MEASURING EFFICIENCY OF THE YOUTH HOSTEL SECTOR IN ANDALUSIA USING AN ADAPTED DEA MODEL

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RESUMEN

Este estudio mide la eficiencia del sector de los Albergues Juveniles de Andalucía mediante la realización de un Análisis Envolvente de Datos (DEA). Los datos sobre la eficiencia en la gestión han sido recogidos en todos los albergues juveniles públicos de Andalucía para el período comprendido entre 2003 y 2012. Los resultados revelan que existen diferencias significativas en la eficiencia entre los diferentes centros. Esperamos que este estudio empírico pueda proporcionar información útil para una mejora futura de la gestión en este sector.

PALABRAS CLAVES

Albergues Juveniles, Eficiencia, Análisis Envolvente de Datos, Contabilidad para la Gestión.

ABSTRACT

This study measures the efficiency of the Youth Hostel sector in Andalusia by carrying out Data Envelopment Analysis (DEA). Management efficiency data has been gathered on all Andalusian Public Youth Hostels from 2003 to 2012. The results reveal that there are significant differences in efficiency. It is expected that the empirical study can provide useful information for future managerial improvement in this sector.

KEY WORDS

Youth Hostels, Efficiency, Data Envelopment Analysis, Management Accounting.

1. INTRODUCTION

The current financial crisis is creating the need for improvements in management efficiency in every economic sector for the survival of the business organization (Arnold, 2009).

Efficiency as a concept is closely related to the economy of resources and has traditionally been defined as the ratio of results (outputs) and resources used (inputs). Furthermore, the efficient allocation of resources is one of the traditional objectives of the Economy including (Robbins, 1932).

Research into the measurement of efficiency is a classic area in Economics and constitutes one of the areas of economic analysis that has undergone great strides in further development in recent times triggered by the increasing competitiveness in all economic sectors. In the lodging industry, this efficiency development carries even greater importance since it is an economic sector whose businesses have a low degree of differentiation. This in turn means that competition is conducted based on a historically very limited number of factors: the price of the services offered, the quality of facilities, and the intrinsic location (Barros and Alves, 2004).

Moreover, the factors that have usually been related to the efficiency in the hotel sector are no longer determinant due to the financial crisis. The classic factors over which it has traditionally pursued efficiency in the hotel sector have been devalued in recent times due to the outbreak of the crisis that took place in 2007 and the consequent difficulty of access to economic and financial resources. This economic situation affects all sectors of the global economy; this impact is even greater in the Youth Hostel sector however, since them usually operate with low prices and very reduced profit margins.

On the one hand, this crisis has caused a real price war in the hotel sector. It has led the continuing decline in hotel rates in Spain since November 2008, representing two years of consecutive declines, and reached a sectorial deflation level of about 8% during the first quarter of 2009, and 2% for the same period of 2010 (National Statistics Institute, 2013).

On the other hand, there is a need to improve hotel efficiency as the only way to address the current situation in order to optimize costs and strive towards a balance in the operating results so that business survival can be achieved in the medium and long term.

Numerous models have been developed to measure and evaluate efficiency in the hotel sector (Anderson et al., 2000; Hwang and Chang, 2003; Barros, 2005; George, 2012; among others). However the particular characteristics of Youth Hostels justify the need to propose a specific DEA model that allows measurement of the efficiency in this sector.

To fulfil this purpose, an extensive literature review has been carried out to analyze previous studies related to business efficiency in the hotel industry. Our analysis is focused on those models employed to measure the efficiency, and especially on the DEA model. Regarding the Youth Hostel sector, there is a significant lack of research. To the best of our knowledge, no relevant studies have been carried out on this sector using DEA. On the basis of this literature review, a model for measuring efficiency in the Youth Hostel sector based on DEA is proposed.

This model has been applied for the analysis of efficiency in all the properties of the Andalusian Public chain of Youth Hostels (AYH) during the period 2003 to 2012.

Consequently, the paper is structured as follows: (1) Firstly, the historical evolution of the Youth Hostel sector is analyzed; (2) in the third section, we set out the basic approach to efficiency and the DEA is set out, the results are summarized of previous studies that proposed models of efficiency for the hotel sector, and the DEA proposed model for Youth Hostel is outlined; (3) the results are presented; and, finally, (4) the conclusions and references are given.

2. THE YOUTH HOSTEL SECTOR

Within the lodging industry, the Youth Hostel sector presents its specific characteristics that differentiate itself from the rest of the industry. Most of these characteristics are largely based on Youth Hostel origins. The Hostelling movement and the first youth hostel (Altena Castle, Westfalia, 1912) are due to the German Professor, Richard Schirrmann who began to use schools in Germany as low-cost accommodation for students on excursions and extracurricular activities, thereby transforming them into meeting places for young people (Martinez, 1993).

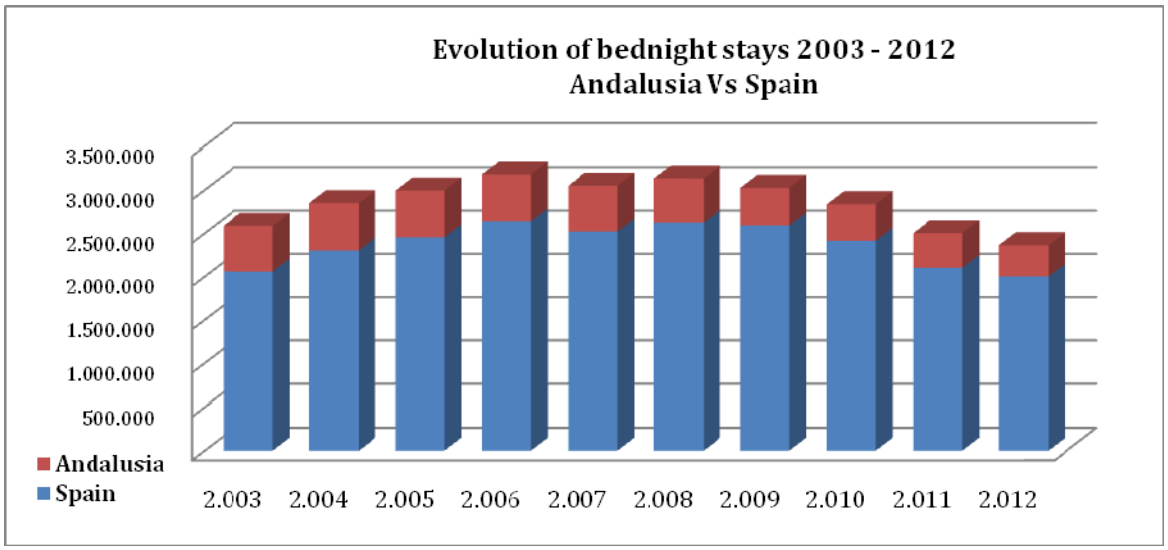
The International Youth Hostel Federation (IYHF) was founded later in 1932, and is currently better known by its commercial name: Hostelling International. Nowadays, IYHF has over 4 million members and over 4,000 affiliated hostels located

in more than 90 partner countries in all the continents. The official denomination of Youth Hostel / HI Hostels are reserved just for associated establishments, whose users need a membership card issued, either by the international federation or by the national associations. Moreover, there are independent hostels which also operate in this sector although they are generally smaller and provide a more limited range of services.

The traditional Hostelling Tourism has evolved and now encompasses a great diversity and demographic spectrum, although they are predominantly young travellers (backpackers, independent travellers, young tourists, and more recently, flashpackers).

Despite the crisis, hostel statistics on different areas of the world indicate that demand remains or is even growing, especially in the United States and Western Europe. Spain currently is one of the five most visited countries. Specifically, the New Horizons III Report (WYSETC, 2013) recognized that this globally, market had reached more than 200 million international tourist arrivals in 2012, which represented 20% of international arrivals, mostly encouraged by both the development of low-cost airlines and other transport media and the wide spread of internet access.

Meanwhile, the market turnover in 2012 was U.S. $ 220 billion, compared to the $ U.S. 190 billion in 2009, whereby hostels were the most popular kind of accommodation used by young people, even exceeding the target of 30% of this market. For this sustained growth, tourism operators are increasingly focusing on this segment which has been prioritized as "target marketing". Hostels generate more movement and increased profitability in the destination, according to the World Tourism Organization (UNWTO, 2011) and the World Youth Student & Educational Travel Confederation (WYSETC, 2012). Moreover, the total expenditure per trip in this segment was U.S. $ 2,600, compared with an average of U.S. $ 950 per trip for international tourists as a whole, because young people tend to travel longer and end up spending more.



At European level, hostels reported more than 26 million bednight stays in 2012, an increase of 6% compared to 2010 (Richards, 2011), while the Spanish have averaged, in the last decade, more than 3 million overnight stays per year, according to the Hotel Occupancy Survey (2010) and Youth Hostels Statistics (2010), compiled by the INE and REAJ, respectively. There were a total of 500,000 stays in Andalusia, all corresponding to AYH, which are the only officially recognized hostels in this autonomous region.

In order to characterize Youth Hostels, we must start by defining them as public or private accommodation, targeted mostly at young travellers who must generally be members of the hostel network (AECA, 2013, p. 37).

Although there are many types of Youth Hostels, their fundamental difference from the rest of the accommodation sector lies in the multi-bed dormitories they offer, thus the unit of production is the single bed, rather than the room. This singularity came from the origin of the hostelling movement, which was founded on the concepts of proximity to the environment, shared educational experiences, coexistence and multicultural exchange, and youth mobility.

A second essential difference of this accommodation sector is the general low price of Youth Hostels, and in particular, for those public-owned establishments. This model has spread mainly in southern Europe where there are government-subsidized prices to compensate for Youth Hostel deficits, although these prices may vary according to age, groups and family unit.

Thirdly, according to the characteristics of the primary target audience, young people, we emphasize that:

a. Hostels have an appropriate infrastructure for sport and active recreation, such as classrooms, game rooms, libraries, workshops and rehearsal rooms, meeting rooms, multimedia equipment, Wi-Fi zones, public telephones. Given the configuration of spaces and common services, Youth Hostels provide the opportunity for coexistence and multicultural learning, and there is a greater possibility for interaction between guests than in a traditional hotel.

b. Extra-hotel services are offered in different format to that of traditional hotels, including: towel and bed linen rental; lockers; public laundry; food, beverages and other products dispensed in vending machines; and sports equipment and entertainment rentals.

As the fourth characteristic, the importance of the Internet, electronic channels and new information and communication technologies should be highlighted since these means enable youth services to be widely known and accessed. In this segment, bookings made through Internet now account for around 80% of the total, compared to 63% in 2007 (STAY WYSE, 2013).

Finally, we must point out that significant levels of growth in demand and changes in trends, together with the effects of the current crisis, demand more productive and professional qualifications in this sector, which would therefore achieve higher quality and improved efficiency in managing Youth Hostels.

3. EFICIENCY, METHODOLOGY AND PROPOSED MODEL FOR THE YOUTH HOSTELS

The efficient allocation of resources constitutes one of the principal objectives of Economics which considers human behaviour as the relationship between final results and scarce means with alternative uses (Robbins, 1932).

Since companies often produce multiple outputs from multiple inputs, efficiency always must be on a multidimensional scale. Thus, the question is how to measure efficiency. This is performed through the comparison of these companies based on their performance in relation to the level of outputs achieved in terms of volume of inputs used, so that classifications can be established according to the values obtained from this comparison.

Various types of efficiency are defined by Farrell (1957) who points out its importance in the study of business management. This author also stablisesn how using multiple outputs / inputs can reach a "satisfactory measure of productive efficiency" that takes into account all the inputs (resources used), and also sets out the calculations involved. Farrell´s contribution has been widely studied from the perspective of business efficiency, and in the specific case of the hotel industry there are many papers on this particuar issue (Oliveira et al., 2013; Salesh et al., 2012; Barros et al., 2009; among others).

There are several methods to measure efficiency. In order to choose one from among the various possibilities, the following classification of existing approaches regarding assessment system efficiency through various indicators and models should be met (Cayon, 2007). The most significant methods are those related to indicators of productivity that are, technically, closest to the economic concept of efficiency. Among these, one can distinguish three main options (Prior et al., 1993): (1) Models using a stochastic production frontier; (2) Parametric Models, which consider the boundary as a parametric function of inputs and start from a particular form of function (Cobb-Douglas, CES, SFA, etc.); and (3) Non-parametric models, which impose no pre-defined way to the function, for example, Data Envelopment Analysis (DEA).

From all the aformentioned models and indicators, DEA presents the most advantages, and has become, in a relatively short time, a widely used technique (Charnes et al., 1978).

A major feature of the DEA model is its ability to support multiple inputs and outputs (Restzlaff-Roberts and Morey, 1993) expressed in different units of measurement (Charnes et al, 1978).

Therefore, DEA is the most commonly chosen method for measuring the efficiency of hotel management (Morey and Dittman, 1995; Johns et al., 1997; Avkir, 1999; Hwang and Chang, 2003; Barros *et al*, 2009) since it enables the definition of a model that is able to provide a range of production frontiers within normal efficiency levels and therefore a number of companies that constitute a sample based on the score achieved which respect to the said border can be classified.

Consequently, we consider DEA proposed by Coelli (1998) as the most appropiated model since it satisfies the properties of constant returns to scale, free disposal of inputs and outputs in the strict sense and convexity. The units of analysis in the DEA are called decision making units (DMU henceforth) and in our reserach, each Youth Hostel and its inputs and outputs represent a single DMU.

Taking into account the aim of this paper which is to measure the efficiency of the Youth Hostel sector in Andalusia by carrying out DEA analysis using a specifically desingned model to incorporate the characteristics of the Youth Hostels.

Therefore, in order to attain this model, the way the DEA technique employed is first defined. The variables used in the proposed model are then determine and the use of each variable is justified.

An extensive literature review has been carried out in order to define the input / output variables used in the proposed model. In this selection, we have identified: (1) the author, the year of publication; (2) DMU / Location / Period of analisys and; (3) input / output variables considered. All this information from the 24 reviwed papers is contained in Table 1.

Table 1: Analysis of efficiency in the hotel industry.

AUTHOR	DMUS / LOCATION / PERIOD OF ANALISYS	INPUTS	OUTPUTS
Oliveira *et al.* (2013)	56 / Portugal / 2005 – 2007	Number of rooms Number of employees Food and Beverage capacity Other costs	Total revenue
Parte & Alberca (2013)	1385 / Spain / 2001 – 2010	Number of full-time employees Property book value Operationalcosts	Sales
Assaf (2012)	192 / 12 Asia Pacific countries / 2007 – 2009	Revenues Number of FTE Number of rooms Other operational costs	Average daily rate Food and beverage revenues Otherrevenues
Salesh*et al.* (2012)	248 / Malaysia / 2007	Labour Operational Expenses Capital	Revenues Grossprofit
Wu*et al.* (2011)	23 / Taipei / 2006	Total number of employees Total number of guest rooms	Room revenues Food and beverage revenues

		Total area of F&B Total operating cost	Otherrevenues
Shuai*et al.* (2011)	48 / Taiwan / 2006 - 2007	Total number of guest rooms Number of full-time employees Operating expenses	Room revenues Food and beverage revenues
Cheng*et al.* (2010)	34 / Taiwan / 1997 – 2006	Total number of guest rooms Number of employees Total area of catering department Total operating expenses Catering expenses	Total operating revenues Average occupancy rate Average room rate Average production value per employee
Hsieh*et al.* (2010)	57 / Taiwan / 2006	Accommodations costs Employees of the accommodation department Catering costs Employees of the catering department	Roomrevenues Catering floors
Pulina*et al.* (2010)	150 / Sardinia Island / 2002 – 2005	Labourcost	Sales revenue Valueadded
Barros *et al.* (2009)	15 / Portugal / 1998 – 2004	Number of Employees Physical capital	Sales AddedValue
Yu*et al.* (2009)	58 / Taiwan / 2004	Room Labour Food and Beverage Labour Rooms Food and Beverage area Expenses	Room revenues Food and beverage revenues Otherrevenues
Perrigot*et al.* (2008)	24 / Taipei / 2005	Age of the hotel chain in years Number of rooms in the chain Number of hotel openings during the year Royalties in percentage Quality: chain ranking	Room revenues: Occupancy rate as a Percentage Other revenues: Total sales in millions of Euros
Shang*et al.* (2008)	60 / Taiwan / 2005	Number of full-time employees Number of guest rooms in a hotel Operating expenses Food and beverage (F&B) capacity (total floor area utilized by all such outlets in a hotel)	Room revenues Food and beverage revenues Miscellaneousrevenues
Rubio & Román (2007)	385 / Andalusia (Spain) / 2002 – 2004	Cost of Goods Sold Labour Expenses Depreciation Other Expenses	Total income
Wang *et al.* (2006)	49 / Taiwan / 2001	Number of full-time employees in room departments Number of rooms Total floor area of food and beverage departments Number of full-time employees in food and beverage departments	Revenues from food & beverage Departments Revenues from room departments Otherrevenues

Table 1: Analysis of efficiency in the hostel industry (Continued).

AUTHOR	DMUS / LOCATION / PERIOD OF ANALISYS	INPUTS	OUTPUTS
Barros (2005)	42 / Portugal / 1999 – 2001	Number of full-time employees Cost of labour Number of rooms Area (square metres) Book value of property Operating Costs External expenses	Sales Number of guest rooms Nights spent in the hotel
Sigala*et al.* (2005)	93 / UnitedKingdom / 2000	Rooms Front office payroll Administration material and other expenses Other rooms' division payroll Other rooms' division material and other expenses Total demandvariability	Average Room Rate (ARR) Number of room nights sold Non-roomnightrevenues
Chiang*et al.* (2004)	25 / Taiwan / 2000	Food and beverage (F&B) capacity Hotel rooms Total cost of the hotel Number of employees	RevPar individual hotel / Market RevPar Food and beverage revenues Miscellaneousrevenues
Barros & Alves (2004)	42 / Portugal / 1999 – 2001	Number of full-time employees Cost of labour Number of rooms Area (square metres) Book value of property Operating Costs External expenses	Sales Number of guest rooms Nights spent in the hotel
Hwang& Chang (2003)	45 / Taiwan / 1994 - 1998	Food and beverage (F&B) capacity (total floor area utilized by all such outlets in a hotel) Number of guest rooms in a hotel Operating expenses Number of full-time employees	Room revenues Food and beverage revenues Miscellaneous revenues
Brown &Ragsdale (2002)	46 / U.S.A. / 1999 – 2000	Typical Price Problems (extent to which respondents reported having complaints during their visits) Service (hotel clerk efficiency at check-in and checkout) Upkeep (condition and cleanliness of room, grounds and public spaces) Number of hotel properties in the U.S.A. Number of guest rooms in the U.S.A.	Guest satisfaction on a 100-point scale Chain´s overall value on a 5-point scale
Avkiran (2002)	23 / Queensland (Australia) / 1997	Full-time staff Part-time staff Bedcapacity	Revenues Roomrate
Anderson *et al.* (2000)	48 / U.S.A. / 1994	Full-time equivalent employees Number of rooms	Total revenues

		Total gaming related expenses Total food and beverage expenses Other expenses	
Johns *et al.* (1997)	15 / UnitedKingdom / 1992	Number of room nights available Total labour hours Total food and beverage costs Total utilities cost	Number of room nights sold Total covers served Total beveragerevenues

Although most these research was carried out before the outbreak of the global crisis of 2007, there has been an increase of interest in this particular issue from the research community within the last lustrum. The majority of the reviewed papers consider variables related to staff as inputs, which makes it difficult to obtain reliable data bases since the DMUs may provide no-accurate information. The majority of the reviewed research used data on the number of employees (Oliveira et al., 2013; Parte &Alberca, 2013; Shuai et al., 2011; Wu et al., 2011; Cheng et al., 2010; Hsieh et al., 2010; Barros et al., 2009; among others),

Another major input variable is the number of rooms. Most of the reviewed studies have used this variable (Oliveira et al., 2013; Assaf, 2012; Shuai et al., 2011; Wu et al., 2011; Cheng et al., 2010; Yu et al., 2009; among others)

As can be appreciated from the previous analysis of the input variables, the number of employees and number of rooms are then the most significant productive measures of the capacity of the hotel facilities on evaluating its efficiency. Moreover, there are several studies that combine both as a part of their model.

The next three input variables have been selected and defined for the DEA model to analyse the Youth Hostel sector:

- **Labour costs: Refers to total expenses including salaries, social security contributions by the company, compensation, and other social costs. This cost item represents an average of the 65.9 % of total costs (X1).**
- **Number of beds: Refers to the total number of available beds in the Youth Hostel (X2).**
- **Total operational costs - Labour costs: Refers to all the operational costs apart from labour and represents 34.1 % of total costs (X3).**

Regarding the output variables, most of these papers used as production data and statistical indicators information related to the level of service (Morey and

Dittman 1995, Brown and Ragsdale 2002) or / and service revenues (Johns et al., 1997, Hwang and Chang, 2003, Chiang et al., 2004, Sigala et al., 2005, Wang et al., 2006, Riera et al., 2007 and Shang et al., 2008). Overnight stays and food and beverage services are considered as one of the most significant outputs of the hotel generated revenue in the majority of cases (Anderson et al., 2000). Therefore, we consider two ouput variables related to the Youth Hostel operating revenues in our DEA model.

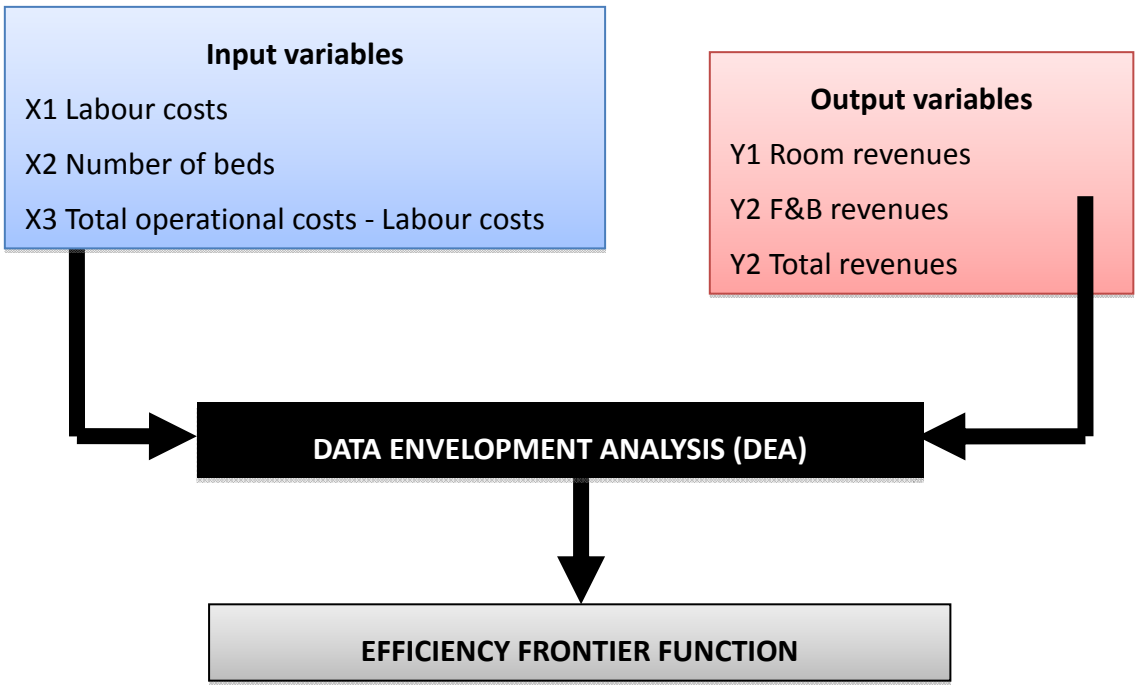
- **Room revenues: Refers to revenues from the sale of beds. This revenue item represents an average of 53.6 % of the total Youth Hostel revenues (Y1).**
- **Food and Beverage Revenues: Refers to the revenues from the sale of meals and breakfast. This revenue item represents an average of 35.9 % of the total Youth Hostel revenues (Y2).**
- **Total revenues: Refers to the income generated from all the sales at the Youth Hostel. (Y3)**

Based on the aforementioned considerations, the proposed DEA model for Youth Hostels can be fully developed. Thus, Figure 1 shows the functional diagram of the model with the input/ouput variables.

The selection of the most representative variables of the production process developed by the DMUs (Youth Hostels) can be performed by estimating the efficient production frontier using data for a representative sample of establishments whose size depends on the total size of the population sampled, and the number of input and output variables to consider.

However, due to the deterministic and non-parametric nature of DEA it must be emphasized that the selection of variables plays a leading role in the development of research and constitutes a fundamental decision that greatly affects the results derived from the model.

Figure 1: DEA Model for the Youth Hostel sector in Andalusia



In order to collect the changes in the efficiency frontier we calculate the Malmquist Productivity Index, firstly the efficiency indexes of each of the units were determined for the periods studied through the data envelopment analysis (DEA) methodology. An input orientation has been used (input minimization) as well as two models have been analized: Constant Returns to Scale (CRS- Charnes et al. 1978) and Variable Returns to Scale (VRS -Banker et al. 1984).

Based on the distances among the periods with respect to the boundary of CRS and VRS, we determine the Malmquist index according to original formula. Subsequently, this index was divided in both indixes of technical and relative efficiency. Finally, the index of relative efficiency was separated into the pure efficiency and scale efficiency indexes (Färe et al. 1994).

Therefore, the methodology allows to differ the reason behind the changes in the total factor productivity: efficiency (" catching up") and technology (innovation). If the CRS are considered, changes in efficiency can be separated into pure efficiency (technology with variable returns to scale) and scale changes (technology with constant returns).

We calculate the Malmquist index with an input orientation, since the short-term residential capacity determines the existence of a maximum occupancy limit, and the production and sales levels. Moreover, the results of that process are not under control by the manager (Ramanathan, 2003; Yu and Lee, 2009). This Input -Oriented Malmquist Index is going to be calculated as the geometric mean of the previous index for periods *t* and *t+1* (Färe et al. 1994).

Mt = Input- Oriented Malmquist Index

Y t = vector of outputs at t

Xt= vector of inputs at t

$$M^t = \frac{D^t\left[x^t, y^t\right]}{D^t\left[x^{t+1}, y^{t+1}\right]}$$

4. EMPIRICAL STUDY: DATA AND DESCRIPTIVE STATISTICS

The Spanish Youth Hostel sector appeared much later than in the rest of Europe. In 1990, the AYH was set up to manage the network of 100%-government-owned Youth Hostels after receiving the suport of the Andalusia Government and the facilities from the Spanish Government. This model of governance was innovative in Andalusia at the time because it provided a more effective and efficient use of available economic, human and institutional resources.

AYH currently has twenty youth hostels which represent almost a 10% of the Spanish youth hostel sector and employs about 309 people. Its total assets was over 141.310.690 € and the net sales level exceeded 11 million €.

Figure 2: Location Map in Andalusia of the 18 Youth Hostels of the AYH.

The AYH is clearly influenced by its public character, since it subject to public policies and the changes caused by the election cycle of Andalusia. The Andalusia Government sets its rates and margins which directly affects AYH results.Thefinal sample is composed of 18 youth hostels belonging to AYH , which have been analyzed for the period 2003-2012. The other four establishments of this network could not be considered since they opened later than 2003. All necessary data was obtained from the AYH databases.

Table 2 shows the classification used by AYH based on each hostels location and business orientation towards the tourism segment: Urban, Rural and Beach. In addition, the most important variables are also shown in order to allow characterization of each hostel: Number of beds, the average number of employees, and annual turnover, averaged over the period analyzed.

Having chosen the DEA model proposed according to the literature review carried out in the hotel industry, the output efficiency model was implemented under the consideration of the variables in Figure 1 of Section 3, whose descriptive statistics are collected in Table 3. This table presents the initial and final intervals of the period, and in addition to the year 2008, sine this represnts the beginning of the economic crisis.

Table 2: Basic information of the AYH.

Hostels	Urban	Rural	Beach	Beds	Employees	Income €
Aguadulce			x	522	4	330,710
Algeciras		x		134	8	348,131
Almeria	x			204	19	605,418
El Bosque		x		191	9	345,259
Cazorla		x		129	12	324,327
Chipiona			x	244	5	255,729
Constantina		x		131	12	306,421
Cordoba	x			212	17	748,580
Cortes		x		204	4	242,775
Granada	x			248	22	776,858
Huelva	x			187	12	382,979
Jerez	x			228	12	323,993
Malaga	x			230	19	682,670
Marbella			x	210	14	535,994
Punta Umbría			x	160	11	476,484
Sevilla	x			439	28	1.186,270
Sierra Nevada		x		368	18	1.169,313
Viznar		x		120	9	288,914

Table 3: Descriptive Statistics

Variable	N	2003				2008				2012			
		Minimum	**Maximum**	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
Labour cost	18	88061	781005	372086,61	168536,02	149148	902010	472855,61	192427,77	93446	727884	358706,38	168617,67
Number of Beds	18	100	322	172,28	61,909	99	510	193,56	102,706	120	522	231,17	108,507
Total operacional cost- Labour cost	18	46172	669676	196291,83	134171,69	168763	484352	251140,33	83394,63	127833	463853	216830,44	82535,86
External Servicies	18	16587	148402,00	56350,88	29425,85	29307	141000	61430,61	31101,08	24852	152431	65598,61	32112,23
Room Revenues	18	62739	768433,00	275332,16	196263,15	80846	799762	305218,55	212323,80	69931	650362	222907,66	158313,90
F&B Revenues	18	40108	395080	155409,61	82182,659	83071	477740	248482,67	105087,043	68352	474740	177018,94	105824,056
Total Revenue	18	138518	1212656,00	483563,77	307776,88	190601	1330661	589528,44	322041,78	157557	1162290	435925,22	262527,54

Table 3 shows the amounts (in €) of the variables used in the proposed DEA model with reference to to all 18 youth hostels included in the sample.

5. RESULTS

The results obtained after applying the efficiency model proposed by Coelli (1998) are presented in Table 4, for the years 2003, 2008 and 2012. It shows some differences in the efficiency levels of the youth hostels since several of them achieve an efficiency score under 0.8, which implies unsatisfactory performance levels. In general terms, there is an inprovement during slapsed period from 2003 to 2008 and a slight decline from 2008 to 2012. It also can be highlighted that 5 of the 18 DMU have been at the efficiency frontier during the whole analysed period (2003-2012).

Table 4: Efficiency levels using various input orientation models.

	2003			2008			2012		
DMU/SCALE	**CRST**	**VRST**	**SCALE**	**CRST**	**VRST**	**SCALE**	**CRST**	**VRST**	**SCALE**
AGUADULCE	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ALGECIRAS	0,914	0,939	0,973	0,815	0,845	0,963	0,799	1,000	0,799
ALMERÍA	0,970	0,971	0,999	1,000	1,000	1,000	0,982	0,983	1,000
EL BOSQUE	0,946	0,955	0,991	0,984	0,984	1,000	0,982	1,000	0,982
CAZORLA	0,896	0,919	0,974	0,892	0,902	0,989	0,651	0,965	0,674
CHIPIONA	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
CONSTANTINA	0,951	1,000	0,951	1,000	1,000	1,000	1,000	1,000	1,000
CÓRDOBA	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
CORTES	0,977	1,000	0,977	1,000	1,000	1,000	1,000	1,000	1,000
GRANADA	1,000	1,000	1,000	1,000	1,000	1,000	0,991	0,998	0,992
HUELVA	1,000	1,000	1,000	0,989	1,000	0,989	0,949	0,950	0,999
JEREZ	0,985	0,987	0,998	0,924	1,000	0,924	0,901	0,932	0,967
MÁLAGA	0,944	0,947	0,997	0,979	0,982	0,997	0,964	0,968	0,995
MARBELLA	0,970	0,982	0,988	0,981	0,981	1,000	0,951	0,952	0,999
PUNTA UMBRÍA	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
SEVILLA	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
SIERRA NEVADA	0,993	1,000	0,993	1,000	1,000	1,000	1,000	1,000	1,000
VIZNAR	0,945	1,000	0,945	0,954	0,957	0,997	0,969	1,000	0,969
Mean	**0,972**	**0,983**	**0,988**	**0,973**	**0,981**	**0,992**	**0,952**	**0,986**	**0,965**

In terms of overall technical efficiency (CRST model), an average level of 0,972 in 2003, 0,973 in 2008 and 0,952 in 2012 is presented, with 8 out 18 hostels at the frontier in 2012. Consequently, there is a inefficiency of around 5%. However, this data is much better than that of the Spanish hotels average, considering that their overall efficiency value stood at 52.6% in 2008 (Albercaand Parte, 2013).

Regarding pure technical efficiency (VRST model) the results give an average level of 0,983 in 2003, 0,981 in 2008, and 0,986 in 2012. Therefore, the youth hostels should increase their outputs by 2% aproximately to achieve optimum efficiency, reaching the border, since only 8 hostels reached the frontier.

Finally, in terms of scale efficiency (CRST/VRST) the average values were 0,988 in 2003, 0,992 in 2008, and 0,965 in 2012. Hostels are no far from their optimal scale of operations, with a slight fall of a 3% in the latter part of the period analyzed.

However, the information provided by efficiency indices is static since they fail to identified frontier changes. Therefore, we calculate the Malmquist index in order to ascertain the productive change by considering the years 2003, 2008 and 2012.

The movements of the frontier or of technical change should be understood as technological progress, while companies which approach to the efficiecy frontier represent the portion of the variation in overall productivity that is not directly attributable to technological progress. This portion is driven by the learning effect, dissemination of knowledge in the application of technology, and better organization.

The total productivity factor (TPF) quantifies the relationship between inputs and outputs. This factor is more appropiated since it incorporates all inputs and outputs involved in the production process. The Malmquist Index enables the variations in the TPF distance functions to be calculated and uses a linear programme to calculate the distance between two periods for a specific DMU by estimating the corresponding frontier.

We present Malmquist indices estimated by the two-step method of Coelli (1998) in two tables. One for 2008 over 2003 (Table 5), and another for 2012 compared to 2008 (Table 6).

Table 5 shows the values for the changes in technology and efficiency (separated into pure efficiency and scale efficiency). Furthermore, the change of the total productivity factor for each of the hostels analyzed is shown for the period between 2008 and 2003, as well as a ranking column in accordance to this total change (TPF). It also incorporates the productivity index separation in technological change (movements of the frontier, CTC) and efficiency change (closer to the frontier, CEF). The last row includes the mean changes. Similarly, Table 6 shows the results for the period 2012 and 2008.

Our results show an increase of the average level of productivity (14,3%) which is accompanied by a positive efficiency change of 5.2% during the period 2003-2008. It has been tempered by a decline in average technical change of 12.2%.

For the period 2008-2012 can be observed a major decrease in the level of productivity (by 21%) result of a significant drop in technical change (7'7%), although we also observed a decrease in the efficiency change of 4.8 %.

Table 5. Malmquist Index Summary year = 2008 (compared to 2003).

Youth Hostel	Efficiency Change	TechnologicalChange	Pure Efficiency Change	Scale Efficiency Change	TPF	TPF Ranking
AGUADULCE	1.000	1.166	1.000	1.000	1.166	**7**
ALGECIRAS	1.217	1.153	1.092	1.115	1.403	**2**
ALMERIA	1.123	1.098	1.019	1.102	1.234	**5**
BOSQUE	1.097	1.122	1.291	0.849	1.230	**6**
CAZORLA	0.883	1.222	1.058	0.835	1.079	**10**
CHIPIONA	0.941	1.111	1.000	0.941	1.045	**12**
CONSTANTINA	1.563	1.481	1.177	1.328	2.315	**1**
CORDOBA	1.000	1.075	1.000	1.000	1.075	**11**
CORTES	1.311	1.036	1.175	1.115	1.358	**3**
GRANADA	1.000	0.909	1.000	1.000	0,909	**17**
HUELVA	0.817	1.159	1.000	0.817	0,948	**16**
JEREZ	0.692	1.209	1.207	0.573	0,836	**18**
MALAGA	1.094	1.010	1.038	1.054	1.105	**8**
MARBELLA	1.078	1.023	0.993	1.085	1.103	**9**
PUNTA UMBRÍA	1.000	1.286	1.000	1.000	1.286	**4**
SEVILLA	1.000	1.021	1.000	1.000	1.021	**13**
SIERRA NEVADA	1.000	1.013	1.000	1.000	1.013	**14**
VIZNAR	0.821	1.215	0.960	0.855	0,997	**15**
Mean	**1.019**	**1.122**	**1.052**	**0.968**	**1.143**	

Table 6. Malmquist Index Summary year = 2012 (compared to 2008).

Youth Hostel	Efficiency Change	Technological Change	Pure Efficiency Change	Scale Efficiency Change	TPF	TPF Ranking
AGUADULCE	1.000	1.306	1.000	1.000	1.306	**1**
ALGECIRAS	1.017	0.732	1.000	1.017	0,744	**12**
ALMERIA	0.938	0.762	0.947	0.991	0,715	**14**
BOSQUE	0.633	1.001	1.030	0.615	0,634	**17**
CAZORLA	1.205	0.684	1.036	1.163	0,825	**6**
CHIPIONA	1.063	0.832	1.000	1.063	0,884	**3**
CONSTANTINA	1.000	0.841	1.000	1.000	0,841	**4**
CORDOBA	1.000	0.675	1.000	1.000	0,675	**16**
CORTES	0.877	0.845	1.000	0.877	0,741	**13**
GRANADA	0.964	0.714	0.970	0.994	0,688	**15**
HUELVA	0.900	0.835	0.945	0.953	0,752	**11**
JEREZ	1.250	0.822	0.770	1.623	1.028	**2**
MALAGA	1.000	0.791	1.000	1.000	0,791	**8**
MARBELLA	0.834	0.903	0.864	0.965	0,753	**10**
PUNTA UMBRÍA	1.000	0.790	1.000	1.000	0,79	**9**
SEVILLA	1.000	0.820	1.000	1.000	0,82	**7**
SIERRA NEVADA	1.000	0.837	1.000	1.000	0,837	**5**
VIZNAR	0.674	0.797	1.042	0.646	0,537	**18**
Mean	**0.952**	**0.823**	**0.976**	**0.976**	**0.784**	

6. CONCLUSIONS

In this paper, we analyze the efficiency level of the hostels of the AYH and its productivity variations for the period 2003-2012, through the efficient frontier delineation determined by the non-parametric DEA technique and Malmquist indices. Within the period under review, special attention is paid to the year 2008 since it was the beginning of the crisis in Spain.

The main conclusion of our paper is that AYH hostels present overall levels of technical efficiency around of 90% aproximately, which is a better situation than in the Spanish hotel industry. However, both pure technical and scale efficiency remain around their optimal scale of operations, especially in the latter part of the period analyzed.

Regarding the productive change, we see an increase of 14.3 % for the 2003-2008 period which can be attributed to an improvement in efficiency change (+5.2%) and to a decrease in the average technical change (-12.2%). On theother hand, there is a severe drop in the level of productivity (-21%) during the crisis period (2008-2012), caused by the collapse of technical change (-7.7%) and the decrease in the efficiency change (4.8%).

Thus, it appears that the crisis has also negatively affected hostels, in the same way as it has in the whole hotel industry, due to their high fixed costs which remained impossible to reduce despite the decrease in activity.

Finally, we must emphasize that the variations in the results obtained by the hostels will be useful for AYH managers in order to ensure better management of the company, by improving the efficiency of the lower ranking AYH hostels with special emphasis on the most efficient ones, according to the ranking obtained.

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