THE ANALYSIS OF RELATIVE EFFICIENCY ON THE HOSPITALS OF THE TURKISH STATE UNIVERSITIES BY USING DATA ENVELOPMENT ANALYSIS (DEA) METHOD

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Abstract

In this paper, the efficiency of the hospitals under the administration of state universities has been measured and evaluated by using DEA method between 1998-2000 in Turkey. In the first stage of the study, the structure of Turkish health-care system has been introduced in a brief way; input/output tables have been created. And empirical results have been summarized - by using EMS (Efficiency Measurement System) software, which is specially designed for academic users on a Compaq Presario 1700 P III, 128 MB Ram- through a table by presenting the DEA method that would be used for the solution of the problem. At the end of the study, some recommendations have been put forward for Turkish health-care system.

Keywords: *Data envelopment analysis, linear programming, efficiency, health care system.*

1. Introduction

Nearly half of the health expenditures in Turkey like other countries are made by hospital having beds. Therefore it is very important that whether this resources are used in productive and efficient way by hospitals which use much resources, Health sector that provides health care services with very limited resources has the only one tool which is using its resources very productively and efficiently in order to do its best and gets meaningful developments in health care indicators. However, studies on productivity measurement, control and development in Turkey are insufficient both in terms of quantity and quality.

Hospital services in Turkey are neither productive nor efficient comparing with developed countries. For example bed occupation rate is low, duration of stayed patient is long, and the rate of increase in the number of in-patient is lower than the rate of increase in the number of outpatient. Moreover, provided health care services are not at an acceptable level. Most of the registered patients do not get sufficient services. The main reason of this situation is the management problem. Furthermore the absence of regional hospitals and manpower planning, problems in training of personal, insufficient and unbalanced wage, various administrative practices of public hospitals that belong to different state organizations prevent their productive and efficient work.

Therefore increasing productivity is necessary in hospitals having bed that are very important in Turkey's health care system which is insufficient and also are insufficient number in Turkey by developing productivity measurement and control system and applications. This study aims to bring this reality to light by observing analysing and comparing university hospitals productivity results between 1998-2000 in Turkey.

2. The Present Conditions in Turkey Health Care Services

Ministry of Health (MH) has been founded in 1920 and continued organizing and modernizing the hospitals in towns and cities until 1960. Health care services has been included in 5 years plans for the first time by State Planning Organization (SPO) in 1960 and it has been started that hospitals must have run productively and efficiently in the fifth 5 years plan (SPO, 1988).

Health care sector in Turkey has rapidly been changing in accord with general tendencies in the world from the beginning after the year 1980. Developing policies and, practicing and providing health care services throughout the country is the duty of MH in Turkey. In 1988 Turkey has reorganized its public administration and constituted 81 provinces according to administrative and geographic criterions. The responsibility of productive and efficient use of the resources of health care services in provinces is the duty of city Health Care Directorates.

Health Care services in Turkey are provided by these organizations below

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I) Public Sector

- City Hospitals
- Social Security Hospitals (Hospitals of Labour)
- Military Hospitals
- Chest Hospitals, Children Hospitals, Traffic Hospitals, Maternity Hospitals, etc.
- Health Centres
- University Hospitals

II) The Private Sector

- Private Hospitals
- Private University Hospitals

The half of the national health care expenditure are made by hospitals in all countries (Sochalski et al., 1997), 71% of the total health care expenditures is made by public health care organizations and 34% of this expenditure is made by MH in Turkey in 1996. 62% of MH expenditures are made by hospitals. 63.4% of 1076 hospitals and 51% of 155819 beds in hospitals are belonging to the MH (Tokat, 1997).

The numbers of hospitals are increasing parallel to the growth in population year by year. For example the university hospitals that are studied were 29 in the year 1994 were 33 in the year 1998 and reached to 34 in the year 2000. The amount reserved for the health care services from the GNP takes an important place in raising the level of health care. This rate increased in developed countries by years while it decreased in Turkey from the 3.49% in the year 1981 to 2.98% in the year 1987 (MH, 1997).

3. Productivity Measurement in Hospitals, DEA, Literature

The concept of efficiency and its use as a management tool are quite new for hospitals. In order to evaluate the existing situation and take related necessary precautions to improve medical services, there should be an established efficiency. However, efficiency measurement system in hospitals is quite difficult. For this reason, it presents great importance what is meant by efficiency in medical services. It shouldn't be interpreted that increase in productivity of the hospitals can be reflected as on increase in examined, hospitalised and operated numbers of patients; or as an increase in the number of medical analysis, consumed medicines and given doctors' reports etc.

There are various approaches to the measurement of service productivity (Mc Loghlin and Coffey, 1990). Generally, three approaches are used to evaluate productivity, and these are followings: the most common are output/input ratios analysis, parametrical methods (statistical) and non-parametrical methods.

Firstly method has been used to locate relationship that is abnormally high or abnormally low. By in its nature, each ratio is limited to only one output and only one input, and it cannot easily accommodate situations in which multiple inputs are used to produce multiple outputs. Typically we take some output measure and divide it by some input measure. Note the terminology here; we view branches as taking inputs and converting them into outputs.

In the parametrical or econometric approach, the form of the production function is either assumed to be known or estimated statistically. Regression techniques reflect efficient relationship only when all the observation themselves are efficient. Regression techniques have been justified in industry studies, where profit maximization is believed to motivate all firms to operate at or near the efficient production frontiers. The third approach (as known deterministic methods) is non-parametric models. These methods are appropriate with mathematical programming (non-parametric) as a solutions technique including DEA.

However, because of the purpose of the application is to measure the relative efficiency of hospitals, which have the same decision making units, DEA is chosen.

Using engineering –like approach, Farrell (1957) attempted to measure the efficiency of a unit of production in the single input-single output case. Charnes, Cooper and Rhodes extended Farrell's idea and proposed a model that generalizes the single-input, single-output ratio measure of efficiency of a single Decision-Making Unit (DMU) in multiple-inputs, multiple outputs setting.

Data envelopment analysis (DEA), occasionally called frontier analysis, was first put forward by Charnes, Cooper and Rhodes in 1978. It is a performance measurement technique can be used for evaluating the relative efficiency of decision-making units (DMU's) in organisations. To use DEA, the analysist must first

identify a group of DMUs with similar organizational goals and similar management decisions. Variables are then identified that represent DMU inputs and outputs related to efficiency. Next, the inputs are modelled as a weighted average as are the outputs and the ratio is formed of outputs over inputs. In the solutions of DEA, the efficiency of unit is maximized subject to efficiencies of all the units in the set having an upper bound of 1. The efficiency of the unit will either equal 1 when it is efficient relative to the other units or will be less than 1 when the unit it is inefficient.

The number of existing beds, the number of physicians (specialist and practitioner) are chosen as the inputs. On the other hand, five types of outputs determined are the number of out-patients, the number of in-patients, total patient days, the number of total operations (big, middle and small) and the number of deliveries.

Examples of such units for which DEA has been applied are the following: banks, police stations, hospitals (Sherman, 1984; Rosko, 1990, Miller and Adam, 1996, Al Shammari 1999, Sarkis and Talluri, 2002), tax offices, prisons, defence bases (army, navy, air force), schools and universities (Coelli, 1996; Athanassopoulos, 1997, Soteriou and et al., 1998, Abbot and Doucouliagos, 2001).

4. Methodology

The sample for this study covered all the 34 university hospitals (only 33 hospitals in1998) of the MH in Turkey between 1998-2000 years. The data upon which this work is based were obtained from the statistical report files of MH in it's web site (MH, 2003).

University Hospitals	Years	Number of existing bed	Number of physicians	Number of out-patients	Number of in patients	Total patient days	Number of total operation	Number of deliveries
Cukurova Uni.	1998	286160	477	323923	22771	177475	11713	2161
	1999	299665	376	328373	23274	234148	11248	1735
	2000	300760	388	319844	24264	237406	12182	1996
Ankara Uni. Cebeci	1998	376315	195	207232	19229	254694	7106	1556
	1999	388360	200	236858	20177	271620	7327	1685
	2000	383250	201	247893	19784	269101	7364	1612
Ankara Uni. İbni Sina	1998	413180	517	205648	29126	352271	16084	0
	1999	415005	517	193262	28425	357377	16443	0
	2000	400405	498	193335	28827	347718	14870	0
Hacettepe Uni.	1998	332150	633	312134	25449	257369	9991	1649
	1999	332150	630	255147	23473	253224	10334	1397
	2000	332150	683	415206	22204	243674	9229	1198
Gazi Uni.	1998	291635	539	356302	24319	222583	10267	1343
	1999	299300	537	385763	23109	260641	9451	1157
	2000	293825	798	376654	21811	200599	9976	1694
Akdeniz Uni.	1998	138335	423	164898	18968	129155	8659	1576
	1999	140525	461	213925	21600	125607	10378	1400
	2000	180675	530	265337	22945	149919	11004	1369
A. Menderes Uni.	1998	36500	109	87943	3740	2693	1876	34
	1999	36500	177	94564	4511	28338	2494	58
	2000	49640	231	109923	6274	31113	2989	189
Bolu İ.Baysal Uni.	1998	31025	52	41364	647	5116	386	0
	1999	31025	82	54468	2044	14946	786	2
	2000	31025	138	73383	2476	16563	1219	18
Uludağ Uni.	1998	261340	413	357429	26022	189711	15059	1328
	1999	278495	560	372647	26447	196193	16734	1183

	2000	285430	654	399351	29773	219283	15441	1024
Pamukkale Uni.	1998	35405	184	49952	2966	26189	1888	240
	1999	41245	193	74788	4066	34368	2585	254
	2000	43800	234	91013	4910	36488	2786	275
Dicle Uni.	1998	318280	466	232337	19525	182403	6630	1371
	1999	337625	424	213387	22951	235038	7458	1366
	2000	362080	451	203245	22476	218167	8718	1239
Trakya Uni.	1998	230680	352	224494	10415	135829	4317	446
	1999	241995	399	191163	12012	143570	5010	659
	2000	282875	148	198987	12717	133333	5168	624
Fırat Uni.	1998	150380	253	176886	13922	109242	5188	1295
	1999	157680	307	213655	17147	137389	7211	1244
	2000	189800	339	189030	17886	151268	7556	1258
Atatürk Uni.	1998	321200	385	292167	23441	230160	6540	1501
	1999	358430	427	319381	26945	254862	7445	1446
	2000	358430	427	319381	26945	254872	7451	1446
Osmangazi Uni.	1998	291270	326	137308	17691	173781	6188	496
	1999	288715	335	157276	19130	186386	7984	563
	2000	289080	413	152453	11135	194875	8524	451
Anadolu Uni.	1998	28105	28	103853	2822	14348	1004	179
	1999	27375	29	107647	2752	12218	965	193
	2000	27375	28	115076	2453	11170	925	143
G.Antep Uni.	1998	51100	140	124430	6047	40095	3602	141
	1999	51100	163	131603	6581	42797	3619	255
	2000	80665	216	112982	5076	32188	2413	669
S.Demirel Uni.	1998	54625	139	110213	5719	41258	2914	40
	1999	63875	165	121920	6695	49102	3169	101
	2000	79935	226	105520	8523	60454	3722	120
Mersin Uni.	1998	-	-	-	-	-	-	-
	1999	51830	124	92518	2268	15344	1208	2
	2000	56940	185	118365	4841	46933	2237	9
Cerrahpaşa Hosp.	1998	644955	1068	380432	32973	446733	20299	1252
	1999	625610	1042	374951	31842	441979	18963	1515
	2000	585095	1067	363263	36235	424699	17234	1079
İstanbul Uni.	1998	573050	989	551920	34472	397086	17988	2492
	1999	566115	968	709933	34226	430935	16031	2082
	2000	566845	1054	594749	42689	536416	21923	2395
Marmara Uni.	1998	117165	304	124217	11209	67849	5455	478
	1999	126290	303	115825	12383	102211	6598	571
	2000	123005	303	172201	14274	118162	6425	510
Ege Uni.	1998	685105	592	594785	55208	495265	19972	1495
	1999	666855	686	586895	52390	429180	20595	1503
	2000	674155	848	558995	49331	429402	22116	1557
Dokuzeylül Uni.	1998	253310	726	357069	357795	208116	14181	481
	1999	264260	796	378446	27227	218326	15849	598
	2000	274480	862	399510	42969	231809	16508	757
	1998	319740	425	204565	204990	249994	10628	2079

Erciyes Uni.	1999	383250	458	219958	27630	271517	11288	2005
	2000	394565	491	211622	28344	280379	11383	1626
Kocaeli Uni.	1998	75920	269	106281	106550	51417	3022	480
	1999	27375	295	118805	6096	47560	2047	462
	2000	96725	320	128061	8057	58982	4028	504
Selçuk Uni.	1998	255500	328	248405	248733	218276	8536	2674
	1999	310250	328	199141	19509	176449	6604	2240
	2000	310250	543	222163	23526	235449	10177	2404
İnönü Uni.	1998	187610	280	144297	144577	117598	6497	859
	1999	185785	297	148100	17835	167583	7863	999
	2000	204035	343	153915	20042	187956	9453	1222
C. Bayar Uni.	1998	66430	238	92392	92631	36279	1988	114
	1999	71540	258	97771	5882	46500	2815	281
	2000	101835	304	114523	7484	56579	3144	337
19 Mayıs Uni.	1998	271195	403	103695	104098	177335	6146	855
	1999	286890	406	149288	19419	190754	6957	1104
	2000	292975	338	169087	20045	202519	7118	1232
Cumhuriyet Uni.	1998	237250	223	84477	84700	149311	3560	210
	1999	235060	239	107844	16821	189214	7420	518
	2000	250390	278	107313	16730	187832	7298	345
Karadeniz Uni.	1998	177755	264	131641	131905	144917	6208	351
	1999	177755	295	118015	14134	147556	6019	252
	2000	179580	338	127890	14407	151579	6608	229
Harran Uni.	1998	34675	47	54155	54202	15860	1224	0
	1999	37595	94	65301	2844	22337	1671	40
	2000	65335	124	74541	3134	27017	1855	87
100. Yıl Uni.	1998	126655	216	117017	117233	77962	2350	598
	1999	126655	211	117017	9182	77962	2350	598
	2000	152570	225	151468	11605	100013	2783	1068

Table I. Input/output data for MH hospitals in 1998, 1999 and 2000.

Certainly, the hospitals input and output are not composed of those. It has been got that some inputs and outputs which especially affect efficiency in a directly way from this paper.

Input types are the following:

- The number of existing bed
- The number of physicians

Outputs types are the following:

- The number of out-patient
- The number of in-patient
- Total patient days
- The number of total operations (big, middle and small)
- The number of deliveries.

5. The Model

The model used in this study is the fractional and non linear DEA model which Charnes et al. have first developed: (A. Charnes et al, 1998)

(Input-Oriented CCR Primal)

(CCR_p-I)

$$\min_{0,\lambda,s^+,s^-} z_0 = \theta - \varepsilon\vec{1}s^+ - \varepsilon\vec{1}s^-$$

Subject to:

$$Y\lambda - s^+ = Y_0$$
$$\theta X - X\lambda - s^- = 0$$
$$\lambda, s^+, s^- \geq 0$$

where is $\vec{1}\lambda = 1$.

(Output-Oriented CCR Primal)

(CCR_D-I)

$$\max_{\mu,\nu} \omega_0 = \mu^T Y_0$$

s.t.
$$\nu^T X_0 = 1$$
$$\mu^T Y - \nu^T X \leq 0$$
$$-\mu^T \leq -\varepsilon\vec{1}$$
$$-\nu^T \leq -\varepsilon\vec{1}$$

This, in fact, was the linear programming formulation's optimisation: makes outputs maximized and inputs minimized. We will use the dual of this primal maximization model:

$$\min.\ z = \sum_{1=1}^{m} x_{ij} a_j$$

Subject to:

$$\sum_{i=1}^{m} x_{ij} a_j - z x_i \leq 0 \quad (j = 1, 2, 3, \ldots, n)$$

$$\sum_{r=1}^{s} y_{rj} a_j \geq y_r \quad (j = 1, 2, 3, \ldots, n)$$

$$\sum_{j=1}^{n} a_{ij} = 1$$
$$a_j \geq 0 \quad (j = 1, 2, 3, \ldots, n)$$

The notations of the formulation are :

z : efficiency score,

x_{ij} : observed value of input i for hospital j ,

y_{rj} : observed value of output r for hospital j

a_j : weights attached to input and output of hospital j,

x_i, y_r : inputs and outputs of the particular hospital whose efficiency is being evaluated (Al-Shammari, 1999).

6. Model Solution

It is a fact that in order to solve a DEA problem, a computer and software, which can analyse

the problem, are required. We used software, EMS (Efficiency Measurement Systems) which is freeware designed for academic users and this program was run by a standard PC (Compaq Presario, P III, 128 RAM).

7. Empirical Results

We had EMS software run by loading data files, therefore the relatively efficiency scores have been summarized with a table below belonging to 1998-2000. The score column displays the relatively efficiency value, and the rank column displays the order of the relatively inefficiency value among the hospitals compared in their own years. The score's being equal to 1 identifies the relatively efficiency, and its being smaller than 1 identifies the relatively inefficiency. The more the value decreases, the more the inefficiency increases.

No.	University Hospitals	1998		1999		2000	
		Score	Rank	Score	Rank	Score	Rank
1	Cukurova	1	1	1	1	1	1
2	Ankara Cebeci	1	1	1	1	1	1
3	Ankara İbni Sina	1	1	1	1	1	1
4	Hacettepe	0,949	4	0,912	6	0,983	4
5	Gazi	0,990	3	1	1	1	1
6	Akdeniz	1	1	1	1	1	1
7	A. Menderes	0,991	2	1	1	1	1
8	Bolu İ.Baysal	0,906	7	0,882	8	1	1
9	Uludağ	1	1	1	1	1	1
10	Pamukkale	1	1	0,931	3	1	1
11	Dicle	0,677	19	0,871	10	0,776	13
12	Trakya	0,743	15	0,685	15	1	1
13	Fırat	0,8968	9	1	1	1	1
14	Atatürk	0,8974	8	0,949	2	0,978	5
15	Osmangazi	0,738	16	0,829	11	0,770	14
16	Anadolu	1	1	1	1	1	1
17	G.Antep	1	1	1	1	1	1
18	S.Demirel	1	1	0,910	7	0,916	8
19	Mersin	-	-	0,545	16	0,996	3
20	Ist. Cerrahpaşa	1	1	1	1	0,961	6
21	İstanbul	1	1	1	1	1	1
22	Marmara	0,717	18	0,914	5	1	1
23	Ege	1	1	1	1	1	1
24	Dokuzeylül	1	1	1	1	1	1
25	Erciyes	0,932	6	1	1	1	1
26	Kocaeli	0,795	12	1	1	0,866	10
27	Selçuk	1	1	1	1	1	1
28	İnönü	0,782	13	1	1	1	1
29	C. Bayar	0,640	20	0,687	14	0,724	15
30	19 Mayıs	0,758	14	0,778	12	0,829	11
31	Cumhuriyet	0,829	11	1	1	0,960	7
32	Karadeniz	0,948	5	0,921	4	0,911	9
33	Harran	0,866	10	0,876	9	0,779	12
34	100. Yıl	0,732	17	0,742	13	0,999	2

Table II – Summary of DEA efficiency scores and rating for MH hospitals (1998-2000)

Totally 33 hospitals have been evaluated in 1998. 14 of those evaluated hospitals (1,2,3,6,9,10,16,17,18,20,21,27) are efficient and the other 19 hospitals are inefficient. As a result, C.Bayar University (indicated with 29) has the lowest score with 0,640 value in that year. This hospital were able to use 63,95 per cent of its sources, or were not able to use 36,05 per cent of each input meaning the inefficient resource usage and idle capacity. The scores of inefficient hospitals vary between (0,640 – 0,991). Inefficiency of resource usage and existence of idle capacity was striking. That any contribution would be made is said to be a matter of resource loss.

Data for 34 hospitals was analysed in 1999. 19 of those hospitals (1,2,3,5,6,7,9,13,16,17, 20,21,23,24,25,26,27,28,31) are efficient and the other 15 hospitals (4,8,1011,12,14,15, 18,19,22,29,30,32,33,34) are inefficient. As a consequence, the number of those efficient had been increased about 27% -five hospitals are added this year- since 1998. Mersin University (19th), taking part in the set for the first time, listed as the lowest one in the column of inefficient with the score 0,544. Despite being efficient the year before, 10 and 18th hospitals are inefficient in 1999. On the other hand, 5,7,13,25,26,31th hospitals are inefficient in 1998, yet they are efficient the year after. The scores of inefficient hospitals vary between 0,545 – 0,949.

In 2000, 20 of 34 hospitals (1,2,3,5,6,7,8,9,10,12,13,16,17,21,22,23,24,25,27,28) are identified as efficient in the table. The rest of them, 14 hospitals (4,11,14,15,18,19, 20,26,29,30,31,32,33,34) are relatively inefficient.

C. Bayar University Hospital, with a 0,724 score, become the least inefficient hospital in this year, too as it did in 1998. The scores of inefficient hospitals vary between (0,724 – 0,999).

When the Table II and the commentaries on it evaluated together, we can get the results table below:

Hospitals relatively efficient during a three-year period.	1,2,3,6,916,17,21,23,24,26
Hospitals relatively inefficient during a three-year period.	4,11,14,15,29,30,32,33,34
The ones only relatively efficient during a two-year period.	5,7,10,13,25,28
The ones only relatively efficient during one year period.	12,18,22,26,31

Table III – The table of relative efficiency for different periods.

8. Results and Recommendations

With relative productivity analysis performed -by using DEA method- on the hospitals of Republic of Turkey, it was aimed to determine the levels of input used excessively by the hospitals relatively productive or by the hospitals found unproductive, and to determine the level of service which could not be rendered by these hospitals in a sufficient level of quality. Accordingly, the level of productivity was fixed as X% between 1998-2000. It was determined that the basic and the fundamental reason for such unproductiveness is that the excessive inputs caused by the unplanned investments are put in service with an idle capacity and that the services rendered are insufficient.

We can arrange the analysis results in the following order:

- The hospitals that are relatively productive became productive by producing and rendering the services more than the hospitals that are relatively unproductive.
- Geographical development and positioning near-centre in respect of productivity-unproductiveness do not cause a considerable difference.
- Although the current numbers of beds and the doctors of the hospitals that are relatively unproductive are same with the other departments, they could not use a sufficient capacity in polyclinic and surgery services.
- The hospitals that are relatively unproductive had not been chosen the way to reduce their unproductiveness level by decreasing the number of inputs, they use excessively, for the next year.

- In the hospitals unproductive and operating with full capacity, input purification does not carried out. Since the increase in service demand was not considered, relative unproductiveness score has decreased more in some sections as the result of the fact that same number of inputs has been used to meet more service demand.
- After the determination of relative productive and unproductive hospitals by using DEA method, it can be saw that the results have been confirmed based on the rational values of all data, achieved by a simple calculation.
- When the relatively productive hospitals are compared to the ones that are relatively unproductive in respect to input/service variables, the difference between the averages depending on the model used is statistically meaningful. It can be said that the hospitals that are unproductive over the years has yielded/rendered less service by using more inputs.

By taking above-mentioned results into consideration, the following recommendations can be put forward for Turkish health system:

- Health methodology programs, fit for productivity principles, able to use insufficient sources rationally, and comprising modern administrative/management sciences must be developed for the health services.
- Faster and more efficient results can be achieved by offering DEA - relative productivity measurement method that is a modern productivity measurement method to the responsible personnel in hospitals' statistic bureaus after training them about this method. Therefore, productive/unproductive departments inside the hospital can be detected once in each three months, and consequently the source usage can be arranged a few times according the months and seasons changing during a year. By this application during a few periods or years, stochastic analyses are possible to carry out after deterministic results are obtained.
- The input achievement can be ensured by transferring the inputs (idle capacity usage) stored/maintained in the hospitals that are unproductive to the hospitals trying to meet the demands over its capacity.
- It has been known that the statistical results related to studies about the hospitals do not certainly show the reality due to structural problems caused by the structure of Turkish health system. Consequently, planning and source assignment transactions carried out after evaluation of such data since the results are generally given in complete will not show the reality. That's why, after the researchers are provided with the actual and completely correct statistical data, the researchers will be able to offer and give the results that will make strategic decision-making easy for the hospital managers and the committees making health service planning.
- The hospital charges must be adjusted in accordance with the real costs and the general economical situation that the home country currently has. For that reason, the hospital managers must be powered with all of management and supervision powers/authorities. Unproductive hospitals can be made effective by activating the idle sources, which is ensured by adjusting the prices/charges.
- Being a research and education hospital does not necessitate for university hospitals to work and operate unproductively. A hospital must base management perception on the productivity basis in order to keep the works going on. It must be noted that the students taking medical education, research personnel, and the students of nurse and health high schools are the factors than can considerably affect the input since they have been studying/working in the hospitals during a specific period of their education. It is a real that unproductiveness scores will decrease more by taking these factors into consideration in a productivity analysis study in which all the inputs will be evaluated by a more detailed study.
- Regarding the national profitability, it is impossible to tell about the loss on general budget caused by the unproductive hospitals compared to the ones that are productive since a financial analysis is not carried out. Moreover, the unproductiveness of some hospitals that receive surgery room and laboratory services less or not at all will be more positive compared to other group in respect to general profitability.

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