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A DEA Approach for Evaluating the Labor Efficiency in the Rural Hotel Industry: A Case Study in Spain

Abstract

In this paper, labor efficiency in the rural hotel industry is analyzed while considering the characteristics regarding labor and infrastructure of the various Spanish provinces. The methodological procedure consisted of the analysis of 52 Spanish provinces. As analysis, Data Envelopment Analysis (DEA) and Multivariate Analysis have been used. Although rural tourism is consolidated in the Spanish holiday culture, the effect of labor efficiency on Spanish provinces is uneven. Performance depends on the geographical area; thus, labor efficiency is only achieved in Asturias and Balearic Islands, where rural tourism has a strong and positive impact on employment. The variable length of stay of the holiday period carries important weight for labor efficiency to be reached in said provinces. It can be observed that hotels located in places with charm and with special environmental protection contribute directly to the labor efficiency of the area due to the direct relationship between the area of protected land and the labor efficiency of the province. Several provincial groups are established with a variety of different characteristics, which confirms that the level of labor efficiency in the sector has yet to be maximized.

Keywords: rural tourism, hotel industry, efficiency assessment, labor efficiency, data envelopment analysis, Spain

1. Introduction

The evolution of the employed population in Spain has been marked by the economic crisis since, in 2008, the employed population suffered a major collapse. Similar to other sectors, the agricultural sector has also been immersed in a trend of job losses; this situation is not temporary but structural because it has remained the case since the 1960s[1]. This scenario results in an uncertain future in the agricultural sector.

A possible solution to this problem is rural tourism; this is relevant in terms of both income and the creation of jobs. Rural tourism constitutes a major economic alternative for rural areas and a strategic axis for rural territorial development. So, the rural hotel industry can be a key activity to generate employment and rural development. This sector provides opportunities for local employment (Sánchez & Sánchez, 2018), fiscal income, and economic diversity (Wang & Pfister, 2008), thereby enabling the development of certain economic rural areas and socially depressed areas to be promoted (Yagüe, 2002; Fleischer & Felsenstein, 2000; Dernoi, 1991). The potential of the sector has been confirmed since the number of people employed in rural tourism has tripled over the last 15 years.

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[1] Reforms in agricultural policy (single-farm payment, compliance with environmental standards, reduction in subsidies, etc.) have caused a significant loss of income, the abandonment of farms, and, consequently, the loss of employment in the agricultural sector.

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Given the role of employment as a key factor in assessing the importance of tourism, this paper focuses on this variable and studies the impact of the sector in terms of labor efficiency in various Spanish provinces.

The measurement of efficiency is a topic of growing interest, mainly due to the competitive environment in which we live, where improvements in profitability and the pursuit of optimal and efficient use of resources are constantly sought (Tavares, 2002; Seiford, 1997). The definition of economic efficiency establishes "that all effects resulting from an economic sense surpasses integrated effort that you have it" (Angelescu et al., 2005, p. 14). In other words, efficiency is associated with the maximum output that can be achieved using certain resources (inputs).

The question that arises is whether rural hotels are capable of creating employment efficiently using available resources. Given the enormous competitiveness in tourism, the study of labor efficiency allows us to know how the hotel industry contributes to increasing the competitiveness of the sector and to the development of the rural environment. The main novelty and contribution of the paper is the type of hotel analyzed, focusing on a very specific geographic destination in rural Spanish areas.

In this context, the first objective of the present paper is to evaluate both labor efficiency in Spanish rural hotels and the development of a provincial efficiency ranking. Secondly, provincial groupings will be determined according to the level of efficiency, which will enable the results of the provincial ranking to be validated.

In order to measure labor efficiency, a non-parametric method, known as Data Envelopment Analysis (DEA), will be applied based on mathematical programming. This analysis has proved useful in a wide variety of contexts and applications (Yang & Li, 2018; Gémara et al., 2018; Gkiza & Nastis, 2017; Ramírez-Hurtado & Contreras, 2017; Balaguer-Coll & Prior, 2009; Toma, 2014; Alzua-Sorzabal et al., 2015). The DEA methodology has been frequently used to study hotel efficiency (see, for example, Lado-Sestayo & Fernández-Castro, 2019; Kularatne et al., 2019; Sellers-Rubio & Casado-Díaz, 2018; Solana-Ibáñez et al., 2016; Ohe & Peypoch, 2016; Benito et al., 2014; Barros, Botti, Peypoch, Robinot et al., 2011; Barros, Botti, Peypoch, & Solonandrasana, 2011) using different inputs and outputs. These papers focus on the study of the sample, on the development of the methodology used, or on the identification of the factors that determine it. Morey and Dittman (1995) applied DEA for the first time in the hotel industry to evaluate the performance of 54 hotels in the United States. Since then, the hotel efficiency literature has widely applied the Cooper-Charnes-Rhodes (CCR) and Banker-Charnes-Cooper (BCC) models (Banker et al., 1984; Charnes et al., 1978).

The present paper is structured as follows. Section 2 analyses the main features of the rural hotel industry in Spain. Section 3 compiles works that have applied the DEA analysis to the tourism sector. Data and methodology are presented in Section 4. The results are given in Section 5. Finally, in Section 6, a summary of considerations is made.

2. The rural hotel industry in Spain

Spain is the world leader in holiday tourism, ranking second in terms of tourist income and number of tourists (World Tourism Organization [UNWTO]). This sector shows a dynamic behavior in continuous expansion even in periods of crisis and in synergy with other sectors, being one of the axes for the economic development of the country (Cuñado et al., 2011).

The offer of rural accommodation has been a fundamental element for the tourist growth of rural areas (Sánchez-Sánchez & Sánchez-Sánchez, 2021a, b; Cánoves et al., 2005). In Spain, tourist accommodation is classified into three different categories: hotel accommodation, non-hotel accommodation, and rural accommodation. In turn, within each of these modalities, different subcategories are established (see Table 1).

Table 1
Types of tourist accommodations in Spain

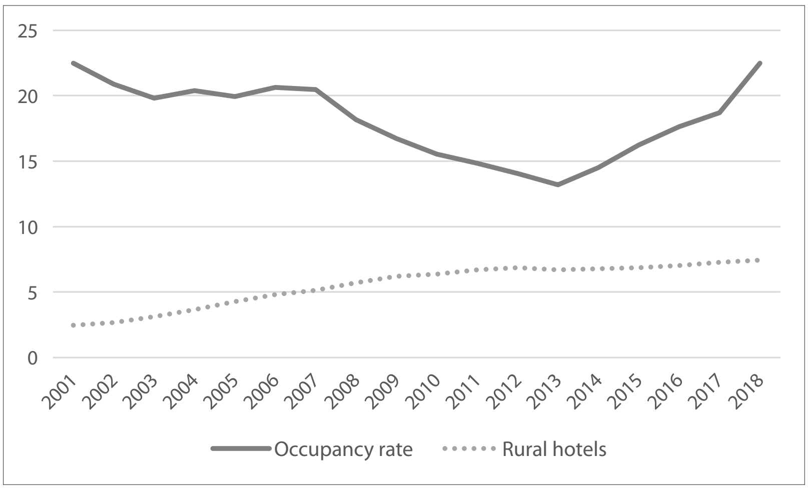
Hotel accommodations	Non-hotel accommodations	Rural accommodations
Hotels Aparthotels Hostels Boarding houses	Tourist apartments Tourist lodgings Tourist camps Camping areas Others according to the law	Rural hotels Rural houses

Source: Author's own, based on Law 2/2011, of January 31, on the development and modernization of tourism in Extremadura (Ley 2/2011).

The main keys to rural accommodation are functionality and integration into the rural environment, its location, the type of construction (which should be as similar to the surroundings), the restoration offered, the interior design, etc.

In the decade of the 80s of the 20th century, a regulatory development for rural accommodation took place in Spain. As a consequence of this, there was a generalized growth of the supply, although it is from the 21st century when there is a more intense growth, reaching the spread of the idea that the supply is oversized, not corresponding with the demand, which gives place at low occupancy levels (Grande, 2006). This oversizing is especially evident in some time periods. The occupancy rate is quite uneven depending on the period considered, producing a decrease in the occupancy level during the period of economic crisis (years 2007 to 2013), while from 2013, the occupancy rate acquired considerable growth. However, in the hotel supply, the growth is constant, being even more significant during the period of economic crisis (Figure 1).

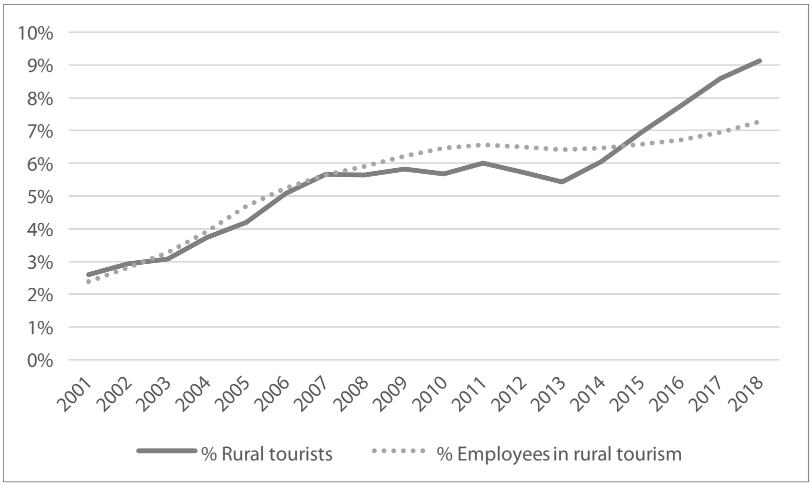
Figure 1
Supply evolution and occupancy rate in Spain (%)



Source: The authors, based on data from the Spanish National Statistics Institute.

At present, rural tourism in Spain is fully established, having experienced a very notable increase, especially in the last five years; this boom has contributed to generating employment in the sector (Figure 2). The increase in the number of tourists is related to a significant change in the supply of rural hotel accommodations. In this sense, the trajectory of rural hotel accommodation shows a progressive expansion (Figure 1). However, despite this growth, Spanish rural tourism is in an intermediate position compared to the most established destinations in this type of tourism, such as Great Britain, Germany or France, and the countries of Eastern Europe where this type of tourism is incipient (Cánoves et al. 2012).

Figure 2
Evolution of tourists and employed population in rural tourism in Spain (%)



Source: The authors, based on data from the Spanish National Statistics Institute.

3. Efficiency analysis in the tourism sector

Efficiency evaluation is basic for tourism management since it helps in the decision-making process and provides a competitive advantage, becoming an important tool to measure the performance of hotels (for a review of the literature on the sector, see, for example, Soltani et al., 2009).

To evaluate efficiency, non-frontier type models were applied (Wijeysinghe, 1993; Wassenaar & Stafford, 1991; Baker & Riley, 1994; Donaghy et al., 1995), although, at present, models based on the concept frontier are used. With respect to this last approach, two different analysis methodologies are used: on the one hand, the DEA and, on the other hand, the parametric stochastic frontier. The DEA methodology (Charnes et al., 1978) is a non-parametric method of linear programming (see, for example, Barros, 2005a; Tsaur, 2001; Johns et al., 1997). As for the parametric stochastic frontier methods (Aigner et al., 1977; Meeusen & van den Broeck, 1977), they are based on econometric models; some papers which use this methodology to analyze efficiency in the hotel industry are those of Barros (2004), Weng and Wang (2006), Kim (2011), Oliveira et al. (2013), Guetat et al. (2015) and Arbelo-Pérez et al. (2017). Recent studies apply more complex methods to analyze efficiency, such as the meta-frontier (Assaf et al., 2012) or bootstrapping techniques (Assaf & Cvelbar, 2010; Yin et al., 2015).

The DEA methodology has several advantages over stochastic frontier methods, but the main advantage is that being a non-parametric method, it is not necessary to consider a functional way to relate inputs and outputs (in the stochastic frontier method, it is necessary).

In recent years, many studies have applied the DEA technique for the analysis of various aspects of efficiency in tourism activity, such as in hotel studies (Higuerey et al.,2020; Lado-Sestayo & Fernández-Castro, 2019; Kularatne et al., 2019; Karakitsiou et al., 2018; Solana-Ibáñez et al., 2016; Ohe & Peypoch, 2016; Manasakis et al., 2013; Assaf et al., 2012; Hsieh & Lin, 2010; Perrigot et al., 2009; Zhou et al., 2008), travel agencies (Dragan et al., 2018; Ramírez-Hurtado & Contreras, 2017; Fuentes, 2011; Köksala & Aksub, 2007; Barros & Dieke, 2007) or airlines (Shirazi & Mohammadi, 2019; Yu et al., 2019; Sakthidharan & Sivaraman, 2018).

There are also DEA applications in the rural tourism sector, for which certain studies analyze the productivity in specific segments of tourism, as in Pestana (2005), which focuses on the efficiency of Portuguese Guest Houses. Other work distinguishes between technical and scale efficiency (Pestana & Mascarenhas, 2005).

Regarding the study sample, the research has focused both on measuring the efficiency of the hotel brand and on studying a sample of hotels in a given destination. From this last perspective, the papers have focused on Asia (Liu et al., 2017; Yi & Liang, 2015; Huang et al., 2012; Wang et al., 2007); the United States (Anderson et al., 1999; Brown & Ragsdale, 2002; Morey & Dittman, 1995), and Europe (for example, in the case of Spain, see Deng et al., 2019 or De Jorge & Suárez, 2014).

Barros and Dieke (2008) compiled the inputs and outputs commonly used in hotel efficiency studies. At the same time, Ball et al. (1986) classified the inputs and outputs used in the DEA methodology into three thematic groups: financial variables, physical variables, and composite variables (reflecting financial and physical variables, for instance, the number of rooms sold/total cooking costs.). As physical variables, the number of employees (Cvetkoska & Barišić, 2017; Oukil et al., 2016; Hadad et al., 2012) and the number of available beds (Assaf et al., 2015; Solana-Ibáñez et al., 2016; Barros, 2005a) are usually used. As financial variables, operating costs (Anderson et al., 2000; Wang et al., 2007), employee salaries (De Jorge & Suárez, 2014; Barros, 2005b), and also profits, income, and sales (Barros & Alves, 2004; Shang et al., 2008; Parte-Esteban & Alberca-Oliver, 2015) are used.

Table 2 shows a summary of the main characteristics of some papers related to hotel tourism efficiency. Recent studies try to explain hotel efficiency through the identification of the factors that determine it (Assaf & Josiassen, 2012; Assaf et al., 2012; De Jorge & Suárez, 2014; Parte-Esteban & Alberca-Oliver, 2015; Yang et al., 2017; Sellers-Rubio & Casado-Díaz, 2018).

The papers which study hotel efficiency in Spain are quite recent (Benito et al., 2014; De Jorge & Suárez, 2014; Parte-Esteban & Alberca-Oliver, 2015; Fernández & Becerra, 2015; Solana-Ibáñez et al., 2016; Arbelo-Pérez et al., 2017). In this context, there are no papers that have specifically studied the hotel efficiency of the Spanish rural sector.

Table 2
References of DEA applications to the tourism sector

Reference	Time frame	Units of analysis	Inputs	Outputs
Hwang & Chang (2003)	1994-1998	45 Hotels in Taiwan	Number of full-time employees, number of hotel rooms, food, and drink storage area, operating expenses.	Income per hotel room, food and beverage income, other income.
Barros & Mascarenhas (2005)	1999-2001	43 Hotels in Portugal	Number of full-time employees, asset value, number of hotel rooms.	Sales, number of tourists, number of overnight stays.
Chiang (2006)	2001	24 Hoteles in Taipei	Number of hotel rooms, food, and drink storage area, number of employees, operating expenses.	Performance index, food and beverage income, other income.
Pulina et al. (2010)	2002-2005	19 regions and 2 provinces	Labor costs.	Sales revenue, value-added.
Rabar & Blažević (2011)	2008	21 counties in Croatia	Number of beds, number of bed places, number of employees.	Number of arrivals, number of nights, invoicing volume.
Barros, Botti, Peypoch, Robinot et al. (2011a)	2003-2007	22 Hotels in French regions	Accommodation capacity, number of tourists.	Number of overnight stays.
Barros, Botti, Peypoch, & Solonandrasana (2011)	1998-2005	15 Hotels in Portugal	Number of full-time employees, book value of property, operating expenses.	Sales, number of tourists.
Huang et al. (2012)	2001-2006	31 Hotels in Chinese regions	Number of full-time employees, number of tourists, asset value.	Total revenue, average occupancy rate.
Hadad et al. (2012)	2008	34 Hotels in developed countries and 71 hotels in developing countries	Number of employees, number of hotel rooms, natural and cultural resources.	Number of tourists.
Detotto et al. (2014)	2000-2006	21 regions in Italy	Gross fixed investment, labor costs.	Sales revenue, value added.
Benito et al. (2014)	2002-2010	17 regions in Spain	Number of accommodation places, number of tourists.	Number of beds.

Table 2 ***(continued)***

Solana-Ibáñez et al. (2016)	2005–2013	17 Hotels in Spanish regions	Number of beds, number of overnight stays.	Number of tourists who stay at least one night, determinants of efficiency (tourist attractions and services), coastal destinations, number of cultural assets, number of museums, meeting attendance percentage, number of federated golf clubs, number of restaurants, number of retailers.
Soysal-Kurt (2017)	2013	29 European countries	Number of employees in tourism sector, tourism expense, number of beds.	Number of tourists, tourism income, number of overnight stays.
Cvetkoska & Barišić (2017)	2010-2015	11 Balkan countries	Number of international tourists, national travellers, tourism expense.	Contribution of tourism sector to GDP, employment.
Sellers-Rubio & Casado-Díaz (2018)	2008-2016	17 Hotels in Spanish regions	Number of hotels, number of beds, number of employees, length of stay, number of international tourists, sun and beach tourist product, number of hotels distinguished with quality distinction.	Average daily expenditure, income per hotel room, average occupancy rate.

Note: SBM indicates slacks-based measure.
Source: Authors.

4. Data and methodology

In this study, the data used has been obtained from official statistics published by the Spanish National Statistics Institute and the National Geographic Institute of Spain for 2016.

The unit of analysis is that of the province, which is understood as a Spanish administrative demarcation. Today there are 52 provinces that comprise the entire Spanish territory. Each province is divided into a variable number of municipalities, and their governments and administration are constitutionally attributed to provincial councils.

The selection of inputs and outputs is based on a review of the literature and the availability of reliable data sources. In the paper of Sánchez and Sánchez (2018), variables such as the number of travelers, overnight stays, establishments, places offered, and employees in rural tourism are used to analyze the impact of rural tourism on employment, showing the usefulness of these variables to characterize the factor that they define as *Tourism-Labor Dynamism*. Some of these variables are also frequently used in the literature to study tourism efficiency (see, for example, Deng et al., 2019; Sellers-Rubio & Casado-Díaz, 2018; Soysal-Kurt, 2017; Hadad et al., 2012; Huang et al., 2012; Lozano & Gutiérrez, 2011; Hwang & Chang, 2003).

A data matrix is formed of 6 variables collected for the 50 Spanish provinces (Ceuta and Melilla provinces are excluded from the analysis due to a lack of information on many of the variables).

For DEA, only one output is considered: that of staff employed in rural tourism (y1). There are, however, five inputs: Travellers (x1), overnight stay (x2), time of stay (x3), open establishments (x4), and seats offered (x5). These variables, together with some descriptive measures, are shown in Table 3.

For the selection of inputs and outputs considered, it has been considered that employment in the rural tourism sector is based on the number of tourists, their accommodation needs, and/or the resources to which tourism is related (i.e., the necessary infrastructure).

The selection of inputs and outputs has been made according to the following efficiency approach. We consider that efficiency occurs when, to serve travelers, taking into account the rest of the inputs, the maximum possible number of employees are hired. Therefore, we talk about efficiency in terms of generating the maximum possible employment.

In order to verify the suitability of the selected inputs and outputs, an isotonicity test is performed (Sigala et al., 2004; Chiang, 2006). Isotonicity refers to the assumption that the inputs and outputs must have a positive correlation, which means that the higher the value of the inputs, the higher the value of the output will also be. Table 4 shows both Pearson's correlation coefficients in pairs between the five inputs and the output, and the p-values, to contrast the significance of the relationships between the pairs of variables.

Table 3
Data description

Variables	Description	Metric	Average	Std. deviation
y1	Employees: number of staff employed in rural tourism	People	450.84	332.509
x1	Travelers: number of people carrying out a tourist trip	People	4,952.22	3,742.933
x2	Overnight stay: number of travelers housed in an establishment for the night	People	12,257.12	10,664.009
x3	Length of Stay: duration of the stay in an area	Days	2.50	0.763
x4	Establishments: places where rural tourism activities take place	Number	314.86	232.202
x5	Vacancy: unoccupied bed in a tourist accommodation establishment	Number	2,974.56	1,990.148

Source: Authors.

Table 4
Pearson's correlation coefficients and p-values

	Travellers	Overnight stays	Length of stay	Establishments	Vacancies	Employees
Travelers	1	0.962**	-0.158	0.705**	0.852**	0.642**
		(0.000)	(0.274)	(0.000)	(0.000)	(0.000)
Overnight stays	0.962**	1	-0.036	0.791**	0.914**	0.705**
	(0.000)		(0.807)	(0.000)	(0.000)	(0.000)
Length of stay	-0.158	-0.036	1	0.259	0.154	0.345*
	(0.274)	(0.807)		(0.069)	(0.287)	(0.014)
Establishments	0.705**	0.791**	0.259	1	0.916**	0.830**
	(0.000)	(0.000)	(0.069)		(0.000)	(0.000)
Vacancies	0.852**	0.914**	0.154	0.916**	1	0.890**
	(0.000)	(0.000)	(0.287)	(0.000)		(0.000)
Employees	0.642**	0.705**	0.345*	0.830**	0.890**	1
	(0.000)	(0.000)	(0.014)	(0.000)	(0.000)	

*p<0.05 **p<0.01.
Source: Authors.

All the inputs are significant and positively correlated with the output. These inputs are correlated with a 1% significance except the variable length of stay, which presents a positive correlation with a 5% significance with the output. Note that all the inputs (except length of stay) are positively correlated with each other, which indicates that provinces with more tourists also have more overnight stays, more tourist establishments, and offer more availability in rural tourism. The presence of these correlations points to a possible redundancy in the dimensions of the selected inputs and outputs (except for the variable length of stay). To reduce the data dimension, a Multivariate Analysis is carried out.

4.1. Data envelopment analysis

DEA is a non-parametric methodology that is employed to ascertain the efficiency level of a set of Decision-Making Units (DMUs) on the basis of data that contain information on certain variables. The variables are classified as inputs or outputs in accordance with a certain production process, and the information is concerned with the consumption of inputs and the production of outputs.

DEA methodology assigns an efficiency value to each DMU in order to compare efficient and inefficient units.

The standard input-oriented CCR DEA model is used here, as introduced by Charnes et al. (1978). Let $U=\{1,2,\ldots,u\}$ be a set of independent DMUs, each of which consumes a set of different inputs, $I=\{1,2,\ldots,n\}$, in quantities x_{ij} to generate a set of different outputs, $O=\{1,2,\ldots,m\}$, in quantities y_{kj}. (x_{ij} is the quantity of the input i for DMU j and y_{kj} is the quantity of the output k for DMU j).

The efficiency value of a DMU, $j_0 \in U$, is computed as:

$$
\begin{aligned}
E(j_0) = \quad & \min \theta_{j_0} \\
s.t. \quad & \sum_{j \in U} \lambda_j x_{ij} \leq \theta_{j_0} x_{ij_0} \quad for\ all\ i \in I \\
& \sum_{j \in U} \lambda_j y_{kj} \geq y_{kj_0} \quad for\ all\ k \in O \\
& \lambda_j \geq 0 \quad for\ all\ j \in U \\
& \theta_{j_0} \quad free.
\end{aligned} \tag{1}
$$

DMU $j_0 \in U$ is efficient if $E(j_0) = 1$ and the deviation variables in the reformulated model below, $s_{ij_0}^{-}$ and $s_{kj_0}^{+}$, are both ze

$$
\begin{aligned}
\min \quad & \theta_{j_0} - \varepsilon \left(\sum_{i \in I} s_{ij_0}^{-} + \sum_{j \in O} s_{kj_0}^{+} \right) \\
s.t. \quad & \sum_{j \in U} \lambda_j x_{ij} = \theta_{j_0} x_{ij_0} - s_{ij_0}^{-} \quad for\ all\ i \in I \\
& \sum_{j \in U} \lambda_j y_{kj} = y_{kj_0} + s_{kj_0}^{+} \quad for\ all\ k \in O \\
& \lambda_j \geq 0 \quad for\ all\ j \in U \\
& s_{ij_0}^{-} \geq 0 \quad for\ all\ i \in I \\
& s_{kj_0}^{+} \geq 0 \quad for\ all\ k \in O \\
& \theta_{j_0} \quad free,
\end{aligned} \tag{2}
$$

where ε is a non-archimedean constant.

A ranking of inefficient DMUs can be performed in accordance with the efficiency values obtained from the previous DEA (the inefficient units obtain their level of efficiency reflected by a score lower than 1), whereas the efficient DMUs cannot be ordered in these terms since they all have a score efficiency value equal to 1. Various approaches in DEA are also available that extend the basic models for the additional ranking of efficient and not only the inefficient DMUs. One of the most commonly used approaches consists of dropping the DMU j_0 being ranked from the initial set of DMUs. This approach is based on super-efficiency since it can lead to efficiency values greater than 1, which can be used to rank all the DMUs. One advantage of this approach over others is that it is applied to rank only the efficient DMUs because the super-efficiency values coincide with the efficiency values for all inefficient units.

For the standard input-oriented CCR DEA model, the super-efficiency value of a DMU, $j_0 \in U$, is computed as:

$$
\begin{aligned}
E^{super}(j_0) = \quad & \min \theta_{j_0} \\
s.t. \quad & \sum_{j \in U \setminus \{j_0\}} \lambda_j x_{ij} \leq \theta_{j_0} x_{ij_0} \quad for\ all\ i \in I \\
& \sum_{j \in U \setminus \{j_0\}} \lambda_j y_{kj} \geq y_{kj_0} \quad for\ all\ k \in O \\
& \lambda_j \geq 0 \quad for\ all\ j \in U \setminus \{j_0\} \\
& \theta_{j_0} \quad free.
\end{aligned} \tag{3}
$$

4.2. Multivariate analysis

Techniques of Multivariate Analysis that will be applied for the treatment of data are those of Factorial analysis and Cluster analysis.

4.2.1. Factorial analysis

The purpose of factor analysis is to identify the factors or dimensions which explain the correlations between the variables. The information initially contained in the observed variables is summarized, through combinations of these, thereby obtaining the dimensions sought. A small number of latent or unobserved variables (dimensions or factors) are then achieved, which explain, in the simplest possible way, the reasons for the variety in the behavior of a set of individuals for whom a set of original variables have been observed.

The act of dealing with variables with different scales leads to the standardization of the variables (for each variable, its average is subtracted and divided by its standard deviation) and to the consideration of the correlation matrix. The variables are therefore treated in relative terms.

4.2.2. Cluster analysis

The factors extracted through the application of Factorial Analysis are employed to identify groups of provinces with homogeneous characteristics through the use of Cluster Analysis. This statistical technique of multivariate analysis is a method of classification that groups objects based on the characteristics they possess. The main objective of this analysis is to identify groups of relatively homogeneous cases based on the selected characteristics. The fundamental idea is that the objects belonging to the same conglomerate or group are as similar as possible to each other, while the conglomerates differ as much as possible (Hair et al., 2000).

For the application of Cluster Analysis, the Euclidean squared distance is used as a measure of similarity between individuals (in our case, the provinces) in order to measure how close or far the values of the variables are. For the creation of the clusters, there are two different methods, hierarchical methods, and non-hierarchical methods. The hierarchical methods contemplate all possible groupings. Non-hierarchical methods are characterized by the allocation of groups of individuals in a fixed number of clusters. In our analysis, first, a hierarchical process is applied, which determines the most appropriate number of clusters, k. Subsequently, the non-hierarchical method of k-means is applied.

5. Results

For the analysis of the labor efficiency in the rural tourism sector of the 50 Spanish provinces, the results are presented in two different ways: on the one hand, the ranking of provinces according to their labor efficiency/inefficiency through the application of the DEA; and the other hand, the analysis of efficiency by applying Multivariate Analysis techniques.

5.1. Labor efficiency ranking

Results show that there are two provinces that achieve labor-relative efficiency: Asturias and Balearic Islands. We talk about relative efficiency in terms of how efficient a province can be when measured in comparison to the remaining 49 provinces. Table 5 presents the provincial ranking of labor efficiency of the rural tourism sector and shows the provinces in decreasing order according to the super-efficiency value.

Despite the development of rural tourism in Spain, this has yet to achieve a full or efficient impact on employment in the Spanish provinces since there are few provinces that achieve labor efficiency.

Table 5
Ranking and super-efficiency values of the provinces

	Ranking of provinces	Super-efficiency value		Ranking of provinces	Super-efficiency value
1	Balearic Islands	3.6929970	26	Almería	0.4743742
2	Asturias	1.1559970	27	Palencia	0.4700622
3	Ávila	0.9817746	28	Castellón	0.4678038
4	Albacete	0.8199854	29	Zamora	0.4656868
5	Santa Cruz de Tenerife	0.8045722	30	A Coruña	0.4602914
6	León	0.8017380	31	Guadalajara	0.4586041
7	Cáceres	0.7652326	32	Ourense	0.4363128
8	Girona	0.7544049	33	Badajoz	0.4238794
9	Lleida	0.7510497	34	Tarragona	0.4231170
10	Salamanca	0.7195032	35	Teruel	0.4217691
11	Cantabria	0.7161946	36	La Rioja	0.3970909
12	Segovia	0.6986611	37	Córdoba	0.3905162
13	Huelva	0.6917766	38	Alicante	0.3901605
14	Las Palmas	0.6394231	39	Zaragoza	0.3866835
15	Navarra	0.6339226	40	Ciudad Real	0.3825063
16	Barcelona	0.6329665	41	Granada	0.3817472
17	Valencia	0.6118908	42	Jaén	0.3800827
18	Madrid	0.6058760	43	Lugo	0.3800826
19	Huesca	0.5820033	44	Cádiz	0.3792652
20	Burgos	0.5437632	45	Pontevedra	0.3673171
21	Málaga	0.5388433	46	Murcia	0.3449025
22	Seville	0.5058400	47	Gipuzkoa	0.3353903
23	Soria	0.4946934	48	Álava	0.3090391
24	Cuenca	0.4827923	49	Toledo	0.3079688
25	Valladolid	0.4775045	50	Bizkaia	0.3035764

Source: Authors.

Figure 3 represents the spatial distribution of Spanish provinces by considering their efficiency scores. Light greyish colors predominate since these delimit a low labor efficiency score. The average score of provincial efficiency is 0.5438, which verifies that 31 of these provinces achieve a below-average efficiency score, while just over a third (19 out of 50) exceeds that score.

Figure 3
Provincial representation in terms of efficiency score

Source: Authors.

The protection of the environmental, ecological, and cultural diversity of rural areas remains fundamental for the sustainable development of the environment. This suggests that there may be a relationship between labor efficiency and the size of the protected natural areas in the province (natural and national parks, natural reserves, protected landscapes, and natural monuments), since the provinces of the ranking that present the highest super-efficiency score are those with the greatest number of hectares of protected land. Therefore, the possible relationships between this measurement of efficiency and the hectares of protected land in each province are evaluated. In order to test this hypothesis, the Kruskal-Wallis test is applied since the normality of the samples remains unverified (Kruskal & Wallis, 1952; Brockett & Golany, 1996). It is verified whether significant differences exist in the average values obtained in the super-efficiency scores among the various groups in which the provinces have been divided in terms of the protected hectares. Four groups of provinces are considered according to the area of protected land: less than 30,000 hectares; between 30,000 and 100,000 hectares; between 100,001 and 200,000 hectares; and more than 200,000 hectares. The Kruskal-Wallis test (Chi-squared=9.375; p=0.025) leads us to reject, with a 5% significance, the hypothesis of equality of means for the super-efficiency scores in the four groups of provinces categorized in terms of the area of protected land. When observing the average values for each group, it can be observed that the provinces with the highest number of protected hectares obtain a higher average super-efficiency score (0.6259) than that of the provinces with the least protected hectares (0.4495). This verifies that the "environmental charm" of the area influences its labor efficiency.

5.2. Analysis of efficiency

In the second part of the analysis, multivariate analysis techniques are used (Factor analysis and Cluster analysis) in an attempt to determine the possible links between provinces (based on the inputs and outputs employed) and the efficiency scores obtained.

5.2.1. Factorial analysis

Bartlett's test of sphericity confirms whether the correlation matrix is an identity matrix, which would indicate that the factorial model is inadequate. Bartlett's test (481.822) is obtained from the χ^2 transformation of the determinant of the correlation matrix, whereby the higher it is, and therefore the lower it's level of significance (0.000), the more unlikely it is that the matrix is an identity matrix, and the more appropriate the factor analysis becomes, which is what happens in our case. As a complement to this analysis, the Kaiser-Meyer-Olkin coefficient, KMO, can be calculated (0.752), whose value results in excellent sample suitability; in our study, therefore, the application of factor analysis is completely appropriate.

According to the criteria for the selection of eigenvalues (retain those whose value exceeds the unit), two dimensions have been selected, which explain 88.284% of the variability (see Table 6). This percentage of explained variance is more than acceptable since the lower level of acceptance is fixed at 60% in studies related to Social Sciences (Hair et al., 2000). The results show a projection of the data in a small space with small dimensions, which was predictable due to the high correlations observed when the isotonicity between inputs and outputs was analyzed.

Table 6
Extracted dimensions and explained variance

	Eigenvalue	% of variance	% cumulative variance
Dimension 1. Tourist-labor efficiency	4.937	70.526	70.526
Dimension 2. Length of stay	1.243	17.758	88.284

Source: Authors.

In Table 7, the factorial matrix is shown, in which the linear correlation coefficients between the dimensions and the variables are collected. This matrix indicates a load of each variable in each dimension such that the dimensions with higher factor weights in absolute terms indicate a close relationship with the variables.

The first dimension, at 70.526% of the total variability (Table 6), can be explained as being strongly related to six of the seven variables used (seats, establishments, labor staff, overnight stays, travelers, and efficiency score). This relationship is determined by the positive correlations (greater than 0.8) of these variables (see Table 7), which indicates that high (or low) values of the dimension are associated with provinces with high (or low) values of seats offered, of establishments, of staff, of overnight stays, of travelers, and of efficiency score. We will label this first dimension as tourist-labor efficiency.

The provinces which obtain higher scores in the first dimension are in order of relevance or higher score (Table 8): Asturias with 4.14 points, Cantabria with 1.91 points, Ávila with 1.62 points, Girona with 1.51 points, and Cáceres with 1.35 points.

Of the total variance, 17.758% can be explained by the second dimension (Table 6). The provinces which make up this dimension present a strong and positive relationship with the variable length of stay (Table 7), which indicates that the high (or low) values of the dimension are associated with the provinces with high (or low) values of the number of days stayed at an establishment. In accordance with these results, this dimension is labeled as the length of stay.

The provinces with the highest scores in the second dimension are (see Table 8): Santa Cruz de Tenerife (3.33 points), Malaga (3.12 points), Balearic Islands (2.85 points), and Las Palmas (1.78 points). Note that these are provinces in which sun-and-sand tourism is deeply rooted, and it can therefore be presumed that travelers, in addition to rural tourism, take advantage of the visit to practice tourism of more traditional nature in these areas. It can also be observed that the province of Balearic Islands obtains the highest score in the ranking of efficient provinces; however, it does not appear as a relevant province in Dimension 1. One possible cause is that the variable length of stay may have stimulated the efficiency of the province, thereby strongly weighting it in the efficiency ranking with DEA; in contrast, in factor analysis, this variable holds no relevance in determining Dimension 1, which now defines efficiency.

The results obtained from the factor scores in each of the dimensions extracted are shown in Figure 4. Note how most provinces are located on the right half of Dimension 1, which indicates that these provinces are not efficient in tourism and labor aspects. Regarding Dimension 2, it can be observed that the provinces are mostly at the top of that dimension. It can therefore be stated that rural tourism in Spain has a short length of stay; there are fewer provinces in which the length of stay is higher, and almost all are coastal provinces with a strong tradition for sun-and-sand tourism. Therefore, as indicated above, it is likely that rural tourism is combined with coastal tourism, and hence the stays are longer.

Table 7
Factorial weights of the factorial matrix

Variables	Dimension 1	Variables	Dimension 2
Seats	0.980	Length of stay	0.932
Establishments	0.919	Travelers	-0.413
Employees	0.914	Overnight stays	-0.296
Overnight stays	0.913	Employees	0.267
Travelers	0.866	Efficiency score	0.170
Efficiency score	0.825	Establishments	0.121
Length of stay	0.175	Seats	-0.031

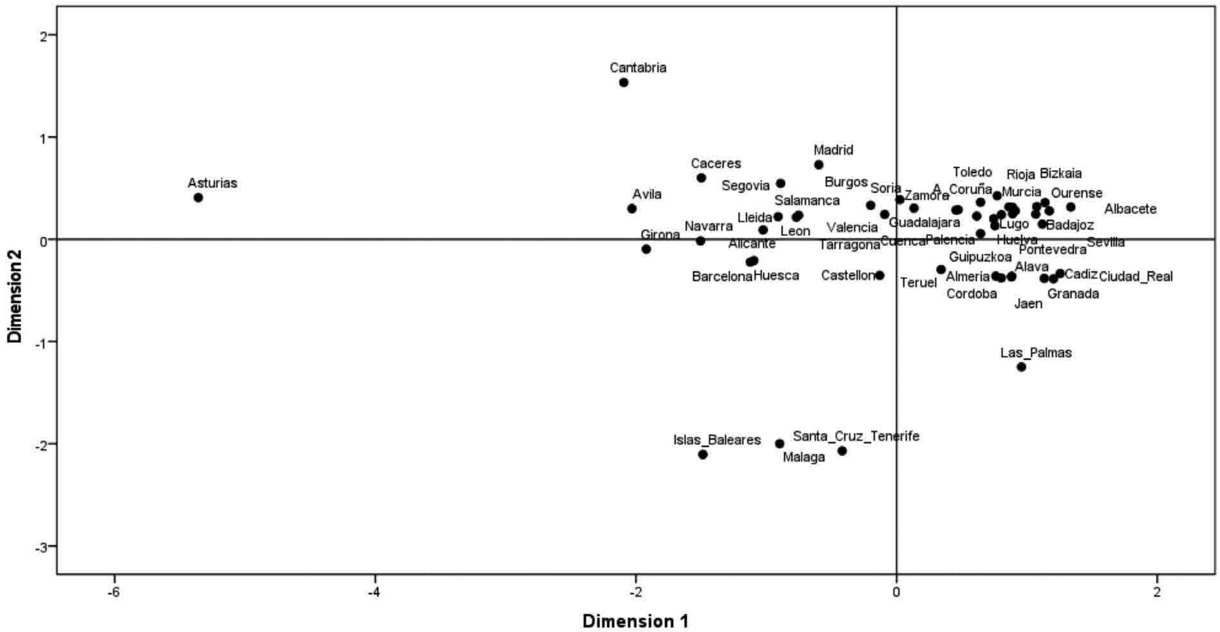
Source: Authors.

Table 8
Factor scores on the dimensions

Provinces	Score dimension 1	Provinces	Score dimension 2
Asturias	4.14	Santa Cruz de Tenerife	3.34
Cantabria	1.91	Málaga	3.12
Ávila	1.62	Balearic Islands	2.85
Girona	1.52	Las Palmas	1.79
Cáceres	1.36	Castellón	0.69
Navarra	1.18	Huesca	0.58
Barcelona	0.88	Álava	0.58
Segovia	0.85	Córdoba	0.56
Huesca	0.85	Teruel	0.54
Lleida	0.76	Granada	0.53
Alicante	0.75	Almería	0.51
Balearic Islands	0.69	Jaén	0.49
Salamanca	0.67	Barcelona	0.48
Madrid	0.63	Ciudad Real	0.48
León	0.63	Girona	0.46
Málaga	0.30	Cádiz	0.45
Burgos	0.29	Navarra	0.29
Valencia	0.15	Asturias	0.19
Soria	0.12	Alicante	0.02
Castellón	0.04	Gipuzkoa	-0.09
Cuenca	-0.01	Ávila	-0.16
Santa Cruz de Tenerife	-0.10	León	-0.20
Zamora	-0.28	Lleida	-0.24
Guadalajara	-0.31	Huelva	-0.26
Teruel	-0.32	Salamanca	-0.31
Gipuzkoa	-0.40	Seville	-0.36
Tarragona	-0.43	Valencia	-0.41
A Coruña	-0,45	Palencia	-0.43
Toledo	-0.49	Tarragona	-0.45
Huelva	-0.52	Valladolid	-0.46
Palencia	-0.56	Zaragoza	-0.52
Valladolid	-0.60	Badajoz	-0.55
Murcia	-0.61	Ourense	-0.56
Zaragoza	-0.65	Guadalajara	-0.58
Lugo	-0.65	Zamora	-0.59
Pontevedra	-0.68	Pontevedra	-0.60
Almería	-0.70	Cuenca	-0.60
Córdoba	-0.74	Burgos	-0.62
Jaén	-0.78	La Rioja	-0.64
Ciudad Real	-0.79	Murcia	-0.65
La Rioja	-0.80	Lugo	-0.66
Badajoz	-0.81	A Coruña	-0.67
Bizkaia	-0.82	Soria	-0.72
Seville	-0.85	Albacete	-0.72
Ourense	-0.91	Toledo	-0.74
Las Palmas	-0.98	Segovia	-0.75
Albacete	-0.98	Cáceres	-0.78
Granada	-0.99	Bizkaia	-0.79
Álava	-1.06	Madrid	-1.07
Cádiz	-1.10	Cantabria	-1.77

Source: Authors.

Figure 4
Factorial scores in each dimension



Source: Authors.

5.2.2. Cluster analysis

The next stage involves the application of cluster analysis. The objective of this technique is to obtain provinces with similar characteristics in the dimensions previously extracted.

The method selected to obtain the clusters is non-hierarchical: the scores obtained in the different provinces for the two dimensions are applied, and it is necessary to determine a priori the number of clusters to be defined. Therefore, a cluster analysis should be carried out first through hierarchical procedures to ascertain the most appropriate number of clusters and, together with their configuration, which serve as a starting point for the non-hierarchical method.

After performing various tests considering different models with different numbers of clusters, the analysis of those variations in the residual variance when a variable number of clusters are considered, leads to four clusters being set as the optimal number since it is the one with the lowest residual variance.

Table 9
Average scores in the clusters

	Cluster			
	1	**2**	**3**	4
Dimension 1. Labor-tourist efficiency	-0.57897	4.14481	-0.02085	0.99190
Dimension 2. Length of stay	-0.23269	0.18587	2.77560	-0.29106

Source: Authors.

Table 9 shows the average scores of the clusters in the two dimensions. According to these average scores (Table 9) and the ranking of the provinces in the clusters (Table10), a classification of the provinces into three groups could be made: first, those that have *good* labor efficiency, whereby cluster 2 has the highest average score with respect to the first dimension, which represents labor and infrastructure efficiency (the province of Asturias features as the most prominent in terms of this dimension); secondly, provinces that have *half* labor efficiency (Alicante, Ávila, Barcelona, Burgos, Cáceres, Cantabria, Girona, Huesca, León, Lleida, Madrid, Navarra, Salamanca, Segovia), formed by those provinces that obtain the second-highest average score in the first dimension; and finally, the group of provinces that have a score below the provincial average in the tourist-labor efficiency dimension (Table 9), which are labeled as having bad labor efficiency.

Cluster 3 receives the highest average score with respect to the second dimension and therefore represents those provinces of rural tourism with special importance in the length of stay. The provinces which obtain the highest average score in the second dimension are Balearic Islands, Málaga, Santa Cruz de Tenerife, and Las Palmas (cluster 3). The province which obtains the second-highest average score in the second dimension is Asturias.

Table 10 shows the provinces that make up each of the clusters.

Table 10
Clusters of the provinces

Cluster	Province
1	31 provinces: Álava, A Coruña, Albacete, Almería, Badajoz, Bizkaia, Cádiz, Castellón, Ciudad Real, Córdoba, Cuenca, Guipuzkoa, Granada, Guadalajara, Huelva, Jaén, La Rioja, Lugo, Murcia, Ourense, Palencia, Pontevedra, Seville, Soria, Tarragona, Teruel, Toledo, Valencia, Valladolid, Zamora, Zaragoza
2	1 province: Asturias
3	4 provinces: Balearic Islands, Málaga, Santa Cruz de Tenerife, Las Palmas
4	14 provinces: Alicante, Ávila, Barcelona, Burgos, Cáceres, Cantabria, Girona, Huesca, León, Lleida, Madrid, Navarra, Salamanca, Segovia

Source: Authors' own.

The analysis carried out confirms that Asturias is the most "complete" province in the sector since it combines both labor efficiency and length of stay.

Multivariate Analysis facilitates in contrasting the results obtained by the DEA methodology since it has been proven that this method excessively weighs the variable length of stay, which causes the efficiency of the province to be "masked", as occurs in the Balearic Islands.

6. Conclusions

The growing importance of the rural tourism industry in Spain as an economic activity warrants the analysis of the relative efficiency of rural areas as tourist destinations. Rural tourism emerges as an alternative to sun-and-sand tourism due, in general, to the change experienced in demand by tourist consumers. This metamorphosis of demand has favored the possibility of generating employment in rural areas through tourist activity.

Tourism constitutes one of the few economic activities that are best surviving the economic crisis: it has favored rural tourism, which has created employment in periods during which it is more common for jobs to be lost. However, in Spain, the effect on employment depends on the geographical area; in general, labor efficiency is not achieved except in the cases of Asturias and the Balearic Islands, where rural tourism has a strong and positive impact on employment. Asturias, with little traditional sun-and-sand tourism, is not the classic tourist destination, but it does enjoy a varied architectural, natural, and landscape heritage and can offer extensive heritage, local gastronomy, and cultural sites. However, the Balearic Islands provide the destination of a more traditional type of tourism in Spain, where tourists mainly seek sun-and-sand holidays. The variable length of stay of the holiday period carries important weight for labor efficiency to be reached in the said province, and it can be supposed that tourists who visit the Balearic Islands combine rural with coastal tourism, hence extending their stay in this area. This is confirmed by the provincial groupings obtained since the provinces with strong roots in coastal tourism (Santa Cruz de Tenerife, Malaga, Balearic Islands, and Las Palmas) are those with the greatest number of overnight stays; this variable stimulates the efficiency of the Balearic Islands. Asturias is, therefore, the only Spanish province where rural tourism has a stronger and more positive impact on employment in the sector.

The inequalities in labor efficiency of the Spanish provinces can be explained through factors such as the presence of places with charm and environmental protection due to the direct relationship between the area of protected land with the labor efficiency of the province. By investing in tourism that respects nature and the environment, tourism and, consequently, employment are both promoted.

According to the results obtained, efficiency improvements are necessary to increase competitiveness; this can be achieved with reforms in basic services in rural areas, such as education, health, and communication infrastructure, increased technological investments, and innovation incentives.

For future research, a broader analysis of the sector could be considered, which would enable the identification of tourism demand in rural areas. This, in turn, would contribute towards ascertaining whether the tourism under development is sustainable, whether it improves the quality of life, and whether it affects the income level of the population of rural areas. These advances would all contribute towards the correct planning of the sector.

It would also be interesting to extend the sample with the aim of comparing tourism efficiency across European countries, especially those in Western Europe, where this sector is more established and enjoys a stronger tradition. The increase in the sample would enable a variety of inputs and outputs to be introduced into the study without losing any power of discrimination; special interest could be focused on variables that capture the environmental impact, both locally and globally, in order to achieve sustainability.

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