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Efficiency Assessment of the Tourism Performance of Turkey using Malmquist Productivity Index

Serpil Aydın[1,a], Talat Senel[1,b]
[1]*Ondokuz Mayıs University, Department of Statistics, Samsun, Turkey*
[a]*serpil.gumustekin@omu.edu.tr*
[b]*tlsenel@omu.edu.tr*

Abstract: Tourism is the basis of the economy and the cultural development. Therefore, tourism is an important indicator of the development of countries. The arrival of foreign tourists for a country, temporary accommodation and travel in the country to various consumption expenditures will have growing effects on the economic and social structure of the country. The main objective of this study is to investigate and examine the impact of tourism on Turkey, over a period of 2006 – 2015.In this study, we used Data Envelopment Analysis (DEA) and Malmquist Productivity Index methods. The data and tourism indicators used in the analysis were taken from Ministry of Culture and Tourism annual statistics reports. Finally, efficiency scores and rank of provinces are examined and evaluated.
Keywords: Efficiency, Malmquist, Tourism, Data Envelopment Analysis

1. Introduction

The tourism industry has an important economic and regional effect in any country and also tourism sector is one of the largest and fastest growing industries in the world. Effectiveness refers to the degree of positive or negative relationship over the expected profitability of the product or service resulting from expenditure and investments. Efficiency measurement shows how profitability is achieved at the level of the investment and the inputs used, by allowing the operator to determine where the level of the economy is in the current market conditions and in a fully competitive environment. Additionally, efficiency is the ratio of output to input in general manner and deals with the operational performance of a province (at micro level) or country (at macro level) (Joppe and 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 and Zhu, 2006). The aim of this study is to examine the efficiency of provinces in Turkey about tourism, over a period of 2006 – 2015. The tourism indicators from the available Ministry of Culture and Tourism annual statistics database including number of facilities, number of rooms, number of beds, number of arrivals and average number of overnights for Turkey.

There are many studies in the literature that measure efficiency in the tourism industry through Data Envelopment Analysis (DEA). A large part of these studies is carried out at the micro level. Therefore, because of the this study evaluated all provinces in Turkey in a comprehensive manner, it is important. Banker and Morey's study (1986) is one of the early studies which implement DEA in the tourism industry. 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. Cracolici et al. (2006), aimed to provide a statistical analysis of the relative economic performance of Italian tourist areas. They used two modelling approaches to estimate the competitiveness of these regions, data envelopment analysis (DEA) and the Malmquist method. Their results show that the competitiveness position of several Italian regions has not improved over the years under consideration. Alvarez – Suarez and Fuentes (2011), analyses the productivity of a group of travel agencies in the town of Alicante during the period 2004 – 2007 using two different technique in order to compare results, draw a conclusions and provide advice for improving the management of the agencies. Soysal – Kurt (2017), aimed 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. They are used

three input and three output variables to assess relative performances of the countries. In their 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.

2. Material and Methods

DEA was originally developed by Charnes, Cooper and Rhodes (1978) with the aim of measuring the relative activities of systems that produce similar goods or services and are called decision making units (DMUs). This method; is a linear programming (DP) -based approach that allows for the measurement of the relative total factor effectiveness of DMUs, where there are multiple input and output variables with different measurement units, and where they cannot be reduced to a common criterion (Gumustekin et al., 2016).

Suppose we have a set of n DMUs in the model, and each DMU has m inputs and s outputs. The CCR model can be mathematically expressed as (1).

$$\text{Max} \quad \frac{\sum_{r=1}^{s} u_{rk} Y_{rk}}{\sum_{i=1}^{m} v_{ik} X_{ik}}$$

Subject to:

$$\frac{\sum_{r=1}^{s} u_{rk} Y_{rj}}{\sum_{i=1}^{m} v_{ik} X_{ij}} \leq 1 \qquad \text{for all j}$$

$$u_{rk} \geq 0 \quad , v_{ik} \geq 0 \quad \text{for all r,k} \tag{1}$$

Y_{rj} = the vector of output r produced by unit j,
X_{ij} = the vector of input i used by unit j,
u_{rk} = the weight given to output r by the base unit k
v_{ik} = the weight given to input i by the base unit k
$(r = 1, \dots, s)$, $(i = 1, \dots, m)$ [Tarim, 2001; Senel and Gumustekin, 2015; Ahn and Min, 2014].

The DEA relative efficiency measure for a target decision making unit k can be determined by solving the CCR (Charnes, Cooper and Rhodes, 1978) or BCC (Banker, Charnes, Cooper, 1986) models. CCR model calculates the efficiency ratio for the DMUs based on their inputs and outputs and it is under constant returns to scale (CRS) technology which are inputs and outputs linked in a strictly proportional manner. The others BCC model is under variable returns to scale (VRS) technology and it estimates the pure technical efficiency of a DMU at a given scale of operation. The only difference between the CCR and BCC models is the convexity condition of the BCC model, which means that the frontiers of the BCC model have piecewise linear and concave characteristics, which lead to variable returns to scale (Fancello et al., 2014).

In recent years, the Malmquist index has become the standard approach to productivity measurement over time within the non-parametric literature. Malmquist indices were introduced by Caves et al. (1982). To introduce the concept of a distance function, consider that in time period t the DMUs are using inputs $X^t \in \mathcal{R}_+^m$ to produce outputs $Y^t \in \mathcal{R}_+^s$. The input distance function $D(X^t, Y^t)$ is defined on the technology Φ^t as the maximal feasible contraction of X^t that still enables the production of Y^t.

$$D(X^t, Y^t) = \max\left\{\lambda\left(\frac{X^t}{\lambda}, Y^t\right) \epsilon \ \Phi^t\right\} \tag{2}$$

The technology of production Φ^t consists of all input – output vectors that are technically feasible for a certain production process (Camanho and Dyson, 2006).

DEA assigns an efficiency score, one to efficient units and less than one to inefficient units. This paper analyze the radial and input oriented efficiency using CCR model under the assumption of the variable returns to scale to measure efficiencies of provinces in Turkey about tourism. With this aim, we consider two outputs: number of arrivals (y_1) and average number of overnights (y_2), and three inputs: number of facilities (x_1), number of rooms (x_2) and number of beds (x_3).In the study, 81 provinces of Turkey in the 2006-2015 period between tourism activities are evaluated. The data were compiled from reports and statistics published on the website of the Ministry of Culture and Tourism. However, since some of the province's datas in some years are missing, they were excluded from the scope of the study. Since there is no obligation to have the same number

of observations for all years in the Malmquist Productivity Index, we did not have any problems with our analysis. Table 1 illustrates that the basic statistics of inputs and outputs.

Table 1. Basic statistics of inputs and outputs

		Number of facilities	Number of rooms	Number of beds	Number of arrivals	Average number of overnights
2006	Min	1,00	13,00	36,00	1,00	18,00
	Max	277,00	56591,00	125082,00	615,00	100958,00
	Mean	11,59	1644,35	3662,49	31,33	3059,52
	Std.Dev.	37,80	7106,55	15828,36	90,32	12409,45
2007	Min	1,00	13,00	36,00	1,00	18,00
	Max	212,00	46557,00	102461,00	625,00	109703,00
	Mean	10,78	1563,07	3530,43	32,65	3272,56
	Std.Dev.	30,11	6084,99	13676,25	91,61	13439,15
2008	Min	0,00	0,00	0,00	1,00	18,00
	Max	169,00	38796,00	84553,00	643,00	122024,00
	Mean	11,03	1621,24	3689,81	32,48	3400,42
	Std.Dev.	27,35	5438,62	12233,63	92,45	14631,51
2009	Min	1,00	20,00	37,00	1,00	18,00
	Max	130,00	24593,00	53108,00	663,00	136065,00
	Mean	11,42	1562,41	3506,91	33,65	3710,04
	Std.Dev.	23,96	4217,25	9522,78	95,27	16283,84
2010	Min	1,00	20,00	37,00	1,00	18,00
	Max	155,00	25942,00	57365,00	686,00	143784,00
	Mean	12,53	1639,59	3614,06	33,51	3792,67
	Std.Dev.	26,42	4377,73	9738,21	96,65	17028,12
2011	Min	1,00	20,00	37,00	1,00	22,00
	Max	144,00	30604,00	67791,00	703,00	153015,00
	Mean	12,63	1676,22	3669,86	35,23	4042,01
	Std.Dev.	26,01	4523,92	10074,62	99,09	18077,59
2012	Min	1,00	16,00	32,00	1,00	32,00
	Max	145,00	30689,00	67191,00	710,00	161567,00
	Mean	13,15	1734,14	3751,74	36,79	4313,42
	Std.Dev.	26,68	4655,30	10176,07	100,63	19139,57
2013	Min	1,00	33,00	78,00	1,00	32,00
	Max	167,00	34961,00	77319,00	710,00	169080,00
	Mean	13,89	1841,16	3971,87	38,23	4582,56
	Std.Dev.	29,56	5178,23	11295,75	101,73	20075,50
2014	Min	1,00	17,00	34,00	1,00	32,00
	Max	186,00	39372,00	82753,00	733,00	179269,00
	Mean	14,32	1867,28	3968,67	39,63	4866,51
	Std.Dev.	30,99	5365,32	11346,21	105,95	21281,56
2015	Min	1,00	17,00	34,00	1,00	32,00
	Max	207,00	39084,00	85973,00	734,00	186245,00
	Mean	15,41	2002,22	4304,03	40,85	4993,36
	Std.Dev.	32,48	5490,59	11971,79	106,65	21861,73

3. Results

We used input oriented CCR efficiency model to calculate efficiencies of provinces tourism efficiency and ranked these provinces. All DEA computation were done by Max – DEA Ultra Package Program and the results are listed in Table 2 which shows the efficiency scores and ranking of the provinces from 2006 to 2015.

Table 2: The results of DEA models

DMU	(2006)	(2007)	(2008)	(2009)	(2010)	(2011)	(2012)	(2013)	(2014)	(2015)
ADANA	0,20	0,23	0,14	0,07	0,07	0,03	0,09	0,19	0,41	0,23
ADIYAMAN	0,05	0,08	0,11	0,05	0,11	0,06	0,04	0,05	0,05	0,07
AFYON	1,00	0,46	0,40	0,34	0,18	0,21	0,31	0,02	0,60	0,69
AĞRI	0,42	0,39				0,20	0,21	0,11	0,12	0,12
AKSARAY	0,12	0,08	0,14	0,10	0,06	0,13	0,10	1,00	0,16	0,26
AMASYA	0,19	0,17	0,22	1,00	1,00	0,36	0,10	0,15	0,56	0,62
ANKARA	0,26	0,45	0,45	0,29	0,22	0,26	0,34	0,36	0,26	0,29
ANTALYA	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
ARDAHAN	1,00			0,84	0,89	0,27	0,20	0,15	0,27	
ARTVİN	0,25	0,49	0,66	1,00	0,27	0,61	0,42	0,36	0,51	0,76
AYDIN	1,00	0,79	0,79	0,60	0,70	1,00	0,96	0,96	1,00	0,72
BALIKES□ R	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
BARTIN	0,32	0,37	0,29				0,62	0,20	1,00	0,43
BATMAN					0,31	0,15	0,05	0,03	0,04	0,41
BAYBURT							0,04	0,13		
BİLECİK	0,20	0,16						0,04		
BİNGÖL	0,27				0,36	0,10	0,05	0,06	0,09	0,87
BİTLİS	0,13			0,62	0,22	0,07	0,04	0,07	0,10	0,10
BOLU	0,33	0,17	0,20	0,16	0,14	0,28	0,18	0,31	0,44	0,39
BURDUR		0,15	0,26					0,81	1,00	0,66
BURSA	0,91	0,34	0,36	0,30	0,25	0,41	0,55	0,62	0,44	0,26
ÇANAKKALE	0,36	0,60	0,65	0,53	0,31	0,79	0,40	0,66	0,81	0,03
ÇANKIRI						0,27	0,16	0,10	0,11	1,00
ÇORUM	0,22	0,07	0,09	0,07	0,10	0,19	0,28	0,42		
DENİZLİ	0,47	1,00	1,00	0,77	0,59	0,69	0,71	0,40	0,52	0,27
DİYARBAKIR	1,00	1,00	1,00	1,00	0,38	0,48	0,23	0,36	0,54	0,21
DÜZCE	0,46	0,29	0,33	0,46	0,19	0,27	0,21	0,26	0,39	0,47

EDİRNE	0,40	0,23	0,34	0,18	0,10	0,15	0,13	0,48	0,77	0,34
ELAZIĞ	0,11	0,22	0,29	0,10	0,13	0,18	0,13	0,10	0,23	0,32
ERZİNCAN	0,21	0,26	0,50	0,36	0,23	0,19	0,16	0,31	0,51	1,00
ERZURUM	0,59	0,50	0,76	0,28	0,22	0,40	0,40	0,44	0,60	0,11
ESKİŞEHİR	0,16	0,20	0,20	0,20	0,05	0,15	0,04	0,05	0,07	0,88
GAZİANTEP	0,11	0,11	0,10	0,07	0,05	0,09	0,08	0,12	0,10	0,10
GİRESUN	0,12	0,12	0,11	0,09	0,04	0,07	0,07	0,19	0,19	0,11
GÜMÜŞHANE		1,00	0,94	1,00	1,00	1,00			0,12	0,10
HAKKARİ	0,25	0,16					0,08	0,04	0,07	1,00
HATAY	0,21	0,16	0,19	0,07	0,08	0,09	0,09	0,15	0,16	0,16
IĞDIR	0,25	0,13	0,20	0,54	0,02	0,06	0,01	0,02	0,09	1,00
ISPARTA	0,36	0,19	0,24	0,11	0,30	1,00	0,74	0,59	0,51	0,40
İSTANBUL	1,00	1,00	1,00	0,83	1,00	1,00	1,00	1,00	0,91	1,00
İZMİR	0,60	0,60	0,67	0,65	0,33	0,73	0,87	1,00	1,00	1,00
K.MARAŞ		1,00	1,00	0,61	0,62	0,55	0,27	0,36	0,60	0,34
KARABÜK	0,30	0,24	0,32	0,71				0,37	0,69	0,60
KARAMAN	0,20	0,06	0,07	0,07	0,04	0,10	0,06		0,09	0,13
KARS	0,06	0,09	0,16	0,24	0,11	0,22	0,28	0,15	0,15	0,30
KASTAMONU	0,86	0,21	0,29	1,00		1,00	0,49	0,24	0,63	0,96
KAYSERİ	0,18	0,09	0,08	0,04	0,07	0,13	0,09	0,09	0,17	0,26
KIRIKKALE	0,04	0,04	0,05						0,12	
KIRKLARELİ	0,55	0,21	0,21	0,19	0,38	0,45	0,21	0,31	0,53	0,43
KIRŞEHİR	0,16	0,06	0,06	0,02	0,53	0,24	0,08	0,09	0,13	
KİLİS								0,12	0,32	
KOCAELİ	0,18	0,23	0,26	0,13	0,07	0,12	0,12	0,17	0,16	0,20
KONYA	0,36	0,19	0,22	0,10	0,18	0,13	0,16	0,26	0,25	0,28
KÜTAHYA	0,36	0,22	0,19	0,19	0,65	1,00		1,00	1,00	1,00
MALATYA	0,44	0,09	0,24		0,12	0,15	0,16	0,16	0,40	0,25
MANİSA	0,65	0,41	0,45	0,34	0,37	0,34	1,00	0,61	0,71	0,64
MARDİN	0,05	0,12	0,10	0,06	0,01	0,02	0,04	0,19	0,30	0,23
MERSİN	1,00	0,30		0,13	0,35	0,20	0,27	0,31	0,50	0,64
MUĞLA	0,82	0,92	0,88	0,53	1,00	1,00	1,00	0,93	1,00	1,00

MUŞ	1,00	1,00	1,00		0,11	0,15	0,08	0,08	0,10	0,07
NEVŞEHİR	0,32	0,26	0,27	0,47	0,67	0,57	0,33	0,46	0,81	0,62
NİĞDE	0,04	0,16			0,04	0,10	0,19	0,05	0,11	0,09
ORDU	0,14	0,17	0,25	0,19	0,07	0,15	0,11	0,19	0,44	0,39
OSMANIYE	0,32	0,26		0,45	0,13	0,09	0,06	0,11	0,10	0,07
RİZE	0,24	0,16	0,18	0,08	0,05	0,19	0,09	0,08	0,37	0,05
SAKARYA	0,12	0,22	0,38	0,20	0,09	0,15	0,13	0,29	0,28	0,33
SAMSUN	1,00	0,47	0,36	0,19	0,07	0,08	0,11	0,41	0,42	0,45
SİİRT	0,21	0,03	0,04	0,19	0,29	0,07	0,05	0,04	0,10	
SİNOP	0,03	0,22	0,17	0,22	0,12	0,35	0,35	0,17	0,33	0,35
SİVAS	0,37	0,42	0,47	0,36	0,11	0,22	0,18	0,55	0,78	0,37
ŞANLIURFA	0,29	0,22	0,22	0,20	0,19	0,22	0,23	0,19	0,26	0,28
ŞIRNAK	0,22		0,09	0,08	0,14	0,16	0,09	0,10	0,10	0,15
TEKİRDAG	0,63	0,34	0,27	0,23	0,20	0,45	0,38	0,37	0,48	0,65
TOKAT	0,18	0,21	0,29	0,51	0,28	0,68	0,50		0,59	0,31
TRABZON	0,65	0,37	0,40	0,38	0,26	0,53	0,34	0,31	0,51	0,54
TUNCELI	0,20	0,05	0,05	0,07	0,03	0,03	0,02	0,07	1,00	0,05
UŞAK	0,57	0,22	0,15	0,16	0,05	0,06	0,04	0,06	0,13	0,17
VAN	1,00				0,47	0,18	0,10	0,11	0,26	0,20
YALOVA	0,18	0,37	0,43	0,49	0,11	0,24	0,16	0,24	0,49	0,67
YOZGAT	1,00	0,19	0,22	0,11	0,18	0,22	0,30		0,71	1,00

The results show that among provinces, the efficiency of Antalya and Balıkesir is relatively best on all of years and Kırıkkale and Adıyaman that of the average efficiency value is relatively worst. As it can be observed, use of the technical and technological efficiency model scores brought a slight difference in ranking of the transportation services in years.

4. Conclusion

During the 2011-2012 period, there was a global crisis in the world. Turkey's economy has also been affected by this crisis. In this paper, we used a Malmquist Productivity Index using CCR input oriented model measure to analyze the performance of the provinces in Turkey about tourism. This measure ranked those provinces on their performance between 2006 and 2015. Overall, Turkey wherein the total productivity of change effectiveness of the separation of the gain change and technical development has shown mixed results. Over the course of the study period, the total productivity growth of more than half of the provinces and efficiency gains have been realized. It has also been observed that technical developments in half of the provinces. The level of efficiency differ from one year to another.

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