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Full Length Research Paper

Expenditure efficiency of social services in developing countries

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This paper assesses the efficiency of developing countries in utilizing public resources for health and education and has two major parts. The first one estimates efficiency by applying a non-parametric methodology: Data Envelopment Analysis, Input-efficiency is scored in a sample of 75 countries using data from 1996 to 2011. The second part of the paper seeks to identify empirical regularities that explain cross-country variation in the efficiency through a Tobit regression. Results show that countries with higher expenditure levels register lower efficiency scores. Similarly, countries with higher income inequality score lower efficiency, as those countries plagued by the HIV/AIDS epidemic. Countries with higher revenue per capita tend to score higher efficiency as well as countries where the degree of urbanization is a larger share of total population.

Key words*:* Efficiency, public education and health, data envelopment Analysis, Tobit regression model.

INTRODUCTION

The population's access to public services, especially on education and health improves living conditions, increases welfare, accelerates growth and reduces poverty incidence. Several studies have highlighted the active role that the state should play in the provision of these services given that they generate positive externalities and other market imperfections that characterize them. Indeed market imperfections justify government intervention through direct production of services or its subsidy policy. This is also why the public sector plays a much more important role in the education and health services than the private sector. However, the public sector is constrained in its actions by the lack public funding resources as well as problems of misallocation.

For nearly two decades, policy spending on social sectors in developing countries raises considerable criticisms. At the macro-economic level, some accuse the government to devote fewer resources to the areas of education and health because of persistent budget deficits and difficulties these countries face increasing tax revenue. In addition, the problem seems not only related to the insufficient volume of expenditure but an inefficient allocation of resources (Rajkumar and Swaroop 2008, Filmerand Pritchett 1999).There is need to pay more attention to the issue of the use of these resources. In fact, a significant improvement in educational attainment and health status could be achieved if funding is ensured by technical efficiencies (World Bank 2004, Hensher 2001).

The theoretical framework of the efficiency measure was originally developed by Farrell (1957), to measure the efficiency of firms or units of decision (UD) in the context of production process. Efficiency is the best use of resources in production. Decision units that produce maximum output from a given level of inputs, or equivalently, a given level of output from a minimum of inputs, can be considered efficient.

The approach is particularly interesting because it uses a concept of relative efficiency (X-inefficiency) and thereby avoiding the adoption of a standard characterizing the situations efficient. A producer will be considered relatively inefficient if another producer uses a lower than or equal input to produce more outputs.

Farrell (1957) investigated the question how to measure efficiency and highlighted its relevance for economic policy makers. It is important to know how far a given industry can be expected to increase its output by simply

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increasing its efficiency, without absorbing further resources. Since that time, techniques to measure efficiency have improved and investigations of efficiency have become more frequent, particularly in industry.

The importance of examining public sector expenditure efficiency is particularly pronounced when a country is experiencing massive fiscal deficits. When services are publicly provided, performance measurement becomes an inevitable management tool. The government needs to identify poorly performing units since market mechanism cannot cut them out. When inefficiency continues, the constituents of that inefficient unit suffer. The government needs benchmarking tools to provide incentives to performers and to induce inefficient units to perform better. According to Bhutan and Hug (1999), benchmarking is first and foremost a tool for improvement, achieved through comparison with other organizations recognized as the best within the area. On the other hand, Ahmed and Rafiq (1998) argue that the central essence of benchmarking is the learning of how to improve activities, processes and management.

Governments provide a host of goods and services to their populations, to achieve various economic and social objectives. The efficiency with which these goods and services are provided is important, not only in the debate on the size of the government and the possible role of the private sector, but also in macro-economic stabilization and economic growth (Herrera and Pang 2005).

Although method proposed and used here can be applied to several sectors where government is the main or an important service provider, we restrict ourselves to efficiency evaluation in education and health in the developing countries. On the other hand, we seek factors that will explain differences in efficiency scores among countries.

The reminder of the paper is organized as follows: the second section is devoted to the literature of the efficiency of government expenditure. The third section lays out the paper's methodology. Section four provides an analysis of the efficiency of government spending both in education and health in developing countries. On the level of the five sections, we will test the relation between the efficiency scores and environmental variables. Section six summarizes the results and the policy implications.

LITERATURE REVIEW

Previous studies on the performance and efficiency of the public sector that applied parametric and non-parametric methods find significant divergence of efficiency across countries. Gupta and Verhoeven (2001), employ the input-oriented free Disposable Hull approach (FDH) to assess the efficiency of government spending on education and health in 37 African countries in 1984-1995. Using several output indicators for health and education, they constructed efficiency frontiers for each of the indicators and for each of the time periods they considered. That is, they used a single input-output for each time period. They find that on average, African countries are inefficient in providing education and health services relative to both Asian and the Western Hemisphere countries. They also report, however, an increase in the productivity of spending through time, as they document outward shifts in the efficiency frontier. Finally the authors report a negative relationship between the input efficiency scores and the level of public spending, which leads them to conclude that higher educational attainment and health output requires efficiency improvement more than increased budgetary allocations.

Evans and al., (2000), adopt a parametric approach to measure efficiency of national health systems for the World Health Organization (WHO), by estimating a fixed effects panel of 191 countries for the period of 1993-1997. These authors documented a positive relationship between their efficiency scores and the level of spending.

Jarasuriya and Woodon (2002), also adopt a parametric approach to estimate efficiency of health and education provision in a sample of developing countries. The authors estimated the efficiency frontier by econometric methods. Using a panel of 76 countries for the period of 1990-1998, they found no relationship between expenditure and the educational or health output variables. This led the authors to conclude that spending more is not a guarantee to obtain better education or health results. The countries with the lowest efficiency in health indicators are all Africans as well as in education attainment. The authors went further by attempting to explain the cross-country variation in efficiency and find that the degree of urbanization and the quality of bureaucracy are the most relevant variables.

Greene (2003a), combines the previous two papers in the sense he concentrated on health efficiency only using the WHO panel data and explained inefficiency scores variation across the sample of counties. Greene's stochastic frontier estimation is much more general and flexible, as it allows for time variation of the coefficients and heterogeneity in the countries' sensitivity to the explanatory variables. The author first estimates a health production function using expenditure (public and private together) on education as inputs, and then explains inefficiency with a set of explanatory variables of which the only significant ones are the income inequality mea sure and GDP per capita.

Afonso, Schuknecht and Tanzi (2003) examine the efficiency of public spending using a non-parametric approach. First, they construct composite indicators of public sector performance for 23 OECD countries, using Variables that capture quality of administrative functions, Educational and health attainment, and the quality of

infrastructure. Taking the performance indicator as the output, and total public spending as the input, they perform single-input, single-output FDH to rank the expenditure efficiency of the sample. Their results show that countries with small public sectors exhibit the highest overall performance. Afonso and Aubyn (2004), address the efficiency of expenditure in education and health for a sample of OECD countries applying both DEA and FDH. This paper presents detailed results by comparing input-oriented and output-oriented efficiency measurements.

Using DEA and FDH in the first stage, Herrera and Pang (2005), examined the efficiency of public spending in providing social services among developing countries. They used Tobit analysis in the second stage to explain variations in efficiency scores. They concluded that countries that are found to be inefficient usually have higher expenditure levels and wage bills higher ratios of public to private financing of services provision and inequality levels, as well as high aid dependency ratios.

ANALYTICAL METHODOLOGY

We apply a non-parametric method that allows the estimation of efficiency frontiers and efficiency losses: Data Envelopment Analysis (DEA). This method is applied to decision making units; they may be firm, non-profit or public organizations that convert inputs into outputs.

Coelli, Rao and Battese (1998), Simar and Wilson (2003), introduce the reader to this literature and describe several applications.

DEA framework

Data Envelopment Analysis (DEA) is a linear programming-based technique for measuring the relative performance of decision making units (DMUs). It computes the comparative ratio of outputs to inputs for each unit, with the score expressed as 0-1 or 0 to 100 percent. A DMU With a score less than 100% is inefficient compared to other units. It is used to identify best practices and is increasingly becoming a popular and practical management tool. DEA has been initially used to investigate the relative efficiency of nonprofit organizations but now, its use has spread to hospitals, school, banks, and network industries, among others (Avkiran, 2001).

The imputation of efficiencies can be most easily conceptualized in terms of the following linear program:

$$\text{maximise}_{u,v}\left(\frac{u' y_i}{v' x_i}\right)$$

$$\text{subject to}\ \frac{u' y_i}{v' x_i} \le 1,\ j = 1,\ldots, N,$$

$$\text{and} \quad u, v \ge 0. \qquad (1)$$

Where *xi* are inputs; *yi* are outputs and *u* and *v* are scalar values chosen for each production unit such that the efficiencies of each unit are maximized and no efficiencies are greater than one. Since, however, the above problem has an infinite number of solutions, an additional constraint is needed, and the program can be rewritten as:

Maximize $_{u,v}$ $(u'y_i)$

Subject to v'xi = 1

u'yi–v'xi≤0,j = 1,……,N

and u,v≥ 0 (2)

Duality of linear program allows us to derive a form of "envelopment" of this problem in the context of variable returns to scale:

minimise$_{\theta,\lambda}\theta$,

Subject to-yi+Y λ≥0 (3)

$\Theta x_i - X\lambda \ge 0$

n1' λ=1

λ≥0

Where θ is a scalar and λ is a (n × 1) vector of constants; n1' λ=1 implies the convexity of the curve of efficiency. The obtained value of θ is the efficiency score for one (DMU) i. It must satisfy the condition θ ≤ 1. If θ = 1, then we are on the efficiency frontier and the DMU is technically efficient. (1 - θ) is the amount of input to be reduced without changing output for efficient production. The linear program problem must be solved n times (because we have n DMU) to obtain a value of θ for each DMU.

DEA can be estimated either as input- or output-oriented. Input-oriented measures address the question - "by how much can input quantities be proportionally reduced without changing the output quantities produced?" while output-oriented measures ask the opposite question - "by how much can output quantities be proportionally expanded without altering the input quantities used?". The two measures provide the same results under constant returns to scale but give different values under variable returns to scale. Nevertheless, both output and input-oriented models will identify the same set of efficient/inefficient decision-making units. In the empirical analysis presented in this paper, we focus on input efficiency scores rather than output efficiency scores, as the former have a straightforward interpretation and more

Table1. Education efficiency score.

Countries	Efficiency score (1996-2003)	Efficiency score (2004-2011)	Efficiency score (1996-2011)
Afghanistan	1.000	1.000	1.000
Argentina	1.000	1.000	1.000
Bahamas	1.000	1.000	1.000
Bangladesh	0.390	0.450	0.420
Barbados	0.625	0.750	0.688
Belize	1.000	1.000	1.000
Benin	0.379	0.424	0.402
Bhutan	0.165	0.198	0.182
Bolivia	0.397	0.492	0.445
Botswana	0.405	0.411	0.408
Brazil	0.177	0.226	0.202
Burkina Faso	0.242	0.23	0.236
Cambodia	0.368	0.376	0.372
Cameroun	0.254	0.268	0.261
Chile	1.000	1.000	1.000
Chine	0.378	0.381	0.380
Colombie	0.286	0.312	0.299
Comoros	0.244	0.312	0.278
Congo	0.371	0.344	0.358
Costa Rica	0.322	0.363	0.343
Cote d'Ivoire	0.177	0.211	0.194
DominicanRep	0.254	0.275	0.265
Domonica	0.433	0.569	0.501
Ecuador	0.189	0.216	0.203
El Salvador	0.174	0.241	0.208
Equatorial Guinea	0.323	0.354	0.339
Ethiopie	0.507	0.45	0.479
Fiji	1.000	1.000	1.000
Gambie	0.321	0.317	0.319
Guatemala	0.287	0.29	0.289
Guinea	0.183	0.221	0.202
Guyana	0.369	0.394	0.382
Honduras	0.213	0.247	0.230
Inde	0.267	0.307	0.287
Indonesie	0.505	0.559	0.532
Jamaique	0.175	0.209	0.192
Kenya	0.260	0.257	0.259
Korea	1.000	1.000	1.000
Lesotho	0.194	0.226	0.210
Liberia	0.336	0.325	0.331
Madagascar	0.146	0.184	0.165
Malawi	0.267	0.295	0.281
Malaysia	0.855	0.878	0.867
Maldives	0.199	0.229	0.214
Mali	0.320	0.302	0.311
Mexico	0.240	0.263	0.252
Mongolia	0.301	0.336	0.319
Mozambique	0.333	0.364	0.349
Myanmar	0.398	0.394	0.396
Népal	0.641	0.593	0.617
Nicaragua	0.230	0.275	0.253
Niger	0.194	0.221	0.208
Nigeria	0.271	0.273	0.272
Pakistan	0.519	0.507	0.513
Panama	0.327	0.342	0.335
Paraguay	0.184	0.211	0.198
Peru	1.000	1.000	1.000
Philippines	0.182	0.212	0.197
Rwanda	0.234	0.258	0.246

Table 1 cont.

Sénégal	0.468	0.473	0.471
Singapore	0.340	0.365	0.353
Soloman Island	0.869	0.811	0.840
South Africa	0.610	0.576	0.593
Sri-Lanka	0.868	0.879	0.874
Swaziland	0.341	0.348	0.345
Thailand	0.158	0.197	0.178
Togo	0.515	0.442	0.479
Tonga	0.258	0.293	0.276
Trinid and Tobaggo	0.553	0.621	0.587
Tunisie	0.611	0.64	0.626
Uruguay	0.395	0.412	0.404
Venezuela	0.270	0.29	0.280
Vietnam	0.436	0.541	0.489
Zimbabwe	0.510	0.527	0.519
Average	**0.42**	**0.44**	**0.43**

relevance for policymaking. As the expenditure allocations (rather than outputs) are under the control of the policymakers, a focus on input efficiency scores is more meaningful.

NON-PARAMETRIC EFFICIENCY ANALYSIS

Data

DEA analysis is used here to determine the relative efficiency of government spending on education and health. Per capita education and health spending by the government in purchasing power parity (PPP), terms is taken as a measure of input. Output is measured by relevant social indicators, the choice of which is determined by their availability in a wide range of countries over many years. In particular, health output is measures by life expectancy, infant mortality; and educational attainment by average years of schooling,and adult literacy rate.

Data on educational attainment, health output, and public spending on education and health are available for 75 developing countries. Data on government spending and output indicators are annual and cover two periods (1996–2003 and 2004–2011).

Empirical results

Individual country efficiency scores for education and health public sector are reported in table 1 and 2, respectively.

Comparing efficiency in developing countries

Table (3) show that Africa has an average, the lowest efficiency of education spending, with an average input efficiency score of 0.33 in the two time periods. The Western Hemisphere performs the best with an average input efficiency score of 0.52, whereas the countries in the Asia are between countries in the other two regions with an average score of 0.44. Countries in Africa score relatively low in terms of efficiency while on average spending more on education as a share of GDP than countries in Asia and the Western Hemisphere. In the period (1996–2011), education spending in Africa averaged 5.2% of GDP, against 4.1% of GDP in Asia and 3.6% of GDP in the Western Hemisphere.

The lowest efficiency of education spending in Africa cannot be explained by differences in private spending on education. Jimenez and Lockheed (1995), find that in 1985 the average share of government schools in primary enrollment in the African countries varied from 80% in East Africa to 84% in West Africa. In both Asia and the Western Hemisphere, the government share in primary enrollment averaged 88% in 1985. In that same year, the government share in secondary enrollment averaged 52% in East Africa and 72% in West Africa, against 78% in Asia and 75% in the Western Hemisphere. Furthermore, James (1991) finds that in the African countries a relatively low share of funding of private education is from public sources, such as government subsidies. These findings suggest that the share of private spending in total education spending is higher in the African than in Asian and Western Hemisphere countries. And as a relatively large part of educational attainment in Africa is produced with private inputs, the African countries are less efficient than those in Asia and the Western Hemisphere, all other things being equal.

Table (1) reinforces table 3's conclusion that African countries, on average, are less efficient with their education spending than countries in Asia and Western Hemisphere.

Table 2. Health efficiency score.

Countries	Efficiency score (1996-2003)	Efficiency score (2004-2011)	Efficiency score (1996-2011)
Afghanistan	0.583	0.849	0.716
Argentina	0.493	0.616	0.554
Bahamas	0.671	0.645	0.658
Bangladesh	0.593	1.000	0.796
Barbados	0.473	0.6	0.536
Belize	0.673	0.738	0.705
Benin	0.486	0.616	0.551
Bhutan	0.733	1.000	0.866
Bolivia	0.729	0.917	0.823
Botswana	0.603	0.714	0.658
Brazil	0.565	0.882	0.723
Burkina Faso	0.53	0.648	0.589
Cambodia	0.625	0.833	0.729
Cameroun	0.542	0.594	0.568
Chile	0.673	0.9	0.786
Chine	0.507	0.642	0.576
Colombie	0.515	0.634	0.574
Comoros	0.636	0.789	0.712
Congo	0.648	0.789	0.718
Costa Rica	1.00	0.9	0.95
Cote d'Ivoire	0.479	0.592	0.535
Dominican Rep	0.522	0.634	0.578
Domonica	0.486	0.605	0.545
Ecuador	0.515	0.616	0.565
El Salvador	0.803	0.937	0.87
Equatorial Guinea	0.538	0.652	0.595
Ethiopie	0.538	0.672	0.605
Fiji	0.775	0.865	0.82
Gambie	0.507	0.634	0.570
Guatemala	0.747	0.683	0.715
Guinea	0.574	0.709	0.641
Guyana	0.924	0.951	0.937
Honduras	0.5	0.891	0.695
Inde	0.603	0.738	0.670
Indonesie	0.565	1.000	0.782
Jamaique	0.603	0.874	0.738
Kenya	0.702	0.643	0.672
Korea	1.000	1.000	1.000
Lesotho	0.686	0.75	0.718
Liberia	0.493	0.605	0.549
Madagascar	0.574	0.643	0.608
Malawi	0.556	0.672	0.614
Malaysia	0.859	1.000	0.929
Maldives	0.726	0.937	0.831
Mauritus	0.673	0.828	0.750
Mexico	0.888	1.000	0.944
Mongolia	0.965	1.000	0.982
Mozambique	0.583	0.714	0.648

Table 2. cont.

Myanmar	0.5	0.831	0.665
Népal	0.648	0.828	0.738
Nicaragua	0.941	1.000	0.970
Niger	0.547	0.664	0.605
Nigeria	0.583	0.725	0.654
Pakistan	0.847	1.000	0.923
Panama	0.486	0.622	0.554
Paraguay	0.515	0.649	0.582
Peru	1.000	1.000	1.000
Philippines	0.538	0.682	0.61
Rwanda	0.538	0.643	0.590
Sénégal	0.467	0.667	0.567
Singapore	0.66	0.818	0.739
Soloman Island	1.000	1.000	1.000
South of Africa	0.614	0.714	0.664
Sri-Lanka	0.603	0.918	0.760
Swaziland	0.507	0.634	0.570
Thailand	0.493	0.639	0.566
Togo	0.507	0.648	0.577
Tonga	0.673	0.836	0.754
Trinid and Tobaggo	0.515	0.664	0.589
Tunisia	0.507	0.625	0.566
Uruguay	0.486	0.611	0.548
Venezuela	0.493	0.631	0.562
Vietnam	0.593	1.000	0.796
Zimbabwe	0.538	0.629	0.583
Average	**0.63**	**0.77**	**0.71**

No African country in the sample has an efficiency score of 1, and the highest efficiency score for a recent time period is 0.640 for Tunisia. Relatively high efficiency scores were also achieved by the Senegal, Zimbabwe, and the South Africa. Many of the African countries are at the lower end of the efficiency score distribution, particularly Madagascar, Côte d'Ivoire and Guinea. Of the Asian countries, the Afghanistan, Fiji and Korea record high efficiency scores. Also, the highest efficiency score for Western Hemisphere countries are for Argentine, Bahamas, Belize, Chile and Peru. Education spending in Jamaique, Paraguay, and Ecuador is relatively less efficient.

The results of table (3) show that high efficiency scores for education spending are clustered at low levels of expenditure as a percent of GDP. This inverse relationship between government spending and relative efficiency suggests that at advanced levels of educational attainment it become harder to emulate examples of best practices. A further explanation could be that as spending and education attainment increase, governments shift resources away from productive uses. For example, Mingat and Tan (1998) demonstrate for a sample of 125 countries that as primary enrollment goes up, resources in primary education are shifted toward decreasing pupil–teacher ratios (this shift in focus begins to occur at primary enrollment rates of as low as 50%). But smaller pupil–teacher ratios do not tend to have a substantial impact on measures of education attainment, and therefore these additional resources do not yield significant increases in enrollment or literacy rates.

Turning to health spending, table (3) show that Asian and Western Hemisphere countries again have higher average input efficiency score (an average of 0.77 and 0.70, respectively, during both time periods, against 0.60 for Africa).

An analysis of the input efficiency scores of individual countries (see table (2)) reinforces the conclusion that African countries, on average, are less efficient with their health spending than countries in Asia and Western Hemisphere. No African country in the sample has an efficiency score of 1, and the highest efficiency score for a recent time period is 0.82 for Mauritius. Relatively high efficiency scores were also achieved by The Comoros, Lesotho, and the South Africa. Of the Asian countries, many of these have an efficiency score of 1 such as

Table (3) present the average efficiency and public spending (% GDP) of education and health, respectively.

Table 3. Average input efficiency score and public spending (% GDP)

Periods	Observation	Average efficiency score	Average public spending
Education expenditure			
Developing countries	75	0.43	4.3
Période 1 (1996-2003)		0.42	3.9
Période 2 (2004-2011)		0.44	4.6
African countries	28	0.33	5.2
Période 1 (1996-2003)		0.32	4.8
Période 2 (2004-2011)		0.34	5.6
Asian countries	22	0.44	4.1
Période 1 (1996-2003)		0.40	3.7
Période 2 (2004-2011)		0.48	4.5
Western hemisphere countries	25	0.52	3.6
Période 1 (1996-2003)		0.54	3.3
Période 2 (2004-2011)		0.50	3.8
Health expenditure			
Developing countries	75	0.71	2.40
Période 1 (1996-2003)		0.63	2.20
Période 2 (2004-2011)		0.76	2.62
African countries	28	0.60	3.1
Période 1 (1996-2003)		0.53	2.9
Période 2 (2004-2011)		0.68	3.3
Asian countries	22	0.77	2.05
Période 1 (1996-2003)		0.68	1.77
Période 2 (2004-2011)		0.86	2.32
Western Hemisphere countries	25	0.70	2.08
Période 1 (1996-2003)		0.65	1.95
Période 2 (2004-2011)		0.75	2.25

Bangladesh, the Bhutan, Indonesia, Korea, Mongolia, Malaysia and Solomon Island. Also, the highest efficiency score for Western Hemisphere countries are for Mexico, Nicaragua and Peru.

Analysis of the table (3) reveals that, as in the case of education, a negative relationship can be identified between input efficiency scores and the level of health spending. Government spending on health as a percent

Table 4. Explaining cross-country variation on efficiency: education and health public sector.

	Public education	Public health
GOVEXP	-.024	-.003
	(.006)*	(.581)
GDPPC	4.16 E-06	4.73E-06
	(.06)***	(.028)**
URBAN	.004	.002
	(.000)*	(.000)*
GINI	-.001	-.001
	(.08)***	(.002)*
VIH/SIDA	-.264	-.292
	(.000)*	(.000)*
Constant	.639	.682
	(.000)*	(.000)*

Notes: Values in parenthesis underneath the estimated coefficients are the estimated p-values.
* Coefficient significant at 1% level; **Coefficient significant at 5% level; ***Coefficient significant at 10% level.

of GDP was on average the highest in the last time period (2004–2011) in the African countries (3.3% of GDP), followed by the Asian countries (2.3% of GDP) and the Western Hemisphere countries (2.2% of GDP).

The development of efficiency over time

Table (3), shows that the average input efficiency score of education expenditure for all observations between periods 1 (1996–2003) and 2 (2004–2011) rose from 0.42 to 0.44. This implies that countries during period 1 were less efficient than during period 2. The efficiency scores for the African countries show the same pattern, a marked increase in period 2, as do countries in Asia. In Western Hemisphere countries, the average efficiency score has declined between the two periods.

Turning to health spending, table (3), shows that the average input efficiency score of health expenditure for all observations between periods 1 (1996-2003) and 2 (2004–2011) rose from 0.63 to 0.77. This implies that countries during period 1 were less efficient than during period 2.The efficiency scores for the African countriesshow an increase in period 2 as do countries in Asia and in Western Hemisphere countries.

Increases in the efficiency score over time indicate that the relative efficiency of government spending has improved, that is, that the country or region has moved closer to the production possibility frontier. This does not imply that individual countries have become more efficient in the latter time periods. As explained above, for a country to become more efficient requires constant or increasing output indicators and falling spending levels.

EXPLAINING EFFICIENCY VARIATION ACROSS COUNTRIES

This section does not try to identify supply or demand factors that affect health and education outcomes, such as those described by Filmer (2003). The scope is limited to verifying statistical association between the efficiency scores and environmental variables.

Econometric methodology

Given that the dependent variable, the efficiency scores, is continuous and distributed over a limited interval (between zero and one), it is appropriate to use a censored (Tobit) regression model to analyze the relationships with other variables. The panel consists of a 75 developing countries during the period 1996-2011. The literature on panel estimation has shown that in panels with this configuration, that is, a large number of cross-section units (countries) and a large time dimension, the fixed-effects estimators of the coefficients will be consistent (Maddala, 1987).

Econometric model

The Tobit estimation on panel data is defined as follows:

$EFF_{i\,t} = \alpha_0 + f(GOVEXP_{i\,t}, GDPPC_{i\,t}, URBAN_{i\,t}, GINI_{i\,t}, AIDS_{it}) + \varepsilon_{it}$(4)

Where EFF_{it} is the efficiency score calculated by DEA method in the first stage; $GOVEXP_{it}$ is the government expenditure (% of GDP); $GDPPC_{it}$ is the revenue per capita in constant 1985 US Dollars;$URBAN_{i\,t}$ is the urban population (% of total) ;$GINI_{i\,t}$ is thegini coefficient; $AIDS_{it}$ is adummy variable for HIV/AIDS.The data is obtained

from the World Bank Development Indicators (WDI) 2009 and WHO (2007).
Eq. (4), allow to examine the impact of the environmental variables on efficiency of public spending.
•GOVEXP: Most of the papers surveyed in the section (2) explore the relationship between the size expenditure (as a percentage of GDP) and efficiency levels. The objective is to verify if additional public spending is associated with better efficiency. While some papers have found a negative association between efficiency and expenditure levels (Gupta and Verhoeven, 2001; Jarasuriya and Quentin, 2002, Afonso et al., 2003), others have found a positive association (Evans and al., 2000).
•GDPPC: We included the per-capita GDP to verify if richer countries tend to be more efficient, a positive sign is expected (Herrera and Pang 2005, Afonso and Aubyn, 2006a).
•URBAN: The clustering of agents make it cheaper to provide services in urbanized areas rather than in rural. Higher degree of urbanization should reflect in higher efficiency, making positive as the expected sign of the coefficient on this variable (Jayasuriya and Quentin, 2002).
•GINI: Ravallion (2003) argues that, besides the mean income, its distribution affects social indicators because their attainment is mostly determined by the income of the poor. Hence, we controlled for the distribution of income by including the Gini coefficient as an explanatory variable. Higher inequality is expected to be associated with lower educational and health attainments, making negative the expected sign of this variable.
•Prevalence of AIDS: Evans and al., (2000), report that AIDS lowers the Disability adjusted life expectancy (DALE) by 15 years or more. Aids also affects education outcomes both directly and indirectly (Drake and al., 2003): directly because school-age children are affected: UNAIDS estimates that almost 4 million children have been infected since the epidemic began, and two thirds have died. However, the indirect channel is relatively more important: AIDS leaves orphaned children that are more likely to drop-out of school or repeat. All these factors reflect how AIDS affect the demand for education. But the supply is also affected by the decreasing teacher labor force due to illness or death, or the need to care for family (Pigozzi, 2004). Prevalence of HIV/AIDS should be negatively associated with education and health outcomes. Consequently, efficiency scores should be negatively associated with this variable.

ANALYSES AND RESULTS

Based on Tobit estimation (fixed effect), the empirical results of Eq. (4) for public education and health sector presented respectively in table (4).

The results of table (4) show that countries with larger expenditure levels (% GDP) register the less efficient scores. This result is not significant for health public sector. As expected, the revenue per capita is positively and significantly associated with efficiency scores in both education and health sector. Countries in which urbanization is a higher degree tend to be more efficient in the provision of services. Income distribution has the negative effect on the educational and health efficiency scores. Results showed a negative relationship between the efficiency scores and HIV/AIDS in both education and health sector.

CONCLUSION

The paper presented an application of non-parametric methods to analyze the efficiency of public spending. Based on a sample of 75 developing countries, the paper estimated efficiency scores for education and health public sector. Our results indicate that developing countries, on average, score efficiency of about 0.43 and around 0.71 in the provision of education and health public service, respectively. This result implying that they could reduce education and health spending between by 57percent or 29 percent while regarding the same output level, if they were as efficient as the comparable benchmark countries. This is just an indicative figure, as the figures vary across countries. It is crucial to identify what are the environmental factors that cause some countries to be more efficient than others in the service delivery.

In a “second stage” the paper verified statistical association between the efficiency scores and environmental variables that are not under the control of the decision-making units. The panel Tobit regressions showed that the variables, which are negatively associated with efficiency scores, include the size of public expenditure (%GDP), income in equality and the prevalence of HIV/AIDS epidemic. A positive association between urbanization and efficiency is also identified in both education and health service. Additionally, the effect of the revenue per capita is clearly positive affecting efficiency scores of education and health, respectively.
In terms of policy implications, it is vital to differentiate between the technically efficient level and the optimal or desired spending level.
Even if a country is identified as an “efficient” benchmark country, it may very well still need to expand its public spending levels to achieve a target level of educational or health attainment indicators. Such is the case of countries with low spending levels and low attainment indicators; close to the origin of the efficient frontier. The important thing is that countries expand their scale of operation along the efficient frontier.

REFERENCE

Ahmed, Pervaiz, Mohammed Rafiq (1998). Integrated benchmarking: a holistic examination of select techniques for benchmarking analysis, *Benchmarking for Quality Management and Technology*, Vol. 5, (3) pp. 225-242.

Afonso, Antonio (2004). A Note on Public Spending Efficiency CESifo *DICE Report*, J. Inst. Comparisons, Vol.2,(1) pp. 35-39.

Afonso, Antonio, Miguel St. Aubyn (2004). Non-parametric approaches to Education and Health Expenditure Efficiency in OECD Countries, ISEG/UTEL, *Department of Economics Working Papers 1/2004/DE/CISEP/UECE.*

Afonso, Antonio, Miguel St. Aubyn (2006a). Cross-country Efficiency of Secondary Education Provision: a Semi-parametric Analysis with Non-discretionary Inputs, *Economic Modeling,* Vol. 23, (3) pp. 476-491.

Afonso, Antonio, Miguel St. Aubyn (2006b). Relative Efficiency of Health Provision: a DEA Approach with Non-discretionary Inputs. ISEG-UTL, Department of Economics *Working Paper 33*/2006/DE/UECE.

Afonso, Antonio, Werner Ebert, Ludger Schnknecht, Michael Thone (2005). Quality of Public finance and Growth, *European Central Bank Working Paper Series 438*.

Afonso, Antonio, LudgerSchnknecht, Vito Tanzi (2003). Public Sector Efficiency: An International Comparison, *European Central Bank Working Paper 242*.

Afonso, Antonio,Ludger Schnknecht and Vito Tanzi (2006). Public sector efficiency: Evidence for new EU member states and emerging markets, *European Central*

Bank Working Paper 581.

Avkiran, Necmi (2001). Investigating technical and scale efficiencies of Australian Universities through data envelopment analysis, *Socio-Economic Planning Sciences*, Vol.35, (1) pp.57-80.

Battese G, Tim Coelli (1992). Frontier Production Functions, Technical Efficiency and Panel Data: With Applications to Paddy Farmers in India, J. Productivity Anal. Vol. 3, (1) pp. 153-169.

Bhutta K, Faizul Huq (1999). Benchmarking-best practices: an integrated approach Benchmarking: Int. J. Vol. 6, (3) pp. 254-268.

Charnes, Abraham, William Cooper, Jean E. Rhodes (1978). Measuring the efficiency of decision making units, Eur. J. Oper. Res. Vol. 2, (6) pp. 429–444.

Chirikos T, Sear AM (2000), "Measuring Hospital Efficiency: A Comparison of Two Approaches", *Health Services Research*, Vol. 34, (6) pp.1389-408.

Clements B (2002). How Efficient is Education Spending in Europe? European Review of Economics and Finance, Vol. 1, (1) pp. 3–26.

Coelli T (1996). A guide to DEAP, version 2.1: A Data Envelopment Analysis (computer) Program, Department of Econometrics, University of New England, Armidale CEPA, Working Paper 96/08.

Coelli, Tim, Prasada Rao, George Battese (1998). An Introduction to Efficiency and Productivity Analysis, *Massachusetts, Kluwer Academic Publishers*.

Deprins, D, L, Simar, H Tulkens (1984). Measuring labor inefficiency in post offices. In M. Marchand, P. Pestieau, H. Tulkens (eds.). The Performance of Public Enterprises: Concepts and measurements, Amsterdam: North-Holland, pp. 243–267.

Drake L, Celia M, Jukes M, Patrikios A, Bundy D, Gardner A, Dolan C (2003). School-age children: Their nutrition and health, SCN News, No.25, pp.4-30.

Evans D, Ajay T, Christopher M, Jeremy L (2000). The Comparative Efficiency of National Health Systems in Producing Health: An Analysis of 191 Countries, GPE discussion Paper Series 29, World Health Organization: Geneva.

Farrell J (1957). The Measurement of productive efficiency, J. Royal Stat. Soc. Vol.120, (3) pp.253-290.

Filmer D (2003). Determinants of health and education outcomes", Background note for World Development Report 2004: The World Bank,Mimeo, May. 24.

Filmer D, Pritchett L (1999). The impact of public spending on health: does money matter? Social Science and Medicine Vol. 49 (1): 1309 – 1323.

Greene W (2003). Fixed effects and bias due to the incidental parameters problem in the Tobit model, Department of Economics, Stern School of Business, New York University.

Greene W (2003a). Distinguishing between heterogeneity and inefficiency: Stochastic frontier analysis of the World Health Organization's panel data on national health care's systems, Department of Economics, Stern School of Business, New York University,

Gupta S, Marijn V, Erwin T (2002). The effectiveness of government spending on education and health care in developing and transition economies, Eur. J. Pol. Econ. Vol.18, (4) pp. 717-737.

Gupta S, Marijn V (2001). The efficiency of government expenditure: experiences from Africa, J. Policy Model. Vol. 23, (4) pp. 433-467.

Herrera S, Pang G (2005). Efficiency of public spending in developing countries: An efficiency frontier approach", *Policy Research Working Paper 3645*. The World Bank.

Hensher M (2001). Financing health systems through efficiency gains", Commission on Macroeconomics and Health *Working Paper Series*3, World Health Organization, Geneve.

James E (1991), "Public policies toward private education: an international comparison", Int. J. Educ. Res. Vol. 15, (5) pp. 359– 376.

Jayasuriya R, Quentin W (2002). Measuring and health

and education indicators. The World Bank *Working Paper 9*, pp. 5-16.

Jimenez E, Lockheed M (1995). Public and private secondary education in developing countries: a comparative study, World Bank Discussion Paper 309. Washington, DC: World Bank.

Maddala GS (1987). Limited dependent variable models using panel data", J. Human Resourc. Vol. 22, (3), pp. 307-338.

Mandl, Ulrike, Adrian Dierx, FabienneIlz kovitz (2008). The effectiveness and efficiency of public spending, European Commission Economic Papers 301.

Mingat A, Jee-Peng T (1998). The mechanics of progress in education: evidence from cross-country data, *Policy Research Working Paper2015*. Washington, DC: World Bank.

Persson, Torsten, Guido Tabellini (2001). Political institutions and policy outcomes: What are the stylised facts?", European University Institute. Mimeo.

Pigozzi MJ (2004). Quality education and HIV/AIDS, UNESCO. Mimeo.

Raikumar A.S, Sworoop V (2008). Public spending and outcomes: Does governance matter? Policy Research *Working Paper 2840* World Bank, Washington DC.

Ravallion M (2003), "On measuring aggregate social efficiency, Policy Research Working Paper 3166.Washington D.C.: The World Bank.

Ruwan J, Wodon Q (2002). Measuring and explaining country efficiency in improving health and education indicators, The World Bank.

Simar L, Wilson P (2003). Efficiency analysis: the statistical approach, lecture notes.

Leopold, Paul W (2003). Efficiency analysis: the statistical approach, lecture notes, July. Vande Sijpe, Nicolas, Glenn Rayp (2004). Measuring and explaining government inefficiency in developing countries, Faculty of Economics and Business Administration Working Paper 2004/266.

World Bank (2004). Making services work for poor people, World Development Report. Washington DC: World Bank.