Comparison of Tourism Sector Efficiencies of International Destinatıons With Super Efficiency Method

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DOI: 10.29322/IJSRP.9.02.2019.p8621
http://dx.doi.org/10.29322/IJSRP.9.02.2019.p8621

Abstract-In recent years, many destinations have entered to international tourism market. This situation has made tourism competitiveness a strategic issue for countries, regions and businesses. One of the important factors determining competitive power in tourism is efficiency. Different approaches have been developed for measuring, modeling and managing the efficiency in tourism field. The aim of this study is to calculate the efficiency of tourism sector of 129 countries worldwide by taking advantage of the present literature and to create an efficiency index. Thus, the tourism sector efficiency comparisons of the countries will be possible. The data of the countries included in the study were obtained from the World Economic Forum (WEF) Travel and Tourism Competition Report 2017. Super Efficiency method was used to calculate sector effectiveness. Four inputs and two output variables were defined in order to measure the tourism sector efficiency of the countries in the study. Input variables are labor force, number of rooms, natural resources and cultural resources. Output variables are the number of international tourists and the average income per tourist. According to the findings of the study, while Bangladesh, Luxembourg and China take place near the top three in terms of tourism sector efficiency, Yemen, Lesotho and Malawi are in the last places.

Index Terms- DEA, Destination, Efficiency, Super Efficiency

I. INTRODUCTION

Tourism is a dynamic sector that evokes economies by generating employment, income, investment and export and it has become one of the largest sectors of the world. In 2017, the tourism sector contributed to the creation of worldwide welfare by constituting 10.4% of global GDP and 9.9% of total employment (WTTC, 2018). The sector has grown almost uninterruptedly over the last 60 years, despite occasional shocks. While the number of international tourists was 25 million in 1950, it reached 278 million in 1980, 674 million in 2000 and 1.235 million in 2016. International tourism revenues obtained from destinations around the world rose from USD 2 billion in 1950 to USD 104 billion in 1980, to USD 495 billion in 2000 and to USD 1.220 billion in 2016. According to UNWTO's long-term forecast report, the number of international tourists worldwide is expected to reach 1.8 billion by 2030 (UNWTO, 2017).

Countries are trying to generate new destinations and to gain market share in different tourism segments in order to get more share from the global tourism market due to their positive effects on local economies (Barros, et al., 2011). It is important to manage tourism regions effectively in order to achieve market share or to maintain market share in tourism. Tourist demand is fluctuant and tourist behavior is unpredictable. The ability of a particular destination to reach certain targets in tourism in the long term depends on its ability to effectively combine and manage its tourism resources (Cracolici, et al., 2006).

The efficiency is generally the ratio of outputs to inputs and is related to the operational performance of a company (micro level) or country (macro level) (Kurt, 2017). In other words, efficiency means to achieve maximum output by using a particular input composition or to produce a particular output composition by using minimal input (Min, et al., 2008). Production units become effective if they can produce the maximum output possible with the inputs they actually use or if they can produce this output at minimum cost (Porcelli, 2009).

The production system of the tourism destination can be characterized by a production process that tries to generate maximum output with appropriate inputs. In this case, considering the inputs it has, the tourist destination is inefficient when it cannot produce the maximum output possible and it will be able to obtain less output (tourism income, tourism demand) compared to relatively efficient destinations (Cracolici, et al., 2006).

In general, parametric and non-parametric methods are used to measure the efficiency of production processes. While parametric methods consist of factor analysis, regression analysis, stochastic boundary approach etc.; non-parametric methods are data envelopment analysis, back error propagation, artificial neural network, etc. (Kurt, 2017). In this study, Data Envelopment Analysis (DEA) and its derivative Super Efficiency method were used.

The purpose of this study is to measure the tourism sector efficiency of 129 international tourism destinations relatively and to to make an efficiency ranking. Relative efficiency of the countries included in the study was calculated by DEA-Superefficiency method from non-parametric methods. The input and output variables used in the analysis and the data related to these variables were selected in accordance with the literature of efficiency measurement in tourism sector. (Data on input and output variables were obtained from the World Economic Forum (WEF) Travel and Tourism Competitiveness Report 2017 (Hadad, et al.)., 2012)).

Production units, efficiency of which is measured, are called "decision-making units (DMU)"and the DMUs convert the resources defined as inputs into outputs through a production process. As a result of the comparison of the output amount produced by each DMU with the output levels produced by other DMUs, or comparing the amount of input used by each DMU to produce output with the amount of input used by other DMUs, efficiency scores of each DMU emerge (Erdoğan, 2011).

II. MEASURING EFFICIENCY IN TOURISM SECTOR

Efficiency is an important criterion showing the sector's performance (Fare, et al., 2007). Since the efficiency is a relative measurement that refers to the production function, it is commonly used as a comparison criterion (Hadad, et al., 2012). Through efficiency measurements, the usage efficiency of production inputs which are used in an economy is assessed to achieve a certain level of production. Eficiency improvement is the result of interfering with business processes to reduce the inputs needed to achieve the same output or to produce more output from a specific set of inputs (Joppe & Li, 2016).

As in other sectors, the efficiency in tourism means trying to explain the effectiveness of resources by associating the input amount with the outputs (Balake, et al., 2006). One of the best parameters for comparing the performance of tourism destinations is efficiency level (Assaf & Dwyer, 2013). The efficiency of the destination can be defined as the technical skill for using the inputs required to offer the services to meet the expectations of the tourists (Fuchs, 2004)

In studies conducted to evaluate efficiency in the field of tourism, a tourism establishment or destination is considered as a production process where certain resources turn into outputs or performance. Non-parametric methods can be used to measure the efficiency of this transformation process. In nonparametric methods, efficiency can be measured by establishing a functional mathematical relationship between input and output in the studies where relative efficiency of service production units, in which the use of parametric approaches is more restrictive, is evaluated (Barrio, et al., 2009). Data Envelopment Analysis (DEA) and its derivatives from nonparametric methods, are commonly used in efficiency analysis, because they bring less restrictive conditions and can easily be adapted to multiple production scenarios. Through this method, efficiency values can be calculated and compared by using multiple linear programming models based on the data obtained from production units to be evaluated (Yen & Othman, 2011).

Various studies have been carried out in order to evaluate efficiency in the field of tourism by using DEA and its derivatives. These are usually micro-level studies aimed at assessing the efficiency of hotels, travel agencies and local tourism destinations. One of the first studies applying DEA in the tourism sector at the micro level is the study of Banker and Morey (1986). The authors compared the technical and efficiency of 60 restaurants in the fast food chain using six inputs and three output variables (Banker & Morey, 1986).

Morey and Dittman (1995) evaluated the performance of the general managers of 54 branches of a chain hotel located in the United States in 1993 with DEA in their study conducted using seven inputs and four outputs (Morey & Dittman, 1995). Johns et al. (1997) compared the efficiency of 15 hotels using four inputs and three output variables. They used the DEA method in the study (Johns, Howcroft, & Drake, 1997).

Hwang and Chang (2003) carried out a study evaluating management performance and efficiency change of 45 hotels between 1994-1998 by using the DEA and Malmpuist TFP. In the study, it has been concluded that the efficiency of the enterprises differs by years due to the differences in customer resources and management styles (Hwang & Chang, 2003). Yen and Othman (2011) compared the relative efficiency of hotel enterprises in Malaysia. DEA method was used in the study (Yen & Othman, 2011)

Limited number of macro-level studies have been conducted in the field of tourism. Some of these studies consist of countrywide efficiency evaluations. One of these studies is the two-stage DEA study conducted by Pestana et al. (2011) to evaluate the performance of the tourism destinations in France. In this study, destinations are accepted as a production enterprise with inputs and outputs. The goal of the destinations in this context is to achieve maximum performance by using inputs effectively (Pestana, et al., 2011).

A macro-level efficiency ranking study on international destinations was conducted by Hadad et al. (2014). In this study, they evaluated the tourism sector efficiency of 105 countries by using data envelopment analysis and super efficiency method. In the study, two output variables were defined for the tourism industry. These variables are Number of Tourists and Revenue per Tourist. The output variables are Labor Force, Number of Hotel Rooms, Cultural and Natural Resources (Hadad, et al., 2012).

Kurt (2017) compared the tourism efficiency of 29 European countries using DEA method (Kurt, 2017). Rasoulzadeh et al. (2017) compared the tourism sector efficiency of Middle East countries (Iran, Turkey, Israel, UAE and Saudi Arabia) and East Asian countries (Indonesia, India, Malaysia, Singapore, Thailand and China) in their study. They used the DEA method in the calculation of efficiency (Rasoulzadeh, et al., 2017).

In this study, the tourism sector efficiency ranking of 129 countries was made by the data obtained from the World Economic Forum (WEF) Travel and Tourism Competitiveness Report 2017. DEA-Super Efficiency method was used in the calculation of sector efficiency. In the study, four input, two output variables were defined in accordance with the literature in order to measure the tourism sector efficiency of countries, Input variables consist of labor force, number of rooms, natural resources and cultural resources. Output variables consist of the number of international tourists and the average revenue per tourist.

III. DATA ENVELOPMENT ANALYSIS AND SUPER EFFICIENCY METHOD

Farrell's study in 1957 underlies the data envelopment analysis. Charnes, Cooper and Rhodes developed Farrell's definition of relative technical efficiency and established a data envelopment analysis method that allows analysis in multiple input and multiple output environments (Savaş, 2014). In this method, which has been introduced to the literature as CCR model, there is a constant return according to the scale. Later on, Banker, Charnes and Cooper discussed the variable return status according to the scale and called it the BBC method. With DEA, calculations of input and output can be done The DEA calculation for input determines the most appropriate input composition to be used in order to produce a certain output composition in the most effective way, while the DEA calculation for output investigates how much output can be achieved at most with a certain input composition (Carefree & Girginer, 2011).

The DEA Efficiency (CCR model) consists of technical and scale efficiency and the relative effectiveness of a decision - making unit (DMU- a country in the study) is defined as the ratio of the total weighted output to the total weighted input (Hadad, Hadad, Malul, & Rosenboim, 2012). The input-oriented CCR DEA model was used in the study. In this model, the relative efficiency of the N number of DMU, each with m inputs and s outputs is obtained according to the following calculation steps;

Max $\sum_{k=1}^{s} v_k\, y_{kp}$

s.t.$\sum_{j=1}^{m} u_j\;\; x_{j\,p}\;\; = 1$

$\sum_{k=1}^{s} v_k\, y_{ki}$ -$\sum_{j=1}^{m} u_j\;\; x_{j\,i}\;\; \leq 0\, \forall i$

$v_k u_j\;\; \geq 0 \forall k, j$

Here k = 1 … s, j= 1… m, i= 1… n

$y_{ki=}$ amount of k output produced by DMU,

$x_{ji=}$ amount of j input used by DMU,

$v_{k=}$ weight given to k output,

$u_{j=}$ weight given to j input.

The above formula is run for **n** times to obtain comparative efficiency scores of all DMUs (Tandon, vd. 2014).

The DEA method is a good tool in comparing relative tourism efficiency between different decision-making units (DMU). According to Cook and Seiford (2009), DEA does not make an efficiency ranking between effective DMUs, as it uses linear programming to measure the relative efficiency of DMUs. (Chaabouni, 2017). In other words, the ones who are effective in the decision-making units take the value of 1 (or 100) and hence it does not indicate which one is more efficient or the efficiency ranking among them (Atan & Arslantürk, 2015). Therefore, Andersen and Petersen (1993) developed the DEA Super Efficiency model in order to eliminate this deficiency of the CCR-DEA model, in other words, to be able to make an efficinecy ranking between effective DMUs. The equality for the Super Efficiency model is shown below:

Equality consists of a n number DMU set with an input vector and output vector of each DMU.

$$\min\theta s.\, t. \sum_{\substack{j=1\\ j\neq k}}^{n} X_j\lambda_j \leq \theta X_k \sum_{\substack{j=1\\ j\neq k}}^{n} Y_j\lambda_j \geq Y_k \lambda_j \geq 0\, j = 1, \ldots, n$$

In the equality; θ shows the efficiency value of k decision making unit. m shows the number of input and q shows the number of output variables. λj represents the variable needed to link input and output vectors with a convergent combination (Chaabouni, 2017).

This model is based on the input-oriented CCR model. In Super Efficiency method, in order for the DMU to be efficient, it is required to have a value of 1 (100) or more than 1. If the value is less than 1 (100), DMU cannot be considered as efficient (Doğan, 2015).

In this model, the decision-making unit is compared to the linear combinations of all other units. Each efficient DMU examined is removed from the reference set. The one with the highest score among the examined DMUs is on the first rank, and the one with the lowest score is on the last rank. Thus, the efficiency ranking of the DMUs is revealed (Atan & Arslantürk, 2015).

C.Methodology

In this study, DEA Super Efficiency analysis method was used. The analysis is conducted in three basic steps. In the first step; the DMUs to be examined were determined. In the second step, the appropriate input and output variables were determined in accordance with the literature in order to evaluate the efficiency of the selected DMUs and the data for these variables was collected from reliable and comprehensive data sets. In the last step, the efficiency results of the DMUs were calculated and they were ranked by using the DEA Super Efficiency analysis method. EMS software was used for calculations. Details of the methodology are given below.

A. Selection of DMUs, Definition of Variables and Data Set

In the study, tourism sector efficiency of 129 DMUs (international destination-country) were compared. The number of DMUs is in line with the rule that the minimum number of DMU is three times more than the total number of inputs and outputs (Raab & Lichty, 2011; Yen & Othman, 2011). The destinations where the data related to input and output variables is fully included are given place in the study.

As agreed in the general production function measurements, the two main production inputs are labor and capital. In the study, labor refers to *the number of employees in the tourism sector and* *capital refers to the tourism sector infrastructure, natural resources and cultural resources* (Hadad et al., 2012). In this context, four input variables were used in the study. In the study, two output variables representing tourism sector were defined. These variables are the number of tourists and the average income per tourist. An efficient tourism sector brings more tourists to the country and generates more revenue per tourist (Hadad, et al., 2012). The number of tourists refers to the number of international tourists visiting the country in one year. The average revenue per tourist is the average earnings per tourist in dollar currency. The average revenue per tourist is a measure of the success in tourism sector. The more efficient tourism sector is expected to generate higher revenue per tourist.

The Travel and Tourism Competitiveness Index Report (WEF, 2017), which is published by the World Economic Forum, has been used, as a comprehensive and reliable database has been required for input and output variables.

B.Findings

The tourism sector efficiency of 129 countries was measured by applying the input-oriented CCR Super Efficiency model. Table 1 shows the scores of the countries according to the efficiency measurement results.

Table 1. Ranking of Destinations with an Efficient or Inefficient Tourism Sector

Countries	TSE	Countries	TSE	Countries	TSE	Countries	TSE
Bangladesh	672,73	Malaysia	72,35	Holland	47,56	Lao	32,27
Luxemburg	350,31	The United Arab Emirates	71,54	Azerbaijan	47,24	Rwanda	32,04
China	326,14	Hungary	70,49	Botswana	44,68	Gambia	30,56
Moldova	316,61	Nepal	70,46	Panama	44,65	Pakistan	30,28
India	299,83	Burundi	69,40	Namibia	44,45	Paraguay	29,93
Lebanon	183,73	Italy	66,15	Bahrain	43,68	El Salvador	27,83
Ireland	166,76	Jordan	66,06	Australia	43,67	Colombia	27,79
USA	139,20	Albania	65,00	Serbia	43,65	Cape Verde	27,37
Kyrgyz Republic	125,43	Switzerland	64,41	Morocco	42,71	Zambia	26,63
France	123,44	Sweden	63,99	Malta	42,56	Cameron	24,99
Sierra Leone	117,24	Bulgaria	63,23	Ethiopia	42,50	Mongolia	23,72
Russia	115,83	Chad	63,07	Oman	42,20	Honduras	23,55
Austria	114,28	Iran	61,39	Mauritius	41,78	Chile	23,37
Denmark	113,06	Czech Republic	60,89	Latvia	41,72	Uganda	22,65
Kuwait	105,71	Qatar	60,61	Finland	40,98	Gabon	21,97
Hong Kong	105,16	Estonia	60,53	Canada	40,77	Senegal	21,47
Spain	99,27	Sri Lanka	59,85	Kenya	40,08	Romania	21,27
Tanzania	96,54	Slovenia	59,57	Jamaika	40,00	Nicaragua	21,09
Turkey	94,94	İsrael	58,82	Kazakhstan	39,96	Bolivia	20,46
Korea	94,02	Barbados	58,44	Norway	39,51	Argentina	19,42
Madagascar	92,39	Lithuania	58,27	Costa Rica	38,98	Côte d'Ivoire	19,02
Slovakia	91,74	Mexico	57,61	Portugal	38,85	Peru	18,77
The Philippines	91,22	Taiwan	55,49	Japan	38,82	Mozambique	18,00
Singapore	84,07	Cyprus	54,65	Armenia	38,17	Algeria	17,72
Mali	83,42	Germany	51,82	Ghana	37,45	Nigeria	15,32
Croatia	81,62	Uruguay	51,68	Macedonia	36,39	Venezuela	15,29
Belgium	79,78	Indonesia	51,56	Trinidad Tobago	36,11	Yemeni	11,33
Poland	79,74	Dominican R.	51,29	Brazil	35,63	Lesotho	11,20
Zimbabwe	78,85	Iceland	50,89	Vietnam	35,12	Malawi	6,46
South Afrika	77,09	Montenegro	50,75	Georgia	34,77		
Thailand	76,58	Egypt	50,14	Tunisia	34,00		
Greece	74,96	New Zealand	49,96	Guatemala	33,70		
Saudi Arabia	73,97	England	49,21	Cambodia	32,50		

TSE= Tourism Sector Efficiency

In Table 2, the fact that the efficiency score for countries is equal to or above 100 shows that country has full technical efficiency or that the country is above the best production limit, while the efficiency score below 100 indicates the inefficiency level of the country. In other words, the inefficiency level is = 100-TE' (Candemir & Deliktaş, 2006). The fact that the efficiency (technical) score is below 100 indicates that the maximum output is not produced with the data inputs under the current technology, or that the current output can be produced with less input.

Table 2 shows the ranking of the countries with an efficiency score of 100 and above. While the CCR efficiency value of these 16 countries is 100 (effective), it is important to know how these are ranked among themselves. In this context, Bangladesh is the country that uses the tourism sector most effectively. Bangladesh is followed by Luxemburg, China, Moldova, India, Lebanon, Ireland, USA, Kyrgyzstan, France, Sierra Leone, Russia, Austria, Denmark, Kuwait and Hong Kong respectively.

Table 2. Tourism Sector Efficiency Ranking of Destinations

Item No	Countries	TSE
1	Bangladesh	672,73%
2	Luxemburg	350,31%
3	China	326,14%

4	Moldova	316,61%
5	India	299,83%
6	Lebanon	183,73%
7	Ireland	166,76%
8	USA	139,20%
9	Kirghizstan	125,43%
10	France	123,44%
11	Sierra Leone	117,24%
12	Russia	115,83%
13	Austria	114,28%
14	Denmark	113,06%
15	Kuwait	105,71%
16	Hong Kong	105,16%

IV. CONCLUSION

In recent years, a large number of studies have been conducted to measure efficiency and performance in the tourism sector. Given the effects of tourism on national economies and increasing global competition, this interest is not surprising. While most of these studies on tourism sector focus on micro-level hotels, restaurants or country-wide destinations, in this study countries are compared in terms of their activities in the tourism sector. For this purpose, the tourism sector efficiency of 129 countries was measured by the data envelopment analysis based Super efficiency model.

The efficiency score is used for ranking DMUs alone in the comparison of overall efficiency. In this context, it is seen that 16 countries with an efficiency score of 100 and above are efficient destinations for the tourism sector. Other destinations are relatively inefficient. Efficiency scores obtained in the study are a comparative measuring of how well the DMUs can utilize inputs to obtain outputs by taking into account the maximum potential. In this context, inefficient destinations cannot manage their tourism resources well.

First of all, the benefits the countries that fall behind in the efficiency ranking will obtain if they invest their scarce resources in tourism and the benefits to be gained when they invest these resources in other sectors should be compared, in other words, the opportunity cost should be calculated. The inefficiency, which is particularly important for the backward and developing countries, causes the scarce resources to be invested in a relatively less efficient tourism area, rather than areas that can be more efficient, and, in a sense, it causes these resources to be wasted.

As a result, the countries that are relatively below the efficiency limit need to improve their skills to select the optimum resource of tourism administrations, to decide the optimum capacity size, and to generate demand to use the existing capacity effectively.

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