

Technical Efficiency of Regional Hospitals, Evidence from Albania using Data Envelopment Analysis

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ABSTRACT

The evolving strategies to finance hospitals in more efficient ways, and, specifically on the reforms of the Albanian Health System to introduce the DRGs, aiming the improvement of hospital service productivity, the technical efficiency of the Albanian hospitals necessities to be evaluated. This study performs, given a level of inputs, the ranking of the regional hospitals based on their technical efficiency.

There have been collected data on all eleven Albanian regional hospitals for three consecutive years, 2015-2017. The data relate to input data such as number of physicians, nurses, hospitals' capacity and its financing. The output data instead, relate to the number of hospital patients' discharges. The data have been analyzed by Data Envelopment Analysis (DEA), a technique used in service management and benchmarking. This technique compares regional hospitals considering all resources used and services provided and identifies the most efficient hospitals or best practice hospitals.

The results suggest that more than 50% of all regional hospitals result efficient, followed by the other hospitals with an average of 7% reduction on technical efficiency.

The study evidenced that the majority of the Albanian Regional Hospitals' operate at the efficient frontier followed by other hospitals that operate just below. The efficient levels of hospitals indicate an optimal use of their capacities in offering services to the population.

Keywords: Albanian healthcare, Healthcare financing system, Albanian Regional Hospitals, Technical Efficiency, DEA Analysis.

INTRODUCTION:

The Albanian healthcare system is currently undergoing important steps in reforming its financing system in relation to performance driven strategic pathways. Currently, in Albania, there are 23 District hospitals, 11 Regional hospitals, 5 University hospitals, and 8 Private hospitals contracted, for specific health services packages, by the Compulsory Health Insurance Fund (CHIF) (CHIF, 2018). The financing of all public hospitals is completed by CHIF significantly on historical base (Persiani N., 2014) through Ministerial Decree without any regard to the performance and the hospitals' efficiency. Given this scenario, the Hospitals' financing isn't depending on the efficiency of the output produced, since there isn't any relationship between the total amount of Hospitals' financing and its efficiency (Dragusha, July, 2018).

In Albania, the hospitals receive a financing that measures around 50% of the entire CHIF budget that goes to the Albanian Hospital Tertiary Healthcare. On the other hands, a set of performance indicators must be considered to drive the hospitals' allocation of financing. Measuring performance, i.e. the improved health status for the hospitals, is rather difficult considering the complexity of the services offered. To evaluate the regional hospitals by their performance, analyzing hospital's technical efficiency can contribute to reach this goal.

Efficiency is explained as the ratio of output to input. The technical efficiency ponders the levels of inputs and

outputs of the hospital. It's considered as input-oriented, when seeking to minimize the inputs given a certain level of outputs, or output-oriented when the system's efforts goes to maximize outputs given a certain level of inputs. The technique for measuring technical efficiency, is a linear model, as for this study, the Data Envelopment Analysis (DEA) is applied.

METHODOLOGY:

The data from all eleven Albanian district hospitals have been collected and organized by hospital, year, input category and output. The inputs considered for measuring the technical efficiency for each hospital are: number of physicians, number of nurses, bed capacity and the hospital's expenditures. The output considered is the patient's discharge number.

For the data analysis, Excel 2016 and DEAP 2 (version 2.0) software are utilized. Data from all eleven hospitals has been collected through institutional official visit, which, upon request, the data was delivered. These data relate to the consecutive period of years 2015-2017. As all four inputs and one output that are engaged for this study, have been assessed and organized as in Table 1, the data was then inserted in DEAP 2 platform for processing.

Data Envelopment Analysis (DEA) is a very powerful service management and benchmarking technique originally developed by Charnes, et al. (1978) to evaluate nonprofit and public-sector organizations. DEA compares service units considering all resources used and services provided and, identifies the most efficient units or best practice units (branches, departments, individuals) and the inefficient units in which real efficiency improvements are possible (Sherman & Zhu, 2006).

DEA utilizes linear programming techniques to asses technical efficiency scores for each hospital, i.e. a fully efficient hospital in terms of technical efficiency, at efficiency frontier, reaches the score 1 (or 100%). Less efficient hospitals score less than 1. The DEA linear programming is represented as follows.

$$\text{Max } h_0 = \sum_{r=1}^s U_r Y_{rj_0}$$

Subject to:

$$\sum_{i=1}^m v_i x_{ij_0} = 1$$

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

$$u_r, v_j \geq 0$$

Where:

y_{rj} = amount of output r from hospital j

x_{ij} = amount of input i to hospital j

u_r = weight given to output r

v_i = weight given to input i

n = number of hospitals

s = number of outputs

m = number of inputs

The benchmark considered to compare all the hospitals, isn't found outside the group, but inside it. This means that the efficiency of a particular regional hospital is determined by the group of all regional hospitals.

FINDINGS AND DISCUSSION:

The data presented in Table 1, presents the inputs' unit and the output's unit for three-year period 2015-2017. For these data, the statistical summary is represented in

Table 2. It can be noticed that, for year 2015 the patient's discharge data related to Shkodër hospital is as 173% greater than the average data related to the last two years, which strongly influences our analysis. Due to this significant discordance on Shkodër's patients discharge data, the efficiency scores represented on **Error! Reference source not found.**, establish Shkodër hospital as the efficient one, and all other hospitals rank subsequently. In order to consider the efficiency scores ranked homogenously and to test the robustness of DEA technical scores, the Jackknife analysis was used (Efron, 1979), omitting the one unit, i.e. Shkodër.

Table 4 illustrates the efficiency scores were, 60% of the hospitals result to be efficient ($\theta_{crts}=1$), following Kukës, Berat, Elbasan and Korçë.

Given the above scenario, a one period DEA analysis was performed by considering the data related to year 2017. In this analysis, referring to the results presented in

Table 5, 6 out 11 regional Hospitals result to be efficient ($\theta_{crts}=1$), following Berat, Shkodër, Vlorë, Elbasan and Korçë.

CONCLUSION:

It is considered that, as demonstrated through the study performed, the majority of the Albanian Regional Hospitals’ operate at the technical efficient frontier followed by other hospitals that operate just below. For an given input, the hospitals maximizes the level of output. The efficient levels of hospitals indicate an optimal use of their capacities in offering services to the population.

On this study, the unit of output, i.e. amount of patients’ discharge has been considered. As it has been mentioned earlier, measuring the service performance is rather difficult considering the complexity of the services offered. Since Health is the main goal of each health system, an improvement on health status should be the ultimate unit of output to be considered on DEA analysis.

This study deserves going deeper into analysis and must be followed by other studies to measure efficiency, considering a variety of other outputs and performing the DEA analysis also in terms of input-oriented.

LIMITATIONS OF THE STUDY:

Measuring improvement on health in Albania, given the absence of a financing system which is based on the performance, and, furthermore, the absence of Diagnoses Related Groups (DRGs) classification system, makes it impossible. The data related to Shkodër hospital, year 2015, lacks explanations

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Table 1: Input and output data by Regional Hospital

Year	Regional Hospital	Berat	Dibër	Durrës	Elbasan	Fier	Gjirokastër	Korçë	Kukës	Lezhë	Shkodër	Vlorë
2017	Physicians	62	15	134	76	89	29	72	28	41	88	101
	Nurses	167	200	328	292	236	87	259	145	153	316	266
	Beds	268	299	340	408	348	177	463	236	162	478	368
	Total Costs ¹	453.315	375.598	768.746	708.338	543.113	342.001	624.027	335.786	354.705	743.586	678.579

¹ In thousand leke. Exchange Rate 1 Lekë = 0.0075 Euro

Year	Regional Hospital	Berat	Dibër	Durrës	Elbasan	Fier	Gjirokastër	Korçë	Kukës	Lezhë	Shkodër	Vlorë
2016	Discharges	7.648	6.995	14.764	11.364	10.398	4.936	9.911	6.030	5.990	12.772	11.171
	Physicians	65	17	143	128	86	28	68	31	41	90	69
	Nurses	167	184	337	290	206	78	265	160	156	320	234
	Beds	268	299	340	432	348	177	463	236	162	478	368
	TotalCosts	415.263	372.690	707.914	715.228	488.577	316.228	586.570	326.177	324.445	708.661	584.766
2015	Discharges	7.114	7.864	15.166	10.957	10.724	5.058	10.204	6.206	6.675	12.929	12.921
	Physicians	59	23	142	92	104	27	75	26	40	89	85
	Nurses	182	199	360	313	243	102	273	140	139	325	234
	Beds	279	299	340	432	368	184	463	236	162	478	368
	TotalCosts	420.834	370.185	752.910	690.911	496.616	299.113	598.911	336.460	296.456	727.265	558.692
Discharges	8.205	7.722	15.753	11.610	12.797	5.162	10.088	5.736	6.297	35.075	13.347	

Source: Compulsory Health Insurance Fund (CHIF)

Table 2: Regional Hospitals Summary statistics

Description	Mean	Standard Deviation	Minimum	Maximum
2017				
Physicians	67	34	15	134
Nurses	223	74	87	328
Beds	322	101	162	478
Total Costs¹	538.890	164.636	335.786	768.746
2016				
Physicians	218	76	78	337
Nurses	70	39	17	143
Beds	325	103	162	478
Total Costs¹	504.229	155.475	316.228	715.228
2015				
Physicians	228	80	102	360
Nurses	69	36	23	142
Beds	328	102	162	478
Total Costs¹	504.396	164.244	296.456	752.910

Table 3: Efficiency Scores for three-year period 2015-2017

Hospital	Efficiency Score	Efficient
Berat	0,42	
Dibër	0,85	
Durrës	0,63	

Hospital	Efficiency Score	Efficient
Elbasan	0,37	
Fier	0,53	
Gjirokaštër	0,49	
Korçë	0,35	
Kukës	0,56	
Lezhë	0,53	
Shkodër	1	*
Vlorë	0,53	

Table 4: Efficiency scores for three-year period 2015-2017, excluded Shkodër Hospital

Hospital	Efficiency Score	Efficient
Berat	0,84	
Dibër	1,00	*
Durrës	1,00	*
Elbasan	0,75	
Fier	1,00	*
Gjirokaštër	1,00	*
Korçë	0,73	
Kukës	0,92	
Lezhë	1,00	*
Vlorë	1,00	*

Table 5: Efficiency scores for one-year period (2017)

Hospital	Efficiency Score	Efficient
Berat	0,96	
Dibër	1,00	*
Durrës	1,00	*
Elbasan	0,91	
Fier	1,00	*
Gjirokaštër	1,00	*
Korçë	0,88	
Kukës	1,00	*
Lezhë	1,00	*
Shkodër	0,94	
Vlorë	0,91	
