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Research Paper

Hedonic price models with geographically weighted regression: An application to hospitality

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ABSTRACT

The objective of this study was to propose and test a methodology that allow destination managers and hoteliers improve the allocation of resources. For this purpose, this paper analysed the impact of both establishment (e.g. category, size and location) and assessment variables of services included in hotel room prices using hedonic price regression and geographically weighted regression (GWR). The data were collected in the low season using TripAdvisor and Google Maps for 57 hotels located in Malaga. Analyses showed that spatial correlation creates different patterns of quality-value perceptions within the same city, which is an advance in the knowledge about the hotel location decision-making processes and their implications on destination marketing. These competitive subsystems cannot be detected with the use of ordinary least squares alone. Although the values extracted using a hedonic price model are consistent with the previous literature, the presence of geographic variability in the estimated hedonic model coefficients might be misleading for some hotels. The fitting coefficient of the GWR confirms the need to incorporate GWR into hedonic price models.

1. Introduction

Location is a key strategic factor for hotels (Yang, Wong, & Wang, 2012). Zhang, Zhang, Lu, Cheng, and Zhang (2011) write that location is the only generally proved and accepted attribute of lodging products. In essence, this is the first building block of hotels, based on which they can set up their operations. After selecting their location, hotels appropriate part of the economic rent of their tourism resources already in place. In a related study, Li, Huang, and Goh (2015) found that commercial land type and the number of attractions around hotels are significantly related with upmarket hotels in Hong Kong. Hotels and their environments, therefore, have a symbiotic relationship. According to Shoval et al. (2011), hotels' locations have a significant impact on subsequent movements, attracting tourists to less important tourist nodes within the hotels' area of influence.

When establishing hotels, managers also need to consider two other strategic decisions that will be difficult to alter in the future: the hotels' category and size (Urtasun & Gutiérrez, 2006). Other variables can be changed, and therefore they constitute a part of hotels' business models. These variables represent the quantity and quality of services provided, which can be altered over the life of a hotel by changing the allocation of resources that the hotel invests in these services or by implementing service or process innovations. These can improve the perceived value of the services provided or reduce the cost of providing these services.

To determine which services are worth developing, hotel managers can analyse each services' impact on overall customer satisfaction using, for example, importance-performance (Martilla & James, 1977) or asymmetric impact-performance analysis (Caber, Albayrak, & Loiacono, 2013). However, for both techniques, surveys must be conducted, and these methods' relationship to profitability is blurred. Another option is to focus on customers' willingness to pay for the facilities and services, which allows hotel managers to compare the implicit prices of each of their hotel's facilities and attributes with their associated cost. Managers can then decide which attributes are worth incorporating, maintaining or becoming the focus of innovation processes. This can be done with hedonic pricing models, whose main strength, according to Fleischer (2012), is that they are based on actual market data. In this way, practitioners can estimate from the available data the implicit prices of characteristics that increase consumer satisfaction (Rigall-I-Torrent et al., 2011).

Because hedonic price models do not need surveys but do provide access to implicit prices – both for the attributes of services and variables of establishment – that can be compared with costs, these models are an interesting tool for management and research. Hotels already established in their destination and their current competitors or those hotels that are considering entering the market can access information about customers' propensity to pay for specific destinations and locations and the combination of attributes customers find more interesting.

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In the same way, the evolution of initiatives carried out by hotels can be understood as their attempt to maximise the value of their hotels' particular characteristics or their clients' willingness to pay for these characteristics.

This paper proposes as a management tool a combination of a hedonic price model with a geographically weighted regression model (GWR), testing both models in a specific destination. However, those interested in using hedonic price models should be aware of a series of problems stem from autocorrelation and heteroscedasticity issues (e.g. [Abbott & Klaiber, 2011](#); [Zabel, 2015](#)) or a failure in the use and configuration of panel models ([Hua & Yang, 2017](#)). Therefore, to use this tool in decision processes, analyses must take the following considerations into account. First, hedonic research must be carried out in one market at a time, which is extremely difficult to delimit using statistical or econometric tests ([Palmquist, 2005](#)). While hedonic research is usually associated with a single market or destination, the question arises of, if location is so important, whether or not an entire destination will behave in the same way because of its specific location and the competition around it. It can also condition the management and marketing strategy of the destination. For example, [Zhang et al. \(2011\)](#) proved that the weighting of establishment variables varies according to the specific location of hotels in the city of Beijing. It is possible, therefore, to assume that, in a city as large as Beijing, different subdestinations or submarkets may exist.

Based on the above consideration, the present research focused on the smaller city of Malaga, located in the south of Spain, which has an area of 395.1 km² according to the [Instituto de Estadística y Cartografía de Andalucía \(2016\)](#). In 2015, Malaga had a population of about 569,000 inhabitants ([Instituto Nacional de Estadística \[INE\], 2015](#)). It is also one of the most important tourist destinations in Spain, with total overnight stays for 2015 at 2,246,494 according to the [INE \(2016\)](#). Malaga is thus a sufficiently important tourism destination and, at the same time, small enough to allow an analysis of spatial differences.

The second consideration is that hedonic price models are sensitive to variations over time ([Palmquist, 2005](#)). Although researchers have previously analysed panel data on hotels (e.g. [Abrate & Viglia, 2016](#); [Li, Ghose, & Ipeirotis, 2008](#)) or tour operators (e.g. [Alegre & Sard, 2015](#)), the models used were mainly static ([Abrate & Viglia, 2016](#)). To circumvent this restriction, the model could have been run in two different time periods and the changes allocated in implicit prices to the changes that occurred during the periods. However, if physical attributes were to be used, which are easily imitated by the competition and subject to depreciation, the question remained of how the various aspects that pertain to depreciation, competitors' initiatives and Malaga hotels' management could be isolated.

In contrast to other studies, this study did not seek to analyse the effect of goods and services on hotel room prices. Instead, it used TripAdvisor ratings. First, this approach eliminated the problem of the variety of services that hotels can offer, allowing all services to be measured using standard rating dimensions that reflect clients' satisfaction with, and perception of, those services. Second, while goods and services offered by hotels are subject to depreciation through depletion during the life cycle of these products and, thus, may show differences in customers' perceptions at different times, TripAdvisor scores allow homogenisation over time. This model can be said to measure the performance of hotels better because the model is insensitive to time, disregarding changes in services that hotels offer.

This, nonetheless, presupposes hotels compete under the Red Queen hypothesis. The Red Queen hypothesis is a coevolutionary theory that was introduced by the biologist [van Valen \(1973\)](#), which has since spread beyond the boundaries of that field of study. In a business context, the Red Queen effect can be seen as interdependence between the actions of all competitors in a sector so that the behaviour of one company influences the performance of all actors, which, in turn, conditions the actions of others. As a result, each firm is forced by its competitors to participate in continuous and escalating initiatives and

development ([Derfus, Maggitti, Grimm, & Smith, 2008](#)). If firms stay inactive for too long, they cannot remain competitive against competing firms.

Therefore, if hotel goods and services had been used in this research, the data would have become quickly obsolete, but, by using TripAdvisor ratings, this did not happen. Hotels must innovate to maintain their ratings on TripAdvisor or innovate more than their competitors to increase these scores. If hotels maintain the same services and facilities for too long, these hotels will fall behind their competition and reduce their customers' satisfaction, which will cause a reduction in ratings, entailing a reduction in demand and, thus, prices.

Our model is based on the premise that hotels – as is true of any other kind of company – have limited resources allocated to maximising delivery of customer value. This strategy is, according to several researchers, positively related to increased profitability and improved customer satisfaction and loyalty (e.g. [Woodruff, 1997](#) and [Slater, 1997](#)). This value delivery is accomplished through a series of attributes that configure hotel services. Given limited resources, managers need to base their decisions about allocating resources on an evaluation of priority given to attributes ([Albayrak & Caber, 2015](#)).

Customer value is the result of clients' perceptions. It is the general assessment that each consumer makes using the difference between the utility of the asset received and the value the customer gives in exchange for this asset ([Zeithaml, 1988](#)). [Matzler, Renzl, and Rothenberger \(2006\)](#) concluded that objective signals about quality do not really reflect the perceptions of customers. They also found that using consumers' perceptions is better than using objective cues, as the former provide better indicators of the impact of service dimensions on perceived price.

The literature on hedonic pricing reveals two kinds of limitations. The first are spatial limitations that concentrate each study in a small region with supposed homogeneity in the influence of variables. That is, few studies have considered possible variations within the same city and the consequences of not taking these variations into account. The second are temporal limitations. In other words, the influence of an attribute on price at a given time does not ensure that this influence is maintained over time. Therefore, the objective of the present study was to use a model that could be applied in different locations and periods to analyse the impact of both establishment (e.g. category, size and location) and assessment variables of services included in all Malaga hotels' room prices. To prevent the influence of seasons and other disruptive variables, the data were collected in the low season during periods without large events. Booking day and booking margin were controlled. Two regression methods were used: hedonic price regression and geographically weighted regression (GWR).

This paper is organised as follows. After this introduction, the literature on determinants of hotel prices is reviewed in section two. In section three, the empirical framework for the analysis of hotel room rates is presented. In section four, empirical analyses are presented. Some implications and conclusions are examined in section five. Finally, limitations and suggestions for further research are presented in section six.

2. Literature review

Many studies in the literature have used hedonic price models to conduct both tourism and hospitality research. Some studies have sought to evaluate the impact of hotel facilities on hotel room prices, for example, identifying characteristics that influence the prices of ski resorts in Austria ([Falk, 2008](#)), Bangkok hotels ([Agmapisarn, 2014](#)) or Taipei hotels ([Chen & Rothschild, 2010](#)). In addition, researchers have focused on the importance of public goods in hotel room prices ([Rigall-I-Torrent & Fluvià, 2011](#)). [Sánchez-Ollero, García-Pozo, and Marchante-Mera \(2014\)](#) used a hedonic price model to evaluate the impact of environmentally sustainable initiatives implemented by hotels, also in reference to room prices. Many researchers have also applied hedonic

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