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Efficiency differences in the tourist accommodation sector in Spain according to the type of establishment: a metafrontier analysis

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ABSTRACT

The tourism industry is a major economic sector worldwide. This is especially so in Spain, which is a leading tourist destination. With globalisation, the sector has become highly competitive. The main aim of this study is to determine the relative efficiencies of different types of Spanish tourist accommodation establishments, taking into account their size and geographic location.
Industry efficiency was determined using Data Envelopment Analysis (DEA) and the metafrontier approach, to compare differences in efficiency according to the type of tourist accommodation. The study findings show that the Hotels category presents higher levels of efficiency than other sectors, and that campsites perform worst in this respect. In terms of company size, hotels are the most efficient form of accommodation when the company has more than ten workers. By geographic location, hotel accommodation is more efficient in sun and beach tourism-oriented regions.
This paper contributes to our understanding of this field by studying the efficiency of the accommodation sector, distinguishing between different types of establishment. Moreover, the study sample contains a larger number of firms than previous studies, providing a broader overview of the field. Findings could be used as a benchmarking tool by public institutions, enabling them to establish appropriate regulatory policies to achieve greater efficiency in the sector, and by company managers to compare efficiencies across types of establishment types, by size and location.

Diferencias en la eficiencia del sector de alojamiento turístico en España según el tipo de establecimiento: un análisis de metafrontera

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RESUMEN

La industria turística es uno de los principales sectores económicos a nivel global. Este sector resulta especialmente relevante en España, al constituir uno de los principales destinos turísticos en el mundo. Con la globalización, el sector se ha vuelto altamente competitivo. El objetivo principal de este estudio es determinar la eficiencia relativa de los diferentes tipos de alojamiento turístico en España, teniendo en cuenta su tamaño y su ubicación geográfica.
La eficiencia del sector se ha estimado mediante la aplicación del Análisis Envolvente de Datos (DEA) y el enfoque de metafrontera, para comparar las diferencias de eficiencia según el tipo de establecimiento turístico. Los resultados del estudio muestran que la categoría de *hoteles* presenta los mayores niveles de eficiencia en comparación con el resto de tipologías de alojamiento, y que los *campings* son los que obtienen los peores resultados en cuanto a la eficiencia alcanzada. Por tamaño de la empresa, los *hoteles* representan la forma de alojamiento más eficiente cuando la empresa tiene más de diez trabajadores, en tanto que, según la ubicación geográfica, el *alojamiento hotelero* es el más eficiente en las regiones orientadas al turismo de sol y playa.
El presente trabajo contribuye al desarrollo del conocimiento en esta área de investigación, mediante el análisis de la eficiencia del sector del alojamiento turístico diferenciando entre los diversos tipos de establecimiento turístico que operan en España. Además, la muestra contemplada en el estudio está formada por un número de empresas considerable, superior al utilizado en estudios previos, ofreciendo de este modo una perspectiva más amplia. Los resultados obtenidos en este trabajo presentan una gran relevancia, como herramienta de benchmarking para las instituciones públicas, permitiéndoles orientar políticas regulatorias adecuadas para lograr una mayor eficiencia en el sector, así como para los gestores de las empresas hoteleras, quienes podrán analizar y comparar las diferencias entre la eficiencia que muestran los distintos tipos de establecimiento, teniendo en cuenta el tamaño y su ubicación geográfica.

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1. Introduction

Rising levels of competition throughout the economy, together with the permanent need to optimise the use of resources for business activities, make it extremely important for companies to evaluate their productivity and performance (Fuentes, 2011). In this context, efficiency analysis is commonly used in different sectors of the economy, both regionally and nationally (Alberca and Parte, 2013).

The tourism industry is a major pillar of activity in many countries, contributing 10.4% of global GDP (WTTC, 2019). Spain, where it is a key driver of economic development, received 83.7 million tourist visits in 2019, 1.1% more than the year before (Frontur, 2020), producing revenues of 71,237 million euros (3.1% more than in 2018). According to the Tourist Accommodation Occupancy Survey (EOAT), in 2019 there were 133,692,046 overnight stays in Spain, of which 81.20% were in hotels, 9.34% in short-term rental accommodation, 6.15% in campsites and 3.3% in other types of accommodation (INE, 2019). Although the COVID-19 pandemic seriously affected hotel occupancy in Spain, since the summer of 2021 some recovery has been observed, with levels returning to those obtained in 2019. Nevertheless, international tourism has fallen considerably, with only 18 million visits in 2020 and 31 million in 2021 (INE, 2022). Therefore, the 2021 recovery of the hotel sector was mainly driven by domestic tourism.

In this context, it would be useful to determine the relative performances of firms in the tourist accommodation sector. Today, with increasingly limited resources and strengthening competition, companies seek to maximise their efficiency. A targeted efficiency analysis would enable policymakers and managers to design appropriate policies. The present research, which obtains detailed information on the behaviour of companies in this sector in the pre-pandemic period, provides a solid basis for drawing valuable conclusions and determining future action.

Specifically, we analyse the efficiency of different types of accommodation establishments, applying a non-parametric model and using the concept of metafrontier (Battese et al., 2004). This approach, as well as showing which types of accommodation obtain higher levels of efficiency, enables us to classify each of the companies analysed within its category of activity.

The study is based on a sample of 4,849 Spanish tourist companies, reflecting a recent trend in empirical research to consider larger sample sizes in order to achieve more representative results (Lado-Sestayo and Fernández-Castro, 2019). Comparable studies include Bernini and Guizzardi (2015), who analysed a sample containing 2,705 hotels, and Sellers-Rubio and Casado-Díaz (2018), with a sample of 1,836 hotels, and Oliver et al. (2012), with a sample of 1,593 hotels, whose sample sizes are smaller than ours. A novel aspect of the present analysis is that the sample is not exclusively composed of hotels (as is the case in the vast majority of previous studies), but also considers alternative formats within the industry, i.e. short-term rentals, campsites and other types of accommodation.

The rest of this paper is structured as follows. In the next section, we review the recent literature in this field. Sections three and four then describe the research methods used and the study variables and data considered. After this, we discuss the main results obtained. The final section presents the main conclusions drawn.

2. Literature Review

Many recent studies have sought to determine levels of efficiency in the tourist accommodation sector, using benchmarking techniques based on frontier analysis (Morey and Ditmann, 1995; Johns et al., 1997; De Jorge and Suarez, 2014; Nurmatov et al., 2021).

Among the aspects examined in the following studies (mostly concerning hotels) are the size of the establishment, its quality, the type of property, whether it forms part of a chain, the location, the attractiveness of the location and the level of seasonality: Assaf and Cvelbar (2010); Chen et al. (2017); Ohe and Peypoch (2016); Oukil et al. (2016); Pulina et al. (2010); Pulina and Santoni (2018); Poldrugovac et al. (2016); Higuerey et al. (2020); Dapeng et al. (2020) and Dimitriadou et al. (2023).

The size of tourist establishments within an economy is commonly analysed, as this factor is directly relevant to the presence or otherwise of economies of scale and can influence the firm's bargaining power (Arbelo et al., 2018). However, previous studies of efficiency as a function of size have drawn contradictory conclusions. While most have observed economies of scale (Assaf and Agbola, 2014; Assaf and Cvelbar, 2010; Assaf et al., 2010; Barros, 2005; Ohe and Peypoch, 2016; Honma and Hu, 2012; Chen et al., 2017; Poldrugovac et al., 2016), some papers have suggested that hotel size may be inversely associated with efficiency (Sami and Mohamed, 2014; Alberca-Oliver, 2014; Lado-Sestayo and Fernández-Castro, 2019), while others have observed no differences between large and small hotels in this respect (Chen, 2007; Oukil et al., 2016). On the other hand, Pulina et al. (2010) and Pulina and Santoni (2018), in a study conducted in Sardinia (Italy), found that medium-sized hotels were the most efficient. Finally, Tewari and Arya (2023), in a study conducted in the Indian hotel industry, found a curvilinear U-shaped relationship between hotel size and efficiency evolution. In this sense, they argue that as the size of small hotels increases, so does their organizational complexity, whereas once the hotel crosses the size threshold, where economies of scale occur, its efficiency increases.

The influence of location on efficiency has also been studied. Thus, Lado-Sestayo and Fernández-Castro (2019) reported that factors related to the location of the establishment are a major cause of differences in efficiency among hotels. According to these authors, the variables corresponding to the tourist destination that have the greatest impact on hotel efficiency are the level of occupancy, the degree of seasonality and the level of market concentration. They also observe that tourist destinations located on the coast present conditions that contribute to hotel efficiency. On the other hand, Assaf and Agbola (2014), in a study conducted in Australia, suggested that hotels located in territories with international appeal are the most efficient performers. Similar results have been obtained by Higuerey et al. (2020), in Ecuador. However, Flegl et al. (2023), in a study conducted in the hotel sector in Mexico, found that international tourism, mainly concentrated in a few coastal states, was associated with very low overall hotel efficiency. Finally, Dapeng et al. (2020), in a study carried out in China, concluded that hotel efficiency is not affected by location within tourist areas, although this kind of location can heighten the negative effects of competition.

With respect to the situation in Spain, very little efficiency analysis of the hotel sector was conducted until the 2010s (Alberca and Parte, 2013). Some recent studies have taken a regional perspective (Rubio and Roman, 2006;

Alberca and Parte, 2013; Sellers-Rubio and Casado-Díaz, 2018) while others have analysed the factors associated with efficiency (Such and Mendieta, 2013; Alberca-Oliver, 2014; Parte-Esteban and Alberca-Oliver, 2015; Mendieta-Peñalver et al., 2018; Arbelo et al., 2017; Arbelo et al., 2018; Deng et al., 2019; Lado-Sestayo and Fernández-Castro, 2019).

Regarding non-hotel tourist accommodation in Spain, however, empirical evidence is practically non-existent. To our knowledge the sole exceptions are Agabo-Mateos et al. (2014), who reported high levels of technical efficiency (around 90%) in youth hostels, Alberca and Parte (2020), who analysed the situation in tourist apartments and hostels (separately), finding a significant inverse association between efficiency and the size of the establishment, and Mudarra-Fernández et al. (2024), who analyzed technical efficiency in rural accommodation companies in Andalusia, showing a technical efficiency of 77.84% and 80.40% in 2019 and 2020, respectively. In a different geographic location, Assaf and Agbola (2014) conducted a study of efficiency in various types of tourist accommodation in Australia. The results obtained suggest that the hotel sector is the most efficient, followed by those of guest houses and motels and, finally, serviced apartments.

The main contribution of the present study is that it poses a research question (RQ1) that, to date, has received insufficient research attention, namely: does the type of accommodation affect the efficiency of the tourist accommodation sector in Spain?

In this analysis by type of accommodation, we incorporate two factors expected to be very relevant to efficiency: the size and the location of the company. Thus, the following research questions are also posed:

> ***RQ2***. *Does the efficiency observed in different types of tourist accommodation vary according to the size of the company?*
>
> ***RQ3***. *Does the efficiency observed in different types of tourist accommodation vary according to the location of the company?*

In summary, the purpose of this study is to conduct an efficiency analysis of the performance of the tourist accommodation sector in Spain, taking a novel approach, in which we not only analyse a large number of companies, but also segment them by types of accommodation, size and geographic location.

3. Methodology

As observed in the previous section, several recent analyses have been made of the tourist accommodation sector using benchmarking techniques based on frontier analysis (Nurmatov et al., 2021), usually stochastic frontier analysis (SFA) and/or non-parametric models like data envelopment analysis (DEA) (Arbelo-Pérez, 2016). A recent bibliometric study reported that DEA is now the most commonly used technique for evaluating efficiency and productivity in the tourism and hotel sectors (Nurmatov et al., 2021).

The present study applies DEA, in conjunction with the concept of metafrontier (Battese et al., 2004). DEA is a deterministic non-parametric technique based on non-linear programming models developed by Charnes et al. (1978), which is used to analyse the relative efficiency of a set of decision-making units (DMUs) with similar characteristics, transforming a set of inputs into a series of outputs, assuming convexity, free unavailability and returns to scale (Bogetoft and Otto, 2011). There exist several models of DEA, classified by the typology of returns to scale (constant or variable) and the orientation considered (input or output).

By type of returns to scale, the analyst may focus on technical efficiency, pure technical efficiency or scale efficiency (which is obtained as the ratio of total to pure technical efficiency). If constant returns to scale are applied (Färe and Lovell, 1978), the variation between inputs and outputs is always in the same proportion (Charnes et al., 1978), and total technical efficiency is estimated (DEA-CCR model). If variable returns to scale are applied, it is pure technical efficiency that is measured (DEA-BCC model); this approach excludes inefficiencies of scale, as companies are compared with similar-sized competitors (Banker et al., 1984). In this study, we address technical efficiency, i.e. the optimal use of productive factors, which is determined with constant returns to scale (DEA-CCR model).

The orientation of the model is selected according to the variables (input or output) best controlled by the DMUs. A model will be input oriented when the DMU seeks the maximum reduction of inputs to continue producing the same level of outputs; in contrast, it will be output-oriented when, with a known level of inputs, it seeks the maximum proportional increase in outputs. The present study considers the input orientation because in the short term the companies in this sector have more control over their inputs than their outputs (Detotto et al., 2014).

The algorithm to be solved for the input-oriented DEA-CCR model follows the following expression:

$$\mathrm{Min}_{\lambda^k,\theta^0}\ \theta^0$$

$$s.t.$$

$$\sum_{k=1}^{K} \lambda^k * x_n^k \leq \theta^0 * x_n^0, \qquad \forall\ n = 1, 2, \ldots N$$

$$\sum_{k=1}^{K} \lambda^k * y_m^k \geq y_m^0, \qquad \forall\ m = 1, 2, \ldots M$$

$$\lambda\ \epsilon\ \mathbb{R}_+^K$$

where:

- θ^0: Efficiency of the unit.
- λ^k: Weight assigned to each company k in the sample in generating the efficient reference.
- x_n^k and y_m^k : Observed variables.
- K: Number of DMUs.
- N: Number of inputs.
- M: Number of outputs.

In addition to the above, by applying the concept of metafrontier (Battese et al., 2004) we can compare the efficiency achieved by different types of accommodation companies. According to Battese and Rao (2002), the technical efficiency of companies operating under different production technologies is not immediately comparable. To overcome this problem, they proposed a stochastic metafrontier model that provided comparable technical efficiency scores, a model that was latter modified by Battese et al. (2004). This methodology allows us to estimate the technical efficiency relative to the metafrontier function (TE), which includes every company, regardless of its type, and the technical efficiency relative to the local frontier for a given group (TE^f). In the

present case, we distinguish four local frontiers for tourist accommodation firms according to their membership of one of the following categories: hotels or similar; short-term rentals; campsites and/or caravan parks; other types of tourist accommodation. The efficiency estimation at the metafrontier shows the position held by an accommodation company with respect to all companies, while that at the local frontier determines the company's position within a homogeneous group.

The frontier of each group of accommodation companies can then be compared with the metafrontier, thus obtaining the Technological Gap Ratio (TGR^f). This term measures the distance from the local frontier to the metafrontier (Battese et al., 2004). In other words, TGR^f is the ratio of the minimum level of inputs obtained at the metafrontier relative to the lowest inputs at the local frontier, given a certain level of outputs (O'Donnell et al., 2008).

$$TGR^f = \frac{TE}{TE^f}$$

Hence, the TGR^f can be interpreted as the (in)efficiency achieved as a consequence of the type of accommodation provided. When the level of TGR^f is close to 1, this means the local frontier is close to the metafrontier, and so this kind of accommodation is most likely to have a lower level of inputs and higher levels of efficiency (Pérez-López et al., 2016). By contrast, the lower the value of TGR^f, the lower the level of efficiency achieved by this sort of accommodation.

4. Data and Variables

Our analysis is based on the Iberian Balance Analysis System (SABI) database [1]. The search was filtered by companies classed under Activity Code 55 of the CNAE-2009 [2], which corresponds to "Accommodation Services". This activity code is divided into the following categories:

- Code 551: Hotels and similar (hereinafter, termed hotels), which provide accommodation in furnished rooms or suites, with a daily cleaning service. Includes hotels, resort complexes, apartment hotels, motels, and bed and breakfast establishments with daily room cleaning.
- Code 552: Self-catering tourist accommodation and other short-stay rentals (hereinafter, short-term rentals). This section constitutes the provision of accommodation in spaces with an independent entrance, cooking facilities, but minimal or no complementary services. It includes camps, apartments, bungalows, rural houses, cabins, youth hostels, mountain huts, self-catering hotels and bed and breakfast establishments with no daily room cleaning service.
- Code 553: Campsites and caravan parks (hereinafter, campsites). Includes the provision of accommodation in campgrounds, caravan parks, recreational, hunting and fishing camps, and spaces and facilities for recreational vehicles. It also includes shelters or bivouacs where the tourist can set up a tent or use a sleeping bag.

[1] The Bureau Van Dijk database, which contains economic and financial information for Spanish and Portuguese companies. The data employed in this study correspond to the non-consolidated accounts of the companies included in the analysis.

[2] The National Classification of Economic Activities, consisting of a hierarchical set of economic activities performed in Spain.

Table 1. Input and output variables employed in previous hotel efficiency research.

Study	Inputs	Outputs
Johns et al. (1997)	Number of room nights available	Number of room nights sold
	Total labour hours	Total covered served
	Total food and beverage costs	Total beverage revenue
	Total utilities costs	
Hwang and Chang (2003)	Number of full-time employees	Room revenues
	Number of guest rooms	Food and beverage revenues
	Total area of meal department	Other revenues
	Operating expenses	
Barros (2005)	Number of full-time emplooyees	Sales
	Cost of labor	Number of guests
	Book value of property	Nights spent in the hotel
	Operating costs	
	External costs	
Rubio and Román (2006)	Operating consumptions	Total revenues
	Labour costs	
	Depreciation	
	Other expenses	
Assaf and Cvelvar (2010)	Number of rooms	Room división total sales
	Costs of materials	F&B división total sales
	Costs of services	
	Amortisation costs	
	Number of employees	
	F&B division capacity (number of seats)	
Pulina et al. (2010)	Labour costs	Sales
	Capital assets	Added value
Alberca and Parte (2013)	Number of employees	Net sales
	Fixed assets	
	Consumptions	
Such and Mendieta (2013)	Number of full-time employees	Total room revenues
	Number of rooms	Total food and beverage revenues
	Staff costs	Total of other revenues
Agabo-Mateos et al. (2014)	Labour costs	Room revenues
	Number of beds	Food and beverage revenues
	Operational costs	Total revenues
Alberca-Oliver (2014)	Labour costs	Net sales
	Net fixed assets	Other operating revenues
	Consumptions	
	Other operating expenses	
De Jorge and Suárez (2014)	Number of full-time employees	Sales
	Number of rooms	Market share
	Labour costs	
	Operating costs	
Detotto et al. (2014)	Labour costs	Sales revenue
	Gross investment in fixed assets	Added value
Parte-Esteban and Alberca-Oliver (2015)	Number of full-time employees	Sales
	Labour costs	
	Book value of the property	
	Operating costs	
Oukil et al. (2016)	Number of beds	Annual revenue
	Salary of employees	Number of guests
		Number of nights
		Occupancy rate

Table 1. Input and output variables employed in previous hotel efficiency research. (cont.)

Study	Inputs	Outputs
Chen et al. (2017)	Number of employees Total area of catering Number of rooms Catering costs	Total revenues Number of guests (annual)
Mendieta-Peñalver et al. (2018)	Number of employees Salary costs Number of rooms	Total revenues RevPar
Alberca and Parte (2020)	Operational costs Total assets Number of employees Labour costs	Total revenues Sales
Dapeng et al. (2020)	Gros fixed assets Total number of employees	Total revenue
Dimitriadou et al. (2023)	Capital cost Labour cost Operational cost	Total revenues Sales
Mudarra-Fernández et al. (2024)	Labour costs Financial costs Material costs	Sales figures

- Code 559: Other forms of tourist accommodation (hereinafter, other accommodation). Includes the provision of temporary or longer-term accommodation in individual or shared rooms, or in student residences, shelters for migrant (seasonal) workers and the like. Also included are boarding houses, guest houses and railway sleeping cars.

The study sample consisted of 4,849 companies, with information dated to December 2018. Of these, 3,338 were classed as Hotels, 951 as Short-term rentals, 399 as Campsites and 161 as Other accommodation. The sample employed represents 16.82% of the total of 28,836 companies operating in the tourist accommodation sector for the year 2018 (INE, 2018). In this regard, it is important to highlight that the information provided by this database is related to the company, so information about how many establishments has a specific company is not provided. So, in some cases -mainly in the Hotel category- the company might have several establishments, while in other cases, the company coincide with the establishment.

Among the studies previously carried out for this sector, there is no common criterion for selecting the variables examined (Alberca and Parte, 2013). Even the selection of inputs and outputs is always subject to data availability (Alberca and Parte, 2013); in this respect, most authors used total income or total sales as the output, with a variety of criteria for the inputs, but usually seeking to represent the production factors of materials, labour and capital (Deng et al., 2019), together with the income received from the provision of accommodation services and from complementary services (Nurmatov et al., 2021).

In Table 1, a summary of the input and output variables used in some of the previous studies on hotel efficiency analysis can be observed.

For the present study, the input variables selected were the number of employees, the operating costs, and the value of fixed assets. The output variable chosen was the net amount of the business (sales). These variables were chosen taking into consideration the prior studies reviewed and the availability of data in SABI database and considering that these variables are among the most commonly used in studies applying DEA to the hotel sector (Nurmatov et al., 2021).

Table 2 shows the descriptive statistics for the input and output variables, for all companies analysed in this study (2018 data). The average company is small in terms of the number of employees. According to EU criteria, a micro-company is one with fewer than 10 employees, a small company is one with 10-50, a medium-sized one has 50-250 and a large one, more than 250 (European Commission, 2003). The variable that shows the most dispersion is the value of fixed assets, because in our sample the capital of large hotel companies is compared with that of small accommodation establishments. Furthermore, Annex I provides information on the number of tourist accommodations included in the study by typology and region.

Table 2. Global descriptive statistics and descriptive statistics by size.

Type	Variable	Mean	Median	Min	Max	Std.Dev.
Global n = 4849	Number of Employees	40.96	15	1	4569	137.01
	Value of fixed asset (€ thousand)	7966.84	1295.67	0.58	1176534	36343.75
	Operating Costs (€ thousand)	3529.67	1193.96	22.99	320528	11294.19
	Net Amount of the Business-Sales (€ thousand)	3932.87	1289.03	0.33	441991	12874.51
Hotel n = 3338	Number of Employees	52.83	21	1	4569	161.80
	Value of fixed asset (€ thousand)	10445.69	1910.61	0.72	1176534	43264.51
	Operating Costs (€ thousand)	4546.61	1644.15	95.23	320528	13321.14
	Net Amount of the Business-Sales (€ thousand)	5078.92	1806.01	3.60	441991	15213.48
Tourist Accomodation n = 951	Number of Employees	14.60	6	1	623	37.15
	Value of fixed asset (€ thousand)	2560.07	607.18	0.58	110168.7	7281.66
	Operating Costs (€ thousand)	1355.68	524.93	22.99	64513.48	3598.37
	Net Amount of the Business-Sales (€ thousand)	1437.63	563.29	0.33	61156.05	3633.75
Campsite n = 399	Number of Employees	14.18	9	1	124	15.46
	Value of fixed asset (€ thousand)	2028.64	737.21	4.34	47983.3	4424.89
	Operating Costs (€ thousand)	1162.43	630.25	128.91	14280.94	1721.93
	Net Amount of the Business-Sales (€ thousand)	1354.55	691.03	111.47	16976.79	2065.82
Other Accommodation n = 161	Number of Employees	16.78	6	1	605	66.95
	Value of fixed asset (€ thousand)	3226.28	364.53	3.25	156600.7	14393.74
	Operating Costs (€ thousand)	1153.44	455.92	86.15	37108.06	3232.41
	Net Amount of the Business-Sales (€ thousand)	1300.59	462.29	129.73	51188.07	4261.88

5. Results and Discussion

This section presents the results obtained from the application of the metafrontier concept and the DEA model. Two efficiency scores were obtained for each company: that of the metafrontier, estimated considering the whole sample regardless of the type of accommodation; and that of the local frontier, estimated considering the different types of accommodation. The technology gap ratio (TGR^f) was obtained as the ratio of the metafrontier and local frontier efficiency scores. The software R with FEAR package (Wilson, 2008) was used for this analysis.

At the outset, three research questions were established.

RQ1. *Does the type of accommodation affect the efficiency of the tourist accommodation sector in Spain?*

RQ2. *Does the efficiency observed in different types of tourist accommodation vary according to the size of the company?*

RQ3. *Does the efficiency observed in different types of tourist accommodation vary according to the location of the company?*[3]

RQ1 examines whether there exist differences in operating efficiency according to the type of accommodation. The results obtained in this respect are presented in Tables 3 and 4. Table 3 shows the efficiency scores for the metafrontier (showing the position of each company with respect to all companies considered in the study), for the local frontier (showing the position held by each company within a group of companies of the same activity type) and the TGR (the (in)efficiency of each category of accommodation).

Table 4 presents the results obtained by the Mann-Whitney U test, which determines whether there were differences between each pair of accommodation companies. In addition, the Kruskal-Wallis test was performed to determine whether the data examined were derived from the same population. The test results highlight the existence of significant differences among the TGR values obtained (Table 3), corroborating the differentiation in the efficiency analysis by type of accommodation company. Specifically, Table 4 shows there are significant differences between each pair of accommodation types, except when the Short-term rentals category is compared with that of Other accommodation, for which the null hypothesis of equality cannot be rejected.

Regarding the efficiency achieved by accommodation type, Table 3 shows that, in general terms, the technical efficiency of the accommodation companies considered is 44.95%. This means that, on average, the tourist accommodation sector in Spain could reduce its inputs by 55%, keeping its level of outputs constant, thus improving its efficiency. By considering different types of accommodation services, we can determine which category is the most efficient.

Analysis showed that the local efficiency scores were higher than those for the metafrontier, which highlights the impact of different types of accommodation within the tourist accommodation sector; when companies are only compared with those belonging to the same category, the overall efficiency improves. The category Other accommodation presents the highest level of efficiency when companies in this class are compared with those that are technically similar (local efficiency index; 69.96%), while the category Hotels presents the lowest level of local efficiency (49.55%). In line with Agabo-Mateos et al. (2014), we found the local efficiency of the category Short-term rentals (55.21%) to be higher than that of the hotels considered.

However, to establish which category is technologically more efficient, the TGR values must be examined. In our sample, the lowest average TGR values were obtained by Campsites (0.64), which suggests that this category is technologically the least efficient, while that of Hotels was the most efficient, with a TGR value of 0.89. This finding is consistent with the results obtained by Assaf and Agbola (2014), who reported that, within the accommodation sector in Australia, the Hotels category was the most efficient. In our study, the category Short-term rentals obtained the second-best results (average TGR = 0.87), followed by Other accommodation (average TGR = 0.71). These results show that the Hotels category is the most likely to be able to reduce its level of inputs with a constant level of outputs. Hence, when considering differences in the accommodation sector, it is necessary to take relative efficiencies into account, because different categories of accommodation operate with very different volumes of inputs and outputs.

With respect to RQ2 and RQ3, we detected possible differences between accommodation categories and the size and location of the establishment. Table 5 shows the results of the TGR analysis by company size and category of accommodation (the results of the Kruskal-Wallis tests revealed significant differences between categories). Four sizes of com-

Table 3. Descriptive Statistics of technical efficiency results for metafrontier, local frontier and TGR by type of accommodation company.

Type	Mean	Median	Min.	Max.	Std. Dev.
Global (n=4849)					
Metafrontier	0.4495352	0.4233521	0.0208333	1	0.1656328
Local frontier	0.5282054	0.5090613	0.0208333	1	0.185214
TGR	0.8620923	0.9012645	0.2246045	1	0.127012
Hotel (n=3338) ***					
Metafrontier	0.4382533	0.4162504	0.03125	1	0.1577577
Local frontier	0.4955318	0.4802959	0.03125	1	0.1733852
TGR	0.8912039	0.9139653	0.5218966	1	0.0915121
Tourist accommodation (n=951) ***					
Metafrontier	0.4854124	0.4530627	0.0208333	1	0.1912952
Local frontier	0.5521479	0.5103082	0.0208333	1	0.188572
TGR	0.8764232	0.926468	0.4069108	1	0.1360739
Campsites (n=388) ***					
Metafrontier	0.4383288	0.4068514	0.1848087	1	0.1342779
Local frontier	0.6753084	0.6559528	0.3429708	1	0.1523336
TGR	0.6449499	0.6243699	0.4137254	1	0.0867613
Other accommodation (n=161) ***					
Metafrontier	0.4992915	0.4697482	0.1755957	1	0.1922478
Local frontier	0.6996386	0.6744907	0.2702922	1	0.1853531
TGR	0.7120105	0.7009841	0.2246045	1	0.162259

***Differences are assumed to be significant at 1% according to the Kruskal-Wallis test for the TGR.

Table 4. Analysis of significant differences between the TGR of different accommodation companies.

Null hypothesis (H0)	5% signif.	1% signif.	0.1% signif.
Hotel = Short-term rentals	H0 rejected	H0 rejected	H0 rejected
Hotel = Campsites	H0 rejected	H0 rejected	H0 rejected
Hotel = Other accommodation	H0 rejected	H0 rejected	H0 rejected
Short-term rentals = Campsites	H0 rejected	H0 rejected	H0 rejected
Campsites = Other accommodation	H0 rejected	H0 rejected	H0 rejected
Short-term rentals = Other accommodation	H0 not rejected	H0 not rejected	H0 not rejected

[3] As it has been previously explained in data section, we only have information about the company, so the location is referred to the company.

panies were considered: micro-company (fewer than 10 employees), small company (10-50 employees), medium-sized company (50-250 employees) and large company (more than 250 employees). The most efficient accommodation category within the micro-companies was Short-term rentals (mean TGR: 0.927). This is in line with Alberca and Parte (2020), who reported that in this sector efficiency scores were negative and significantly associated with the size of the company. However, the Hotel category is the most efficient when the company has more than 10 employees (i.e. for small, medium-sized and large companies). Indeed, the TGR results show that large companies with a TGR equal to 1 are the most likely to reduce their level of inputs and hence increase efficiency (Pérez-López et al., 2016). These results are similar to those obtained in other studies, which also highlight the existence of economies of scale in the hotel sector, such as Chen et al. (2017), Assaf and Cvelbar (2010), Barros (2005), Assaf et al. (2010), Such and Mendieta (2013) and Arbelo et al. (2018).

Table 5. Analysis of TGR by company size.

Size	Code	Mean	Median	Min.	Max.	Std. Dev.
Micro***	Hotel (n=845)	0.820	0.813	0.522	1.000	0.097
n = 1824	Short-term rentals (n=633)	0.927	0.969	0.472	1.000	0.096
	Campsite (n=226)	0.635	0.615	0.464	1.000	0.086
	Other accommodation (n=120)	0.750	0.725	0.309	1.000	0.151
Small***	Hotel (n=1788)	0.888	0.905	0.649	1.000	0.072
n = 2265	Short-term rentals (n=279)	0.789	0.804	0.422	1.000	0.142
	Campsite (n=161)	0.659	0.650	0.414	0.834	0.079
	Other accommodation (n=37)	0.620	0.633	0.281	0.940	0.127
Medium-sized***	Hotel (n=606)	0.982	0.987	0.570	1.000	0.024
n = 654	Short-term rentals (n=34)	0.679	0.679	0.407	0.990	0.144
	Campsite (n=12)	0.648	0.666	0.439	0.956	0.154
	Other accommodation (n=2)	0.314	0.314	0.225	0.402	0.126
Large***	Hotel (n=99)	1.000	1.000	1.000	1.000	0.000
n = 106	Short-term rentals (n=55)	0.631	0.600	0.447	0.812	0.135
	Campsite (n=0)					
	Other accommodation (n=2)	0.512	0.512	0.428	0.596	0.119

***Differences are assumed to be significant at 1% according to the Kruskal-Wallis test for the TGR.

Finally, Table 6 presents the TGR results, classified by region and type of accommodation. The location of the company is significantly associated with efficiency (Lado-Sestayo and Fernández-Castro, 2019) and therefore is included among our study variables with the type of accommodation in order to examine which category is most appropriate for each region. In this respect, the Kruskal-Wallis test reveals significant differences in efficiency among the categories in each region (except for the autonomous cities of Ceuta and Melilla, where there are relatively few hotels). Thus, in Andalusia average efficiency levels are similar for hotels and short-term rentals, while in the Balearic and Canary Islands, hotels are more efficient; in the other regions of Spain, efficiency is higher in short-term rentals than in the other types of tourist accommodation.

These three Autonomous Communities – Andalusia, the Balearic Islands and the Canary Islands – are highly specialised in the tourism sector, which may explain their greater efficiency (Higuerey et al., 2020). However, Pulina and Santoni (2018) reported that hotels located in areas specialised in tourism tend to be less efficient, due to their lower level of occupancy in the low season. Contrasting with both these views, Dapeng et al. (2020) found that in tourist areas efficiency was not affected by location, although this factor did increase the negative effects of competition on hotel efficiency.

Seasonality is another factor that can affect the efficiency of hotels located in tourist areas. According to Lado-Sestayo and Fernández-Castro (2019), the concentration of business activity within specific periods has a positive effect on prices and enables cost savings. Pulina and Santoni (2018), on the other hand, indicated that a strong seasonal distribution tends to heighten inefficiencies. In any case, this factor does not appear to contribute significantly to the efficiency results obtained in our study. From the standard deviations obtained for the monthly levels of hotel occupancy and the number of monthly overnight stays, we conclude that the Balearic Islands present the highest level of seasonality in Spain, and the Canary Islands, the lowest, while Andalusia (measured through monthly overnight stays) is below the national average, according to data calculated from the Hotel Occupancy Survey (INE, 2019).

In each of these three regions, the model of tourism is predominantly that of Sun and Beach, a focus which could be associated with greater hotel efficiency (Sellers-Rubio and Casado-Díaz, 2018; Lado-Sestayo and Fernández-Castro, 2019). Furthermore, many of the hotels are located in resort areas, a distribution that is also associated with higher levels of efficiency (Arbelo et al., 2017; Arbelo et al., 2018). In addition, these regions receive large numbers of international tourists (only Catalonia has more) and enjoy high rates of hotel occupancy. In this respect, the island regions exceed the national average and all other regions (INE, 2019). For the hotels in question, each of these factors is associated with greater efficiency (Hwang and Chang, 2003; Parte-Esteban and Alberca-Oliver, 2015; Sellers-Rubio and Casado-Díaz, 2018; Lado-Sestayo and Fernández-Castro, 2019). Finally, the island regions have the greatest proportion of large

Table 6. Mean value of TGR by region.

REGION	Hotels	Short-term rentals	Campsites	Other accommodation
Andalusia***	0.8910	0.8956	0.6398	0.6714
Aragon***	0.8701	0.9234	0.6208	0.6190
Asturias***	0.8601	0.9247	0.6266	.
Balearic Islands***	0.9204	0.8491	0.6878	0.6959
Canary Islands***	0.9466	0.8244	0.6560	0.8956
Cantabria***	0.8444	0.9014	0.5895	0.7477
Castilla y León***	0.8561	0.8760	0.6283	0.7038
Castilla La Mancha***	0.8591	0.8720	0.6360	0.7431
Catalonia***	0.8876	0.8926	0.6620	0.7218
Ceuta	0.9658	0.9643		
Valencia***	0.8819	0.8914	0.6405	0.8736
Extremadura***	0.8727	0.8965	0.6080	0.5562
Galicia***	0.8697	0.8796	0.6341	0.6599
La Rioja***	0.8843	0.9881	0.6125	
Madrid***	0.8885	0.9010	0.6386	0.6768
Melilla	0.8729			0.5652
Murcia***	0.8939	0.9232	0.6677	
Navarra***	0.8487	0.8900	0.5994	0.6492
Basque Country***	0.8643	0.9223	0.6367	0.8103

***Differences are assumed to be significant at 1% according to the Kruskal-Wallis test for the TGR.

hotels in the entire sample (these establishments account for 37% of the sample in the Canary Islands and 28% in the Balearic Islands). This, too, might contribute to the greater hotel efficiency observed in these regions (Assaf and Agbola, 2014).

6. Conclusions

The tourism industry is one of the most important economic sectors, not only internationally but also for the specific case of Spain, which is one of the most important tourist destinations in the world. This sector is characterised by high levels of competition, which are accentuated by globalisation. In this context, it is very useful to analyse the efficiency of the sector, in order to determine performance and to apply a study method that reveals the efficiency achieved by different types of tourist accommodation.

The efficiency analysis we present is based on a sample of 4,849 Spanish companies operating in the field of tourist accommodation. This paper makes two novel contributions to our understanding. Firstly, the study sample contains a very large number of companies. In addition, these firms are widely diverse, featuring not only hotels but several other types of tourist accommodation, too. Finally, the study method applied is very suitable to achieve the goals described.

The following main results were obtained. Spanish accommodation companies operate with a technical efficiency of 44.95%. However, this value differs according to the type of accommodation considered. The metafrontier concept was applied to determine which type of accommodation obtained the highest levels of efficiency. This analysis showed that Hotels are the most efficient type and Campsites, the least. Data envelopment analysis (DEA), in conjunction with use of the metafrontier concept, enhanced the quality of comparison made, revealing differences in efficiency estimations when the comparison was focused on a group of homogeneous companies (local efficiency) or on other types of companies (metafrontier efficiency). The efficiency of the different types of accommodation varies according to the size and location of the company. For example, among micro-companies, the category Short-term rentals is the most efficient, while for companies with more than 10 employees, hotels are the best performers. As regards location, the hotel sector presents high levels of efficiency in regions that specialise in sun and beach tourism, especially the island regions. These regions have high levels of hotel occupancy and receive a considerable number of international tourists. Moreover, there is a higher proportion of large hotels in these regions than elsewhere.

The results and conclusions presented in this paper could be used as a benchmarking tool by national and regional public institutions, enabling them to establish appropriate regulatory policies and increase the efficiency of companies operating in this context, a factor that is especially important in the current post-pandemic period. The companies, too, may benefit directly from this analysis, using it to establish an effective strategy for improving their efficiency. Thus, for example, micro-enterprises in the tourist accommodation sector could take as a reference the strategies undertaken by some successful companies in the Short-term rentals category, while companies with more than 10 employees, as well as those located in regions specialising in sun and beach tourism, should try to imitate some of the strategies implemented by the hotels.

However, this study also presents some limitations, which must be acknowledged. First, this study only refers to different accommodation companies, as it is provided in the SABI database, but in some cases, these companies may have different establishments distributed geographically, that have not been considered in the present analysis. Moreover, the spatial distribution of the companies included in the sample was not considered in our analysis and it may influence aspects such as market concentration, levels of occupancy, seasonality and other factors related to the tourist destination, which may influence the efficiency of individual operating companies. Our analysis was limited to a regional perspective. Additionally, other limitation is that a cross-sectional analysis was performed.

For future research, it would be useful to extend the database and take into account how many establishments each accommodation type has and its specific location and study the effects of the main characteristics of tourist destinations on the efficiency of the accommodation sector, applying spatial econometric models.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Annex

Annex I. Observations by typology and region.

REGION	Hotels	Short-term rentals	Campsites	Other accommodation
Andalusia	389	118	46	20
Aragon	104	22	21	1
Asturias	77	16	14	0
Balearic Islands	457	156	3	14
Canary Islands	291	158	2	7
Cantabria	65	13	11	2
Castilla y León	151	29	7	20
Castilla La Mancha	70	12	6	5
Catalonia	757	198	172	38
Ceuta	1	1	0	0
Valencia	255	89	51	6
Extremadura	36	9	8	1
Galicia	129	25	9	7
La Rioja	16	2	4	0
Madrid	360	67	14	33
Melilla	3	0	0	1
Murcia	31	5	9	0
Navarra	48	8	13	2
Basque Country	98	23	9	4
Total	3338	951	399	161