PERFORMANCE MEASUREMENT OF TURKEY'S TOURISM SECTOR BY USING DATA ENVELOPMENT ANALYSIS

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In the recent years, Turkey has known as one of the most popular tourist destinations in the world. The assessment of tourism performance is clearly one of the most important and profitable parts of increasing tourism industry. This paper reports the tourists' impacts of 35 different countries on the Turkey's tourist industry from 2006 to 2010. A recent robust model in Data Envelopment Analysis (DEA) is applied as well as Windows Analysis (WA) to identify the countries which have most impacts on Turkey's tourism industry. It is illustrated which one of countries with less number of tourists, less accommodation time and less number of overnight staying, had spent more money in package and individual journeys in Turkey. The proposed methodology not only illustrates how a country is able to measure its tourism industry, but it also guides how it can improve its tourism industry in order to improve its receipts.

Keywords: DEA, Kourosh and Arash model, Efficiency, Tourism, Windows analysis.

1. Introduction

Tourism is one of the largest growing sectors in the world economy, and held a 45% market share of international tourist arrivals, which increased from 25 million in 1950 to 277 million in 1980, 439 million in 1990, 684 million in 2000, 922 million in 2008 and 1,035 million in 2012 [1]. According to the latest World Tourism Organization, international tourism grew by 5% in the first nine months of 2013, which reached a record 845 million worldwide, an estimated 41 million more than in the same period of 2012 [1].

Turkey is known as a tourism country which has sharply developed after 1980, and was one of the top ten countries in international tourism to gain competitive advantages remarkably. Turkey had also the 6^{th} rank in international tourism arrivals (34.7 million in 2011 and 35.7 in 2012) and 11^{th}rank in international tourism receipts (US$ 22.6 billion in 2011 and US$ 25.7 billion) [1].Although, Turkey had the double-digit growth receipts among the 25 largest international tourism earners, its receipts rank is not as good as its arrivals rank in 2012. Therefore, there is a need to measure the performance of Turkey's tourism industry in order to increase Turkey's receipts rank.

Moreover, there are a good number of studies on tourism and its relation to other sectors in the literature of tourism such as its relation to employment [2],

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economy [3][4][5], transportation [6][7][8], culture [9], hotel industry [10], security [11][12] sociology [13] sustainable development [14][12][15] sport [16][17] demand and supply [18][19] environment [20] water [21][22][23] geography [24] hospitality [25][26] migration [27][28] poverty [29][30] peace [31] and so on. However, there is no study to investigate the impact of tourists from different countries on Turkey's tourism in the literature. Therefore, measuring the impact of each country on Turkey's tourism is necessary to improve Turkey's receipts rank. It can be also a good practice for other countries to improve their receipts from their possible arrivals.

In order to measure the mentioned objectives, a recent technique in Data Envelopment Analysis (DEA), called Kourosh and Arash Model (KAM) proposed by Khezrimotlagh *et al.* (2013) [32] is selected. DEA is a popular non-parametric technique to estimate the performance evaluation of a set of homogenous Decision Making Units (DMUs) with multiple inputs and outputs. It was proposed by Charnes *et al.* (1978) [33], and has been dramatically improved in many contexts such as Economics, Managements, Business and Industrial Engineering and so on [34]. KAM is also a recent roust model in DEA, which covers many of DEA subjects, and has improved the discrimination power of DEA significantly. It simultaneously ranks and benchmarks both technically efficient and inefficient DMUs, and identifies the most efficient DMUs with a strong logical method.

Moreover, the technique of Widows Analysis (WA) [35] is also considered in order to rank countries and measure their tourists' impact on Turkey's industry in years 2006-10.WA can be adopted to detect trend of a DMU over time [36][37][38].

Some factors were also selected from the Turkish Statistical Institute web page "http://www.tuik.gov.tr". The factors are divided into two groups by proposed assumptions in order to calculate the most beneficial countries on Turkey's tourism industry. The technique of KAM and WA are used and their results are depicted with some appropriate figures as well as clear illustrations and suggestions to improve Turkey's tourism industry. It is illustrated how Turkey should plan for each country to increase its receipts from its arrivals.

The rest of this paper is organized into 5 sections. Section 2 is a background on DEA. Section 3 illustrates the used methodology to divide factors into two groups for applying KAM as well as its advantages on measuring the tourism performance. The results of applying KAM and WA for each country are depicted in Section 4 and the paper is concluded in Section 5.

2. Data Envelopment Analysis (DEA)

DEA is a non-parametric tool for assessing the relative efficiency of DMUs proposed by Charnes *et al.* (1978) [33]. It does not need many requirements in

comparison with other decision making tools, and does not have computational complexities for solving its models. From a set of input and output data, DEA provides a feasible region with a linear programming model in order to find the best performers among the available DMUs. Recently, Khezrimotlagh *et al*. (2013) [32] improved the foundation of DEA and its first definitions to increase DEA's power to distinguish DMUs with multiple inputs and outputs inclusive controllable, non-controllable, real and integer data.

In order to introduce KAM, suppose that there are n DMUs (DMU_i, $i = 1, 2, \dots, n$) with m non-negative inputs (x_{ij}, $j = 1, 2, \dots, m$) and p non-negative outputs (y_{ik}, $k = 1, 2, \dots, p$), such that, at least one of the inputs and one of the outputs of each DMU are not zero. Assume that for every i there is a j such that $x_{ij} \neq 0$and also for every i there is a k such that$y_{ik} \neq 0$. Consider an epsilon vector $\epsilon = (\varepsilon^-, \varepsilon^+)$ in $\mathbb{R}_+^{m+p}$, where ε^- is $(\varepsilon_1^-, \varepsilon_2^-, \dots, \varepsilon_m^-)$ and ε^+ is $(\varepsilon_1^+, \varepsilon_2^+, \dots, \varepsilon_p^+)$. The components of epsilon should be commensurate corresponding to data, therefore, they usually define as$\varepsilon_j^- = \varepsilon x_j$, and $\varepsilon_k^+ = \varepsilon y_k$, for a suitable $\varepsilon \in \mathbb{R}_+$, $j = 1,2, \dots, m$, and $k = 1,2, \dots, p$. The linear ε-KAM in variable returns to scale is as follows where the weights are the inverse of data to have commensurate slacks, and whileDMU_l ($l = 1, 2, \dots, n$) is under evaluation:

$$\begin{aligned}
&\max \textstyle\sum_{j=1}^{m} s_{lj}^-/x_{lj} + \sum_{k=1}^{p} s_{lk}^+/y_{lk}, \qquad (1)\\
&\text{Subject to}\\
&\textstyle\sum_{i=1}^{n} \lambda_{li} x_{ij} + s_{lj}^- = x_{lj} + \varepsilon x_{lj}, \text{ for } j = 1, 2, \dots, m,\\
&\textstyle\sum_{i=1}^{n} \lambda_{li} y_{ik} - s_{lk}^- = y_{lk} - \varepsilon y_{lk}, \text{ for } k = 1, 2, \dots, p,\\
&\textstyle\sum_{i=1}^{n} \lambda_{li} = 1,\\
&\lambda_{li} \geq 0, \text{ for } i = 1, 2, \dots, n,\\
&s_{lj}^- \geq 0, \text{ for } j = 1, 2, \dots, m,\\
&s_{lk}^+ \geq 0, \text{ for} k = 1, 2, \dots, p.
\end{aligned}$$

The best technical efficient target with ε degree of freedom (ϵ-DF) and the best technical efficiency score with ε-DF are respectively given by:

$$\begin{cases} x_{lj}^* = x_{lj} - s_{lj}^{-*} + \varepsilon x_{lj}, \text{for } j = 1,2, \dots, m, \\ y_{lk}^* = y_{lk} + s_{lk}^{+*} - \varepsilon y_{lk}, \text{for } k = 1,2, \dots, p. \end{cases} \qquad (2)$$

$$KA_{\varepsilon}^{*l} = \frac{p \times \sum_{j=1}^{m} \left(\frac{x_{lj}^*}{x_{lj}}\right)}{m \times \sum_{k=1}^{p} \left(\frac{y_{lk}^*}{y_{lk}}\right)}. \qquad (3)$$

The notations used in KAM are as follows:

n: number of DMUs, m: number of inputs, p: number of outputs,

i:index of DMUs, j: index of inputs, k: index of outputs,

l: index of evaluated DMU,

x_{lj}: non-negative observed value of input$j$ of DMU$_l$,

y_{lk}:non-negative observed value of output k of DMU$_l$,

s_{lj}^-: non-negative slack or potential reduction of input$j$ of DMU$_l$,

s_{lk}^- : non-negative slack or potential increase of output$k$of DMU$_l$,

λ_i : multipliers used for computing linear combinations of DMUs' inputs andoutputs, ε: non-negative real number.

When epsilon is zero, linear KAM is the same as the weighted additive model proposed by Charnes *et al*. (1985) [39]. Khezrimotlagh (2014) [40] also improved KAM to non-linear KAM in order to measure the minimum efficiency scores of DMUs on feasible region as well as increasing discrimination powers of DEA.

Each DMU is observed only once in DEA process, therefore, in order to measure the changes in efficiency over the time, DEA window analysis can be provided to estimate the efficiency trend of DMUs over time [41]. In order to explain window analysis, assume that there are nDMUs (DMU$_i$, $i = 1, 2, \dots, n$) withavailable dataof $q(\geq 3)$periods for each DMU. Suppose that the window length is r $(2 \leq r \leq q-1)$, therefore, the first window contains the first r periods of available data of nDMUs, that is, making a production possibility set with $n \times r$ number of decision making units. The second window contains the first r periods of available data after excluding the first period. This process is continued until reaching to the last r periods of available data of DMUs. For example, suppose that there is only a DMU $A$with data of five periods1-5 and 3 length of window, that is,$n = 1$, $q = 5$ and $r = 3$. Table 1 illustrates the first, second and third rows of window. For instance, the first row of window contains the data of A in periods 1, 2 and 3, which are marked with $A11$, $A12$ and $A13$. It means for the first row of window there are three different DMUs. While DEA is applied for these three DMUs their measured efficiency scores put instead $A11$, $A12$ and $A13$, and so on for other window rows. After that the average and standard division of all efficiency scores are calculated to reflect the punctuation of efficiency scores for A in periods 1-5.

Table 1

Window analysis for n = 1, q = 5 and r = 3.

DMU	Period	1	2	3	4	5
	First row	$A11$	$A12$	$A13$		
A	Second row		$A22$	$A23$	$A24$	
	Third row			$A31$	$A32$	$A33$

A good discussion on windows analysis can be found in Cooper *et al*. (2007) [42] and Chung*et al*. (2008) [41].

3. Discussion and selection of factors to apply DEA

As can be seen in the reports of UNWTO, the receipts and arrivals ranks are usually considered to depict the trend of tourism industry of a country. The benefits of tourism are usually calculated based on the number of tourists. However, these simple information are not significantly able to help a country to improve its tourism industry. Many tourists visit Turkey from countries around the world in each year. How is Turkey able to increase its receipts from its arrivals?

One of the factors to measure the performance of tourism industry is clearly "the number of tourists". Tourists usually stay on hotels, motels and other prepared accommodation, but there are also some tourists who are not foreign and they live in other countries, and may not use the prepared accommodation during their journeys in their hometown. They may use their own house, or stay with their families and friends. Moreover, some tourists may only pass through a country to another country, and do not use any accommodation or spending money during their journeys.

On the other hand, it is quite obvious that a country should plan to increase more number of tourists in order to improve its tourism industry. However, a country should also know those countries with less number of tourists which have high impacts on its receipts. In other words, suppose that there are two countries *A* and *B*. Assume that 100 tourists of *A* and 10 tourists of *B* visited a country while the tourists of *A* spent \$500 and the tourists of *B* spent \$200. This simple example shows, although, the number of tourists of *B* is only 10 in comparison with the number of *A*'s tourists, each of the *B*'s tourist spent \$20 in average, whereas the *A*'s tourists only spent \$5 in average, that is, the impact of *B*'s tourists is more than the impact of *A*'s tourists in receipts. Therefore, the country should plan to increase the number of tourists from B and should prepare some more advantages to encourage *A*'s tourists to spend more money during their journey.

The above clear example illustrates that there is a need to measure which one of countries with less number of tourists, less accommodation time and less number of overnight staying, have been had more impacts on Turkey's tourism industry. Thus, three different kind of inputs can be considered as follows:

Input 1: the number of tourists who come to Turkey for different reason in years,

Input 2: the number of overnight staying: according to accommodation type in years,

Input 3: the number of resident tourists in each year, for example: who were Turkish, but living in other countries and may not have used hotels for staying during their trips.

Table 2

Summary of the Turkey's tourism industries factors in 2006-10.

Year	Statistics items	Input 1	Input 2	Input 3	Output 1	Output 2
	Minimum	15,782.00	2,582.00	3,461.00	1,021,078.00	266,034.00
	First quartile	1,234,085.50	141,597.50	192,653.50	93,125,852.00	11,840,368.50
	Median	2,698,263.00	318,937.00	375,806.00	170,610,891.00	38,980,019.00
2006	Average	4,939,529.74	458,483.43	546,138.29	272,337,689.11	86,428,860.97
	Third quartile	6,109,829.00	497,546.00	596,382.00	285,905,160.00	73,729,648.00
	Maximum	37,617,181.00	3,040,595.00	3,744,789.00	1,865,836,516.00	800,703,151.00
	Standard division	6,830,292.16	571,823.74	674,192.50	331,864,575.46	158,210,577.07
	Minimum	1,391.00	238.00	2,715.00	879,206.00	122,094.00
	First quartile	1,425,127.50	146,638.50	176,544.50	107,908,328.50	15,365,283.50
	Median	2,710,264.00	341,842.00	420,207.00	185,467,206.00	39,922,696.00
2007	Average	5,530,979.60	526,138.71	603,316.89	309,924,274.46	89,788,678.71
	Third quartile	6,671,544.00	586,840.50	595,813.50	358,908,567.00	71,145,797.00
	Maximum	42,265,315.00	3,498,985.00	4,108,735.00	2,332,207,139.00	733,891,606.00
	Standard division	7,625,917.31	665,280.40	761,602.33	402,350,648.03	151,743,548.74
	Minimum	50,309.00	9,725.00	141.00	11,721,412.00	2,186,451.00
	First quartile	1,280,974.00	136,097.50	220,780.50	114,761,636.50	21,541,212.50
	Median	3,129,340.00	365,948.00	488,681.00	261,538,861.00	56,118,462.00
2008	Average	6,316,839.26	580,056.71	692,133.63	368,863,843.03	111,182,419.80
	Third quartile	6,815,682.50	678,201.50	805,745.50	449,248,146.50	106,212,749.00
	Maximum	45,001,734.00	3,557,718.00	4,432,779.00	2,484,640,498.00	758,849,090.00
	Standard division	8,822,725.45	720,181.85	834,631.11	437,713,228.56	171,200,954.40
	Minimum	86,406.00	22,414.00	1,816.00	18,507,596.00	3,443,655.00
	First quartile	1,325,995.50	144,934.50	253,757.50	105,037,698.00	20,899,483.00
	Median	3,308,812.00	404,063.00	500,977.00	230,236,476.00	61,160,199.00
2009	Average	6,514,516.00	624,842.00	732,625.37	342,774,657.40	110,170,344.26
	Third quartile	7,286,928.00	718,510.50	873,191.50	430,986,843.00	102,806,327.50
	Maximum	43,712,051.00	3,703,056.00	4,279,267.00	2,123,233,507.00	813,867,531.00
	Standard division	9,217,844.32	748,496.53	820,041.80	383,804,107.59	164,801,290.47
	Minimum	53,754.00	5,116.00	4,436.00	13,188,775.00	2,473,412.00
	First quartile	1,172,963.00	144,622.00	220,828.00	97,557,596.00	20,634,886.00
	Median	3,327,818.00	399,779.00	494,892.00	242,813,355.00	70,177,832.00
2010	Average	6,690,505.40	667,255.31	775,975.66	333,169,318.97	111,898,039.97
	Third quartile	7,297,775.00	766,337.50	941,655.00	389,319,421.00	109,462,157.00
	Maximum	41,675,419.00	3,625,603.00	4,199,219.00	1,886,351,283.00	734,009,368.00
	Standard division	9,659,916.84	776,515.84	847,902.42	361,880,681.77	158,087,407.56

Note that, it is not supposed to decrease the above inputs values in this study. It is only assumed to find those countries with less number of inputs values, in order to calculate the impact of each country on Turkey's tourism industry, and find the most beneficial tourists. The inputs can also be supposed as undesirable inputs, because increasing their values can undoubtedly effect on increasing the receipts of a country. However, the purpose of this paper is not benchmarking countries and it is only finding the beneficial tourists for Turkey's tourism industry. When a KAM score of a country is less than 1, it means the country has a good number of tourists for Turkey, but Turkey requires to improve its plan to improve its receipts from the tourists of that country.

On the other hand, tourists spending may have been done in package tours or individually. Therefore, the two following factors are considered as outputs which their high values are interest for the objective of this paper:

Output 1: the package spending by foreign tourists according to their nationalities within the context of package tours,
Output 2: the individual spending by foreign tourists according to their nationality within the context of individual tours.

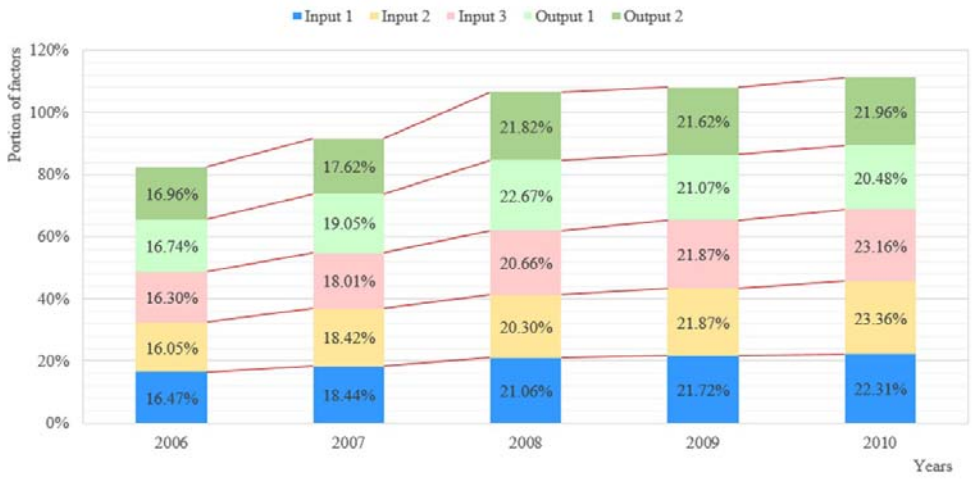

Fig. 1: Average comparison of Turkey's tourism factors over 2006-10.

Table 2 demonstrates the statistics central tendency values of the mentioned factors for all countries in Turkey's tourism industry through 2006-2010. Minimum, first quartile, median, average, third quartile and maximum values of factors as well as the standard division values are illustrated. According to the table, the input values increased from 2006-10, however the first output got its maximum in 2008.

Figure 1 depicts the differences of average's factors changed over years 2006-10. From the figure, it is clear that the factors were increased except output 1 which has a pick in 2008. For instance, the average value of input 1 in 2006 was 4,939,529.74, and in 2007 was 5,530,979.60 and so on. If all average values of input 1 from 2006-10 are considered, only 16.47 percentages are belonged to 2006 and it is increased to 18.44 percentages in 2007, 21.06 percentages in 2008, 21.72 percentages in 2009 and 23.31 percentages in 2010. This increasing can also be seen for input 2 by 16.05, 18.42, 20.30, 21.87 and 23.36 percentages in years 2006-10, respectively. Correspondingly it is for input 3 and output 2 except the values of output 2 in 2008 to 2009 which show a decrease from 21.82 to 21.62 percentages. For output 1, the values are 16.74, 19.05, 22.67, 21.07 and 20.48 percentages through 2006-10 which show that the values of output 1 reached to its maximum in 2008.

Moreover, Figure 2 in overall depicts the growing trend of Turkey's tourism industry, and this study exemplifies the effective countries for this growing. In the next section, it is illustrated which countries had more impact on Turkey's receipts and tourism industry which would help Turkey's to find a right direct to increase its receipts as well as its arrivals.

4. Results of KAM and WA

In this study, countries around the world are classified as 35 DMUs. The factors are divided into 3 inputs and 2 outputs according to discussion of previous section. Table 3 illustrates the 35 DMUs called A01-A35. The impacts of each country were measured by applying KAM in variable returns to scale technology while epsilon is introduced as one millionth for each year. It means in order to measure the technical efficiency scores of DMUs and test the instabilities of the technically efficient DMUs, one millionth errors are considered. This error does not have any effects on data, and does not mean that data are changed, but is useful for increasing the discrimination powers of DEA [32].

Table 3: The Impacts of 35 countries on Turkey's tourism industry in years 2006-10.

Countries	DMU	2006	2007	2008	2009	2010	Average
Australia	A01	0.3579481	0.4481221	0.5372467	0.5365984	0.5520361	0.4863903
Austria	A02	0.7834435	0.5703547	0.5230766	0.6103290	0.6278182	0.6230044
Azerbaijan	A03	0.1044118	0.0541054	0.0951677	0.1150798	0.1313956	0.1000321
Belgium	A04	0.8739941	0.8425432	0.7386123	0.9999999	1.0000000	0.8910299
Bulgaria	A05	0.0908994	0.1397915	0.2578512	0.3940010	0.3904284	0.2545943
Canada	A06	1.0000000	0.6174419	1.0000000	0.6016394	0.6776706	0.7793504
Denmark	A07	0.9993186	0.6533953	0.4580765	1.0000000	0.6501383	0.7521858
England	A08	0.9999999	0.9999987	0.9999974	0.9999981	0.9999998	0.9999988
France	A09	0.8536818	1.0000000	0.8212144	0.7956739	0.8446947	0.8630530
Georgia	A10	0.0171612	0.0330147	0.0240207	0.0358633	0.0326559	0.0285432
Germany	A11	0.9999999	0.9999999	0.9999999	0.9999999	0.9999999	0.9999999
Greece	A12	0.9999991	0.4492489	0.9999998	0.4683191	0.9999996	0.7835133
Iran	A13	0.2108226	0.2079736	0.1985589	0.3260988	0.3728315	0.2632571
Israel	A14	0.9999985	0.6952474	0.6051935	0.5602365	0.5566075	0.6834567
Italy	A15	0.8322609	0.7752999	0.9999960	0.9999995	0.7603539	0.8735821
Japan	A16	0.9999991	0.9999987	0.9999986	0.9999965	0.9999983	0.9999983
Netherland	A17	0.9545503	0.9301353	0.7692484	0.8510747	0.8900849	0.8790187
OECD Countries	A18	1.0000000	0.8030091	1.0000000	0.7241941	0.8394208	0.8733248
Other African Countries	A19	0.9999942	1.0000000	0.9999952	0.9999971	0.9999989	0.9999971
Other American Countries	A20	0.8127752	0.6647161	0.5589210	1.0000000	0.6567850	0.7386395
Other Countries	A21	0.9999991	1.0000000	0.9999988	0.9999991	0.9999974	0.9999989
Other East Asian Countries	A22	0.3944830	0.5307369	0.9999993	0.5514592	0.9999970	0.6953351
Other European Countries	A23	0.7692655	0.7817065	0.9999995	0.9999979	0.7941906	0.8690320
Other South Asian Countries	A24	0.5029770	0.7695607	0.3532987	0.6702180	1.0000000	0.6592109
Other South-East AsiaCountries	A25	0.3393141	0.5381381	1.0000000	1.0000000	0.6414174	0.7037739
Other Western Asian Countries	A26	0.4122938	0.9998294	0.9999990	0.9999993	0.9999996	0.8824242
Russia	A27	0.9999999	0.9999998	0.9999998	0.9999985	0.9999997	0.9999995
Society of Independent States	A28	0.5124862	1.0000000	0.6073023	0.5651025	0.6754717	0.6720725
Spain	A29	0.9999984	0.9999993	0.9999996	0.7522503	0.9999999	0.9504495
Sweden	A30	0.6693432	0.9999992	0.5353157	0.6383838	0.6827283	0.7051540
Switzerland	A31	0.6842343	0.5916232	0.4667669	0.7196768	0.6705470	0.6265697
Syria	A32	0.1410045	0.1723499	0.2107824	0.2603613	0.2028837	0.1974764
Tunis	A33	0.9999990	0.9999849	0.9999943	0.9999971	1.0000000	0.9999951
Ukraine	A34	0.6268115	0.7451643	0.6271287	0.9999984	0.5662520	0.7130710
USA	A35	0.9999977	0.9999983	0.9999993	0.9999930	0.9999998	0.9999977

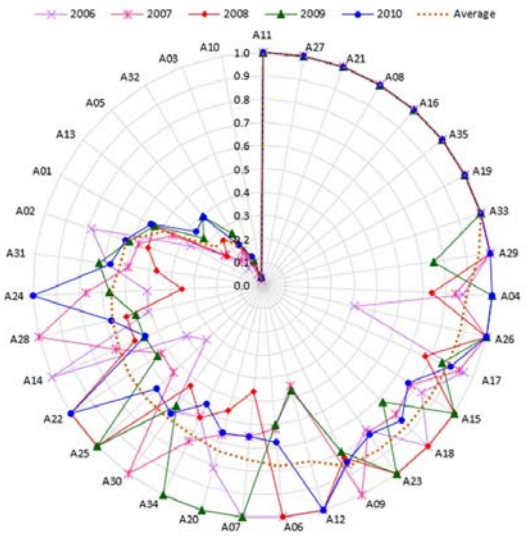

Fig. 2: The measured impact of 35 countries by 0.000001-KAMin years 2006-10.

The KAM impact of each DMU for years 2006-10 as well as the averages of these impacts are illustrated in third to eighth columns of Table 3. As can be seen, KAM mostly measured the impact of selected countries less than 1 which shows that the impact of these countries can be improved by providing a good plan to encourage their tourists to spend more during visiting Turkey. In other words, the related industries of Turkey should plan to provide interested goods or places for such tourists.

In order to read the results of Table 3, radar charts are depicted in Figures 2 and 3. The used data for figures are arranged from the most average impact to the list average impacts on Turkey's tourism industry from 2006-10.

Figure 2 depicts that Germany (A11), Russia (A27), other countries (A21), England (A08), Japan (A16), USA (A35), other African countries (A20) and Tunis (A33) are the first eight countries which their tourists with less values of inputs had more values of outputs in all years 2006-10. These countries had more impacts on Turkey's tourism industry whereas Georgia (A10), Azerbaijan (A03), Syria (A32), Bulgaria (A05), Iran (A13), Australia (A01), Austria (A02) and Switzerland (A31) were the last eight countries with least impacts on Turkey's tourism industry. In other words, the last eight countries, although, had a good number of tourists, their tourists did not spent money as good as other countries. These results may have enough reasons for Georgia, Syria, Bulgaria and Iran or even Azerbaijan due to being Turkey's neighbors, but Turkey requires to focus on ways to increase the receipts from Australia, Austria and Switzerland.

There were also good beneficial increase from tourists of Spain (A29), Belgium (A04) and Other Western Asian Countries (A26) in 2010, whereas a

decrease impact can be seen from tourists of Netherland (A17), Italy (A15), OECD Countries (A18), Other European Countries (A23) and France (A09) in 2010. A rapid growth was also from tourists of Other South Asian Countries (A24) after fluctuation from 2006-2009. Tourists from Greece (A12) and Other East Asian Countries (A22) had also a fluctuation impact from 2006-10. Moreover, a sharp decreasing was from tourists of Sweden (A30) and Society of Independent States (A28) from 2007, tourists of Israel (A14) from 2006,tourists of Canada (A06) from 2008 and tourists of Denmark (A07), Other American Countries (A20), Ukraine (A34), Other South-East Asia (25) from 2009.

In order to depict the differences of the first eight countries, Figure 3 is considered with the scale of six decimal digits.

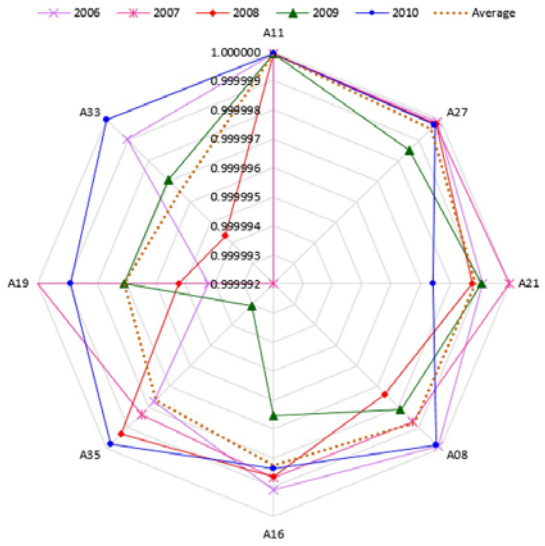

Fig. 3 The discrimination of first eight DMUs with most impact on Turkey's tourism.

Fig. 3 clearly depicts the 0.000001-KAM results for the first eight countries as well as discriminating the impact of each country from 2006-10.Similar to Figure 2, the scores were arranged from the most average values to least average values according to the last column of Table 3. The doted segment lines illustrate the average impact scores. Germany (A11) was the most beneficial countries among other countries followed by Russia (A27) which had a decrease impact in 2009 only. After decreasing in the impact scores of England (A08) and Tunis (A33) in 2007 the impact scores were increased in 2008-10. There was also a sharp fall in the impact scores of USA (A35) in 2009 in comparison with other years. The impact of Other Countries (A21) and Other African Countries (A19) had also a fluctuation in 2006-10.From Figures 2 and 3, it is clear that the impact scores are different for each countries in 2006-10.

Table 4: The results of window analysis by 0.000001-KAM.

DMU	First row of window			Second row of window			Third row of window			Statistical results			
	2006	2007	2008	2007	2008	2009	2008	2009	2010	Min	Average	Max	Sd.
A01	0.414917	0.383969	0.527818	0.384026	0.538286	0.456001	0.533050	0.463305	0.533424	0.383969	0.470533	0.538286	0.061526
A02	0.636984	0.444129	0.523077	0.444129	0.518044	0.541968	0.518044	0.549601	0.495310	0.444129	0.519032	0.636984	0.054950
A03	0.095524	0.043910	0.095233	0.041464	0.090668	0.106340	0.090668	0.106340	0.098628	0.041464	0.085419	0.106340	0.023472
A04	0.727785	0.720796	0.732660	0.719278	0.738365	1.000000	0.734818	0.999998	1.000000	0.719278	0.819300	1.000000	0.127903
A05	0.088044	0.124930	0.257851	0.124930	0.257851	0.342018	0.257851	0.342961	0.361443	0.088044	0.239764	0.361443	0.097915
A06	0.999999	0.453935	1.000000	0.463476	1.000000	0.489680	1.000000	0.488831	0.559227	0.453935	0.717239	1.000000	0.254397
A07	0.579412	0.489616	0.456620	0.491717	0.458077	0.999995	0.458077	0.999995	0.525941	0.456620	0.606606	0.999995	0.213505
A08	0.999999	0.928040	0.974553	0.870061	0.931086	0.845676	0.999970	0.845676	0.829964	0.829964	0.913892	0.999999	0.064353
A09	0.669887	1.000000	0.809346	1.000000	0.797884	0.698163	0.808529	0.709914	0.668961	0.668961	0.795854	1.000000	0.121379
A10	0.016859	0.028160	0.023933	0.027147	0.023471	0.030728	0.023500	0.030728	0.026337	0.016859	0.025652	0.030728	0.004085
A11	1.000000	0.999999	1.000000	0.999999	1.000000	0.999999	1.000000	0.999999	0.862406	0.862406	0.984711	1.000000	0.043241
A12	0.999712	0.457582	1.000000	0.457582	1.000000	0.431062	1.000000	0.431062	0.577046	0.431062	0.706005	1.000000	0.266001
A13	0.181580	0.170878	0.198559	0.170878	0.198559	0.272855	0.199672	0.272855	0.319716	0.170878	0.220617	0.319716	0.050730
A14	0.645542	0.532006	0.605194	0.527439	0.605194	0.478847	0.605194	0.478847	0.535011	0.478847	0.557030	0.645542	0.056770
A15	0.610816	0.607172	0.999996	0.599852	0.999996	0.947023	0.983536	0.947023	0.700482	0.599852	0.821766	0.999996	0.174988
A16	0.748333	0.749543	0.999999	0.748248	0.999999	0.999987	0.941483	0.768540	0.999998	0.748248	0.884014	0.999999	0.118024
A17	0.848349	0.738894	0.769217	0.693359	0.738042	0.724454	0.747292	0.745273	0.709715	0.693359	0.746066	0.848349	0.041743
A18	0.962419	0.648088	1.000000	0.648088	1.000000	0.653513	1.000000	0.653513	0.689168	0.648088	0.806088	1.000000	0.165798
A19	0.557690	0.999996	0.999995	0.999998	0.892403	0.999995	0.909811	0.999995	0.830476	0.557690	0.910040	0.999998	0.137942
A20	0.559189	0.487802	0.491157	0.550439	0.558052	0.999999	0.556805	0.999999	0.604570	0.487802	0.645335	0.999999	0.192557
A21	0.379962	1.000000	0.467251	1.000000	0.465529	0.441020	0.999999	0.553588	0.571328	0.379962	0.653186	1.000000	0.250979
A22	0.424095	0.469562	0.999999	0.469562	0.999999	0.494019	0.999999	0.494019	0.999995	0.424095	0.705695	0.999999	0.263921
A23	0.612305	0.686357	0.999999	0.652983	0.999999	0.750524	0.999999	0.750703	0.637531	0.612305	0.787822	0.999999	0.156239
A24	0.367225	0.609210	0.347334	0.636029	0.348193	0.530027	0.343267	0.521662	0.999999	0.343267	0.522550	0.999999	0.201597
A25	0.361700	0.419517	1.000000	0.445845	1.000000	0.999999	1.000000	0.999999	0.605158	0.361700	0.759135	1.000000	0.275929
A26	0.299904	0.387760	0.999999	0.385951	0.967979	0.999999	0.962870	0.999999	0.999993	0.299904	0.778273	0.999999	0.298508
A27	0.999994	0.913577	1.000000	0.893128	1.000000	0.753801	1.000000	0.753801	0.796878	0.753801	0.901242	1.000000	0.101980
A28	0.460864	1.000000	0.570385	1.000000	0.530459	0.523681	0.554373	0.539229	0.562601	0.460864	0.637955	1.000000	0.195819
A29	0.686743	0.729790	1.000000	0.727594	1.000000	0.685186	1.000000	0.685186	0.999999	0.685186	0.834944	1.000000	0.148464
A30	0.514448	0.823828	0.529427	0.820308	0.518053	0.522199	0.518053	0.522199	0.600600	0.514448	0.596568	0.823828	0.123092
A31	0.534329	0.472391	0.465326	0.477853	0.466767	0.581105	0.469590	0.581105	0.490907	0.465326	0.504375	0.581105	0.045618
A32	0.112342	0.136506	0.210782	0.136506	0.210782	0.232280	0.212830	0.231467	0.180162	0.112342	0.184851	0.232280	0.042823
A33	0.999988	0.466826	0.549144	0.504983	0.600235	0.570316	0.999989	0.574041	1.000000	0.466826	0.696169	1.000000	0.217983
A34	0.502650	0.703137	0.582290	0.703137	0.582290	0.999973	0.630006	0.999971	0.471180	0.471180	0.686070	0.999973	0.183229
A35	0.615465	0.793531	0.999999	0.773387	0.999999	0.999984	0.999999	0.882204	0.999998	0.615465	0.896063	0.999999	0.132707

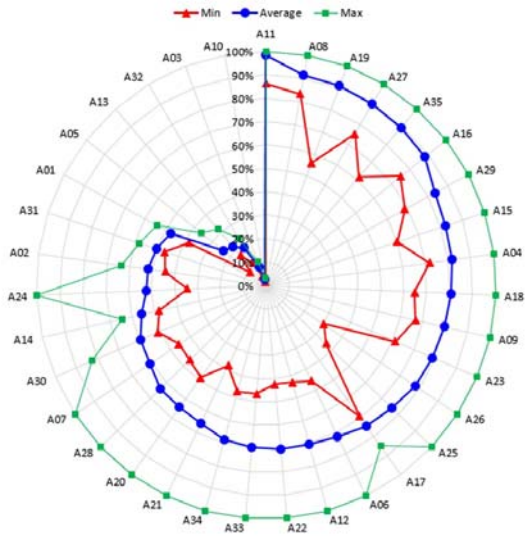

Fig. 4. Results of Window Analysis.

In order to measure the appropriate impact scores through these five years, the methodology of window analysis when $n = 35$, $q = 5$ and $r = 3$ are used and the results of 0.000001-KAM are illustrated in Table 4.

The results of first window inclusive 105 DMUs (35 DMUs in 2006, 35 DMUs in 2007, 35 DMUs in 2008) are represented in second, third and fourth columns of Table 4. The next six columns of Table 4 demonstrate the results of second and third windows. Moreover, the last four columns display the minimum, average, maximum and standard division values of all the scores in previous columns for each row. The minimum standard division values are 0.004085 and 0.023472 for Georgia (A10) and Azerbaijan (A03), the last two countries by WA ranks, respectively, and the maximum standard division values are 0.298508 and 0.275929 for Other Western Asian Countries(A26) and Other South-East Asia Countries (A25), respectively.

Fig. 4 depicts the results of window analysis, that is, minimum, average and maximum values for each country during 2006-10. The WA scores of DMUs are also arranged from the most WA average scores to least WA average scores. The ranks of the last eight countries are not changed significantly, and are approximately the same as their ranks in Fig. 2. Indeed, countries A10, A03, A32, A13, A05, A01, A31, and A02 had a good number of inputs, but Turkey should provide effective plans to earn more money from this number of tourists.

On the other hand, there are slight differences in the ranks of the first eight countries by comparing Figs. 2 and 4. Germany has still the first rank, but the ranks of England (A08) and Russia (A27) are replaced. Other African Countries (A19) has the third rank in Figure 4, whereas its previous rank was seventh in Fig. 2. Tunis (A33) significantly lost its rank and got the rank nineteenth by WA. In short, the results represent that Turkey should improve its tourism industry by increasing its receipts from the countries with lower ranks, and increasing the number of tourists from the countries with higher ranks. The countries with lower rank had a good number of tourists, and can be more beneficial on Turkey's tourism industry by providing appropriate plans.

5. Conclusion

This paper reports the beneficial tourists on Turkey's tourism industry from 2006-10. A robust methodology in DEA is proposed to discriminate impacts of tourists from different countries on Turkey's tourism industry by giving an appropriate score to each country. The results illustrate that tourists from Germany were the most beneficial tourists on Turkey's tourism industry. Some of the other beneficial tourists can be arranged as the tourists from England, Russia, USA, Japan, Spain and Italy. It means Turkey by improving number of tourists from these countries can improve its receipts dramatically. In contrast, Turkey should improve its plans to encourage tourists from Georgia, Azerbaijan, Syria,

Bulgaria, Iran, Australia, Austria and Switzerland to occupy more in package and individually spending. Turkey from these countries, although, had a good number of tourists, it did not received enough package and individual spending, and requires to improve its plans for such tourists. For future researches it is suggested to consider more number of tourism's factors if data are available.

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