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Efficiency in the hotel industry: an empirical examination of the most influential factors

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ABSTRACT

The purpose of this article is to provide insights into hotel efficiency and investigate which hotels are performing better. Hotel efficiency is examined using data envelopment analysis (DEA) and the output-oriented BCC model is applied on the hotels' internal accounting information. The study further explores whether there are differences in efficiency between hotels of different size and quality. The results show that average efficiency is high, but not all hotels are performing at their maximum efficiency. A significant relationship between size and hotel efficiency has been found. This study provides a potential framework for efficiency measurement and contributes to the growing body of knowledge in the area of hotel efficiency in the context of a country that is predominantly concentrated on seasonal seaside tourism. The results of this research offer useful insights for hotel managers, suggest ways of enhancing hotel productivity and provide guidance on which aspects to focus their attention in the decision-making process.

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Introduction

Now that competitiveness between hotels is increasing, hotel managers are starting to realise that improving their performance can become their advantage and with competitive benchmarking these improvements can be identified and made (Min & Min, 1997). Company efforts to achieve superior performance include the implementation of various emerging business tools and management philosophies (Hernaus, Bach, & Vukšic, 2012). When financial resources are limited, business practices have to be focused on the activities that have the most significant influence on hotel efficiency, as well as on financial results. Sources of inefficiency should be determined first so that hotel managers can devote their attention on areas that will result in better performance. This is particularly significant for the hotel industry where there is a high degree of seasonality. Efficiency is one of the key factors of management control and a prerequisite for making improvements. There are many different approaches on how to measure the efficiency of hotel companies (Baker &

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Riley, 1994; Van Doren & Gustke, 1982; Fay, Rhoads, & Rosenblatt, 1971; Ismail, Dalbor, & Mills, 2002; Kimes, 1989; Wassenaar & Stafford, 1991) and data envelopment analysis (DEA) is one of them.

Hotel efficiency can vary for many reasons. Mixed results have been found in different research. From the surrounding environmental factors, the vicinity of the seashore has the greatest impact on performance, while historical buildings and monuments do not have any impact (Shahroudi & Dery, 2011). Research in Crete has shown that nationally-branded hotels are most efficient, followed by local brand and independent hotels and internationally-branded hotels are the least efficient (Manasakis, Apostolakis, & Datseris, 2013). Sanjeev (2007) explored the relationship between the efficiency and size of hotels in India and found no clear link. Assaf and Knežević (2010) examined the effect of the hotels' business year, star rating and size and found that they are positively related. Davutyan (2007) found out that 4-star hotels in Turkey have higher efficiency scores than 5-star hotels. Large hotels and chain hotels have better performance results than small and independent hotels (Assaf, Barros, & Josiassen, 2012). Accounting information is the first source where managers must seek guidance prior to making decisions and introducing new processes and innovations in hotels in order to enhance their efficiency.

The first section introduces the concept of DEA and explains the basic methods. The next section explains the research done in the field of the hotel industry. Afterwards, DEA is situated into the Croatian context. In this section empirical research and results are delivered. At the end a discussion and conclusion are presented.

Data envelopment analysis – a general overview

On the basis of previous research (Debreu, 1951; Farrell, 1957; Koopmans, 1951) Charnes, Cooper and Rodes first proposed the model of DEA in 1978. DEA is a nonparametric method where the use of multiple inputs and outputs is allowed. Combining these inputs and outputs, the relative efficiency for an organisation or parts of an organisation (also called decision-making units [DMU]) is calculated. In a sample of DMUs, the ones with the best practice are identified. An efficiency frontier is set, the DMUs on the frontier are efficient (best practice) and the ones that are below the frontier are inefficient. Efficiency is shown by an index with values from 0 to 1 (0 to 100%). The result 1 represents an efficient unit and if a unit has a result smaller than 1 then this unit is inefficient. For the DEA to be applicable to a sample, the DMUs in the sample have to be engaged in similar activities so that a common group of inputs and outputs can be determined and the units have to operate in a similar environment (Dyson et al., 2001). One of the advantages, unlike conventional accounting methods, is that the DEA makes it possible to compare the relative performance between multiple performance measures (Rouse, Harrison, & Chen, 2010).

Two approaches can be differentiated: the input-oriented approach and the output-oriented approach. The input-oriented approach assumes minimisation of inputs for the given level of output. The output-oriented approach supposes maximisation of outputs for the given inputs.

There are different variations of the DEA method. The first model (Charnes, Cooper, & Rhodes, 1978) is a constant returns to scale (CRS model or also called CCR model – named after its authors) model that implies that the change in outputs/inputs will be the same as the change in inputs/outputs. Banker, Charnes and Cooper in 1984 introduced variable returns

on the scale model (VRS model or BCC model also named by the initial of the authors). In this model the level of outputs/inputs does not need to change in the same proportion as the level of inputs/outputs, it can increase, remain constant or decrease. Some other basic models are: additive model, multiplicative model, cone ratio model, assurance region model and super efficiency model.

The DEA can be applied to various areas like Internet companies of various industries (Cao & Yang, 2011), Internet marketing strategies of hotel companies (Sigala, 2003), the banking sector (Dong, Hamilton, & Tippett, 2014), hospitals (Guerra, de Souza, & Moreira, 2012), the agriculture sector (Aktan & Samut, 2013), etc. Other researchers have used it as an instrument for sustainability analysis (Chang, Kuo, & Chen, 2013; Korhonen & Luptacik, 2004; Zhang, Bi, Fan, Yuan, & Ge, 2008).

Data envelopment approach in the hospitality industry

The DEA can be effectively applied in assessing economic and environmental performance of tourism management and this can be particularly useful for countries where the tourism industry has both increasing economic relevance and a growing impact on the environment (Bosetti, Cassinelli, & Lanza, 2004, p. 12). One of the advantages of the DEA is that can be used on a small sample of hotels (Assaf & Knežević, 2010; Cheng, Lu, & Chung, 2010). In 1996 Parkan applied various techniques to evaluate the performance of hotel companies in the US. One of the techniques was DEA. This was one of the first attempts to measure the efficiency of hotel companies by applying this method. Hwang and Chang (2003) used the DEA to measure the relative managerial efficiency of hotels in Taiwan and the Malmquist productivity approach to measure the managerial efficiency change. Barros, Peypoch, and Solonandrasana (2009) used the directional distance function and the Luenberger productivity indicator on the sample of 15 hotel companies in Portugal. The main advantage of this approach is that it minimises inputs and maximises outputs at the same time. In 2009 plural form chains performance of French hotel companies and efficiency was compared to predominantly franchised chains and predominantly company-owned ones (Perrigot, Cliquet, & Piot-Lepetit). Chen (2009) upgraded the basic model and proposed an approach to create a set of common weights so business units could be compared on a mutual basis. Looking at market orientation, subjective performance measures have the strongest effect on the hotel companies' performance in Norway (Haugland, Myrtveit, & Nygaard, 2007). Hotel companies that concentrate on their core business and have a focused strategy perform better than companies that concentrate on diversified activities (Neves & Lourenco, 2009). Barros and Santos (2006) propose that for improving efficiency an enhanced-incentive policy should be implemented, as well as to upgrade the quality of hotel management practices, adjust prices according to market demands, ensure better labour controls and adopt procedures for benchmarking. Ashrafi, Seowb, Lee, and Lee (2013) tried a different approach. They treated years as DMUs and in this way they evaluated efficiency of the hotel industry as a whole on sample hotels in Singapore. Wu, Tsai and Zhou (2011) developed a non-radial DEA model that reduces the inefficiencies regarding modifications in output with non-proportional augmentations. One of the characteristics of efficient hotel companies is that they assign more resources to food and beverage (F&B) operations and inefficient companies, on the other hand, tend to allocate more resources to hotel operations and other expenses and they also have more employees (Anderson, Fok, & Scott, 2000). The

first relational network DEA of a hotel was done in Taiwan on a sample of 57 international hotels (Hsieh & Lin, 2010). In 2009 Hyperbolic network DEA was conducted on hotels and production processes and marketing processes were integrated for a more comprehensive view of hotel performance (Yu & Lee, 2009).

Studies in the area of the hotel industry have used various accounting financial and non-financial information for input and output variables (Table 1).

For financial input variables, expenses for different departments, labour expenses and various energy expenses are commonly applied. From non-financial inputs, the number of rooms and the number of employees are frequently used. Concerning financial output variables, it can be noticed that the total revenue or revenue segmented by departments is employed in almost all cases. The occupancy rate and number of guests are non-financial output variables that are consistently utilised.

Table 1. Overview of variables used in research of the hotel industry.

Author	INPUT	OUTPUT
Johns, Howcroft, and Drake (1997)	Room nights available, labour hours, Food and beverage (F&B) costs, utilities cost	Room nights sold, covers served, beverage revenue
Hwang and Chang (2003)	Full-time employees, guest rooms, area of meal department, operating expenses	Room revenue, F&B revenue, other revenues
Chiang, Tsai, and Wang (2004)	Hotel rooms, F&B area, employees, total cost of the hotel	Yielding index, F&B revenue, miscellaneous revenue
Barros (2005)	Full time workers, cost of labour, rooms, surface area of the hotel, book value of property, operational costs, external costs	Sales, number of guests, nights spent
Barros and Santos (2006)	Labour, full-time-equivalent employees, capital	Sales, added value, earnings
	Electricity consumption, water consumption, liquefied petroleum gas, employees	Occupancy rate, revenue, number of guests
Önüt and Soner (2006)	Employees, electricity consumption, water consumption, liquefied petroleum gas consumption	Occupancy rate, revenue, number of guests
Chen (2007)	Price of labour, price of F&B, price of materials	Total revenue of hotel
Davutyan (2007)	No. of available beds, employees, operating expenses	Beds sold to return customers divided by number. of available beds, beds sold
Perez-Rodrıguez and Acosta-Gonzalez (2007)	Price of labour, price of capital, financial costs	Total annual revenue
Min et al. (2008)	Cost of sales, payroll and labour related expenses, other operating and non-operating expenses	Revenue from rooms, revenue from F&B, revenue from other services
	Rooms expenses, F&B expenses, expenses from other services	Revenue from rooms, revenue from F&B, revenue from other services
	Cost of sales, payroll and labour-related expenses, other operating and non-operating expenses	Occupancy ratio, profit margin
	Rooms expenses, F&B expenses, expenses from other services	Occupancy ratio, profit margin
Barros et al. (2009)	No. of employees, physical capital	Sales, added value
Neves and Lourenco (2009)	Current assets, net fixed assets, shareholders' equity, cost of goods and services	Revenues and earnings (EBITDA)

(Continued)

Table 1. (*continued*)

Author	INPUT	OUTPUT
Perrigot et al. (2009)	Age of the hotel chain in years, labour, Number of rooms in the chain, expansion costs: Number of hotel openings during the year, franchising contract: royalties in percentage, chain ranking	Room revenues: occupancy rate in percentage, other revenues, total sales
Yu and Lee (2009)	Full-time employees in the room service department, full-time employees in the F&B department, number of rooms, floor area in the F&B service department; expenses for each service sector, shared input	Rooms revenue, F&B revenue, other revenue
Chen, Hu, and Liao (2010)	No. of guest rooms; employees; floor space of catering division	F&B revenues; rooms revenues; other revenues
Hsieh and Lin (2010)	Accommodation costs, number of employees of the accommodation department, catering cost, employees of the catering department, rooms, catering floors	Accommodation revenue, catering revenue
Hsieh et al. (2010)	No. of rooms, number of employees, facilities expenses, management expenses	Occupied room rate, total revenue
Assaf and Magnini (2011)	No. of outlets, full time equivalent employees, other operational costs	Total revenues, occupancy rate
Avkiran (2011)	Full-time staff, permanent part-time staff, bed capacity	Revenue and cost of a double room
Chen (2011)	Employees, surface area of floors, guest rooms, operating expenses, depreciation expenses	No. of guests, occupancy rate, guest satisfaction index,room revenue, other revenue
Shahroudi and Dery (2011)	No. of rooms, full-time employees, area of hotel	No. of guests, number of rooms occupied
Yen and Othman (2011)	Room nights available, number of employees, book value of the property, total operating expenses, non-operating expenses, F&B costs	No. of room nights occupied, number of guests; average occupancy rate, operating revenues, other revenues, F&B revenues
Honma and Hu (2012)	No. of employees, number of temporary staff, number of seats in restaurants and bars, number of rooms	Real revenue
Ashrafi et al. (2013)	Standard average room rate, total international visitor arrivals, GDP	Hotel room revenue, hotel F&B revenue, occupancy rate, gross lettings
Manasakis et al. (2013)	No. of employees, number of beds, total operational cost	Total revenues, total number of nights spent

Source: Authors.

Empirical research – data envelopment analysis in the Croatian context

The latest data record 605 hotels in Croatia (Ministry of tourism Republic of Croatia, 2014). The majority of hotels have been rated with 3 stars (49.75%), followed by 4 star rated hotels (31.73%), 13.17% are of the lowest quality and only 4.79% are the highest quality and rated with 5 stars. With regard to the size of hotels, it is measured by the number of rooms. Usually, size is measured in terms of the size of the company, which is defined by accounting law. Our sample consists of hotels, not hotel companies. The main difference is that a hotel company can own one or more hotel. With regard to the size of hotels according to the number of hotel rooms, in Croatia small hotels hold 78% of the overall accommodation

capacity, followed by 21% of medium-sized hotels, 1% of accommodation capacity belongs to large hotels (Ministry of tourism Republic of Croatia, 2014).

Croatia is a small country with an economy that depends largely on tourism. In 2014 tourism revenues generated 17.2% of the gross domestic product (Ministry of tourism Republic of Croatia, 2015). Croatia is ranked 35th on the Travel and Tourism Competitiveness Index with its main competitive advantages in health and hygiene, tourism infrastructure, affinity for travel and tourism, cultural resources and ICT infrastructure (World Economic Forum, 2013). One of the main characteristics of tourism in Croatia is its seasonality and the fact that most tourist arrivals and overnight stays occur within the scope of four months, from June to September on the coast. A country rich in natural and cultural heritage, as well as a country with developed tourism infrastructure, a season this short indicates that the tourism potentials are not being used to their maximum. Hotel offers are perishable and an unsold room cannot be sold the next day. It is of crucial importance that information needed for decision-making reflects all aspects of the business and that it is reported in a timely manner. Hotel managers usually measure their success with classic performance measurement tools like revenue per available room, occupancy rate, return on investment and similar indicators, but to get a more in-depth analysis efficiency results should be used. These classic performance measurement indicators are usually determined as a ratio of two variables (Thanassoulis, Boussofiane, & Dyson, 1996) and do not represent the overall hotel company performance. The main advantage of efficiency measured by the DEA over other performance measurement indicators is that it can evaluate and monitor multiple dimensions of performance (Wöber, 2002) and allows a combination of financial, as well as non-financial, measures.

We want to examine the current state in Croatian hotels from this perspective and therefore propose the following research questions:

Research question 1: *What is the level of efficiency in Croatian hotels?*

We wanted to examine which hotel characteristics cause variations in efficiency. The surrounding environmental factor was not applicable while, according to the data of the Croatian Bureau of Statistics (2013), Croatia had a capacity of 305,000 rooms in 2012 from which 91% are located on the coast. Additionally, the brand of the hotel is not suitable for the investigation, while nationally- and internationally-branded hotels represent only a small portion of the overall number of hotels in Croatia. Another possibility could be to investigate the difference between company ownership, but Croatian hotels are predominantly of private ownership. For this reasons, we decided to test if there is any efficiency variance among hotels of different size and quality. Hotels' number of stars (star rating) is commonly used to rate hotels' quality (Israeli, 2002).

In order to examine which hotel characteristics cause variations in efficiency, we propose the following:

Research question 2: *Is there any difference in efficiency between hotels of different size?*

Research question 3: *Is there any difference in efficiency between hotels of different quality (star rating)?*

In this research two methods were applied. First a DEA was used to calculate efficiency scores, followed by analysis of variance to determine if there are differences in efficiency between hotels of different size and star rating.

The main data sources for this sample were the Croatian Hotel Benchmarking programme for hotels' accounting information and a questionnaire for hotels' non-accounting information. In this research the sample consists of 105 hotels in Croatia for the year 2013. This represents 17.4% of hotels in Croatia. According to their quality, 13% of the hotels in the sample are 5-star rated, 54% are 4-star rated, 31% are 3-star rated and 2% are 2-star rated.

Based on the research of Barros and Santos (2006), Chen (2007), Min, Min, and Joo (2008), Hsieh, Wang, Huang, and Chen (2010) and Assaf and Magnini (2011), the new hotel efficiency model is proposed (Table 2).

The input and output variables were selected according to literature review, but also according to the accessibility of the data. Input variables are the ones that are used to produce services and output variables are seen as an outcome from the production process. According to the Uniform System of Accounts for the Lodging Industry (USALI), hotels are segmented into operating departments. Three main profit departments are recognised and include rooms, F&B and other operated departments (American Hotel & Lodging Educational Institute, 2014). Following this, expenses from these departments were used as input variables. Since energy and labour expenses make a significant proportion of the overall hotel expenses, they were also included in the equation. Hotel expenses are employed in order to produce services and products that will generate revenues from guests, therefore total revenue and occupancy rate are selected as output variables.

Hotel financial and non-financial information is used and the variables include the following:

- Rooms expenses – Includes salaries and wages, employee benefits and other expenses (cable/satellite television, commissions, complimentary guest services, contract services, guest relocation and transportation, laundry and dry cleaning, linen, operating supplies, reservations, telecommunication, training, uniforms and other expenses) expressed in financial measures.
- F&B expenses – Includes the cost of F&B, salaries and wages, employee benefits and other expenses (china, glassware, silver and linen, contract services, laundry and dry cleaning, licences, miscellaneous banquet expenses, gratis food, music and entertainment, operating supplies, telecommunications, training, uniforms and other expenses) expressed in financial measures.
- Expenses associated with other services – Other services are all other operated departments that have revenues like telecommunications, garage and parking, golf course, guest laundry, health centre, swimming pool, tennis and all other operated departments. They include the cost of salaries and wages, employee benefits and all other expenses expressed in financial measures.

Table 2. Model – Hotel efficiency.

Inputs:	Output:
Energy expenses	Total revenue
Room expenses	Occupancy rate
F&B expenses	
Expenses associated with other services	
Labour expenses	

Source: Authors.

Table 3. Correlation matrix.

	Total revenue	Occupancy rate
Rooms expenses	.697**	.198*
F&B expenses	.873**	.262**
Expenses associated with other services	.437**	0.163
Energy expenses	.746**	.378**
Labour expenses	.908**	.353**
Total revenue	1	.360**
Occupancy rate	.360**	1

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).
Source: Authors.

- Energy expenses – Includes the cost of water, electricity, gas, oil and other fuels expressed in financial measures.
- Labour expenses – Includes total cost of salaries and wages (cost of salaries and wages, payroll taxes and employee benefits) from the employees of all of the departments in the hotel.
- Total revenue – Includes revenue from room department, F&B department and all other operated departments (minus allowances).
- Occupancy rate – Rate of the number of occupied rooms divided by the total number of rooms.

In the second stage of analysis, the variable hotel ratings – that represents hotel quality – are also included, together with the variable number of rooms that denotes hotel size. The number of rooms was divided into three categories depending on the size (The European Consumer Centres' Network, 2009). Hotels which have less than 151 rooms were categorised as small. Hotels ranging between 151 and 400 were classified as medium-size and hotels with more than 400 rooms were labelled as large hotels.

According to Thanassoulis et al. (1996) and Cooper et al. (2001) the analysed sample has to meet the requirement that the minimum number of DMUs has to be a function of number of inputs and outputs that are used in each model. Other authors demand that the minimum number of DMUs has to be greater than three times the sum of total number of inputs and outputs (Mehregan, 2008; Raab & Lichty, 2002). Our model satisfies all of these conditions.

DEA also has to meet the condition that all inputs have to be positive and positively related to at least one output (Perrigot, Cliquet, & Piot-Lepetit, 2009). In our case all the variables comply with this rule. The correlation coefficients between variables can be seen in Table 3.

The efficiency results are very sensitive to outliers (Donthu, Hershberger, & Osmonbekov, 2005; Johnson & McGinnis, 2008; Simar, 1996), hence outlier detection was conducted. There are various ways of detecting outliers in DEA. We use a technique that was applied in previous research (Kerstens, 1996; Verardi & Dehon, 2010).

This method of detecting outliers consists of two steps. The first step is to calculate the Mahalanobis distances (Mahalanobis, 1936) for all data points of all model variables (input and output variables). The Mahalanobis distance represents the distance between the data points that defines the distribution of all data points and is calculated by the expression:

$$D_M(x) = \sqrt{((x-\mu)^T S^{(-1)}(x-\mu))} \tag{1}$$

Mahalanobis squared distance D2 follows χ2 distribution. The second step is determining the probability associated with each data point by using CDF χ2 distribution. The calculation of D^2 was made in SPSS in the module Regression. If the probability that D^2 follows χ2 distribution is less than the threshold, the data point is an outlier. The calculation of probability connected with D^2 is made using CDF for χ2 distribution according to the formula: Pi=1-CDF(Di2). Data was sorted according to the declining value of pi. The threshold for potential outliers was $p<0.01$. Five outliers were detected and excluded from further analysis. More detailed results are available from the authors on request.

In determining efficiency results the CCR output-oriented model was applied with constant returns on scale. We decided to use output-oriented DEA that maximises output with the same level of inputs, while the input-oriented approach works on minimising inputs which can affect the level of quality of the service that can have serious consequences in the hotel business. A constant return on scale was chosen and it is assumed that the proportionality assumption is satisfied. The analysis was made using MaxDEA software. Efficiency results can be seen in the Table 4.

For confidentiality reasons, hotels are named by numbers. In the efficiency results 100% denotes maximum efficiency. The minimum hotel efficiency is 23% and maximum 100% with an average of 73%. More than half of hotels perform at a level that is lower than the average. The results of the remaining hotels show that they have a higher than average or maximum efficiency. These scores display efficiency from the model sample and should not be confused with the absolute measure.

Table 5 summarises the descriptive information about all the variables. Financial variables are expressed in Euros.

In this section variables we will be interpreted. All the financial variables are presented in euros. Room expenses have a mean value of 261,912 € ranging from 10,498 € to 865,899 €.

Table 4. Hotel efficiency results.

Hotel	Efficiency	Hotel	Efficiency	Hotel	Efficiency	Hotel	Efficiency
1	87%	26	100%	51	52%	76	86%
2	100%	27	100%	52	42%	77	60%
3	100%	28	65%	53	69%	78	41%
4	66%	29	43%	54	71%	79	100%
5	100%	30	100%	55	84%	80	66%
6	100%	31	100%	56	51%	81	36%
7	77%	32	38%	57	45%	82	63%
8	100%	33	33%	58	88%	83	82%
9	100%	34	100%	59	100%	84	50%
10	52%	35	93%	60	100%	85	47%
11	91%	36	71%	61	57%	86	64%
12	66%	37	48%	62	58%	87	67%
13	81%	38	49%	63	100%	88	72%
14	77%	39	23%	64	98%	89	57%
15	100%	40	94%	65	73%	90	46%
16	95%	41	100%	66	57%	91	88%
17	98%	42	62%	67	100%	92	56%
18	100%	43	53%	68	100%	93	58%
19	100%	44	75%	69	65%	94	42%
20	100%	45	100%	70	96%	95	68%
21	81%	46	60%	71	67%	96	54%
22	94%	47	61%	72	100%	97	48%
23	50%	48	96%	73	34%	98	79%
24	88%	49	100%	74	97%	99	59%
25	45%	50	55%	75	59%	100	57%

Source: Authors.

Table 5. Descriptive statistics.

Variable	Observation	Mean	Std. Dev.	Min	Max
Room expenses	100	261912	206342	10498	865899
F&B expenses	100	517308	376073	20542	1678459
Other expenses	100	47408	71157	0,00	299916
Labour expenses	100	910295	658643	77667	2852492
Energy expenses	100	213728	192983	9252	1333582
Number of stars	100	3.75	0.69	2.00	5.00
Number of rooms	100	208.50	115.70	6.00	491.00
Total revenue	100	4057512	2710427	250950	12508186
Occupancy rate	100	43.88	12.58	15.82	70.17

Source: Authors.

Table 6. Analysis of variance.

	No. stars	Hotel size
Efficiency	W(3, 4.716)=0.352	F(2,97)=5.011

Source: Authors.

The F&B expenses have a minimum value of 20,542 € and a maximum value of 1,678,459 € with a mean of 517,308 €. Expenses from other operated departments range from 0, which are hotels that do not have any other departments except rooms and an F&B division, to the maximum of 299,916 € and a mean valued at 47,408 €. The cost of labour has the highest values of expenses, the minimum is 77,667 € and the maximum 2,852,492 €, the mean is set at 910,295 €. Energy expenses range from 9,252 € to 1,333,582€ and the mean is 213,728€. Hotels in the sample range from 2- to 5-star rating with an average of 3.75 stars. If we analyse the number of rooms, the smallest hotel has six rooms and the biggest has 491 rooms, with a mean of 208.5 rooms. The minimal hotel revenue is 250,950€ and the maximum is 12,508,186€, and a mean valued at 4,057,512€. The occupancy rate variable ranges from 13% to 70% with a mean value of 43%.

The relationships between the number of stars and hotel size in relationship to hotel efficiency were also explored. An analysis of variance (ANOVA) was used (Table 6). The Welch test was used in cases where ANOVA assumptions were violated, that is, where the homogeneity of the variance test was found to be significant.

Research results indicate that there exists statistically significant relationship between the hotel size and efficiency. Bonferroni post hoc test indicated statistically significant difference in efficiency of small hotels in comparison to medium. Small hotels operate at the average efficiency level of 85%, while medium-sized hotels have average an efficiency level of 70%. Furthermore, research results demonstrate that there is no statistically significant relationship between hotel quality and efficiency.

Discussion

The results indicate that hotels operate at a relatively high level of efficiency, since the average efficiency of a hotel within the group amounts to 73%. When comparing these results with previous research, Croatia has lower level of efficiency than other countries. While Chen's (2010) results of the international tourist hotel sector in Taiwan reveal an average efficiency of 80%, Assaf and Knežević's (2010) research in Slovenian hotels shows a high average of 88%. This efficiency can be an excellent benchmark for hotel managers to use

when comparing themselves with their competitors since it comprises different expenses, total revenue and occupancy rate. Since the average efficiency is lower than in other countries, Croatian hotels need to significantly improve their performance. Possible cause for these poor results could be seen in low average occupancy rate for our sample.

Every hotel has its own unique characteristics and there is no universal formula on how to enhance its performance. Hotels have two possible options to improve their efficiency. Their first option is to reduce the inputs that they use in the process of production of services – in this case, minimising F&B, labour, energy and other expenses. Their second option is to increase outputs, which are the results that have been obtained from the process of producing services, which in our example refers to revenues and occupancy rate. Hotel managers need to carefully consider both of these options. Minimising costs can have positive short-term effects, but in the long-term there is a danger of impacting service quality, as well as customer and employee satisfaction. Revenue maximisation can be achieved by increasing the prices of services and hotel managers need to attentively test their hotel's price elasticity. The easiest way to increase occupancy is to lower the selling price of services, but this contradicts with the goal of maximising revenues. The ideal solution would be to raise prices while offering guests some added value with regard to the hotel's main competitors at the same time.

Similar to previous studies (Assaf & Knežević, 2010; Davutyan, 2007), a difference in efficiency results between small- and medium-sized hotels has been found. Small-sized hotel, although they have more limited resources, manage it better than medium-sized hotels. Furthermore, there is no relationship between small- and medium-sized hotels and large hotels. One of the potential reasons for this is that in Croatia, only 1.3 % of hotel are 'large' (Ministry of tourism Republic of Croatia, 2014). It can be also seen that small hotels have higher efficiency than medium-sized hotels. A possible argument for this could be that smaller hotels manage smaller levels of resources and it is easier for them to maximise their occupancy rate. Our research results are in contrast to the studies of Hwang and Chang (2003), Wang, Hung and Shang (2006) and Sanjeev (2007) where no difference has been found.

The potential strategies for managers in improving the overall profitability should focus on identifying the key success factors and creating competitive advantages. Some hotel companies are successful because they have implemented proper strategies, while others are not successful because of their inability to identify and implement the right strategies.

Conclusion

Hotel companies are in a constant struggle to maximise their potential and finding new ways to achieve this. Performance measurement and accounting information can be of high value here. The advantage of efficiency information provided by DEA is that all the inputs and outputs of a business are taken into consideration and it provides a wider perspective of the performance. In this research, a potential framework for evaluating efficiency was proposed. Efficiency was examined on a sample in Croatia, but it can be applied to other countries that have similar conditions, like high dependence on tourism and an emphasis on seaside tourism that is limited to one season. The aim of this article was to present hotel efficiency results as a source of information that is needed to improve business performance and provide benchmarks for hotels that have not reached maximum efficiency. Finding the

most appropriate solution for enhancing hotels performance is a very complex matter that should be tackled together with the accounting department (cost and revenue management experts) and the sales and marketing department. Only with an appropriate and balanced relationship between revenue and cost management can hotels attain an optimal strategy to raise their efficiency and consequently enhance performance.

To our knowledge, this is the first efficiency research done on the sample of Croatian hotels. It is especially valuable, while in contrast to other research, it uses hotels internal results. This study also contributes to the ongoing debate concerning the difference in efficiency among hotels of different size (Assaf & Knežević, 2010; Chen, 2010; Davutyan, 2007; Hwang & Chang, 2003; Sanjeev, 2007; Wang, Hung & Shang, 2006).

Future studies should be focused on extending the hotel sample and longitudinal data would be also preferred, since this data only provides a snapshot of the current state. Additional improvements could be made by introducing new input and output variables. The differences in efficiency regarding operation type, location or some other characteristics could also be addressed.

References

Aktan, E. H., & Samut, K. P. (2013). Analysis of the efficiency determinants of Turkey's agriculture sector by two-stage Data Envelopment Analysis (DEA). *Ege Academic Review, 13*, 21–28.

American Hotel & Lodging Educational Institute. (2014). *Uniform system of accounts for the lodging industry* (11th ed.). Lansing, Michigan: American Hotel & Lodging Educational Institute.

Anderson, R. I., Fok, R., & Scott, J. (2000). Hotel industry efficiency: an advanced linear programming examination. *American Business Review, 18*, 40–48.

Ashrafi, A., Seowb, H. V., Lee, L. S., & Lee, C. G. (2013). The efficiency of the hotel industry in Singapore. *Tourism Management, 37*, 31–34.

Assaf, A., & Knežević, C. L. (2010). The performance of the Slovenian hotel industry: evaluation post-privatisation. *International Journal of Tourism Research, 12*, 462–471.

Assaf, A. G., & Magnini, V. (2011). Accounting for customer satisfaction in measuring hotel efficiency: Evidence from the US hotel industry. *International Journal of Hospitality Management, 31*, 642–647.

Assaf, A., Barros, C. P., & Josiassen, A. (2012). Hotel efficiency: a bootstrapped metafrontier approach. *International Journal of Hospitality Management, 31*, 621–629.

Avkiran, N. K. (2011). Applications of data envelopment analysis in the service sector. In W. W. Cooper, L. M. Seiford, J. Zhu, F. S. Hillier, & C. C. Price (Eds.), *Handbook on Data Envelopment Analysis* (2nd ed.). (pp. 403–443). Dordrecht: Springer, Netherlands.

Baker, M., & Riley, M. (1994). New perspectives on productivity in hotels: some advances and new directions. *International Journal of Hospitality Management, 13*, 297–311.

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science, 30*, 1078–1092.

Barros, C. P. (2005). Measuring efficiency in the hotel sector. *Annals of Tourism Research, 32*, 456–477.

Barros, C. A. P., & Santos, C. A. (2006). The measurement of efficiency in portuguese hotels using data envelopment analysis. *Journal of Hospitality & Tourism Research, 30*, 378–400.

Barros, C. P., Peypoch, N., & Solonandrasana, B. (2009). Efficiency and productivity growth in hotel industry. *International Journal of Tourism Research, 11*, 389–402.

Bosetti, V., Cassinelli, M., & Lanza, A. (2004). *Using Data Envelopment Analysis to evaluate environmentally conscious tourism management* (FEEM Working Paper No. 59.). Retrieved from http://www.feem.it/userfiles/attach/Publication/NDL2004/NDL2004-059.pdf

Cao, X., & Yang, F. (2011). Measuring the performance of Internet companies using a two-stage data envelopment analysis model. *Enterprise Information Systems, 5*, 207–217.

Chang, D. S., Kuo, L. C. R., & Chen, Y. T. (2013). Industrial changes in corporate sustainability performance – an empirical overview using data envelopment analysis. *Journal of Cleaner Production, 56*, 147–155.
Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research, 2*, 429–444.
Chen, C. F. (2007). Applying the stochastic frontier approach to measure hotel managerial efficiency in Taiwan. *Tourism Management, 28*, 696–702.
Chen, T. F. (2009). Performance measurement of an enterprise and business units with an application to a Taiwanese hotel chain. *International Journal of Hospitality Management, 28*, 415–422.
Chen, T. H. (2011). Performance measurement in a small Taiwanese hotel chain. *Cornell Hospitality Quarterly, 52*, 354–362.
Chen, C. T., Hu, J. L., & Liao, J. J. (2010). Tourists' nationalities and the cost efficiency of international tourist hotels in Taiwan. *Africa Journal of Business Management, 4*, 3440–3446.
Cheng, H., Lu, Y. C., & Chung, J. T. (2010). Improved slack-based context-dependent DEA–A study of international tourist hotels in Taiwan. *Expert Systems with Applications, 37*, 6452–6458.
Chiang, W. E., Tsai, M. H., & Wang, L. S. M. (2004). A DEA evaluation of Taipei hotels. *Annals of Tourism Research, 31*, 712–715.
Cooper, W. W., Li, S., Seiford, L. M., Tone, K., Trall, R. M., & Zhu, J. (2001). Sensitivity and stability analysis in DEA: some recent developments. *Journal of Productivity Analysis, 15*, 217–246.
Croatian Bureau of Statistics. (2013). *Statistical yearbook of the Republic of Croatia*. Retrieved November 6, 2014, from http://www.dzs.hr/
Davutyan, N. (2007). Measuring the quality of hospitality at Antalya. *International Journal of Tourism Research, 9*, 51–57.
Debreu, G. (1951). The coefficient of resource utilization. *Econometrica, 19*, 273–292.
Dong, Y., Hamilton, R., & Tippett, M. (2014). Cost efficiency of the Chinese banking sector: a comparison of stochastic frontier analysis and data envelopment analysis. *Economic Modelling, 36*, 298–308.
Donthu, N., Hershberger, E. K., & Osmonbekov, T. (2005). Benchmarking marketing productivity using data envelopment analysis. *Journal of Business Research, 58*, 1474–1482.
Dyson, R. G., Allen, R., Camanho, A. S., Podinovski, V. V., Sarrico, C. S., & Shale, E. A. (2001). Pitfalls and protocols in DEA. *European Journal of Operational Research, 132*, 245–259.
Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society. Series A (General), 120*, 253–281.
Fay, C. T., Rhoads, R. C., & Rosenblatt, R. L. (1971). *Managerial accounting for hospitality service industries*. Bubuque, Iowa: William C. Brown Publishers.
Guerra, M., de Souza, A. A., & Moreira, D. R. (2012). Performance analysis: a study using Data Envelopment Analysis in 26 Brazilian hospitals. *Journal of Health Care Finance, 38*, 19–35.
Haugland, S. A., Myrtveit, I., & Nygaard, A. (2007). Market orientation and performance in the service industry: a data envelopment analysis. *Journal of Business Research, 60*, 1191–1197.
Hernaus, T., Bach, M. P., & Vukšic, V. B. (2012). Influence of strategic approach to BPM on financial and non-financial performance. *Baltic Journal of Management, 7*, 376–396.
Honma, S., & Hu, J. L. (2012). Analyzing Japanese hotel efficiency. *Tourism and Hospitality Research, 12*, 155–167.
Hsieh, L. F., & Lin, L. H. (2010). A performance evaluation model for international tourist hotels in Taiwan – an application of the relational network DEA. *International Journal of Hospitality Management, 29*, 14–24.
Hsieh, L. F., Wang, L. H., Huang, Y. C., & Chen, A. (2010). An efficiency and effectiveness model for international tourist hotels in Taiwan. *The Service Industries Journal, 30*, 2183–2199.
Hwang, S. N., & Chang, T. Y. (2003). Using data envelopment analysis to measure hotel managerial efficiency change in Taiwan. *Tourism Management, 24*, 357–369.
Ismail, J., Dalbor, M., & Mills, J. (1991). Using RevPar to analyse lodging- segment variability. *Cornell Hotel and Restaurant Administration Quarterly, 43*, 73–80.
Israeli, A. A. (2002). Star rating and corporate affiliation: their influence on room price and performance of hotels in Israel. *International Journal of Hospitality Management, 21*, 405–424.

Johns, N., Howcroft, B., & Drake, L. (1997). The use of data envelopment analysis to monitor hotel productivity. *Progress in Tourism and Hospitality Research, 3*, 119–127.
Johnson, A. L., & McGinnis, L. F. (2008). Outlier detection in two-stage semiparametric DEA models. *European Journal of Operational Research, 187*, 629–635.
Kerstens, K. (1996). Technical efficiency measurement and explanation of French urban transit companies. *Transportation Research Part A: Policy and Practice, 30*, 431–452.
Kimes, S. E. (1989). The basics of yield management. *Cornell Hotel & Restaurant Administration Quarterly, 30*, 14–19.
Koopmans, T. C. (1951). An analysis of production as an efficient combination of activities. In T. C. Koopmans (Ed.), *Activity analysis of production and allocation, cowles commission for research in economics* (pp. 33–97). New York, NY: John Wiley & Sons.
Korhonen, P. J., & Luptacik, M. (2004). Eco-efficiency analysis of power plants: An extension of data envelopment analysis. *European Journal of Operational Research, 154*, 437–446.
Mahalanobis, P. C. (1936). On the generalised distance in statistics. *Proceedings of the National Institute of Sciences of India, 2*, 49–55.
Manasakis, C., Apostolakis, A., & Datseris, G. (2013). Using data envelopment analysis to measure hotel efficiency in Crete. *International Journal of Contemporary Hospitality Management, 25*, 510–535.
Mehregan, M. H. (2008). *Evaluation of organizational performance: a quantitative approach using data envelopment analysis* (pp. 165–173). School of Management: Tehran University.
Min, H., & Min, H. (1997). Benchmarking the quality of hotel services: managerial perspectives.The. *International Journal of Quality & Reliability Management, 14*, 582–597.
Min, H., Min, H., & Joo, S. J. (2008). A data envelopment analysis-based balanced scorecard for measuring the comparative efficiency of Korean luxury hotels. *International Journal of Quality & Reliability Management, 25*, 349–365.
Ministry of tourism Republic of Croatia. (2014). *Popis kategoriziranih turističkih objekata: hoteli, kampovi i marine u Republici Hrvatskoj* [List of categorised tourist facilities: hotels, camps and marinas in Republic of Croatia]. Retrieved September 21, 2014, from http://www.mint.hr/default.aspx?ID=2505
Ministry of tourism Republic of Croatia. (2015). *Tourism in numbers 2014*. Retrieved November 1, 2014, from http://business.croatia.hr/Documents/3676/Turizam-u-brojkama-2014.pdf
Neves, J. C., & Lourenco, S. (2009). Using data envelopment analysis to select strategies that improve the performance of hotel companies. *International Journal of Contemporary Hospitality Management, 21*, 698–712.
Önüt, S., & Soner, S. (2006). Energy efficiency assessment for the Antalya Region hotels in Turkey. *Energy and Buildings, 38*, 964–971.
Parkan, C. (1996). Measuring the performance of hotel operations. *Socio-Economic Planning Sciences, 30*, 257–292.
Perez-Rodrıguez, J. V., & Acosta-Gonzalez, E. (2007). Cost efficiency of the lodging industry in the tourist destination of Gran Canaria (Spain). *Tourism Management, 28*, 993–1005.
Perrigot, R., Cliquet, G., & Piot-Lepetit, I. (2009). Plural form chain and efficiency: insights from the French hotel chains and the DEA methodology. *European Management Journal, 27*, 268–280.
Raab, R. L., & Lichty, R. W. (2002). Identifying subareas that comprise a greater metropolitan area: the criterion of county relative efficiency. *Journal of Regional Science, 42*, 579–594.
Rouse, P., Harrison, J., & Chen, L. (2010). Data envelopment analysis: a practical tool to measure performance. *Australian Accounting Review, 20*, 165–177.
Sanjeev, G. M. (2007). Measuring efficiency of the hotel and restaurant sector: the case of India. *International Journal of Contemporary Hospitality Management, 19*, 378–387.
Shahroudi, K., & Dery, M. (2011). Assessment of the efficiency of Guilan province's hotels using two-stage DEA method. *Australian Journal of Basic and Applied Sciences, 5*, 1495–1502.
Sigala, M. (2003). Developing and benchmarking internet marketing strategies in the hotel sector in Greece. *Journal of Hospitality & Tourism Research, 27*, 375–401.
Simar, L. (1996). Aspects of statistical analysis in DEA-type frontier models. *Journal of Productivity Analysis, 7*, 177–185.

Thanassoulis, E., Boussofiane, A., & Dyson, R. G. (1996). A comparison of data envelopment analysis and ratios as tools for performance assessment. *Omega: The International Journal of Management Science, 24*, 229–244.

The European Consumer Centres' Network. (2009). *Classification of hotel establishments within the EU*. Retrieved January 3, 2015, from http://ec.europa.eu/consumers/ecc/docs/hotel_establishment_classification_EU_en.pdf

Van Doren, C. S., & Gustke, L. D. (1982). Spatial Analysis of the US. *Annals of Tourism Research, 9*, 543–563.

Verardi, V., & Dehon, C. (2010). Multivariate outlier detection in Stata. *The Stata Journal, 10*, 259–266.

Wang, F. C., Hung, W. T., & Shang, J. K. (2006). Measuring pure managerial efficiency of international tourist hotels in Taiwan. *The Service Industries Journal, 26*, 59–71.

Wassenaar, K., & Stafford, E. R. (1991). The lodging index: an economic indicator for the hotel/motel industry. *Journal of Travel Research, 30*, 18–21.

Wöber, K. W. (2002). *Benchmarking in tourism and hospitality industries: the selection of benchmarking partners*. Oxon: CABI Publishing.

World Economic Forum. (2013). *Travel and tourism competitiveness report 2013*. Retrieved December 6, 2014, from http://www3.weforum.org/docs/WEF_TT_Competitiveness_Report_2013.pdf

Wu, J., Tsai, H., & Zhou, Z. (2011). Improving efficiency in international tourist hotels in Taipei using a non-radial DEA model. *International Journal of Contemporary Hospitality Management, 23*, 66–83.

Yen, F. L., & Othman, M. (2011). Data envelopment analysis to measure efficiency of hotels in Malaysia. *SEGi Review, 4*, 25–36.

Yu, M. M., & Lee, B. C. J. (2009). Efficiency and effectiveness of service business: evidence from international tourist hotels in Taiwan. *Tourism Management, 30*, 571–580.

Zhang, B., Bi, J., Fan, Z., Yuan, Z., & Ge, J. (2008). Eco-efficiency analysis of industrial system in China: A data envelopment analysis approach. *Ecological Economics, 68*, 306–316.