (London Ward, 2018). Figures 6 and 7 respectively display the effect of *CI* and *HD* by wards. Figure 6 shows a uniform agglomeration effect in London, the intensity of which is generally lower than the intensity of the agglomeration effect in Paris. Consequently, co-locating hotels near their competitors produces a similar positive effect regardless of the ward. Hotels should

seek locations near the most attractive hotels to fully benefit from the ag-
glomeration effect. Figure 8d shows that there are hardly any differences in
the intensity of the agglomeration effect between different categories,
which was confirmed by ANOVA, Welch's ANOVA and Kruskal-Wallis
tests.

Regarding horizontal differentiation, Figure 7 shows that in most
wards, the effect is negative; consequently, hotels benefit by providing non-
differentiated services. However, in some wards located to the east (River-
side, City of London or Whitechapel) the effect is positive, so hotels must
design differentiation strategies. Thus, in the eastern part of London, dif-
ferentiated agglomerations are more beneficial, while in the rest of the city
they are less beneficial than non-differentiated agglomerations.

Discussion

The analysis of the competitive environment plays a fundamental role in
the management of a hotel both in location decisions (Woo & Mun, 2020)
and in the design and management of the most appropriate differentiation
strategies (Kim *et al*., 2020), making hotel agglomeration a topic that con-
tinues to arouse interest in hotel research both to understand how hoteliers
choose the location of a new hotel (Cró & Martins, 2018; Fang *et al*., 2019;
Fang *et al*., 2021; Lee *et al*., 2018; Qin *et al*., 2021) and to understand the ben-
efits and drawbacks associated with hotel agglomeration (Kim *et al*., 2020;
Li & Du, 2018; Park *et al*., 2022; Rezvani & Rojas, 2020; Sánchez-Pérez *et al*.,
2020).

Our study represents a new contribution to analyse the factors that
make it possible to unbalance the agglomeration vs. competition confronta-
tion, but unlike recent previous studies (Li & Du, 2018; Rezvani & Rojas,
2020; Sánchez-Pérez *et al*., 2020) our results show that the imbalance of both
effects is linked to the spatial location of the hotel and the competitive envi-
ronment. Our empirical study includes a large sample of hotels that en-
compasses different countries and destinations, in contrast to recent studies
that only analysed one destination or country (Kim *et al*., 2020; Li & Du,
2018; Rezvani & Rojas, 2020; Sánchez-Pérez *et al*., 2020), which has allowed
us to expand previous findings. Thus, contrary to Rezvani and Rojas (2020)
and Sánchez-Pérez *et al.* (2020) who establish in their results that the effect
associated with hotel agglomeration is static within the same destination or

country, the findings of our work are in line with the results obtained by Park *et al.* (2022) since shows the coexistence of agglomeration and competition effects in the same destination (Madrid case). In contrast with Park *et al.* (2022), our results show different consequences of hotel agglomeration by destination.

Our study has also overcome the limitations of previous studies in measuring hotel agglomeration and instead of using the number of competitors (Sánchez-Pérez *et al.*, 2020), number of rooms available (Park *et al.*, 2022) or geographical distance to competitors (Park *et al.*, 2022; Sanchez-Pérez *et al.*, 2019), our study proposes to analyse the effects of agglomeration through a competition index that, following an approach similar to Ye *et al.* (2022), incorporates online consumer reviews in the evaluation of the competition, which has been scarcely considered in previous studies (Rezvani & Rojas, 2020).

Like other recent studies (Rezvani & Rojas, 2020; Sánchez-Pérez *et al.*, 2020), our work has addressed the role of the vertical differentiation strategy based on the hotel category with respect to the hotel agglomeration. Our findings show that the role of the hotel category can vary depending on the destination so that, for example, in the case of Madrid, a higher hotel category can both alleviate the negative effect associated with greater competition and enhance the positive effect associated with a greater agglomeration, in line with other previous studies (Sánchez-Pérez *et al.*, 2020). On the contrary, in the case of Paris and London, the role of the hotel category is irrelevant to enhance the positive effect of the hotel agglomeration.

Even though hotels compete both vertically and horizontally (Liu *et al.*, 2020), few previous studies have addressed the conformity vs. differentiation dilemma (Kim *et al.*, 2020). Our study aims to cover this research gap and following a similar approach to Kim *et al.* (2020) and Liu *et al.* (2020), proposes a new way of measuring horizontal differentiation based on the service offer and allows evaluating whether the offer of services of a hotel is adequate to its competitive environment (Liu *et al.*, 2020).

Finally, at a methodological level, our study is based on a geographically weighted regression model that accounts for spatial heterogeneity and spatial dependency, an issue recently demanding in hospitality research (Nicholls & Kim 2022). Although studies on location and hotel agglomeration have begun to take spatial autocorrelation into account in their analysis (Fang *et al.*, 2019; Fang *et al.*, 2021; Qin *et al.*, 2021), studies related to the impact of the hotel agglomeration on the hotel economic outcomes (Li &

Du, 2018; Park *et al.*, 2022; Rezvani & Rojas, 2020; Sánchez-Pérez *et al.*, 2020) have not addressed this methodological gap that our study has tried to cover.

Conclusions

Given the relevance attributed in previous research to the agglomeration vs. competition confrontation, both in the hotel differentiation strategy (Kim *et al.*, 2020) and in the location decision-making of new hotels (Luo & Yang, 2016) and of international chains (Woo & Mun, 2020), our study reaches new conclusions on the relationship between the competitive environment, differentiation, and hotel price. Our findings are based on a geographically weighted regression model that incorporates new measurements of both the competitive environment of a hotel and its differentiation degree with respect to its competitors which allows us to contemplate the heterogeneous effects, depending on geographical location, on hotel price. We provide a new perspective to hotel agglomeration studies by showing how geographical location can influence both the relationship between the competitive environment and hotel price and the moderating role that differentiation strategies can play.

Theoretical implications

Firstly, through a GWR model, we have reconciled the results of previous studies, given that, in the same destination agglomeration and competition effects can coexist at the same time, so that the prevalence of one over the other, as well as the intensity of the resulting effect, are linked to geographical location. Thus, our study extends previous results on agglomeration vs. competition that were based on stationary models.

Secondly, the joint use of the GWR model together with a new measure of the competitive environment, which integrates both the hotelier's and client's perspective and incorporates the attractiveness of the hotel based on online consumer reviews as a measure of vertical differentiation, has made it possible to overcome the limitations of previous studies, based mainly on hotel category, regarding the asymmetry of the effects of competition and agglomeration. Thus, the least attractive hotels benefit most from the agglomeration effect and the most attractive are the ones that suffer the

least from the competition effect in all the destinations analysed whereas in some destinations category is unable to moderate the effect of the competitive environment. Thus, category, which is mainly based on the physical standards of the hotel, only constitutes one of the dimensions incorporated in attractiveness, which would explain the relevance of attractiveness over category as a vertical differentiation factor.

Thirdly, our study also extends previous results on which type of agglomeration, differentiated or undifferentiated, is more beneficial both vertically and horizontally, this being also linked to hotel location. Finally, our work represents a new contribution to the incorporation of online reviews in the competitor's assessment, overcoming the limitations of previous studies (Ye *et al.*, 2022).

Practical implications

Managerially, our proposal provides tools that support hoteliers both in their decisions, not only regarding hotel location, but also concerning the marketing-mix. It is worth noting that our work highlights the feasibility of using GIS to manage each hotel individually, depending on the specific location within a city.

A first practical implication highlighted by the results of this work lies in the implications of geographic location decisions on the consequences and effects that hotel concentration and hotel competition may have on each hotel; something which could even extend to other types of establishments. It is observed how the urban planning pattern of a city can lead to the proximity to other similar establishments having a positive or negative effect. Also, it is useful to consider the margin for agglomeration and whether there are other locations with opportunities to develop hotel agglomerations (e.g., the outskirts). We can also find a pattern where the effect of competition is homogeneous across the city (e.g., London), or neighbourhood-dependent (e.g., Madrid). Therefore, hoteliers' and entrepreneurs' location decisions should be conditioned by both the urban planning of the city and the distribution of hotels throughout the city, without ruling out that being next to others can be positive (e.g., at Paris).

A second practical implication is for hotel branding. Our findings reveal a different pattern of competition effects depending on the hotel category. Consequently, hotel chains can manage their brands by adapting to the urban planning and distribution of hotels. Thus, it may be appropriate to

reinforce the single brand, or to adopt multi-brand strategies that compensate for the negative effects of competition (e.g., Accor).

A third, and more operational implication, is related to the services offered by each hotel, the portfolio of services can be tailored to the specific hotel based on its specific geographic location (e.g., in Madrid). Also, offering more services may have negative consequences for demand (e.g., London), so that product decisions are conditioned by the agglomeration and competitive situation in each area.

Finally, pricing and communication decisions are also conditioned by the location and agglomeration of competitors. In some places (e.g., Madrid), price competition is fiercer than in others (e.g., London). Also, social media communication performance could benefit from agglomeration, whereby hoteliers may increase their use as more competitors are in close proximity. Indeed, given the dynamic nature of online consumer reviews, the methodology proposed in this research allows hotel managers to continuously evaluate competitors over time, supplying information for these decisions.

Research limitations

This work presents certain limitations that may indicate a path for future lines of research. First, given the coexistence of agglomeration and competition effects at the same destination, future studies should analyse the hotel concentration threshold above which the agglomeration effect becomes a competition effect in a specific location and what the factors are that can influence this threshold. Second, future research must analyse what specific characteristics or externalities of a hotel environment, such as historical heritage, facilities, or access to public transport, encourage the existence of an agglomeration in a certain geographical location. Third, our work has considered a static measure of online reputation, but future works must consider its dynamic nature and, through a dynamic evaluation of the competitive environment, be able to analyse whether the agglomeration vs. competition confrontation depends on temporary factors such as seasonality or booking dates. Additionally, the sample was drawn in 2017 and the conclusions are limited by not considering the COVID-19 pandemic. Future work should perform comparisons between prepandemic and post-pandemic data to analyse how the pandemic may have impacted on the effects of hotel agglomeration and hotel competition. Fi-

nally, future works should analyse whether certain customer profiles favour competitive or agglomeration effects by incorporating the characteristics of each customer when evaluating a hotel.

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Ministry of Education and Science
Republic of Poland

Annex

Table 1. Ranking of subcriteria for hotel attractiveness

Ranking	Criteria	Subcriteria	Final weight
1	Cost (0.2491)	Perceived price (1)	0.2491
2	Perceived Quality (0.4277)	Service provided (0.5521)	0.2361
3	Perceived Quality (0.4277)	Cleanliness (0.4479)	0.1916
4	Infrastructure (0.3232)	Location (0.525)	0.1697
5	Infrastructure (0.3232)	Facilities (0.475)	0.1535

Table 2. Sample descriptive statistics

Variable	Mean	St. dev.	Median	Min	Max
Size	94.340	104.829	65	2	2009
LAge	7.604	0.008	7.604	7.378	7.610
Online_Reputation	7.962	1.007	8.1	1	10
CI	3950.953	1657.342	1582.683	0.123	17528.880
Hotel_Category	3.244	0.891	3	1	5
HD	1.863	3.037	1.000	0	102.951
LPrice	4.359	0.542	4.261	3.018	7.147

Table 3. Multicollinearity Statistics

	OLS	Geographically weighted regression					
		Min	0.25	Median	Mean	0.75	Max
Variable	**VIF**						
Size	1.110	1.036	1.132	1.189	1.208	1.269	1.475
LAge	1.110	1.003	1.013	1.022	1.050	1.036	1.698
CI	1.011	1.007	1.022	1.032	1.039	1.052	1.161
Hotel_Category	1.193	1.079	1.221	1.285	1.282	1.338	1.539
Online_Reputation	1.075	1.037	1.074	1.089	1.120	1.114	1.775
HD	1.067	1.006	1.074	1.103	1.113	1.136	1.377

Table 4. OLS results and diagnostics

Variable	Coefficient	Std.Error	t-value	p-value	Robust Std.Error	Robust t-value	Robust p-value
Intercept	30.622***	7.604	4.027	5.8E-5***	7.202	4.252	2.2E-5***
Size	6.8E-4***	8.4E-5	8.085	8.5E-16***	1.1E-4	5.932	3.3E-9***
LAge	-3.580***	1.001	-3.578	3.5E-4***	0.948	-3.778	1.6E-4***
CI	-7.0E-6***	1.5E-6	-4.683	2.9E-6***	1.5E-6	-4.724	2.4E-6***
Hotel_Category	0.200***	0.010	19.599	2.2E-16***	0.011	18.480	2.2E-16***
Online_Reputation	0.038***	0.009	4.388	1.2E-5***	0.010	3.764	1.7E-4***
HD	-0.013***	0.003	-4.721	2.4E-6***	0.003	-3.870	1.1E-4***

OLS Diagnostics

	Value	p-value	df
R^2	0.169		
Adj R^2	0.167		
AIC	5033.878		
AICc	5033.919		
Joint F-Statistic	118.564	2.2E-16***	(6,3507)
Joint Wald Statistic	711.386	2.2E-16***	6
Koenker (BP) Statistic	22.069	0.001***	6
Jarque-Bera Statistic	1970.183	2.2E-16***	2

***Significant at 1%

Table 5. Moran's I tests OLS residuals and GWR residuals

	Moran's Index	Expected Index	Variance	Z score	p-value
OLS	0.334	-2.8E-4	2.8E-5	62.265	2.2E-16
GWR	0.081	-2.8E-4	2.8E-5	15.229	2.2E-16

Table 6. GWR model estimation

Geographically weighted regression						
	Min	**0.25**	**Median**	**Mean**	**0.75**	**Max**
Intercept	-216.500	-8.014	5.223	-0.406	25.471	135.416
Size	-0.002	-1.1E-4	1.2E-4	1.8E-4	5.3E-4	0.002
LAge	-17.433	-2.940	-0.348	0.432	1.445	28.779
CI	-5.1E-5	-1.4E-5	-2.5E-6	-6.3E-6	3.5E-6	1.8E-5
Hotel_Category	0.090	0.168	0.191	0.215	0.255	0.416
Online_Reputation	-0.030	0.056	0.090	0.100	0.147	0.249
HD	-0.030	-0.008	-8.7E-4	1.5E-4	0.008	0.034
Local R²	0.183	0.331	0.394	0.475	0.650	0.906
R²	0.488					
Adj R²	0.455					
AIC	3473.627					
AICc	3652.105					

Note: ***Significant at 1%.

Table 7. F1-test, F-test, and F3-test

GWR model vs OLS model						
F1 statistic	0.654					
p-value	2.2E-16***					
F statistic	0.616					
p-value	2.2E-16***					
Spatial variation						
	Size	**LAge**	**CI**	**Hotel Category**	**Online Reputation**	**HD**
F3 statistic	2.903	1.174	1.618	4.388	2.990	1.347
p-value	2.2E-16***	0.054*	0.021**	2.2E-16***	2.2E-16***	1.1E-4***

Note: *Significant at 10%, **Significant at 5%, ***Significant at 1%

Figure 1. Hierarchical model for hotel attractiveness
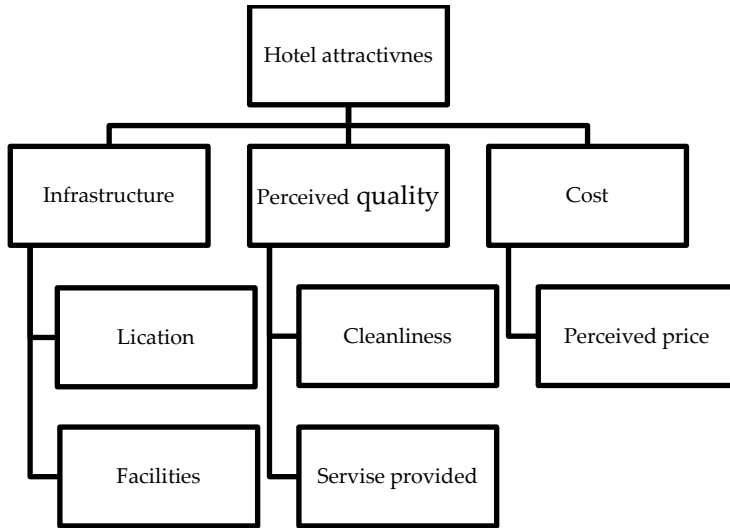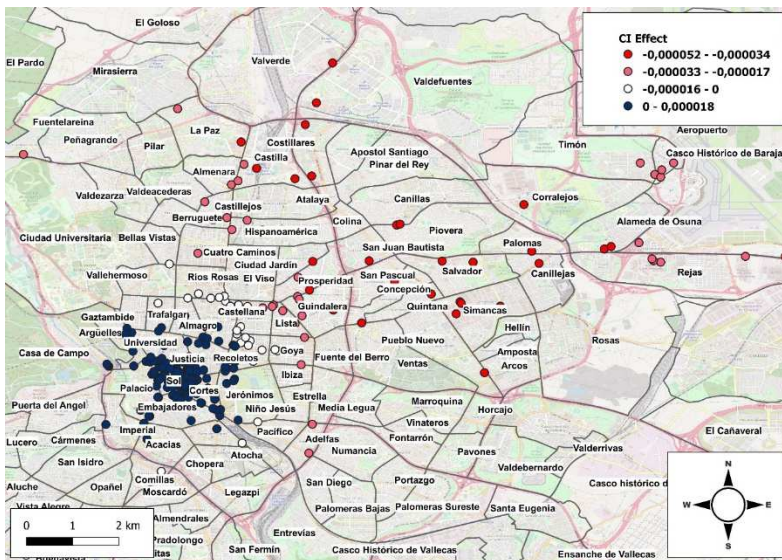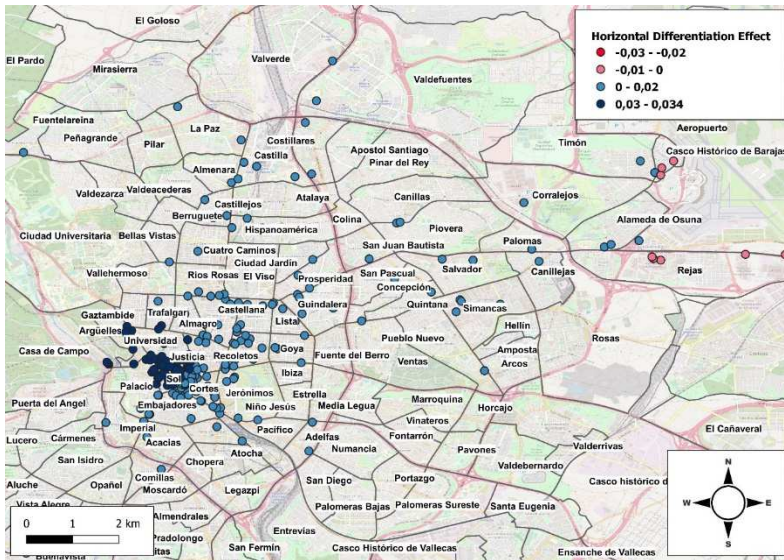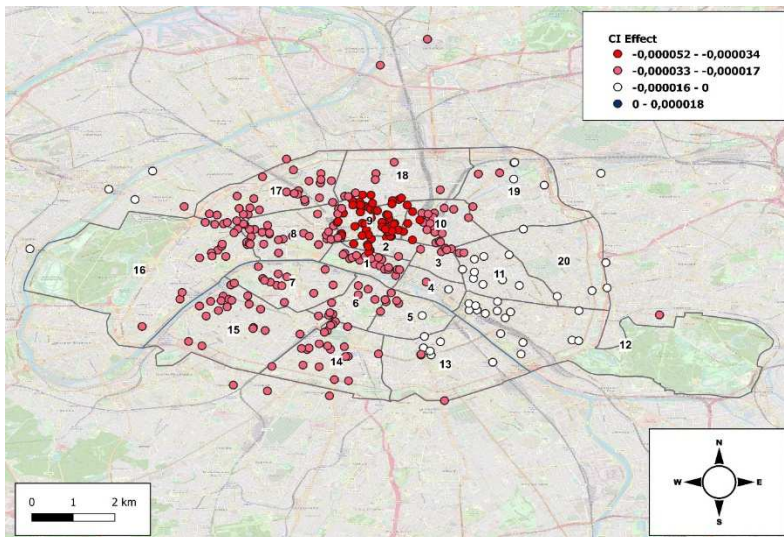

Figure 2. Spatial distribution of *CI* effect for Madrid. Baseline map Open Street Standard

Figure 3. Spatial distribution of *HD* effect for Madrid. Baseline map Open Street Standard
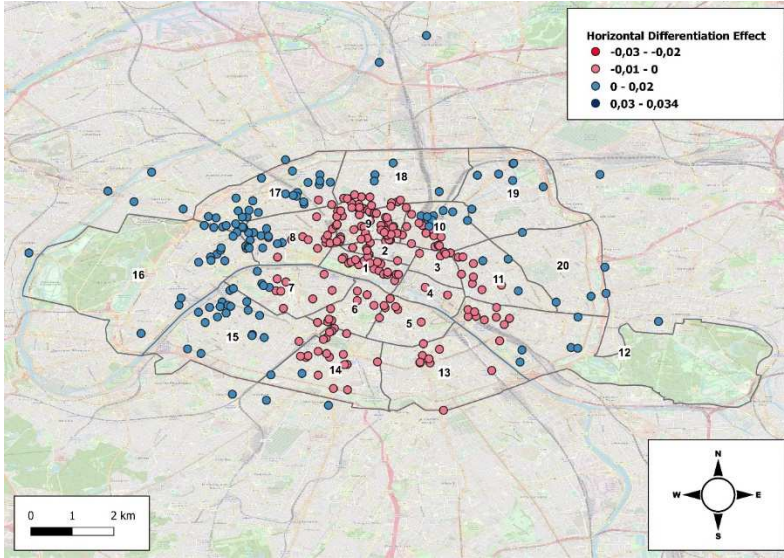

Figure 4. Spatial distribution of *CI* effect for Paris. Baseline map Open Street Standard
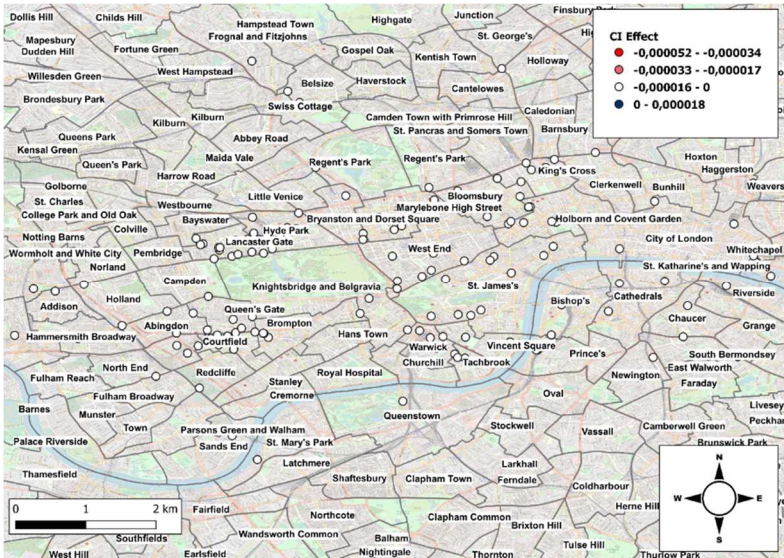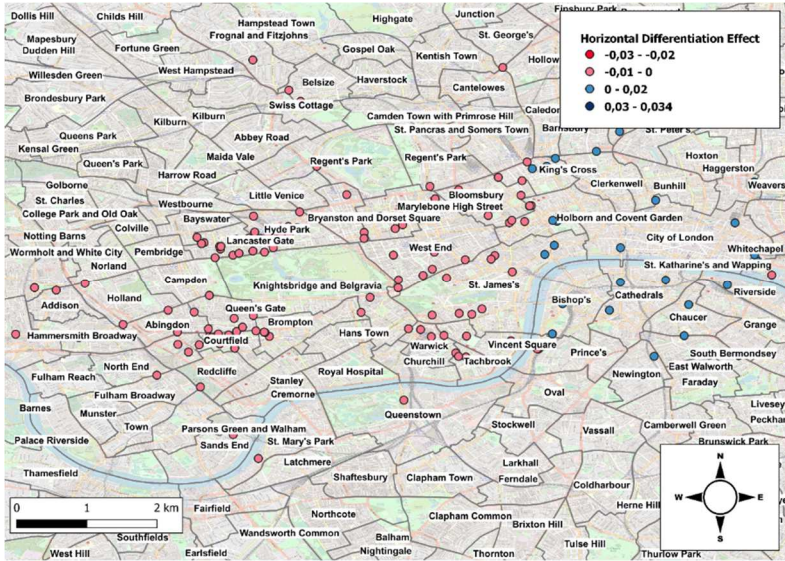
Figure 5. Spatial distribution of *HD* effect for Paris. Baseline map Open Street Standard

Figure 6. Spatial distribution of *CI* effect for London. Baseline map Open Street Standard

Figure 7. Spatial distribution of *HD* effect for London. Baseline map Open Street Standard

Figure 8. Beanplots for competition and agglomeration effect by hotel category