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The impact of tourist destination on hotel efficiency: A data envelopment analysis approach

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ABSTRACT

This paper evaluates the impact of location on hotel efficiency using a sample of 400 Spanish hotels, the novel aspect being that location is considered at the tourist destination level. Moreover, for the first time, the location variables are based on the main theoretical models concerning location in the hotel sector, namely geographical positioning models, agglomeration and urbanization economic models and competitive environment models. The methodology consists of a four-stage data envelopment analysis (DEA) model that decomposes super-efficiency in the portion attributable to the tourist destination and the portion attributable to hotel management. Then, managerial efficiency is regressed against hotel characteristics, while tourist destination efficiency is explained by the characteristic of each location. The findings highlight the importance of tourist destinations, providing novel empirical support for the propositions of the main location models. Indeed, the tourist destination is the main cause of differences in the level of efficiency among hotels. The occupancy level, degree of seasonality and market concentration are the variables with the greater impact on efficiency.

Keywords

Data Envelopment Analysis; Efficiency; location; tourist destination; hotel.

Highlights

- This paper discusses location effects in the analysis of hotel efficiency.
- The proposed four-stage model is a novel means of analysing hotel efficiency.
- Tourist destination variables are the main cause of differences in efficiency.

1. Introduction

The study of the tourist destination is of special importance for the hospitality industry because its product can only be consumed where it has been generated (Bull, 1994). Moreover, the tourist destination has been shown to have a significant impact on hotel profitability and survival (Lado-Sestayo, Vivel-Búa & Otero-González, 2016a). However, despite the importance of the characteristics of the tourist destination, they have been neglected in studies of efficiency in the hotel sector, hindering understanding of the extent to which inefficiencies are due to hotel management or to the characteristics of the location at the tourist destination level (Barros, 2005). Knowledge of the causes of inefficiencies is important for benchmarking purposes as it allows identification of the scope for improvement for both hotel and tourist destination managers (Huang, Mesak, Hsu, & Qu, 2012).

This paper analyses the efficiency of 400 Spanish hotels, considering the characteristics of the tourist destination and internal factors related to the firm. From a theoretical perspective, there are three approaches to studying the impact of location on the hotel sector: one line of research is focused on geographical positioning variables; a second line is concerned with the study of the existence of externalities; the third approach analyses the impact of the competitive environment (Yang, Luo, & Law, 2014). These approaches have not yet been considered in the study of hotel efficiency, so filling this gap is the first main objective of this paper.

Most studies on efficiency in the hotel sector have focused on firm characteristics, usually dealing with hotels from one single market, with some exceptions (e.g. Assaf, 2012; Neves & Lourenço, 2009), and using small sample sizes (Oliveira, Pedro, & Marques, 2015; Wöber, 2007). In addition, the few recent studies which have considered some external aspects of hotels, mostly environmental variables, highlight the existence of differences in efficiency levels among locations. However, these studies have focused on regional characteristics and have not incorporated factors at the tourist destination level (De Jorge & Suárez, 2014; Parte-Esteban & Alberca-Oliver, 2015; Pulina, Detotto, & Paba, 2010). It is common for a region to have several tourist destinations, so the impact of the location might be different within the same region. For example, in Spain there are 17 regions and 97 tourist destinations. Moreover, some of these tourist destinations are in the same region, but they are very different regarding seasonality, accessibility and other characteristics (rural vs. urban, coastal vs. inland, etc.). Therefore, a regional empirical study may not be sufficient to evaluate the impact of location on efficiency. Thus, unlike previous studies which have addressed regional effects, the second main objective of this paper is to evaluate the impact of location factors at the tourist destination level.

Methodologically, data envelopment analysis (DEA) is used to provide a synthetic indicator of efficiency, considering sales revenue as the output variable, while the inputs are labour costs, depreciation and operational costs. This paper makes two main methodological contributions. First, it proposes a four-stage DEA model to break down efficiency into the aspects attributable to tourist destination and to hotel management using the concepts of "programme" and "managerial" efficiency (Charnes, Cooper, & Rhodes, 1981). No previous study has applied this methodology to analyse the impact of location on efficiency in the hotel sector. The second contribution is related to the measurement of efficiency through "super-efficiencies", extending the efficiency rankings also to efficient units, unlike ordinary efficiency scores (which assign the same scoring to all efficient units). Super-efficiencies make it possible to explain efficiency through linear models with straightforward coefficients, avoiding the Tobit models imposed by ordinary efficiency scores (as truncated variables). Furthermore, as super-efficiencies are particularly helpful in identifying potential outliers, their use becomes more appealing when large samples are used, as is the trend in recent literature.

The second stage in the empirical analysis is the study of the determinants of hotel efficiency. In particular, a disaggregated regression model explains the determinants of the two components mentioned above, studying the incidence of tourist destination variables with regard to the efficiency attributable to hotel location and the impact of hotel-specific characteristics on managerial efficiency. This disaggregated model is compared against a traditional synthetic model – the most popular methodology in previous studies – explaining the overall efficiency.

To summarize, the contributions of this paper are as follows: first, it is novel in incorporating hotel location models in the study of hotel efficiency, allowing the benchmarking of both hotels and tourist destinations. Location is considered at the tourist destination level, using a sample representative of multiple locations in Spain, the second largest market in the world by number of visitors. Second, it proposes a novel methodology employing a four-stage DEA model to decompose and explain the effects of internal and external factors on hotel efficiency, isolating the impact of tourist destination variables, which have not been examined in previous studies. Furthermore, this paper considers the super-efficiency approach, which is particularly helpful when dealing with large samples.

The paper is structured in four sections. Following this introduction, section 2 provides the framework through a literature review and explains the basic DEA methodology. Section 3 presents the four-stage DEA model and its empirical application, analysing hotel efficiency estimated and determining factors. Finally, the main conclusions and implications are provided in section 4.

2. Framework

2.1 Previous literature: location and hotel efficiency

The study of efficiency in the hotel sector is quite recent (Wöber, 2007) and has focused on quantifying the level of efficiency, with few investigations that also evaluate its determinants.

After pioneering work by Morey and Dittman (1995) on the United States (US) market, the first studies were characterized by small sample sizes and a focus on a single tourist destination within a country, especially the US (Anderson, Fish, Xia & Michello 1999; Barros, 2005), but also in other countries (e.g. Taiwan in Hwang & Chang, 2003).

Later on, research was carried out on Asian markets, such as China, Japan and Korea (Honma & Hu, 2012; Min & Joo, 2009), European markets, such as Italy, France and Spain (Parte-Esteban & Alberca-Oliver, 2015), and African countries, such as Angola (Barros & Dieke, 2008). From a multi-country perspective, Neves and Lourenço (2009) analysed two international firms with hotels in different countries and Assaf (2012) studied a sample of Asian hotels and tour operators. Table 1 identifies the most recent studies analysing the efficiency levels in the hotel sector. Three aspects stand out as the main contributions of these works: i) the use of higher sample sizes relative to the first studies, favouring their representativeness; ii) the implicit recognition of differences between locations, highlighting the need for studies that examine the effect of location on efficiency in the hotel sector in depth (Parte-Esteban & Alberca-Oliver, 2015); iii) the incorporation of methodological innovations, evaluating not only the level of efficiency but also its determinants and the temporal dimension.

Table 1
Recent studies on the level of hotel efficiency using the DEA methodology.

Author(s)	*Sample*	*Variables*	
	No. of hotels/Market/Period	*Inputs*	*Outputs*
Oliveira, Pedro, and da Cunha Marques (2015)	28/Portugal/2005–2007	Number of rooms; number of employees; F&B capacity; labour costs; capital costs; other costs	Total revenues
Parte-Esteban and Alberca-Oliver (2015)	1385/Spain/2001–2010	Number of full-time employees; book value of property; operational costs	Sales
De Jorge and Suárez (2014)	303/Spain/1999–2007	Employment; labour costs; number of rooms; operational costs	Sales; market share
Alberca-Oliver and Parte-Esteban (2013)	1593/Spain/2001–2008	Number of full-time employees; property book value; operational costs	Total revenue
Oliveira, Pedro, and Da Cunha Marques (2013a)	28/Portugal/2005–2007	Number of rooms; number of employees; number of seats F&B; other costs; capital expenditure	Total revenue; price of rooms; price of F&B
Oliveira, Pedro, and Da Cunha Marques (2013b)	28/Portugal/2005–2007	Number of rooms; number of employees; number of seats F&B; other costs	Total revenue
Assaf (2012)	192 hotels and 65 tour operators/12 Asia Pacific countries/2007–2009	Fixed capital; number of full time employees; other operational costs	Total revenues
Honma and Hu (2012)	15/Japan/2004–2008	Number of employees; number of temporary staff; number of seats in restaurants and bars; number of guest rooms	Total revenues
Huang, Mesak, Hsu, and Qu (2012)	31 regions/China/2001–2006	Number of full-time employees; number of guest rooms; total fixed assets	Total revenue; average occupancy rate
Barros, Botti, Peypoch, Robinot, Solonandrasana, and Assaf (2011)	22 regions/France/2003–2007	Tourist arrivals; accommodation capacity (hotels and camping)	Bed nights
Shuai and Wu (2011)	48/Taiwan/2006–2007	Total number of rooms; number of full-time employees; operating expenses	Room revenues; F&B revenues
Wu, Tsai, and Zhou (2011)	23/Taipei/2006	Total number of rooms; total number of employees; F&B capacity; total operating cost	Room revenues; F&B revenues; other revenues

Hsieh and Lin (2010)	57/Taiwan/2006	Accommodation costs; number of employees in the accommodation department; catering costs; number of employees in the catering department	Room revenues; catering revenues
Hu, Chiu, Shieh, and Huang (2010)	66/Taiwan/1997–2006	Price of labour; price of F&B; price of other operations	Room revenues; F&B revenues; other operating revenues
Pulina, Detotto, and Paba (2010)	150 (21 regions)/Sardinia Island/2002–2005 (2000–2002 at macro level)	Labour costs; physical capital (only at hotel level)	Sales revenue; value added
Wu, Liang, and Song (2010)	23/Taipei/2002–2006	Number of rooms; number of employees; F&B capacity; total operating costs	Room revenues; F&B revenues; other revenues
Barros, Peypoch, and Solonandrasana (2009)	15/Portugal/1998–2004	Number of employees; physical capital	Sales; added value
Botti, Briec, and Cliquet (2009)	15 hotel chains/France/1997	Costs; territory coverage; chain duration	Sales
Min and Joo (2009)	31/Korea/2003	Costs of land property; building capacity; other fixed assets; other current assets. Costs of goods sold; selling, general and administrative expenses; non-operating expenses	Room revenues; F&B revenues; other revenues. Operating income; non-operating income
Neves and Lourenço (2009)	83/different countries/2000–2002	Current assets; net fixed assets; shareholders' equity; cost of goods and services	Total revenues; EBITDA
Perrigot, Cliquet, and Piot-Lepetit (2009)	15 hotel chains/France/1999	Age of the hotel chain in years; number of rooms in the chain; number of hotel openings during the year; royalties in percentage; chain ranking	Occupancy rate; total sales
Yu and Lee (2009)	58/Taiwan/2004	Number of full-time employees in the room service department; number of full-time employees in the F&B department; number of rooms; floor area in the F&B department; total expenses for each service sector; number of back office staff	Room revenues; F&B revenues; other revenues
Barros and Dieke (2008)	12/Angola/2000–2006	Total costs; investment expenditure	REVPAR
Shang, Hung, and Wang (2008)	57/Taiwan/2005	Number of rooms; F&B capacity; number of full-time employees; operating expenses	Room revenues; F&B revenues; other revenues

Chen (2007)	55/ Taiwan/2002	Price of labour; price of F&B; price of materials	Total revenues

Notes: F&B denotes food and beverages. A review of the literature prior to 2007 can be found in Wöber (2007).

Regarding the larger sample size, Pulina et al. (2010) pioneered such studies, using a sample of 150 hotels on the island of Sardinia. This effort to increase the sample size was followed by Assaf's (2012) study of 192 Asian hotels, De Jorge and Suarez's (2014) work including 303 Spanish hotels and Parte-Esteban and Alberca-Oliver's (2013, 2015) research with a sample of 1593 Spanish hotels, the largest sample in the analysis of efficiency in the hotel sector so far. However, the greater representativeness of hotel characteristics derived from larger sample sizes is achieved at the expense of the inclusion of hotels from a wider variety of tourist destinations within a country. This heterogeneity enhances the importance of the factors of location and the need to study their impact on hotel efficiency in greater depth.

It is important to consider that the hotel sector is influenced to a large extent by the characteristics of the location. Indeed, previous literature has shown that the characteristics of the tourist destination significantly affect hotel profitability and survival (Lado-Sestayo et al., 2016a, 2016b; Yu & Lee, 2009). Despite this, none of the previous studies considered variables related to the tourist destination in the study of hotel efficiency. On the one hand, considering hotels in a single tourist destination, as was usual in the first works on hotel efficiency, prevents the generalization of results. On the other hand, considering hotels in different tourist destinations using a larger sample size, as in recent studies, may bias the results if the effects of location are not properly isolated. As mentioned above, some recent studies have found important differences in efficiency levels among hotels located in different regions within a country (Parte-Esteban & Alberca-Oliver, 2015). For example, Pulina et al. (2010) found considerable differences in efficiency levels among Italian regions in an analysis of the effect of hotel size on efficiency. Shang, Wang, and Hung (2010) found differences in efficiency levels among hotels located in cities or metropolitan areas and hotel resorts in Taiwan. However, no previous study has considered the tourist destination effect. In this context, the main contributions of this paper are that it breaks down efficiency into the portions attributable to location at the tourist destination level and to hotel management and analyses the determinants of these two components separately.

Focusing on the determinants of the efficiency level, only three previous studies considered the effect of location, but these did so at the regional level. Huang et al. (2012) analysed 31 Chinese regions (22 provinces, 5 autonomous regions and 4 autonomous municipalities) and emphasized the need for further studies on other countries to analyse differences in the main determinants. The location variables used by these authors were: the percentage of national A grade tourist attractions, the ratio of inbound arrivals received by a particular region to the total inbound arrivals to China, the educational attainment of the urban employed, the average annual earnings of employees in the Chinese hotel industry, the number of hotels and trade openness. For the Spanish market, the pioneering studies considering hotels from different tourist destinations are very recent. De Jorge and Suárez (2014) used regional dummies and the market concentration of the hotel with respect to its four main competitors. Parte-Esteban and Alberca-Oliver (2015) considered bed capacity, the hotel occupancy rate, the number of arrivals, the number of visitors staying overnight, tourist flow in the region, regional gross domestic product (GDP) and coastal character. All these studies for Spain confirmed the existence of significant differences in efficiency among regions (NUTS[1] II), but they did not consider tourist destination variables.

Spain has 17 regions, but also 97 tourist destinations which can be in the same or different region (Fig. 1). Moreover, the Spanish tourist destinations are highly heterogeneous, for example in terms of seasonality, coastal character and accessibility. Lado-Sestayo et al. (2016a, 2016b) and Vivel-Búa, Lado-Sestayo and Otero-Gónzalez (2016) found differences in profitability, hotel survival and the probability of default among Spanish tourist destinations, even within the same region. Thus, the inclusion of regional variables is not sufficient to capture the effect of location on hotel efficiency. This paper helps to fill this empirical gap by studying the effect of location variables at the tourist destination level on hotel efficiency.

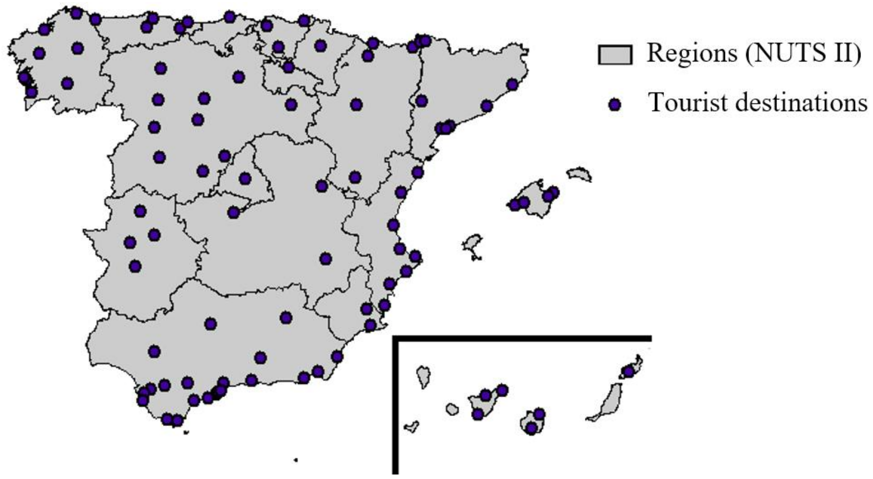


Fig. 1. Regions (NUTS II) and tourist destinations in Spain

This research is based on the theoretical models developed by economists and geographers that aim to explain the reasons for the spatial distribution of hotels. It is considered that these could contribute to explaining the reasons for differences in the levels of efficiency among hotels located in different tourist destinations. It is possible to distinguish three theoretical approaches concerning hotel location, with different foci. First, geographical positioning models focus on the distance from the city centre or main sights (Egan & Nield, 2000) and transport nodes (Ashworth & Tunbridge, 1990), indicating that hotels prefer locations near city centres. A second line of research addresses the existence of agglomeration economies (Marshall, 1890) and urbanization economies (Jacobs, 1969), focusing on the study of externalities and the existence of complementary services (Canina, Enz, & Harrison, 2005; Chung, & Kalnins, 2001; Yang, 2012).

[1] Nomenclature of territorial units for statistics, abbreviated NUTS is a geographical nomenclature that divides the economic territory of the European Union into regions according to Regulation No 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS).

According to these models, hotels prefer to be in locations with a high density of hotels or complementary services. Finally, based on the propositions of the New Industrial Organization and the Chicago School, there are some models that analyse the impact of market structure on the hotel sector (Davies, 1999; Lado-Sestayo et al., 2016b; Pan, 2005; Urtasun & Gutiérrez, 2006). These models consider that hotels prefer to be located where there is lower level of competition, associated with a higher level of market concentration.

The three theoretical models about hotel spatial distribution have been used in the analysis of performance measures. So, Sainaghi (2011) and Lee and Jang (2011), relate hotel proximity to city centre with revenue and proximity to airports with price, respectively. Luo and Jang (2016), found a positive effect of urbanization degree on hotel profitability. Lado-Sestayo et al (2016b) found a positive relationship between market concentration and hotel profit margin. However, none of the previous literature has considered the relationship between tourist destination variables and hotel efficiency.

In summary, it can be observed that the majority of recent studies recognize the existence of differences in efficiency levels among hotels in different regions, but do not study their causes. Only a few studies control for the effect of these differences by including variables at the regional level in the empirical analysis of hotel efficiency (De Jorge & Suárez, 2014; Parte-Esteban & Alberca-Oliver, 2015). However, as indicated above, different tourist destinations may exist within the same region, so this analytical approach is not sufficient to control the locational effect (Lado-Sestayo et al., 2016a). Therefore, it is necessary to study of observed differences between locations in greater depth, identifying to the extent to which the level of efficiency can be explained by the tourist destination and by hotel characteristics. The disaggregation of hotel efficiency makes it possible to discern the efficiency attributable to hotel managers and to policymakers and consequently favours comparative studies among tourist destinations and countries. Thus, this paper aims to contribute to fill the gap between empirical studies on hotel efficiency and the theoretical models related to location in the hotel sector (Yang et al., 2014), considering the three dimensions of location identified in the previous literature (geographical location, agglomeration and competition models). It seeks to gain knowledge concerning the identification and quantification of factors related to hotel managers and tourist destination policymakers that contribute to increasing hotel efficiency.

2.2 Measuring hotel efficiency: DEA methodology

This paper analyses the determinants of hotel efficiency using hotel and tourist destination variables by proposing a four-stage DEA model that decomposes efficiency into the part attributable to hotel management and that attributable to location. Subsequently, it proposes a disaggregated econometric model which explains these two components of efficiency.

DEA is a method which evaluates the performance of productive units compared to a best-practice productive frontier using mathematical programming (Charnes, Cooper, & Rhodes, 1978). It provides a single figure summary of performance using data derived from multiple inputs and outputs with a clear economic meaning: it is the maximum simultaneous proportional improvement (reduction of inputs or increase in outputs) in all dimensions of performance. Each unit is compared to an efficient frontier, which consists of Pareto–Koopmans-efficient decision making units (DMUs) and linear combinations of these. The frontier is piecewise linear nonparametric and is free of assumptions concerning the functional form of the production function.

The model can be input or output oriented, setting input savings or output expansion as respective targets, although both models provide the same efficiency scoring under the assumption of constant returns to scale of the Charnes–Cooper–Rhodes (CCR) model. The envelopment version of the CCR input-oriented model is given by:

$$Min\,\{h_0 - \varepsilon \cdot \left[\sum_{r=1}^{s} S_r^+ + \sum_{i=1}^{m} S_i^-\right]\}$$

$$Subject\ to$$

$$\sum_{j=1}^{n} \lambda_j \cdot y_{rj} - S_r^+ = y_{r0}, r = 1, \ldots, s$$

$$\sum_{j=1}^{n} \lambda_j \cdot x_{ij} + S_i^- = h_0 \cdot x_{i0}, i = 1, \ldots, m$$

$$\lambda_j, S_r^+, S_i^- \geq 0$$

where

h_0 is the maximum proportional simultaneous reduction in all inputs.

ε is an infinitesimal value which penalizes any inefficiencies (slacks or surpluses) beyond the maximum proportional improvement measured by h_0.

y_{rj} is the amount of output *r* produced by DMU *j*.

x_{rj} is the amount of input *i* produced by DMU *j*.

λ_j is the weight of DMU *j* in the composite unit against which the unit is benchmarked.

S^+_r is the surplus of the benchmark composite above the DMU in output *r*.

S^-_i is the slack of the benchmark composite above the DMU in input *i*.

The subscript 0 identifies the DMU being scored.

The former model must be run for each DMU as each firm may be benchmarked against a different composite of efficient units. Fig. 2 illustrates the model for two inputs and one output. In this figure, the solid points U1 to U6 represent the performance of the DMUs. The efficient units, 1, 2 and 4, are Pareto-efficient and relate to the efficient frontier (thick line). Inefficient units are benchmarked against this frontier: unit U6 is compared to the composite DMU U6´, a linear combination of U2 and U4, which will produce the same amount of output with only a fraction of the inputs. This fraction of inputs, the efficiency score, is the ratio of the distance $\overline{O\,U6'}/\overline{O\,U6}$. In this way, through the radial measure of efficiency, the trade-offs between variables in setting a global feasible target for inefficient firms are considered and each firm is compared to a composite or virtual unit with a similar "focus" (i.e. similar relative consumption of inputs). Slacks or surpluses in constraints reflect possible additional improvements in specific variables beyond the maximum proportional simultaneous improvement, implying comparison with the extreme segments of the frontier, which have only an infinitesimal impact on efficiency scores.

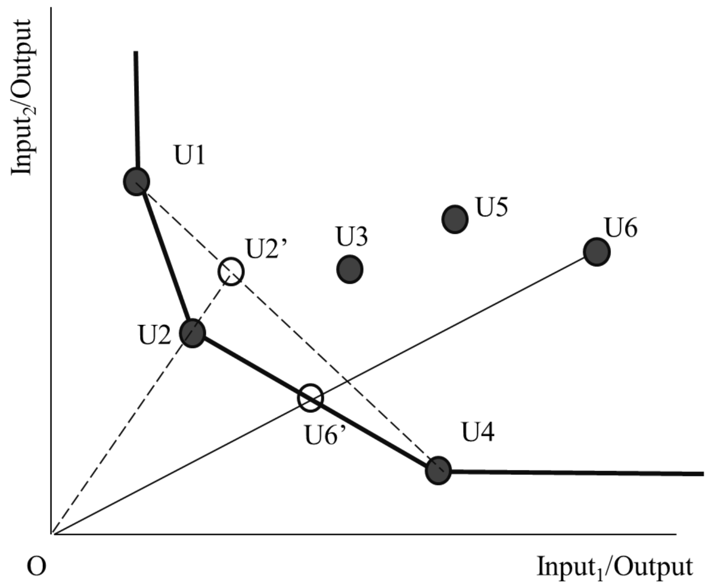


Fig. 2. The basic DEA model

In the original DEA model, all efficient units receive the same 100% efficiency scoring (truncated variables). To rank efficient units, Andersen and Petersen (1993) developed a methodology known as "super-efficiencies". The scores of efficient units are computed by comparing them to a new efficient frontier, built excluding the unit under scrutiny. Thus, in Fig. 2 the efficiency score for Unit 2 would be $\overline{O\,U2'}/\overline{O\,U2}$.

The fractional version of the DEA model expresses the score as an efficiency ratio of an aggregate of outputs to an aggregate of inputs, where the weights attached to each variable are the most favourable for each DMU. This perspective makes the results of DEA more easily acceptable to managers as the weighting of variables cannot be blamed for the scorings. Different assumptions about the comparability among units produced different DEA models. Some of the most widely used are the nonconvex FDH model (Deprins et al., 1984), which limits comparisons to individual units, and the variable returns to scale BCC model (Banker et al. 1984), which limits comparison to units of similar size.

A series of studies go beyond efficiency estimation, trying to explain the evaluated performance by regressing the efficiency scores on environmental variables. Simar and Wilson (2007) reference 45 published works using this methodology. In order to estimate efficiency, these works apply a variety of the CCR, BCC and FDH models, while for the regression most of them deal with truncated efficiency scores using tobit models.

3. Empirical analysis

3.1 Methodology: a four-stage DEA approach

The basic DEA model used to compute super-efficiencies is the CCR model. The efficiency score is a synthetic indicator of the ratio of inputs to outputs, which is benchmarked against the best observed units. This provides the maximum simultaneous proportional improvement in all dimensions of performance. The improvement in performance measures both the maximum reduction of inputs or increase in outputs, since under the constant returns to scale assumption the input-oriented and the output-oriented versions produce equivalent results. Super-efficiency scores provide additional information concerning the ranking of efficient units and avoid the limitations of using truncated variables. In addition, the super-efficiencies are helpful to detect outliers, which is especially relevant when analysing high sample sizes. As pointed out by Thrall (1996), using super-efficiencies produces infeasibility under the variable returns to scale assumption, so it precludes the use of the BCC model, while the CCR model is infeasible if and only if certain zero patterns appear in the data domain (Seiford & Zhu, 1999).

Another major development in DEA applied in this work is the distinction between the concepts of "programme" and "managerial" efficiency (Charnes et al., 1981). These concepts make it possible to decompose the inefficiency of units working under different circumstances, such as different programmes or geographical areas, distinguishing between inefficiency due to the different environment and that attributable to management. An in-depth analysis of the causes of inefficiencies is of interest to improve the black-box approach of DEA models, but most previous studies focus on internal aspects despite the importance of location in the hotel sector (Kao, 2014, 2016).

In Fig. 3, let us assume that units A1 to A3 work under similar conditions, while units B1 to B3 share another set of circumstances (e.g. units A belong to a particular geographical area and units B to another area). The estimation of the global efficient frontier is the first stage and this produces the dotted line through A1, A2 and B2, so the global efficiency of A3 and B3 would be $\overline{O\,A3'}/\overline{O\,A3}$ and $\overline{O\,B3'}/\overline{O\,B3}$ respectively. These scores may be decomposed, comparing each unit only to those in the same group, to the solid line frontiers, so the managerial inefficiencies of these units would be $\overline{O\,A3''}/\overline{O\,A3}$ and $\overline{O\,B3''}/\overline{O\,B3}$ (**second**

stage). The remaining part of inefficiencies, $\overline{O\,A3'}/\overline{O\,A3''}$ and $\overline{O\,B3'}/\overline{O\,B3''}$, would be attributable to differences in the circumstances under which both groups operate. To compare the efficiency of the different programmes or areas, only projections of the DMUs on their specific efficient frontiers should be considered, leaving individual managerial inefficiencies aside; i.e. to compare the different areas, A3 should be substituted by its efficient benchmark on the efficient frontier for its area, A3”, and B3 should be substituted by its corresponding benchmark on the frontier for the second area, B3” (**third stage**). In the **fourth stage**, once managerial inefficiency has been removed, these projections of the DMUs are considered to compare the efficiency of different locations.

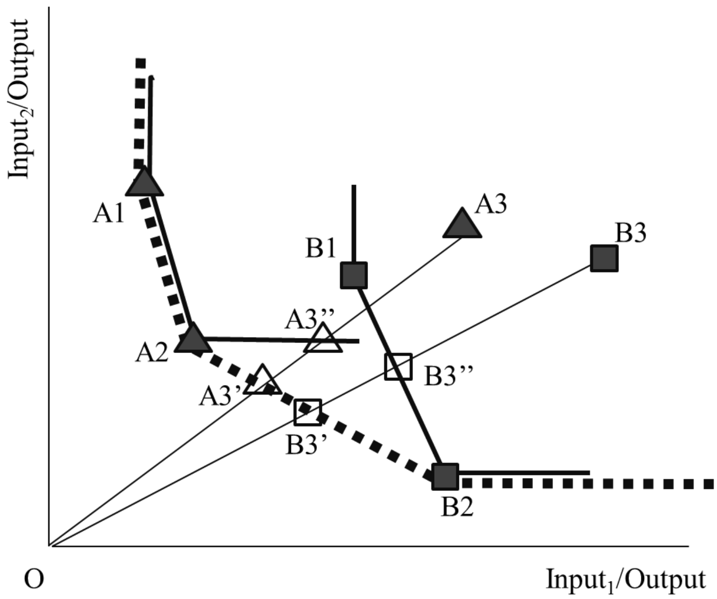


Fig. 3. DEA adopting the programme and managerial efficiency approach

To explain the efficiency scores provided by the four-stage DEA model, the efficiency scores of the hotels compared to the frontiers for each tourist destination, $\emptyset_i$ (pure managerial efficiency), are regressed against the hotel-specific characteristics. Once managerial inefficiencies have been removed, projecting each inefficient hotel on the corresponding efficient frontier for its area, the efficiencies of the tourist destinations, $\emptyset_j$, are explained by the characteristics of these areas. This disaggregated model, Eq. (1a) and Eq. (1b), is compared to a traditional synthetic model Eq. (2), which explains the global efficiency, $\emptyset_{ij}$, simultaneously incorporating hotel and tourist destination variables:

$$\emptyset_i = \propto_1 + H_i\beta_1 + D_i + \varepsilon_i \qquad (1a)$$

$$\emptyset_j = \propto_2 + L_j\beta_2 + \varepsilon_j \qquad (1b)$$

$$\emptyset_{ij} = \propto_3 + H_i\beta_1 + L_j\beta_2 + \varepsilon_{ij} \qquad (2)$$

where ∝ is a constant term, the subscript i represents the hotel and j is the tourist destination; H are the hotel characteristics variables, L are the tourist destination variables and D is a dummy variable of tourist destination effects.

To the best of our knowledge, none of previous works dealing with the explanation of efficiency scores has applied the decomposition of efficiency into its managerial and location components. This decomposition has been justified on the basis of the literature about hotel spatial distribution and its usefulness is tested through the empirical model.

3.2 Hotel efficiency at the tourist destination level

This paper evaluates the efficiency of 400 hotels located in the 97 Spanish tourist destinations in 2011. The Alimarket database was used to collect data on hotel characteristics and the SABI database was used to collect the accounting information of individual hotels. Data on the 97 Spanish tourist destinations were obtained using the National Institute of Statistics (NSI) database. Finally, information on the position of transport nodes was identified in EuroGeographics.

The variables selected to evaluate the efficiency level correspond to those most commonly used in DEA analysis in the hotel sector, as shown in the literature review in Table 1: sales revenue as output and depreciation, labour costs and operational costs as inputs. An extensive review of previous studies using these variables can be found in De Jorge and Suárez (2014). Special attention was paid to the coherence among variables, particularly to avoid mixing variables in absolute values with ratios.

A descriptive analysis of the variables used in the DEA analysis can be found in Table 2, in which a high level of correlation between all variables can be observed. This supports the adequacy of the variable selection as a positive relationship between input and output is expected. In addition, the correlations between the inputs seem to indicate that the productive structure does not differ significantly between the hotels.

Table 2
Descriptive analysis of inputs and outputs.

Variables	Correlation matrix				Descriptive statistics		
	Sales revenue (O)	Labour costs (I)	Depreciation (I)	Operational costs (I)	Mean	SD	N
Sales revenue (O)	1	0.960	0.706	0.857	2,141.605	3,162.565	400
Labour costs (I)	0.960	1	0.672	0.798	847.650	1,129.456	400
Depreciation (I)	0.706	0.672	1	0.776	197.568	301.189	400
Operational costs (I)	0.857	0.798	0.776	1	422.033	645.168	400

Notes: O denotes the output and I the input. SD is the standard deviation. N is the number of observations.

Fig. 4 shows the overall efficiency for each hotel calculated in the DEA analysis (y axis) and the tourist destinations (x axis). At first sight, important differences between tourist destinations can be observed. There are also considerable differences in the levels of efficiency between tourist destinations in the same region (NUTS II). For instance, Lloret del Mar has an average efficiency level of around 50%, while Barcelona has 80%, but both are in the Catalonia region. Moran's I test (with a value of 5.988) confirms that spatial autocorrelation is statistically significant (p-value < 0.001). The null hypothesis, which is the existence of a random spatial distribution of the variable studied, is rejected at the 99% significance level using an inverse distance matrix which incorporates all hotels in the sample. The test was run for different neighbourhood matrices, rejecting the null hypothesis in all cases. These results support the existence of location effects on hotel efficiency, which should be analysed at the tourist destination level. The next section addresses this issue.

● Hotel efficiency level ($\emptyset_{ij}$) — Average efficiency level in tourist destination j

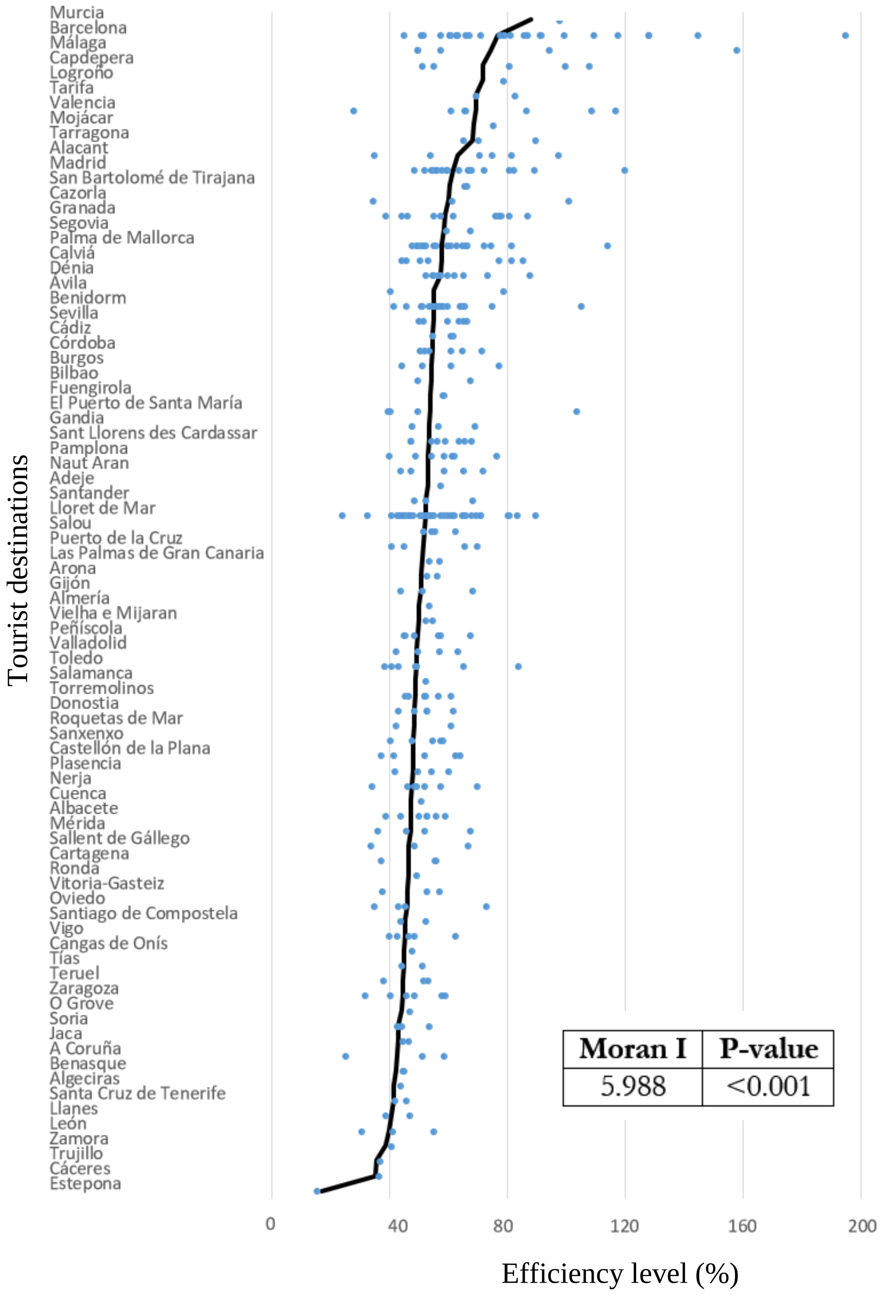
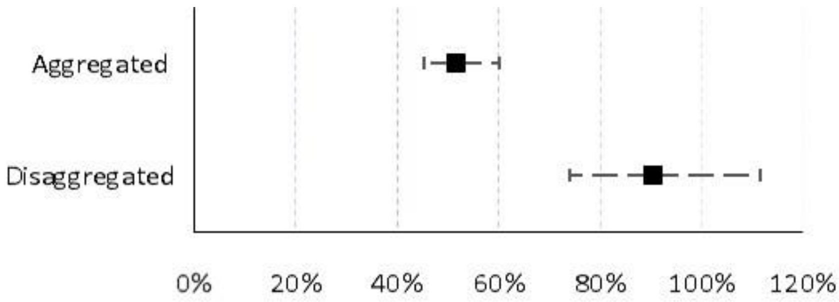


Fig. 4. Hotel efficiency and average efficiency level in tourist destination

Figure 5 shows the differences between the results of the disaggregated (four-stage) DEA model and the previous aggregate model. As shown in the figure, decomposition increases the median value of hotel super-efficiencies from 52% to 90%, as could be expected because the location effect is expected to be completely removed. Moran's I test for the hotel super-efficiencies in the disaggregated model gets a value of 0.612, with a P-value of 0.270. This shows that managerial efficiency is not spatially correlated, i.e., that the effect of the tourist destination has been removed through the disaggregated model. Thus, hotel characteristics should be used to explain managerial efficiency, while the characteristic of each tourist destination should be used to explain tourist destination efficiency.



Methodology	Moran I	P-value
Aggregated model	0.612	0.270
Disaggregated model	5.988	<0.001

Fig. 5. Median and interquartile range of hotel efficiency in the aggregated and disaggregated models.

3.3 Determinants of hotel efficiency at the tourist destination level

The determinants of efficiency are classified in two groups, those corresponding to hotel characteristics and those corresponding to tourist destination (Table 3). It should be noted that there is no unanimity in the selection of determinants of hotel efficiency. Many researchers have selected them solely based on previous studies. This paper not only uses traditional determinants, but also tourist destination variables which have not been evaluated previously (Table 3). These have been selected using the theoretical framework of the three location models developed in the hotel sector. First, geographical positioning models emphasize centrality and proximity to transport nodes as relevant aspects of hotel service. Thus, those tourist destinations with better accessibility will enjoy a competitive advantage over other locations, generating higher incomes for incumbent hotels and consequently increasing efficiency. To include this aspect, the distance between the nearest international airport and the tourist destination is considered (Ashworth & Tunbridge, 1990; Egan & Nield, 2000). This measure was considered by Lee and Jang (2011) to relate hotel distance to international airport and price. Regarding efficiency analysis, Honma and Hu (2012) found that hotel distance to international airports has a negative effect on hotel global efficiency using DEA methodology in their analysis of Japan's major hotel companies. Hence, the first hypothesis is formulated as follows:

Hypothesis 1. *The accessibility of the tourist destination has a positive impact on efficiency.*

Second, agglomeration models highlight the importance of externalities arising from agglomeration and urbanization economies. The concentration of economic activity and especially of hotel activity favours knowledge exchange, as well as the development of the leisure sector. From this perspective, those hotels located in tourist destinations with high agglomeration will take advantage of positive externalities, increasing their efficiency level. The existence of agglomeration economies is quantified using population density as an indicator of economic activity concentration in the tourist destination (Canina et al., 2005). Luo and Jang (2016) found a positive relation between this variable and hotel profitability, so a similar effect may be expected regarding efficiency analysis. Also, Peiró-Signes et al. (2015) found a positive effect of agglomeration on revenue per available room. So, the corresponding hypothesis is:

Hypothesis 2. *Agglomeration in the tourist destination has a positive impact on efficiency.*

Third, competency models pay special attention to differentiation and to the competitive environment. From this perspective, the relative position of the hotel plays a key role in explaining the profit margin. Thus, those tourist destinations with high levels of competition, associated with low market concentration, will have lower profitability (Porter, 2008). On the other hand, tourist destinations with a high market concentration favour collusive practices, increasing the profit margin (Lado-Sestayo et al., 2016b). Consequently, a higher level of market concentration has a positive impact on the level of hotel efficiency. Market concentration was considered at the regional level by De Jorge and Suárez (2016) in the analysis of efficiency. Also, Lado-Sestayo et al., (2016b) found a positive relation between market concentration and profit margin at the tourist destination level. Therefore, the hypothesis is:

Hypothesis 3. *Market concentration in the tourist destination has a positive impact on efficiency.*

In addition to hotel location models, the level of demand, the occupancy rate and the level of seasonality at the tourist destination level are included as control variables because they are also expected to affect the level of efficiency. For example, Parte-Esteban and Alberca-Oliver (2015) found that occupancy, demand level and coastal character have an impact at the regional level on hotel global efficiency.

The determinants of hotel characteristics reflect the main aspects of hotel activity. These include hotel size, which Honma and Hu (2012) found to have positive impact on efficiency; space dedicated to conference rooms, according to the higher efficiency of resort hotels in contrast with metropolitan ones found by Parte-Estaban and Alberca-Oliver (2015); market share, since Barros and Dieke (2008) found a positive effect of market share on efficiency; quality (number of stars), following De Jorge and Suárez (2014); management agreements with hotel chains, to confirm the results of Wang et al. (2006) and Chen (2007); and the distance of the hotel to the centre, according to the positive effect of centrality on TrevPAR found by Sainaghi (2011).

Table 3
Determinants of hotel efficiency considering hotel characteristics and tourist destination characteristics.

		Variable *[label]*	Definition
Hotel characteristics	Size	Assets *[size]*	$\boldsymbol{total\ assets\ in\ thousand\ euros_i}$
	Market orientation	Meeting space capacity *[conference]*	$\boldsymbol{space\ capacity\ m^2{}_i}$
	Share	Market share *[share]*	$\boldsymbol{\frac{Revenues\ of\ hotel_i}{Total\ revenues\ in\ tourist\ destination_j}}$
	Quality	Star rating *[stars]*	$\boldsymbol{Number\ of\ stars\ _i}$
	Management	Management agreements *[chain]*	$\boldsymbol{Dummy\ variable\ of\ existence\ of\ management\ agreement_i}$
	Centrality	Centrality *[dist_CBD]*	**Distance to the touristic destination in km** $_i$
Tourist destination	Accessibility	Accessibility *[dist_airport]*	$\boldsymbol{\frac{\sum_{i=1}^{I} Distance\ from\ the\ closest\ airport\ in\ km\ _{ij}}{I}}$
	Agglomeration	Population density *[urban]*	$\boldsymbol{Population\ density\ _j}$
	Competition	Market concentration *[hhi]*	$\boldsymbol{Ln(Herfindahl\ Index)_j}$
	Occupancy	Occupancy level *[occu]*	$\boldsymbol{\frac{\sum_{m=1}^{12} Monthly\ average\ occupancy_{jm}}{12}}$
	Demand	Demand level *[visitors]*	$\boldsymbol{Number\ of\ tourists\ in\ the\ tourist\ destination\ _j}$
	Seasonality	Degree of seasonality *[season]*	$\boldsymbol{\sigma^2{}_j(\frac{\sum_{m=1}^{12} Average\ occupation_m}{12})}$

Notes: i represents each firm; t represents the time period; j represents each tourist destination; m represents each month of the year (used when monthly data are available).

Table 4 contains a descriptive analysis of the variables selected as potential determinants of efficiency. Focusing on variables related to tourist destinations, the results show important differences among these areas regarding population density, demand level, market concentration and accessibility. At the hotel level, the main differences are observed in meeting space capacity and the existence of management agreements. According to the variance inflation factor (VIF), there are no multicollinearity problems between the variables, so they can be incorporated in the model together. Finally, the correlations between tourist destination efficiency scores and the tourist destination variables are much higher than the correlations of efficiency scores and explanatory variables at the hotel level, reinforcing the importance of considering spatial effects.

Table 4
Descriptive analysis of efficiency determinants

Dimension	*Variables*	*Correlation*		*Descriptive statistics*			
		Score hotel	Score tourist destination	Mean	SD	VIF	N
Hotel	*size*	-0.031	-	5.104	12.018	1.82	400
	conference	-0.022	-	78.745	287.389	1.16	400
	share	0.141	-	2.085	3.252	2.32	400
	stars	-0.024	-	3.105	0.843	1.23	400
	chain	0.043	-	0.085	0.279	1.14	400
	dis_cbd	0.112	-	21.947	28.440	1.18	400
Tourist destination	*dist_airport*	-	-0.372	42.242	35.917	1.47	400
	urban	-	0.432	2.143	3.402	1.75	400
	hhi	-	0.527	0.035	0.031	2.88	400
	visitors	-	0.401	1.502	2.218	2.43	400
	occu	-	-0.097	54.516	13.212	2.08	400
	season	-	-0.329	0.258	0.089	1.58	400

Notes: SD is the standard deviation. VIF is the variance inflation factor. N is the number of observations.

Table 5 presents the results of the proposed disaggregated model and the traditional synthetic model. Both models strongly confirm the impact of tourist destination variables on efficiency. Even the results of the aggregated model justify this assertion: four internal variables and three tourist destination variables have a statistically significant effect on overall efficiency. The proposed disaggregated model improves the explanatory power remarkably, both in terms of goodness of fit and in terms of the significance of the coefficients. It is worthy of note that in the analysis of the tourist destination component of efficiency all the location variables have a statistically significant impact.

The variables associated with the theoretical framework of location models in the hotel sector are the core of this research and the proposed model confirms the three hypotheses. First, the negative effect of distance from transport nodes on efficiency is consistent with geographical positioning models (Hypothesis 1). Second, the positive effect of population density on efficiency is consistent with agglomeration models (Hypothesis 2). Third, the positive effect of market concentration is consistent with competency models (Hypothesis 3).

The results also point out some other relevant effects. There is a positive effect of seasonality, which may be due to the positive effect on prices and the possibility of cost savings resulting from the concentration of activity in specific periods. The positive effect of management agreements with hotel chains is in line with the previous studies (Such-Devesa & Mendieta-Penalver, 2013). Regarding size, its complex effect may demand further study as absolute size has a negative influence (Parte-Esteban & Alberca-Oliver, 2015), while market share (relative size) has a positive impact.

Table 5
Regression models

	Disaggregated model		*Aggregated model*
	Model 1a	*Model 1b*	*Model 2*
Dependent variable	*Score Hotel*	*Score Destination*	*Score Global*
size	-1.305***		-0.152*
	0.445		(0.078)
conference	-0.001		0.002
	0.008		(0.004)
share	6.179***		0.620**
	2.370		(0.295)
stars	0.730		-0.592
	5.558		(0.957)
dist_cbd	0.022		0.050**
	0.184		(0.025)
chain	40.797**		7.998**
	18.211		(3.823)
dist_airport		-0.058*	-0.017
		(0.030)	(0.021)
hhi		3.513**	-0.040
		(1.733)	(1.143)
urban		0.562***	1.476***
		(0.203)	(0.429)
visitors		3.797***	1.400***
		(0.467)	(0.493)
occu		0.567***	0.173**
		(0.092)	(0.072)
season		52.536***	13.820
		(11.084)	(8.911)
C	112.747***	32.502***	36.543***
	22.681	(8.121)	(7.662)
Dummy tourist destination	Included		
N	282	282	400
R2	0.254	0.438	0.228
Log-likelihood	-1505	-1116	
F-test	-	91.53***	4.84***
AIC	3076.068	2245.827	3291.378

BIC	3196.251	2271.195	3343.267
VIF	2.46	1.94	1.75

Notes: *Coeff.* represents the beta coefficients of the independent variables, *Std. Error* represents the standard errors robust to heteroscedasticity, following the method proposed by Huber and White (Huber, 1967; White 1980, 1982). The disaggregated model is run for areas with at least 5 DMUs. R^2 is a measure of the goodness-of-fit of the model. *Log-likelihood* is the value of the log likelihood function. *F-test* is a joint test of the nullity of the estimated parameters. *AIC* is the Akaike information criterion and *BIC* is the Bayesian information criterion, which can be used to compare the models. VIF is the mean of the variance inflation factor, which can be used to measure multicollinearity. ***, **, * indicate significance at 1%, 5% and 10% respectively.

Fig. 6 shows the joint effect of location variables on the tourist destination component of efficiency for each of the 97 Spanish tourist destinations identified by the National Statistics Institute. To provide this graphic representation, the area of influence of each tourist destination was evaluated using Thiessen polygons. This is the most appropriate methodology if the distance determines the level of influence, as is the case in the hotel sector (Lado-Sestayo et al., 2016a).

The darker colour means a higher contribution of the location factor in increasing hotel efficiency through variables outside the control of hotel managers. The spatial analysis indicates that the tourist destinations situated on the coasts, especially the (warmer) islands and Mediterranean and south-western coasts, have conditions that contribute to increasing hotel efficiency. In contrast, a low contribution is found in the centre, except for the capital, Madrid.

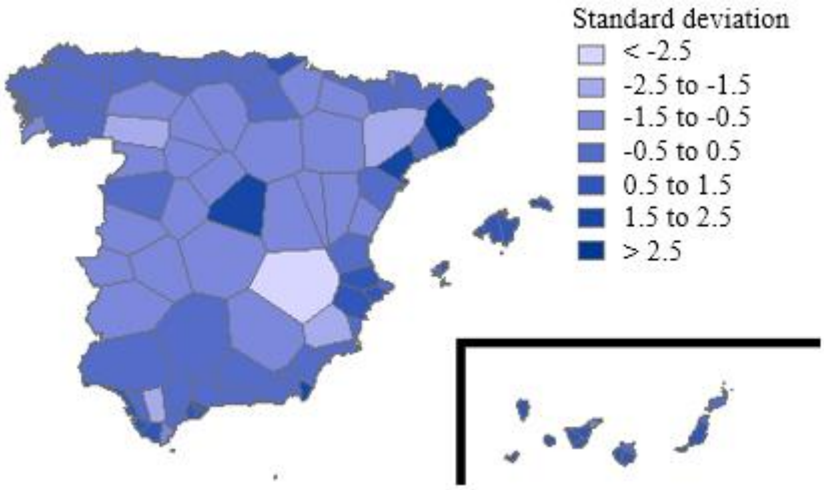
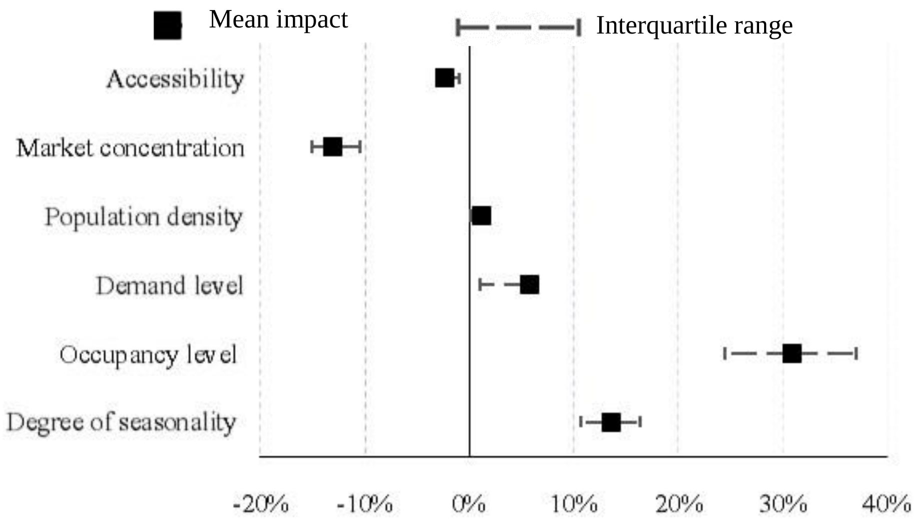


Fig. 6. Joint effect of tourist destination variables on hotel efficiency

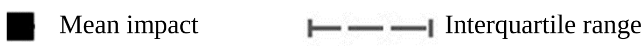
The quantitative impact of the significant explanatory variables on efficiency is shown, differentiating between the impact of the tourist destination (Fig. 7) and the impact of the characteristics of the hotel (Fig. 8). The results indicate that the impact of the tourist destination on efficiency is much higher than the effect of hotel characteristics. In particular, occupancy level, degree of seasonality and market concentration are the variables with the greater average impact, with values of 30.93, 13.55 and -13.12 percentage points respectively. The fourth variable in the impact ranking – demand level – has a significantly lower average impact (5.70), but its effect is very different from one hotel to another (interquartile range 5.31). In sum, the combination of these aspects reflects the effect of tourist destination on hotel efficiency according to our results.

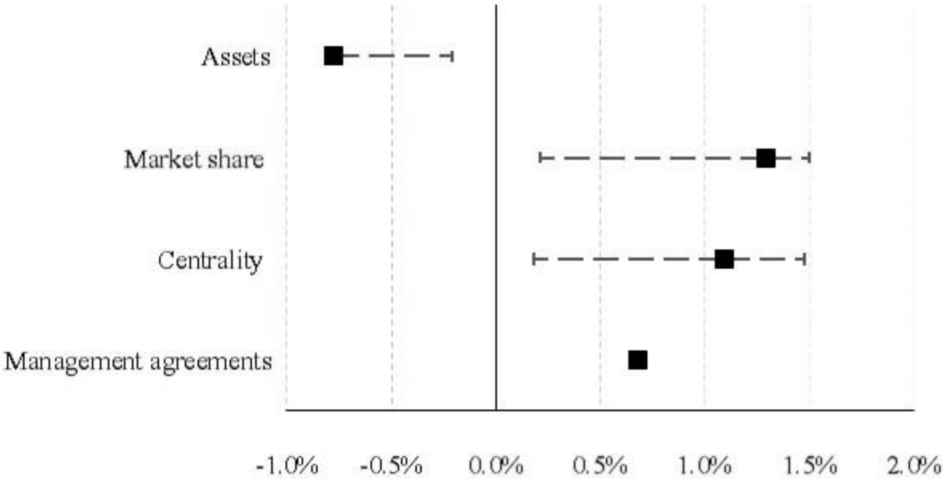


Tourist destination	Mean	Q1	Q3	Interquartile range
Accessibility	-2.431	-2.830	-0.993	1.837
Market concentration	-13.117	-15.048	-10.473	4.575
Population density	1.203	0.094	1.304	1.210
Demand level	5.705	0.959	6.266	5.307
Occupancy level	30.931	24.457	36.974	12.517
Degree of seasonality	13.553	10.683	16.276	5.593

Fig. 7. Mean and interquartile range impact of determinants at the tourist destination level on the efficiency score

Regarding the impact of hotel characteristics on efficiency, having removed the effect of the tourist destination, the most important variables in explaining efficiency are market share and centrality, with an average impact of 1.29 and 1.09 percentage points respectively. It should be noted that despite their statistical significance, these impacts are minor compared to those of location factors.





Hotel	Mean	Q1	Q3	Interquartile range
Assets	-0.774	-0.774	-0.208	0.566
Market share	1.293	0.215	1.503	1.288
Centrality	1.094	0.181	1.478	1.297
Management agreements	0.680	0.000	0.000	0.000

Notes: "Meeting space capacity" and "Star rating" were not significant determinants in the regression models, so they are not included in this table.

Fig. 8. Mean and interquartile range impact of determinants at the hotel level on the efficiency scores

4. Conclusions

Empirical studies on efficiency in the hotel sector have not deepened in the analysis of the impact of location, despite the theoretical frameworks of geographical location, agglomeration and competition, which highlight the importance of the inclusion of tourist destination variables.

This paper has analysed the efficiency level of Spanish hotels to assess the impact of location at the tourist destination level. Moreover, the determinants have been analysed using both firm and tourist destination variables: firm variables concern size, diversification, market share, quality, distance from the tourist centre and management agreements with a hotel chain; tourist destination variables include geographical positioning, externalities and the competitive environment, according to the three theoretical approaches concerning the impact of location.

Efficiency is evaluated through, a four-stage DEA model decomposing efficiency into the component attributable to hotel management and the component attributable to tourist destination was proposed, using super-efficiency scores. Then, a disaggregated regression model was used to analyse the determinants of the first component by considering internal variables and the determinants of the second component by considering a set of variables for the tourist destination consistent with the theoretical framework of hotel location models. So, from a methodological point of view, this paper has made three main contributions: i) the use of "programme" and "managerial" efficiency to decompose the level of efficiency between the hotel and the tourist destination; ii) the use of super-efficiencies to rank efficient hotels and reduce the effect of outliers; iii) consideration of the location at the tourist destination level and not at the regional level.

This methodology was **applied** to a sample of 400 hotels in 97 tourist destinations in Spain, the second largest market in the world by number of visitors. The **results** confirm the **usefulness of the disaggregated model** proposed and the importance of considering variables related to the tourist destination. Even the traditional synthetic model, in which overall efficiency is explained, supports this assertion: 7 out of 12 internal and external explanatory variables have a statistically significant impact on efficiency. Moreover, the disaggregated model enhances the explanatory power remarkably: not only both the goodness of fit and the significance of the coefficients are improved, but in the analysis of the location component all explanatory variables (accessibility, population density, market concentration, occupancy, demand and seasonality) have significant impacts.

These results have relevant implications for both academic studies about hotel efficiency and for hotel management and policy-making. Regarding hotel efficiency studies, a major implication is the ratification of the propositions of the main hotel location models: accessibility, agglomeration and market concentration in the tourist destination have a positive impact on efficiency. Previous studies found that these three variables were determinants of other performance measures: Lee and Jang (2006) found that accessibility has a positive effect on price; Peiró-Signes et al. (2015) confirmed the positive effect of agglomeration on revenue per available room, on average daily rate and on hotel occupancy; and Lado-Sestayo et al., (2016a) proved the positive effect of market concentration on profit margin. Therefore, the current work supports previous findings and confirms that those variables used in the analysis of other performance measures may be extended to the explanation of efficiency. Also, the proved relevance of the tourist destination variables prevents against increasing sample size through simple addition of hotels from different tourist destinations in efficiency analysis.

The findings concerning the impact of location could be useful to improve management both at hotels and in tourist destinations. Identifying tourist destination characteristics which increase hotel efficiency presents areas of common interest for managers and policymakers. These common interests may have direct policy implications, such as interest in fostering policies oriented to increase local demand, accessibility and agglomeration, since these variables have positive effects on hotel efficiency. Hence, there is room for different public-private collaboration formulas oriented to promote destination image, to improve communications (e.g., improving communication with international airports in distant destinations) or to develop complementary economic activities in the tourist destination. However, the findings also point out the existence of some conflicting interests, such as those regarding the desired market structure: hotels have incentives to favour concentration to increase their efficiency; however, according to previous studies (Lado-Sestayo et al., 2016a; Pan, 2005), this effect would be obtained through price increases, which may undermine the competitiveness of the tourist destination in the medium term. One possible way to try to reconcile this conflict would be to combine policies which foster concentration with a reduction in barriers to entry, so market contestability would offset the positive effect of concentration on prices. Regarding the internal variables, the results indicate that hotel managers should pay attention to possible affiliation agreements in the short or medium term and to the hotel size in the long run.

This paper has some limitations that should be noted. It was not possible to obtain more up-to-date information because there is a delay in incorporating accounting information in the relevant database. The year 2011 is the most recent year that all the databases have in common to evaluate efficiency at the level of the hotel and tourist destination. Also, it should be noted that the decomposition of efficiency is only possible in tourist destinations with a large enough sample of hotels. Finally, Simar and Wilson (2007) showed that the multistage efficiency analyses may be biased because of the problems related to the separability property. This limitation, as pointed out in Daraio et al. (2015), is shared by virtually all the published studies; and the problem may be expected to affect our multistage methodology to a lesser extent thanks to the estimation of a specific efficient frontier for each area, grouping firms facing similar circumstances.

The findings suggest future lines of research. One of these would be to compare these results with those obtained for other markets and other time periods. Dynamic analysis can be introduced through the Malmquist Productivity Index, exploring the complexities of combining this approach with the managerial and program efficiency. It might also be interesting to study how policies on tourist destinations affect efficiency levels as a means of detecting those policies with a higher investment multiplier effect in the development of the hotel sector. In this line, it could be of interest the analysis of the impact that market orientation of tourist destination has on hotel efficiency and how changes, for example to reduce seasonality, affects hotel efficiency.

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