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A Data Envelopment Analysis for Evaluating Romania's Health System

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Abstract

Health Systems' efficiency is one of the most sensitive topics in Health Economics. Therefore, the importance of how resources are used to provide the maximum satisfaction attainable is crucial. This paper aims to assess the European Health Systems in terms of efficiency. In achieving the goal of the research, a set of relevant variables was selected from Eurostat database. A Data Envelopment Analysis has been applied to evaluate the efficiency of the Health Systems. There were used immunization rate and health expenditures as input variables, and survival rate for adults and tuberculosis rate as output variables. The study emphasizes that Romania has an inefficient Health System and even though the Romanian Health System has known different types of reforms and improvements in the last two decades, certain areas still fall below the European average and the system is still failing to provide proper services to its citizens.

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1. Introduction

The present study intends to evaluate the Romanian health system, compared with 26 other European countries. The central idea is that productivity depends on the citizens' health level and a more efficient health system may induce a higher rate of economic growth on the medium and long term. This problem fits into the broader area of human capital. The problem of investment in human capital is extensively discussed in the specialized literature. During time, it was observed that there is a significant correlation between the economic output and the expenditures made to raise the level of health. R. Barro, G. Becker, J. Mincer, P. Howitt, Kevin Murphy, R. Tamura and N. Jones are some of those who have examined these relationships. Furthermore, to emphasize the important role of population's health status in dimensioning the output, authors such as M. Grossman launched the concept of health capital, which refers to the health stock held by an individual or a nation and which can influence the productivity in various ways. In this analysis framework, the discussions were polarized in several directions, a very important one being related to the financing of the health systems and their efficiency in creating health capital. There are different opinions regarding the link between the augmentation of the spending on health care and the needs of the patients or the demonstrable outcomes. In some works it is claimed that there is no clear link between the two variables or that it cannot be talked about a commensurate impact (Banta & al, 1981, Eisenberg, 1986; Culyer, 1988; Freeny & al, 1986; Lomas 1990, Ham 1988; Anderson and Mooney, 1990). On the other hand, authors such as De Robert & al (1994), RG Evans and Stoddart (1994), McKeown (1979), Sagan (1987) argue that increasing the spending on

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health has a significant impact on productivity, healthy people generating higher productivities. Therefore, measuring the efficiency of the health systems is an important issue, making the subject of many studies. World Health Organization (2000) measures the performance of the healthcare for most of the countries (193). Although it was highly criticized because of the suspicions regarding the collecting and estimation methods (Alan, 2001) or methodology (Jamison and Sandbu, 2001), it is the most complex document due to the large volume of used information. Core values that were analyzed were the overall level of health, its distribution among population, the ratio between the health expenditure and output and the distribution of services. The public health system can be analyzed, from the point of view of efficiency, in terms of diseases' incidence, risk factors, mortality and the provision of preventive and screening services (Mays GP and al; 2006). The efficiency can be measured from the point of view of Pareto optimality. It was the approach of Kumar et al (2004), which compared the health systems of 18 countries based on the data regarding the health expenditure, healthcare, pharmaceuticals, life expectancy and infant mortality. Smith (2002) estimated that measuring the efficiency of health systems depends on four important factors: "the extent to which the chosen performance measures reflect faithfully the objectives of the system, the nature and quality of the data, the incentives for clinicians to scrutinize and act upon the data, and the culture of the organization within which the data are deployed." The use of DEA to measure the efficiency of public systems has been implemented since 1978, on several case studies from Africa (Kirigi JM et al (2008)). In recent works, DEA was used to establish reference standards for hospitals, clinics or health services in developing countries (Goncalves et al, 2007; Ersoy et al, 1997; Ozcan et al, 1994; Kirigi et al, 2001; Majumdar, 1994). An interesting direction for using DEA is found in the study conducted by Daskalakis, Katharaki and Mantas (2008). They analyze the degree of efficiency and Interoperability of Information Technology in Greece, concluding that in most of the cases there are serious limitations in using the physical or cyber-infrastructure to achieve the interoperability. In the study conducted by S. Faye (2012), the method was used to analyze the technical efficiency for public hospitals in Senegal, compared to the rest of the hospitals from the African continent. A large study (Benneyan, Ceyhan, Sunnetci), conducted on a group of 65 countries and focused on six specific directions of the health systems: clinical outcomes, health adjusted life years, access, equity, safety and resources, ranks the countries according to the state of efficiency/inefficiency, in order to identify the possible causes of the poor results obtained by some states.

2. Data and method

The study uses data regarding the 27 EU member states. Data were collected from the Eurostat database. Due to the fact that the study concerns the 27 EU member states, we used four variables in the model. The following two variables were chosen as inputs: Non Immunized Rate and Health expenditures. The following two variables were chosen as outputs: Adult Survival Rate and Tuberculosis Rate. Adult Survival Rate is obtained from Adult Mortality Rate. It is calculated as the ratio $(1000 - \text{Adult Mortality Rate}) / \text{Adult Mortality Rate}$. Non Immunized Rate is obtained from the immunization rate for children, and refers to the percentage of children reaching their first birthday who have not been fully immunized against measles. The incidence of tuberculosis is the estimated number of new pulmonary, smear positive, and extra-pulmonary tuberculosis cases per 100.000 inhabitants. Health expenditures represent per capita government expenditure on health at average exchange rate in US dollars. A country's health system can be regarded as a production system that transforms inputs into outputs. In order to identify the inefficient health systems we applied the Data Envelopment Analysis (DEA). This analysis is a data-oriented evaluation method and it is used to assess the inefficiency of the 27 countries of the EU. DEA utilizes mathematical programming, which can handle large amounts of numbers and relations.

3. Results

Table 1 shows the descriptive statistics for the four variables. Thus, the percentage of children non-immunized against measles ranges from 1% (Greece, Hungary and Slovakia) to 22.5% (Malta). Per capita public health expenditures range from 278 USD per inhabitant (Bulgaria) to 6770 USD per inhabitant (Luxembourg). Just analyzing the amplitude of the values for this variable, it can be observed the significant differences between the

health expenditures in the European Union states. Adult Survival Rate ranges from 2.17 (Lithuania) to 12.18 (Sweden) with a mean of 7.39.

Table 1. Descriptive Statistics

Indicator	Non-Immunized	Public Health Expenditure	Adult Survival Rate	Tuberculosis Rate
Min.	1	278	2.17	0.9987
Median	4.5	1845	7.96	0.9999
Mean	5.667	2360	7.39	0.9998
Max.	22.5	6770	12.18	1.0000
St Dev	5.42	1727	3.11	0.0002

The results of the DEA model are shown in table 2. The CCR input-oriented, constant returns to scale model identified the following countries on the efficiency frontier: Finland, Greece and Luxembourg. The level of inefficiency of each country's health system is determined by comparison to the referent health system that is efficient.

Table 2. DEA Results

Country	Score	Rank	Country	Score	Rank
Finland	1	1	France	0.57	15
Greece	1	1	Germany	0.53	16
Luxembourg	1	1	United Kingdom	0.46	17
Slovakia	0.99	4	Italy	0.46	18
Hungary	0.99	5	Slovenia	0.39	19
Sweden	0.93	6	Portugal	0.37	20
Denmark	0.80	7	Lithuania	0.35	21
Netherlands	0.79	8	Cyprus	0.31	22
Czech Republic	0.67	9	Romania	0.29	23
Poland	0.67	10	Estonia	0.28	24
Belgium	0.64	11	Latvia	0.26	25
Spain	0.63	12	Bulgaria	0.20	26
Ireland	0.59	13	Malta	0.15	27
Austria	0.59	14			

Furthermore, very close to the efficiency frontier there were identified Slovakia and Hungary, each of them lacking less than 0.001 efficiency points to become efficient. Romanian health system has an efficiency score of 0.29. This value means that the country has to decrease the utilization of inputs to 29% of the current state to become as efficient as Greece (Romania's reference country).

Analyzing the weights of the inputs for the 27 countries, it can be observed that most of the countries from the eastern bloc (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia) got their efficiency score 100% from the Non Immunized Rate, where they performed better. In the developed countries, per capita public health expenses are significantly higher than that of eastern countries. The developed countries (Austria, Denmark, France, Germany, Italy, Ireland, Malta, United Kingdom) obtained the score 100% from the health expenses variable.

Table 3 Expenditures with healthcare (per capita PPP, USD)

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Czech Republic	898	916	922	926	939	982	1083	1195	1337	1385	1472	1554	1650	1830	1924
Hungary	659	658	679	764	811	854	971	1116	1285	1306	1413	1486	1429	1506	1453
Poland	406	473	493	554	568	584	642	733	748	807	857	935	1074	1271	1359
Slovakia	504	581	563	584	598	724	837	934	1023	1057	1139	1350	1605	1849	1898
Slovenia	972	1057	1153	1228	1300	1451	1579	1703	1766	1862	1976	2092	2126	2420	2476
Bulgaria	285	239	246	280	332	373	482	552	607	651	719	766	813	853	858
Romania	195	214	267	243	277	297	354	399	410	480	517	568	670	840	773

Source: Transmonnee database

As it is shown in the relationship between the results we have obtain and the health expenditure per capita in Table 3, the Eastern European countries that have spent the smallest amounts have, nowadays, the lowest efficiency in the health sector. Romania was among them.

4. Discussion

As shown in our analysis, Romania's health system is situated on the 23 place among the 27 analyzed systems, with a gap of 71% compared to the first ones ranked. The health system in Romania has been affected, during time, by the lack of reforms, the poor funding and by the lack of interest of the authorities in establishing a long-term strategy. As a result, after 1990 the population health status has been continuously deteriorating.

The health system before 1990, although it was suffering of a lack of performing facilities, managed, however, to cover the basic needs of the population, generating high rates of immunization, eradication of some diseases such as tuberculosis or syphilis and keeping under strict control the epidemics. Although the number of physicians was relatively low and the performing hospital facilities almost inexistent, the good training of healthcare professionals and the policies of strict control of the population's health have led to an increase in efficiency. After 1990, the control policies have disappeared, because of the democratization of the system, without being replaced with the strategies of screening and prevention of diseases. Increasing mobility of the population, the possibility of emigration and the augmentation of the poverty have led, on the one hand, to the increasing number of chronic diseases and mortality, but also to the impossibility of exhaustive application of some preventive measures, such as immunization and screening. On the other hand, the poverty, the economic decrease, the mismanagement and the lack of funding have led to the deterioration of healthcare services, to the elimination of some hospital capacities and to the medical staff migration towards developed countries. Therefore, the main health indicators have worsened, increasing at an alarmingly rate the infant mortality, the number of chronic diseases and reviving those diseases that were considered eradicated.

In terms of funding, if the European average, according to Eurostat, is 8%, in Romania the healthcare obtains an average expenditure of only 3.2%. In 2008 there were spent 473 USD / capita, the lowest amount in the EU and one of the lowest in Europe after Ukraine and Belarus. The crisis brought a decline in the budget by 7.9% in 2009

compared to 2008. And the situation from the coming years, 2010-2012, became even worse, causing the intensification of a phenomenon specific for the last years, the migration of qualified health professionals, leading to a serious shortage of doctors and nurses. Combined with poor equipment, the inadequate and mismanagement of public funds and budgets of the House Health Insurance, the problem predicts a collapse of the entire system.

Romania together with Bulgaria, Latvia and Estonia have continuously underfinanced the healthcare system, positioning itself on last places in terms of the relationship between outputs and inputs. Instead, Slovenia, Slovakia, Czech Republic, Hungary and Poland are “champions”, succeeding, through an adequate funding and a proper implementation of health policies, to overcome in terms of efficiency the developed countries. Although it is difficult to understand, we can explain this discrepancy by the fact that these countries did not allow the deterioration of the health infrastructure, of the health status of the population and the loss of staff after 1990, thus keeping continuity from the communist period, which has excelled in terms of those output indicators we have considered.

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