HEALTH CARE PERFORMANCE AND HEALTH FINANCING SYSTEMS IN COUNTRIES FROM CENTRAL AND EASTERN EUROPE*

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Abstract

A common feature of all health systems from emerging economies is the shortage of financial resources. This fact is currently exacerbated by the economic crisis that has led many governments to reconsider the level of public spending in the health sector.

Starting from the Romanian experience, the paper aims to highlight the linkage between the performance of the health system and the total health spending for selected countries from Central and Eastern Europe. Romania has the lowest level of health expenditure as percentage of GDP in Europe, even if its growth rate for 2003-2008 was the highest. In addition, empirical evidence shows that these resources are used inefficiently. Despite the increasing resources allocated to the health sector, statistical analysis shows that health system efficiency, as measured by under-5 (child) mortality rate, is still low.

We use regression analysis based on cross-section data in order to explain the differences in health expenditure and their implication on the system efficiency. Health data have been provided by international organizations. Cross-section regression results suggest that total health spending and GDP per capita are the most important factors explaining differences in health status across Central and Eastern European countries, though other lifestyle factors could play important roles.

Keywords: resource allocation, funding, efficiency, ethics, health services, developing countries.

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1. Introduction

Health care systems from Central and Eastern Europe have faced profound reforms after the 1990s in the context of political, social and economic changes that have marked these countries. The reforms have focused on all functions of the health system – financing, provision, stewardship and resource development. The features of health care systems and reform experiences vary substantially across emerging economies from Central and Eastern Europe (International Monetary Fund, 2010, p. 3). Despite these reforms and increasing financing available, the performance of these health systems is still low compared to that reported for industrialized countries. The differences in the efficiency of health care systems between CEE countries and OECD countries have been well documented by Verhoeven, Gunnarsson and Lugaresi (2007) and Jafarov and Gunnarsson (2008). A strategy for enhancing efficiency in the health care sector should be based on an understanding of the determinants of health care status.

In the light of the above considerations, the aim of the paper is to examine which factors (inputs) explain the differences in health outcomes (measured as under-5 (child) mortality rates) across Central and Eastern European countries. We hypothesized a direct linkage between the under-5 (child) mortality rate and total health expenditures. For this purpose we use cross-country data from eighteen Central and Eastern European countries for selected years between 1995-2008 for under-5 (child) mortality rate together with four explanatory variables (per capita GDP, share of total health expenditure in GDP, number of physicians per 1,000 people, and urban population) that determine health outcomes. The results of this study can be useful in the formulation of public policy regarding the improvement of health outcomes.

The rest of the paper is organized as follows. In the next section a review of the existing literature is provided. In section three, an explanation of the model and data is given. Section four discusses the empirical findings. Section five concludes the paper and highlights the limitations of this study.

2. Literature review

Efficiency in health care systems represents a measure of the quality and/or quantity of output (*i.e.*, health outcomes or services) for a given level of input (*i.e.*, health spending) (World Health Organization, 2011, p. 61).

According to the OECD, measuring efficiency in health care spending represents "a comparison of inputs with outputs or outcomes of the health care system to assess the degree to which goals are achieved while minimizing resource usage". (OECD, 2010, p. 46). The efficiency of health care can be measured at three levels: the disease, sub-sector and system level (Häkkinen and Joumard, 2007).

- The disease level approach for specific diseases focuses on the health gains brought by specific treatment. The benefits of a medical intervention are frequently measured by QALYs (Quality-Adjusted Life Years) and DALYs (Disability-Adjusted Life Years). This approach can also be used in allocating resources across health care programs.

- The sub-sector approach mostly focuses on hospital and output measures (*i.e.*, the number of hospital treatment in relation to their costs and/or the number of consultations per physician). Comparing with the disease level, this approach takes into consideration more homogenous activity and thus we can provide sector-specific policies.
- Using a disease-level or sub-sector level approach for measuring and comparing efficiency across countries is plagued by severe data constraints and model limitations. As a consequence, a system level approach is often implemented for measuring efficiency across countries and over time. This approach is using the population health status (mortality and longevity data) as the outcome and health care spending as one of the inputs. Indicators of health care spending efficiency at the system level can be complemented by indicators of the quality of care and other performance indicators.

Due to the health data provided by OECD, there are many studies regarding the efficiency of health systems focusing on developed economies. Hitiris and Possnett (1992), Babazono and Hilman (1994), Elola, Daponte and Navarro (1995), DeRosario (1999), Or (2000a; 2000b), Berger and Messer (2002), Retzlaff-Roberts, Chang and Rubin (2004), Afonso and St. Aubyn (2006), and Asiskovitch (2010), among others, have studied the efficiency of health systems in developed economies. Evans *et al.* (2000), Self and Grabowski (2003), and Rajkumar and Swaroop (2008) extended their cross-section analysis to a wider sample of both developed and developing countries.

In the last years, a few studies have been conducted in order to measure and compare the efficiency of health care systems from developing countries. Bhalotra (2007), Gani (2009), Anyanwu and Erhijakpor (2009) have studied the efficiency of health systems in developing economies from different regions of the world. Jafarov and Gunnarsson (2008) studied the efficiency of government spending on health care and education in Croatia by using Data Envelopment Analysis (DEA).

Regarding the relationship between health outcomes and health inputs at system level, the results are mixed in the economic literature. Filmer and Pritchett (1999) show that there is a tenuous relationship between public health spending and health outcomes. They found that an increase from three to six percent of GDP would improve child mortality by only 9% to 13%. Joumard (2011) found a weak link between health care spending and outcomes.

On the other hand, some studies have found a positive relationship between spending on health and health outcomes (Evans *et al.*, 2000; Or, 2000a, 2000b; Baldacci, Guin-Siu and De Mello, 2002; Berger and Messer, 2002; Bokhari, Gai and Gottret, 2007; Bhalotra, 2007; Gani, 2009; Anyanwu and Erhijakpor, 2009).

A study of 191 countries conducted by Evans *et al.* (2000) found that efficiency is positively related to the level of health expenditure per capita. Using data from 47 African countries between 1999 and 2004, Anyanwu and Erhijakpor (2009) have studied the relationship between total health expenditure and per capita income and two health outcomes (infant mortality and under-five mortality). They found that health expenditures have a statistically significant effect on infant mortality and

under-five mortality in African countries. Gani (2009) found that per capita health expenditure is an important factor in determining health outcomes in seven Pacific Island countries. Bokhari, Gai and Gottret (2007) found that public health spending is an important contributor to health outcomes.

However, there is a lack of agreed methods for quantifying the extent to which health status depends on socio-economic and lifestyle factors (Hussey *et al.*, 2009).

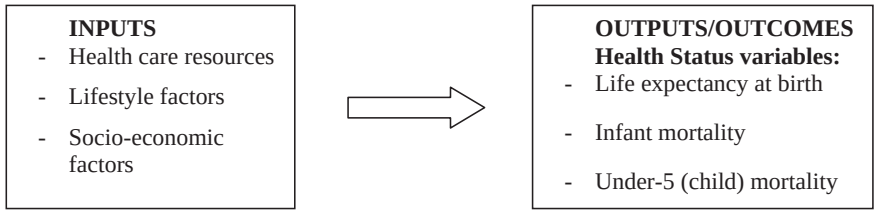

Figure 1: Structure of a health production-function

Most previous studies used a production-function approach in order to assess the performance of health care systems, both over time for specific countries and/or across countries. This approach consists in identifying two types of variables: outcome/outputs variables and input variables that contribute to the production of that output. The production function is usually estimated using ordinary least squares (OLS).

The most used outputs (or health status) variables are life expectancy at birth, infant mortality and the under-5 (child) mortality rate (the probability of dying between birth and age five years expressed per 1,000 live births). In addition, some studies are using other health outcomes such as QALY, DALY, HYE (Healthy-Years Equivalent), HALE (Health-Adjusted Life Expectancy), standardized death rates (SDR), maternal mortality rate and incidence of tuberculosis. For example, Elola, Daponte and Navarro (1995) employed as dependent variables infant mortality and life expectancy and premature mortality by sex. Or (2000a, 2000b) used in his studies potential years of life lost (PYLL). Self and Grabowski (2003) and Evans *et al.* (2000) selected DALE (Disability-Adjusted Life Expectancy) as the most representative dependent variables.

The main categories of input (factors) that determined the population health status as resulted from the most important previous studies are the following (Joumard, 2008 and OECD, 2010, p. 51):

- Health care resources measured in monetary terms (total health care spending or public health spending) or in physical terms (the number of physicians per 1,000 people, number of beds, or Magnetic Resonance Imaging (MRI) units);
- Lifestyle factors. Most empirical work has included data on consumption of tobacco and alcohol, obesity, and/or some proxy for diet[1].
- Socio-economic factors. The most used socio-economic factors are GDP per capita (measured in purchasing power parity), education, and pollution. Some

1 Diets can be proxied by several variables such as consumption of fat, sugar, calories, or fruits and vegetables, or several of these.

studies include additional factors such as level of poverty, degree of urbanization, income distribution – Gini coefficient[2], access to safe water, unemployment, ethnic origin and/or religion, and occupational status.

A few other studies focus on specific factors such as governance or type of health system. Rajkumar and Swaroop (2008) highlighted the role of good governance in improving the efficacy of public spending. According to their study, the public health spending lowers the child mortality rates more in countries with good governance (as measured by a corruption index). More exactly, a 1% increase in the share of public health spending in GDP lowers the under-5 mortality rate by 0.32% in countries with good governance, 0.2% in countries with average governance, and has no impact in countries with weak governance (Rajkumar and Swaroop, 2008, p. 97). Their findings are supported by the latest World Health Report stating that "effective governance is the key to improving efficiency and equity" (World Health Orgnization, 2011, p. 60).

Elola, Daponte and Navarro (1995) analyzed the association between health care systems and health indicators in 17 Western European countries. They found that national health services (NHS) are more efficient at producing lower infant mortality rates than social security systems.

3. Data and methodology

Our analysis uses annual data for eighteen Central and Eastern European countries[3]. Due to the lack of data availability, we construct our database by using health related date provided by several international organizations and only for three years: 1995, 2000 and 2008. These are years for which data are available across a sizeable sample of countries. World Health Organization (WHO) provided data on share of total health expenditure in GDP[4]. Eurostat provided data on the number of physicians. World Bank (WB) provided most of the data from its most popular dataset, World Development Indicators (WDI).

As illustrated in Figure 2, there is a direct relationship between health expenditure per capita and under-5 (child) mortality rate for the eighteen countries analyzed. The countries that registered the higher level of health expenditure per capita have the best health outcomes (the lower rate of under-5 child mortality rate).

Our approach in this paper is to interconnect one measure of efficiency (under-5 child mortality rate) with some independent variables such as per capita GDP (measured

2 Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution.

3 Albania, Bulgaria, Belarus, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Moldova, Malta, Poland, Romania, Russian Federation, Slovak Republic, Slovenia, Ukraine

4 Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation.

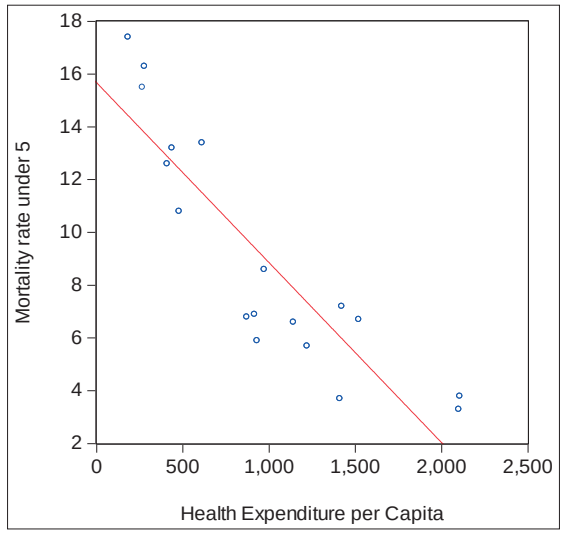

Figure 2: Scatter plot of health expenditure per capita vs. under-5 (child) mortality rate, 2008, 18 countries

in purchasing power parity adjusted dollars), share of total health expenditure in GDP, number of physicians per 1,000 people, and urban population (% of total). We have chosen the most used type of variables that can influence health status: health related factors (share of total health expenditure in GDP and number of physicians per 1,000 people) and socio-economic factors (GDP per capita and urban population). The methodology is similar to the approach used by OECD (2010).

We estimate the following functional form:

Ln (HSi,t) = C(1) + C(2) ln (PCGDP) + C(3) ln (THSGDP) + C(4)* ln (NR_PHYSICIANS) + C(5) *ln (URBAN_POPULATION),

where the variables for country *i* are:

- HS – health status as measured by the under-5 (child) mortality rate;
- PCGDP – per capita GDP measured in purchasing power parity[5] adjusted dollars;
- THSGDP – share of total health expenditure in GDP;
- NR_PHYSICIANS – the number of physicians per 1,000 people; and
- URBAN_POPULATION – the percentage of population living in urban areas.

Due to the lack of data, some factors and some countries were excluded from the regression analysis. We have intended to use tobacco and alcohol consumption, a measure of income inequality (Gini coefficient), education (measured by the share of population aged 25-64 with an upper-secondary degree or higher) and consumption of fruits and vegetables in our regression analysis but data paucity has made impossible to include them.

5 Spending is measured in PPP terms in order to be able to compare expenditure levels across countries.

4. Empirical results

The cross section regression includes 54 observations over three years (1995, 2000 and 2008) for 18 countries from Central and Eastern Europe. The mean value of under-5 mortality rate is 13.56 (see Table 1). The mean value of number of physicians is 3.03 per 1,000 people, while urban population represents on average 63.94%. The average share of public health spending in GDP is 6.44%, and ranges from less than 3.6% to over 10% of GDP. On average, a typical country has a per capita GDP of USD 7,453.

Table 1: Summary statistics on under-5 mortality rate, GDP per capita, total health expenditure, number of physicians and degree of urbanization (data from 18 countries over 3 years: 1995, 2000 and 2008)

Variables	Observations	Mean	Standard deviation	Min	Max
Under-5 mortality rate	54	13.56296	7.641157	3.300000	37.70000
GDP per capita	54	7453.080	7142.977	354.0014	31409.84
Total health expenditure	54	6.442593	1.187291	3.600000	10.70000
Number of physicians	54	3.039204	0.817306	1.306000	4.579000
Urban population	54	63.94000	11.83789	38.90000	94.26000

We used an ordinary least square (OLS) cross-sectional regression in order to see the dependence of the under-5 (child) mortality rate related to GDP per capita, share of total health expenditure in GDP, number of physicians, and urban population.

Table 2: OLS regressions: factors affecting health status

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	7.815221	0.846068	9.237107	0.0000
C(2)	-0.436898	0.034262	-12.75177	0.0000
C(3)	-0.648874	0.188558	-3.441246	0.0012
C(4)	-0.108479	0.114325	-0.948860	0.3473
C(5)	-0.089700	0.189907	-0.472339	0.6388
R-squared	0.833761			
Adjusted R-squared	0.820191			

Table 2 presents the results, containing the OLS estimates of our model. It indicates that one percentage point increase in per capita GDP is associated with a 0.43% reduction in child mortality. At the same time, a one percentage point increase in the total health spending in GDP is linked with a 0.64% reduction in child mortality. Our results imply that total health spending and GDP per capita are certainly important contributors to health outcomes in the CEE countries.

The number of physicians and the urban population influence child mortality. According to our regression, one percentage increase of the number of physicians is associated with a 0.10% reduction in child mortality. Similarly, a one percentage increase in the grade of urbanization is linked to 0.08% decrease in child mortality.

These four variables explain 92.19% of the variation in cross-national child mortality rates. Our empirical results support two hypotheses: (1) countries with higher GDP per capita have lower child mortality rates, and (2) the total health spending (as percentage of GDP) has significant influence on the health status in the CEE countries.

5. Conclusions

Improving health system efficiency is an important topic nowadays. The first step in adopting a strategy for enhancing the efficiency in the health sector is the understanding of the determinants of health status (or health outcomes).

Using data from a cross-section of countries covering 1995, 2000 and 2008, we show empirically that the differences in the health outcomes between CEE countries can be largely explained by the level of GDP per capita and by total health spending. The results suggest that one percentage point increase in per capita GDP is associated with a 0.43% reduction in child mortality and a one percentage point increase in the total health spending in GDP is linked with a 0.64% reduction in child mortality. This paper also finds that the urban population and the number of physicians matter for health outcomes in CEE countries. The results are broadly in line with those obtained by Evans *et al.* (2000), Rajkumar and Swaroop (2008), Bhalotra (2007), Gani (2009), and Anyanwu and Erhijakpor (2009) by studying different groups of (developing) countries. Using cross-country data from seven Pacific Island countries for selected years between 1990 and 2002, Gani (2009) found that per capita health expenditure is an important factor in determining health outcomes. Additional core factors that determine health outcomes are per capita incomes and immunization. Bhalotra (2007) pointed out significant effects of health expenditure on infant mortality rates in India. Using data from 47 African countries between 1999 and 2004, Anyanwu and Erhijakpor (2009) showed that total health expenditures have a statistically significant effect on infant mortality and under-five mortality rate.

Our analysis contributes to the understanding of the link between the health outcomes (measured as under-5 mortality rates), on the one hand, and the level of GDP per capita and the value of total health spending on the other hand in selective countries from Central and Eastern Europe. To the best of our knowledge, this is the only study in the literature that examines this link only in the above-mentioned region and for the years 1995, 2000 and 2008. In the previous studies only a few countries from the region have been included in the cross-section analysis.

As explanatory variables selection was influenced by lack of some data, we consider that our analysis could be extended with other determinants of health status, such as tobacco and alcohol consumption, education, consumption of fruits and vegetables and corruption as soon as the data will be available.

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