Measuring Tourism Efficiency of European Countries by Using Data Envelopment Analysis

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Abstract

This study aims to measure relative efficiency of 29 European countries with the data of the year 2013 using input-oriented and constant returns to scale Data Envelopment Analysis and to offer improvement suggestions for the countries found inefficient based on their measured relative efficiency scores. Three input and three output variables are used to assess relative performances of the countries. In this study, tourism expenses, number of employees and number of beds are used as input variables; tourism receipts, tourist arrivals and number of nights spent are used as output variables. As the result of the analysis, 16 countries are found relatively efficient and 13 countries are found relatively inefficient. This study is one of the few publications within the scope of European countries based on data envelopment analysis. Unlike most researches evaluating the efficiency of tourism establishments at the micro level, this paper is thought to contribute to the related literature as it evaluates relative efficiency of the countries at the macro level for tourism industry. Considering the variables used in the analysis, it is expected to give ideas to relatively inefficient European countries on efficiency improvement.

Keywords: Data Envelopment Analysis (DEA), Tourism, Efficiency, European countries

Introduction

It is known that tourism sector is one of the largest and fastest growing industries in the world. Thanks to generation of employment, export revenues, investments and infrastructure developments, tourism sector makes serious contribution to socio-economic process directly and indirectly. According to the report of United Nations World Tourism Organization (UNWTO, 2016), on a global basis, tourism revenues provided by destinations was US$ 2 billion in 1950; in 2015 it amounted to US$ 1260

billion. According to the previous year it increased by 4.4% in real terms. In addition to tourism revenues, total value of tourism exports provided by international transportation services reached US$ 1.5 trillion in 2015. International tourist arrivals were 25 million in 1950; in 2015 they reached 1186 million. International tourist arrivals increased by 4.6% according to the previous year. In 2015, tourism industry contributed 10% to world gross domestic product (GDP) regarding direct, indirect and induced effects. In terms of employment, it contributed employment one out of every eleven.

Efficiency is the ratio of output to input in general manner and deals with the operational performance of a firm (at micro level) or country (at macro level) (Joppe & Li, 2016). The processes which produce more outputs per input have bigger efficiency. If the largest possible output per input is provided, optimum efficiency will be achieved. Without using new technologies or making various changes, it is impossible to increase the efficiency (Sherman & Zhu, 2006).

Efficiency assessment can be divided into two categories as parametric and non-parametric. In parametric methods, production function is preset and changes that may randomly affect production are considered (factor analysis, regression analysis, stochastic frontier approach etc.). In non-parametric methods, analyses are done without presetting production function through linear programming (data envelopment analysis, back error propagation, artificial neural network etc.) (Yi & Liang, 2015; Oukil et al., 2016).

A tourist destination is a geographical area where tourists enjoy many different experiments and can be divided into several levels as country, region, city, holiday resort. It is possible to analyze the tourist destination like a commercial business. In this case, it aims to produce maximum output managing its inputs effectively (Barros et al., 2011). Physical and human resources of the tourist destination are the inputs of virtual tourist production process. From this point, outputs are affected by factors like tourist arrivals, bed-nights, added-value, employment, customer satisfaction, scientific information, capital resources, infrastructure, etc. (Cracolici et al., 2008; Porter, 1990).

A tourist region may be inefficient for the following reasons (Cracolici et al., 2008):

•   The capacity may not be used efficiently because of public regulations (limitations on hotel construction and transportation infrastructure, etc.).

•   Global effects may influence outcomes of strategic and operational marketing actions (growing interest in the natural environment, restructuring of the economies around the world, growing complex technology-human resource interface, etc.).

• Physiography, culture and social impacts may limit operations on the tourist destinations (environmental limits, relief of residents, etc.).

The objective of this study is to measure and compare tourism efficiencies of 29 European countries relatively. Because of this purpose, relative tourism efficiencies are measured with variables accepted in the literature by using the non-parametric method Data Envelopment Analysis (DEA). DEA method is preferred in this paper because of some reasons. One of these, the calculation process is not relatively difficult. The method allows identification and modification of factors affecting efficiency. It evaluates the efficiency of a DMU regarding other DMUs with common factors. It provides optimal weights for each factor and DMU. It permits that poor decision making units (in this paper, countries) are easily detected. Input-oriented CCR model used in this paper focuses on what should be the optimum amount of input corresponding to a certain amount of output. In the analysis, input-oriented CCR model is preferred from the DEA approaches because it may be difficult to make changes in the amount of the outputs of the countries.

The paper consists of five parts. Following the first and introduction part, in the second part literature review made in the field of DEA on tourism, in the third part DEA methodology, in the fourth part efficiency analysis of European countries and its findings, in the last part conclusions are located in the paper.

Literature Review

There are many studies in the literature that measure efficiency in the tourism industry through DEA. A large part of these studies is carried out at the micro level, assessing the efficiency of the hotels and restaurants. Banker and Morey's study (1986) is one of the early studies which implement DEA in the tourism industry at the micro level. They measure technical and scale efficiencies of 60 restaurants in fast food chain using six input and three output variables. Inputs are expenditures for supplies and materials, expenditures related to labor, advertising expenditures, the age of the store, whether the store is located in an urban or rural area, and whether it has a drive-in window. Outputs are breakfast sales, lunch sales and dinner sales. It is understood from the application that the target output can be obtained by saving the inputs. Johns et al. (1997), firstly use DEA in the hotel sector, compare 15 hotels with each other through DEA using four input and three output variables in 12-month period. The input variables are number of room nights available, total labor hours, total beverage and food costs, and total utilities cost. The output variables are number of room nights sold, total covers served and total beverage revenue. In the conclusion of the study, DEA is determined to be usable for diagnosing and identifying outstanding

behavior regarding gross profit and measured productivity. Anderson et al. (2000) apply DEA method to 48 hotels in United States using the data of the year 1994. Input variables are the full-time equivalent employees, the number of rooms, total gaming related expenses, total food and beverage expenses, and other expenses. As output variable, total revenue generated from the chosen inputs except employees for the year ending 1994 is used. Using these variables, overall, allocative, technical, pure technical and scale efficiencies of the hotels are measured. As the result of the study, they understand that efficient firms allocate more resources to food and beverage operations, and the less efficient firms spend more on hotel operations and other expenses, and have employees and rooms overmuch. Hwang and Chang (2003) use DEA and Malmquist index to measure managerial performance and efficiency changes between the years 1994-1998 for 45 hotels with the data of the year 1998. Inputs are number of full-time employees, guest rooms, total area of meal department and operating expenses. Outputs are room revenue, food and beverages revenue, and other revenues. In conclusion, they find there are serious differences on efficiency changes derived from customer resources and management styles. Barros and Alves (2004) try to analyze the efficiency of 42 hotels in Portuguese public-owned hotel chain for the period of 1999-2001 by using output-oriented DEA. They rank the hotels regarding their total factor productivity changes. Number of full-time workers, cost of labor, book value of property, operating costs and external costs are used as inputs. As outputs, number of guests and nights spent in the hotel are used. Consequently, they find that while most hotels provide efficient technical change, they do not provide technological change. Barros and Mascarenhas (2005) measure technical and allocative efficiency through DEA with the data of the year 2001 for 43 hotels in Portuguese state-owned chain. Inputs are labor, capital and the number of rooms. Outputs are sales, the number of guests and nights spent. Input prices are price of labor, price of physical capital and price of rooms. In the conclusion of the study, they recognize DEA has several managerial advantages. One of the advantages of using DEA is identifying strategically important pousadas. Another advantage is discovering overall competence and capability of a pousada. Oukil et al. (2016) make a two-stage DEA application for 58 hotels in Sultanate of Oman. Inputs are number of beds and salary of employees. Outputs are annual revenue, number of guests, number of nights and occupancy rate. In the result of the analysis, they find a major part of the hotels in Oman technically inefficient. They determine that location of the most hotels found efficient is at the capital of Muscat, and variables affecting the hotel efficiency mostly are star rating and cultural attractions.

One of the studies evaluating tourism efficiency at the macro level is the study of Peypoch (2007). Peypoch measures tourism efficiency for French tourism industry with the data set of the years 2000-2003 by Luenberger productivity indicator. The analysis is performed on a nationality-by-nationality basis. Seven countries and one continent are participated in the analysis. He uses the number of tourist bed-nights in hotels and campsites as input variables, and uses tourism receipts based on tourist nationality as output variables. He concludes that compared to the other non-parametric methods like Malmquist productivity index, Luenberger productivity indicator are more useful than the other because of not needing input or output orientation. Cracolici et al. (2008) measure 103 Italian regions' efficiencies with the data set of the year 2001 by constant returns to scale output-oriented DEA and Cobb-Dougles stochastic frontier production function. Inputs are the regional state-owned cultural patrimony and heritage, tourist school graduates and the labor units employed in the tourism sector. Output is bed-nights. According to DEA analysis, only seven regions are found efficient. According to the results of stochastic frontier approach, labor units are found the most effective variable. Compared two methods with each other, the results show a low consistency. Bi et al. (2011) use a two-stage DEA model to measure the efficiency of China's 31 regions. In the first stage, manpower, materials and financial resources are used as inputs. The second stage is the transformation process of tourist facilities and services to economic and social benefits. Inputs used in the first stage are fixed assets and persons engaged in the tourism industry. Outputs are number of star-rated hotels, number of travel agencies and number of other tourism corporations. Inputs used in the second stage are number of excellent tourism cities, number of star-rated hotels, number of travel agencies and number of other tourism corporations. Outputs are the total number of visitors, foreign exchange earnings, tourist income, tax delivery, profits and rate of job growth. In the results of the study, they find that compared to developed countries Chinese regional tourism industry develops at a low level and there are serious efficiency differences between 31 regions. Barros et al. (2011) evaluate the efficiency of 22 French regions for the years 2003-2007 using a two-stage DEA method in their study. In the first stage, they calculate the efficiency scores; in the second stage, they use a bootstrapped truncated regression model. Inputs used to measure the efficiency are accommodation capacity and arrivals; output is nights slept. In the regression model tourism attractors are used. These are monuments, museums, theme parks, beaches, ski resorts and Natural Parks. According to the study's findings, primary factors that affect the efficiency are sea, sun and strategy based on beaches endowment. They believe that developing theme parks, monuments, ski resorts and Natural Parks can enhance tourism attraction and improve the

efficiencies. Assaf (2012) measures and compares the efficiencies of leader tour operators and hotel firms in 12 Asian Pacific countries for the years 2007-2009. He uses a combination of stochastic frontier in Bayes framework and DEA as the method. Inputs for the hotels are number of rooms, number of full time equivalent employees and other operational costs. For the tour operators, inputs are the same as the hotels; in addition to those the number of rooms by the number of outlets is used. Total revenues are used as output for both hotels and tour operators. In the results, Australia has the highest efficiency in hotel and tour operator industry. The author believes that the factors affecting that finding are outstanding air freight and tourism infrastructure, and serious tourism appeal. Hadad et al. (2012) examine tourism efficiency of 34 developed and 71 developing countries in two parts using DEA based on super-efficiency with the data of the year 2008. Inputs are number of employees, number of rooms, natural resources and cultural resources. Outputs are number of tourists and expenditure per tourist. As the result of the study, in developed countries Luxembourg, France, Ireland and Singapore; in developing countries Ukraine, Bosnia, Brunei, Bahrain, Puerto Rico, Hungary and Croatia are found efficient. It indicates that globalization and accessibility play an important role in the efficiency of the tourism industry. Assaf and Barros (2013) measure and compare performances of hotel industries of countries worldwide with the stochastic frontier semi-parametric approach. 26 from 37 countries are analyzed for the first time in the literature. Using the data set of the years 2006-2008, they analyze 519 hotels with three input and three output variables. Inputs are number of outlets, number of full-time equivalent employees and other operational costs. Outputs are operational revenue, annual occupancy rate and market share. According to the findings, they find the most efficient countries in hotel industry as Spain, France, Germany, the USA, United Kingdom (UK), United Arab Emirates (UAE) and Turkey. Kosmaczewska (2014) evaluates tourism interest in terms of efficiency for the years 2007-2009. She analyzes 27 European Union (EU) countries through CCR, BCC and NIRS (non-increasing returns to scale) models. As input, the arrivals in tourist accommodation establishments are used; as outputs, collective tourist accommodation establishments and GDP per inhabitant are used in the analyses. Consequently, she determines that the efficiency of richer and poorer countries resemble each other. In Atan and Arslantürk (2015)'s study, efficiency analyses of 91 worldwide countries are performed for the years 2006-2010 through CCR and BCC models. Inputs are number of arrivals, total activity, tourism expenses, tourism expenses for passenger transportation needs and tourism expenses for travel needs. Outputs are tourism revenues, tourism revenues for passenger transportation needs and tourism revenues for travel needs. As the result of the study, according to

CCR model 65 countries, BCC model 67 countries are found efficient. The findings of both models resemble each other.

In recent years, a considerable amount of study has been done on efficiency and productivity analysis in the tourism literature. Both its economic contributions and increasing competition in the global tourism market have promoted the number of studies on tourism efficiency. However, the majority of the tourism efficiency studies is bounded by travel agents, hospitality industry and food & beverage facilities (micro-level) (Hadad et al., 2012). When it is considered that efficiency measurement is usually carried out for commercial businesses, countries in this paper are considered as commercial businesses aiming to produce maximum output managing their inputs effectively. The efficiency of the tourism industry at the macro level has been discussed in few studies. Unlike most studies evaluating the efficiency of tourism establishments, the study is thought to contribute to the related literature as it evaluates relative efficiencies of the countries at the macro level for tourism industry. In addition, it is one of the few publications within the scope of European countries based on data envelopment analysis.

Data Envelopment Analysis

DEA is firstly developed by Charnes, Cooper and Rhodes (1978) (CCR) and is a non-parametric method that is used to assess the relative efficiency of decision making units (DMUs) in the situations where multiple inputs and outputs are available (Despotis & Simirlis, 2002). DEA determines the efficiency of DMUs with common inputs and outputs through the ratio of weighted outputs to weighted inputs of each DMU. DMUs are compared with each other by constituting linear programming model (LP). The efficient frontier consisting of the best observations is specified so that the efficiencies of all DMUs are calculated by the distance from this frontier. DMUs on the efficient frontier are relatively efficient; those outside the frontier are relatively inefficient. Reference sets consisting of the efficient DMUs are determined for the inefficient DMUs, thus suggestions providing to be efficient for the inefficient DMUs can be given.

DEA is firstly used to improve planning and controlling of the activities of public institutions by Charnes et al. (1978). Afterwards, it is used to measure the relative efficiency in many areas and institutions as hospitals, schools, factories, government business enterprises, service industry, etc. One of the areas DEA used in is tourism industry that is discussed in this paper.

Figure 1 shows the classification of DEA approaches by returns to scale and orientation. DEA models are divided into two categories according to scale as constant returns (CRS) and variable returns (VRS). CRS assumes

that there is no substantial relationship between scale and efficiency of the DMU. If inputs change in a proportion, outputs change in that proportion. In VRS, there are increasing, decreasing and constant returns to scale for production process. According to the orientation, DEA differs depending on input-oriented, output-oriented and nonoriented. In input-oriented models, it is aimed to minimize the amount of inputs to produce predetermined outputs. In output-oriented models, it is aimed to produce maximum output using predetermined inputs. CCR (Charnes, Cooper & Rhodes, 1978) is the first DEA model that calculates total efficiency based on constant returns to scale. In BCC (Banker, Charnes & Cooper, 1984) model, there is no obligation to be constant returns to scale. BCC model investigates local returns to scale under the assumption of VRS (Charnes et al., 1994). Each DMU must provide both technical and scale efficiency to be CCR-efficient, while it is sufficient to provide only technical efficiency to be BCC-efficient (Bowlin, 1998). Because input-oriented constant returns to scale CCR model is used in this study, only this model is discussed in the following section.
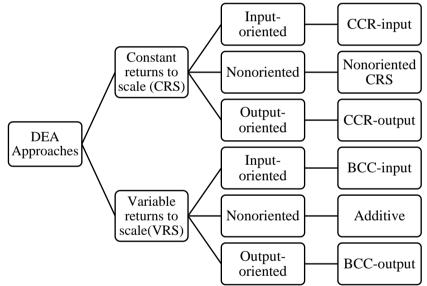

Figure 1. Classification by returns to scale and orientation (Ali, 1994)

Input-oriented CCR model

Input-oriented CCR model focuses on what should be the optimum amount of input corresponding to a certain amount of output. In CCR model, the efficiencies of DMUs are provided by the ratio of virtual outputs to virtual inputs.

Assume that n is the number of DMUs, s is the number of outputs and m is the number of inputs; CCR model for DMU_o is as follows (Charnes et al., 1978):

$$max h_o = \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}}$$

subject to:

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1 \qquad j = 1, \dots, n$$

$$v_i, u_r \geq 0 \; ; \qquad i = 1, \dots, m \; ; \qquad r = 1, \dots, s$$

Because the model above is fractional programming form, for facilitating the solution it is transformed into linear programming form. The results of both models are the same. CCR model in LP form for DMU$_o$ is as follows (Cooper et al., 2006):

$$\max \theta = \sum_{r=1}^{s} u_r y_{ro}$$

subject to:

$$\sum_{i=1}^{m} v_i x_{io} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 \qquad j = 1, \dots, n$$

$$v_i, u_r \geq 0 \; ; \qquad i = 1, \dots, m \; ; \qquad r = 1, \dots, s$$

In the model above, by generating maximization problems for all DMUs, efficiency scores of each DMU are obtained. To assess the efficiencies correctly, the number of DMUs must be greater than the sum of the number of inputs and outputs three times (Raab & Lichty, 2002). v_i and u_r respectively represent the weights of each input and the weights of each output (the relative importance degrees). The equality constraint represents the sum of the virtual inputs of DMU$_o$. Inequality constraint states that the sum of the weighted outputs cannot be greater than the sum of the weighted inputs for each DMU. The inequalities as many as the number of DMUs are added on the LP model. The objective function represents the virtual outputs of DMU$_o$. If the optimum value of the objective function (θ^*) is equal to 1, DMU$_o$ will be efficient. If the value θ^* is smaller than 1, DMU$_o$ will be inefficient relatively.

The dual form of CCR model for DMU$_o$ is as follows (Banker et al., 2004):

$$minimize \quad \theta - \varepsilon \left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+ \right)$$

subject to:

$$0 = \theta x_{io} - \sum_{j=1}^{n} x_{ij}\lambda_j - s_i^- ,$$

$$y_{ro} = \sum_{j=1}^{n} y_{rj}\lambda_j - s_r^+ ,$$

$$0 \leq \lambda_j, s_i^-, s_r^+ \qquad \forall i, j, r.$$

The dual model with adding slack variables contains information for inefficient DMUs about what should be done to become efficient.

θ is a value between zero and one. It determines how much the input x_{io} should be reduced to θx_o radially to get DMU$_o$ to the efficient frontier (Kulshreshtha & Parikh, 2002; Cooper et al., 2006).

The values λ_j are the density values of the elements in the reference sets that provide DMU$_o$ to be efficient.

The value s_i^- (input excesses) is the slack input value belonging to i. input of DMU$_o$. The value s_r^+ (output shortfalls) is the slack output value belonging to r. output of DMU$_o$.

According to dual model, if the weighted inputs of relatively inefficient DMU$_o$ are converted to $(\theta x_{io} - s_i^-)$ and the weighted outputs of relatively inefficient DMU$_o$ are converted to $(y_{ro} + s_r^+)$, DMU$_o$ will be efficient.

To determine the possible input excesses and output shortfalls, two-stage LP model is solved (Cooper et al., 2007):

Stage I

The dual form of the model is solved and then the value θ^* is found. The value θ^* is the same as the efficiency value calculated in the primal linear model. The value θ^* obtained will be used in Stage II.

Stage II

Using the value θ^*, the following model is solved:

$$\max_{\lambda, s^-, s^+} w = es^- + es^+$$

$$\textit{subject to:}$$

$$s^- = \theta^* x_o - X\lambda$$
$$s^+ = Y\lambda - y_o$$

$$0 \leq \lambda_j, s_i^-, s_r^+$$

$e = (1,…, 1)$ a vector whose elements equal to 1.

$$es^- = \sum_{i=1}^{m} s_i^- \quad ; \quad es^+ = \sum_{r=1}^{s} s_r^+$$

The purpose of Stage II is to find a solution which makes the sum of the input excesses and output shortfalls maximum maintaining $\theta = \theta^*$. In

order to be CCR-efficient with optimal solution values $(\theta^*, \lambda^*, s^{-*}, s^{+*})$, DMU_o must satisfy following two criteria (Cooper et al., 2007):

      I. $\theta^* = 1$

      II. All slacks (s_i^{-*}, s_r^{+*}) are equal to zero.

But in some cases, it can be seen that only the first constraint is satisfied. In this situation, DMU_o is characterized as "weak efficient".

Analyses and Findings

In this study, DEA method is applied to 29 European countries with high income and upper-middle income using variables compiled from the studies in the literature (Hwang & Chang, 2003; Oukil et al., 2016; Hadad et al., 2012; Assaf, 2012). The application is performed using constant returns to scale (CRS) and input-oriented (CCR) DEA through MDEAP 2 software developed by Michel Deslierres. In the analysis, three input and three output variables thought to affect the tourism efficiency and used commonly in the literature are used. In order for the analysis to produce more reasonable results, countries with similar income levels are preferred for the analysis. The grouping of countries by income levels is based on the order of The World Bank. Due to limited data availability, only European countries are participated in the analysis.

Inputs

Number of employees: Employed persons by full-time/part-time activity in the tourism sector.

Tourism expenses: The money spent for tourism activities.

Number of beds: Number of beds in tourist accommodation establishments.

Outputs

Tourist arrivals: The number of the tourist coming from other countries. (overnight visitors).

Tourism receipts: The money spent by international tourists.

Number of nights spent: 1 night or over nights spent in tourist accommodation establishments.

Descriptive statistics of variables used to measure the efficiency of European countries are given in Table 1. Data set of the variables is accessed from Eurostat, The World Bank and World Economic Forum. As it is seen from the standard deviation values in Table 1, data is spread over a wide range.

Table 1. Descriptive statistics of variables for European countries

Variables	Minimum	Maximum	Mean	Std. Deviation
Number of employees (thousand)	175,9	39.531,4	8.299,121	10.545,1351
Tourism expenses (million $)	384	91.366	12.507,97	19.841,258
Number of beds (thousand)	38,40	5.049,73	1.074,2069	1.484,45145
Arrivals (thousand)	944	84.726	16.156,24	19.910,034
Tourism receipts (million $)	1.190	66.049	17.196,34	19.790,611
Number of nights spent (thousand)	3.079,21	1.312.992,49	218.993,5648	353.920,05784

In Table 2, European countries are numbered from 1 to 29 to identify reference countries which will be discussed in later section. The findings of input-oriented (CCR) and constant returns to scale (CRS) DEA model are given in Table 2.

According to the findings, 16 countries are found efficient; 13 countries are found inefficient. Efficient countries whose efficiency scores are equal to 1 are Cyprus, Croatia, Estonia, Finland, France, Greece, Hungary, Ireland, Latvia, Luxembourg, Malta, Poland, Portugal, Spain, Switzerland and Turkey. Inefficient countries whose efficiency scores are found less than 1 are Austria, Belgium, Bulgaria, Czech Republic, Denmark, Germany, Italy, Lithuania, Netherlands, Romania, Slovak Republic, Slovenia and United Kingdom. Regarding variables used, the countries with the lowest efficiency score are Italy with 0,455 efficiency score, Netherlands with 0,616, Belgium with 0,651 and United Kingdom with 0,66. It should be considered that the efficiency scores calculated in DEA are relative measures.

Table 2. Efficiency scores of European countries for the year 2013

No	Countries	Efficiency scores
1	Austria	0,813
2	Belgium	0,651
3	Bulgaria	0,792
4	Cyprus	1,000
5	Croatia	1,000
6	Czech Republic	0,783
7	Denmark	0,848
8	Estonia	1,000
9	Finland	1,000
10	France	1,000
11	Germany	0,760
12	Greece	1,000
13	Hungary	1,000
14	Italy	0,455
15	Ireland	1,000
16	Latvia	1,000
17	Lithuania	0,879

18	Luxembourg	1,000
19	Malta	1,000
20	Netherlands	0,616
21	Poland	1,000
22	Portugal	1,000
23	Romania	0,962
24	Slovak Republic	0,828
25	Slovenia	0,975
26	Spain	1,000
27	Switzerland	1,000
28	Turkey	1,000
29	United Kingdom	0,660

To interpret the findings in more detail, let us take Belgium, which is inefficient, and Switzerland, which is efficient. One reason for Belgium's inefficiency relative to Switzerland may be the fact that the number of nights spent per bed in Switzerland is about 503,7, while in Belgium it is about 258,8. Furthermore, tourist arrivals per bed in Switzerland is 36,4, while in Belgium 20,5. These mean that Switzerland uses its bed capacity more than Belgium. In addition, the number of tourist arrivals per employee in Belgium is lower. Because the ratio is about 2,01 in Switzerland, it is about 1,68 in Belgium. Another example is United Kingdom, which is inefficient. The number of nights spent per bed is about 220,9 in United Kingdom. Similarly, the ratio of tourist arrivals per bed is 7,8 in United Kingdom. Both imply that United Kingdom cannot use its bed capacity as well as Switzerland.

Table 3. Reference sets and λ density values of European countries according to CCR model

Country no	Reference countries and λ density values									
	No	λ	No	λ	No	λ	No	λ	No	λ
1	4	3,10869	5	0,0114	10	0,0167	19	9,98518		
2	9	0,14296	15	0,41309	18	0,34945	27	0,39034		
3	5	0,08693	19	2,04323	28	0,07176				
4	4	1,000								
5	5	1,000								
6	9	0,11111	21	0,06912	26	0,14683				
7	4	2,32512	9	0,41505	15	0,21843				
8	8	1,000								
9	9	1,000								
10	10	1,000								
11	9	9,06177	27	0,91642						
12	12	1,000								
13	13	1,000								
14	5	0,04979	13	0,00083	19	12,2053	26	0,45896		
15	15	1,000								
16	16	1,000								
17	8	0,35955	13	0,00482	21	0,05458	28	0,00172		
18	18	1,000								
19	19	1,000								
20	4	3,31776	9	1,51475	10	0,00668				
21	21	1,000								
22	22	1,000								

No										
23	21	0,10707	26	0,06358						
24	8	1,50457	13	0,12338	21	0,0227	28	0,00626		
25	4	0,23432	16	0,17319	22	0,07169	26	0,00998	28	0,00605
26	26	1,000								
27	27	1,000								
28	28	1,000								
29	4	2,54309	9	4,6719	22	0,61776	26	0,2705		

Reference sets determined to give suggestions which will provide to be efficient for the inefficient countries and λ density values are given in Table 3. According to the reference sets given in the table, the most referenced countries are Finland (6 times), Cyprus (5 times), Spain (5 times), Turkey (4 times) and Poland (4 times). Thanks to the countries in the reference set of an inefficient country and λ density values, input quantities to achieve to be efficient are calculated. For relatively inefficient countries, actual input values, target input values calculated according to CCR model and potential improvement rates for the input variables are respectively given in Table 4 and Table 5.

Table 4. Actual and target input values of European countries according to input-oriented CCR model

No	Countries	Efficiency scores	Actual Input Values			Target Input Values		
			Number of employees (thousand)	Tourism expenses (million $)	Number of beds (thousand)	Number of employees (thousand)	Tourism expenses (million $)	Number of beds (thousand)
1	Austria	0,813	4.104,7	10.277	981,07	3.339,08	8.360,1	798,08
2	Belgium	0,651	4.530,3	21.876	372,87	2.952,9	10.913,5	243,04
3	Bulgaria	0,792	2.934,9	1.527	302,43	2.323,28	1.208,78	239,4
4	Cyprus	1,000	365,1	1.222	87,14	365,1	1.222	87,14
5	Croatia	1,000	1.524,0	903	867,11	1.524,0	903	867,11
6	Czech Republic	0,783	4.937,1	4.595	740,67	3.865,56	3.597,71	579,92
7	Denmark	0,848	2.687,6	10.132	417,59	2.279,45	6.392,18	354,17
8	Estonia	1,000	621,3	995	55,48	621,3	995	55,48
9	Finland	1,000	2.456,7	5.292	254,11	2.456,7	5.292	254,11
10	France	1,000	25.763,6	42.907	5.049,73	25.763,6	42.907	5.049,73
11	Germany	0,760	39.531,4	91.366	3.326,82	26.349,94	62.666,23	2.528,58
12	Greece	1,000	3.513,2	2.437	1.207,39	3.513,2	2.437	1.207,39
13	Hungary	1,000	3.892,8	1.908	422,04	3.892,8	1.908	422,04
14	Italy	0,455	22.190,5	26.972	4728,18	10.092,12	12.266,73	2.150,35
15	Ireland	1,000	1.881,2	6.201	211,03	1.881,2	6.201	211,03
16	Latvia	1,000	893,9	715	38,4	893,9	715	38,4
17	Lithuania	0,879	1.292,8	966	69,29	1.135,9	848,76	60,88
18	Luxembourg	1,000	238,7	3.804	66,75	238,7	3.804	66,75
19	Malta	1,000	175,9	384	43,36	175,9	384	43,36
20	Netherlands	0,616	8.285,2	20.056	1.404,85	5.104,72	12.357,01	707,76
21	Poland	1,000	15.568,0	8.675	679,45	15.568,0	8.675	679,45
22	Portugal	1,000	4.429,4	4.143	491,1	4.429,4	4.143	491,1
23	Romania	0,962	8.549,1	2.056	303,24	2.766,66	1.978,09	291,75
24	Slovak Republic	0,828	2.329,2	2.367	190,31	1.928,25	1.959,55	157,55
25	Slovenia	0,975	905,9	923	105,56	883,51	900,19	102,95

26	Spain	1,000	17.139,0	16.414	3.437,36	17.139,0	16.414	3.437,36
27	Switzerland	1,000	4.460,7	16.053	246,49	4.460,7	16.053	246,49
28	Turkey	1,000	25.519,8	4.817	1.051,16	25.519,8	4.817	1.051,16
29	UK	0,660	29.952,5	52.748	4.001,02	19.778,31	34.830,69	2.641,96

For example, considering the inefficient country Denmark with 0,848 efficiency score, its reference countries are found as Cyprus with $\lambda_4=2,32512$ density value, Finland with $\lambda_9=0,41505$, Ireland with $\lambda_{15}=0,21843$. The calculation of Denmark's target values of input variables to become efficient is as follows:

$$X_{Denmark} = (X_1, X_2, X_3) = \{(365,1; 1.222; 87,14) \times 2,32512 + (2.456,7; 5.292 \quad; 254,11) \times 0,41505 + (1.881,2; 6.201; 211,03) \times 0,21843$$
$$= \{(2.279,45; 6.392,2; 354,17)\}$$

Potential improvement rates for the inputs in Table 5 are calculated according to the formula $\left(\frac{Target\ value - Actual\ value}{Actual\ value} * 100\right)$.

Table 5. Potential improvement rates of European countries according to input-oriented CCR model

No	Countries	Potential Improvement Rates (%)		
		Number of employees	Tourism expenses	Number of beds
1	Austria	-18,65 %	-18,65 %	-18,65 %
2	Belgium	-34,82 %	-50,11 %	-34,82 %
3	Bulgaria	-20,84 %	-20,84 %	-20,84 %
4	Cyprus	0 %	0 %	0 %
5	Croatia	0 %	0 %	0 %
6	Czech Republic	-21,7 %	-21,7 %	-21,7 %
7	Denmark	-15,19 %	-36,91 %	-15,19 %
8	Estonia	0 %	0 %	0 %
9	Finland	0 %	0 %	0 %
10	France	0 %	0 %	0 %
11	Germany	-33,34 %	-31,41 %	-23,99 %
12	Greece	0 %	0 %	0 %
13	Hungary	0 %	0 %	0 %
14	Italy	-54,52 %	-54,52 %	-54,52 %
15	Ireland	0 %	0 %	0 %
16	Latvia	0 %	0 %	0 %
17	Lithuania	-12,14 %	-12,14 %	-12,14 %
18	Luxembourg	0 %	0 %	0 %
19	Malta	0 %	0 %	0 %
20	Netherlands	-38,39 %	-38,39 %	-49,62 %
21	Poland	0 %	0 %	0 %
22	Portugal	0 %	0 %	0 %
23	Romania	-67,64 %	-3,79 %	-3,79 %
24	Slovak Republic	-17,21 %	-17,21 %	-17,21 %
25	Slovenia	-2,47 %	-2,47 %	-2,47 %
26	Spain	0 %	0 %	0 %
27	Switzerland	0 %	0 %	0 %
28	Turkey	0 %	0 %	0 %
29	United Kingdom	-33,97 %	-33,97 %	-33,97 %

For example, according to Table 5, some improvements are required to make Denmark efficient. To make Denmark efficient, number of employees (thousand) should be reduced from 2.687,6 to 2.279,45; tourism expenses (million $) should be reduced from 10.132 to 6.392,2; number of beds (thousand) should be reduced from 417,59 to 354,17. Thus, it can be applied -15,19 % improvement to number of employees, -36,91 % improvement to tourism expenses and -15,19 % improvement to number of beds. Because the analyses are for input-oriented CCR model, there will be no change in outputs.

Conclusion

In many studies in the literature, tourism efficiency analyses have been done in subcategories of tourism industry like hospitality industry, travel agencies, and restaurants. In some of the studies, economic efficiency assessment has been also considered. This study evaluates tourism efficiency at the macro level (based on countries) using basic characteristics (number of employees, tourism expenses, number of beds, tourism receipts, tourist arrivals, number of nights spent) that affect the efficiency of tourism industry. For this purpose, tourism efficiency of 29 European countries with high income and upper-middle income is tried to be analyzed. In the analysis, CCR-DEA method is used with the data set of the year 2013. According to the findings of the analysis, 16 countries are identified efficient; 13 countries are identified inefficient. The countries identified relatively efficient are Cyprus, Croatia, Estonia, Finland, France, Greece, Hungary, Ireland, Latvia, Luxembourg, Malta, Poland, Portugal, Spain, Switzerland and Turkey. Relatively inefficient countries are Austria, Belgium, Bulgaria, Czech Republic, Denmark, Germany, Italy, Lithuania, Netherlands, Romania, Slovak Republic, Slovenia and United Kingdom. The countries with the lowest efficiency scores are found as Italy, Netherlands, Belgium and United Kingdom. It should be considered that the efficiency scores calculated in DEA are relative measures and there are other controllable and uncontrollable factors (globalization, physical capitals, cultural and natural resources, accessibility, environmental sustainability, safety, etc.) affecting the efficiency. It is necessary to use various indicators for more detailed evaluation of the efficient use of resources. From this point, these findings do not give the countries definite results about their tourism efficiency, give only a preliminary idea on the balance of inputs/outputs according to the given variables. This paper may be suggestive in terms of resource allocation and long-term decisions of local governments and major tourism companies.

Due to the limitation of data availability, the number of countries and variables used in the analysis are limited. For a more comprehensive

analysis, variables affecting tourism efficiency (natural and cultural resources, etc.) can be enhanced. In this study, when the relative efficiencies of European countries are analyzed through DEA method, only input-oriented CCR model is used. By revising the number of countries and using various DEA models, it is possible to obtain different findings.

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