Public Services Efficiency at the Macro Systemic Level
- Public Education Services -

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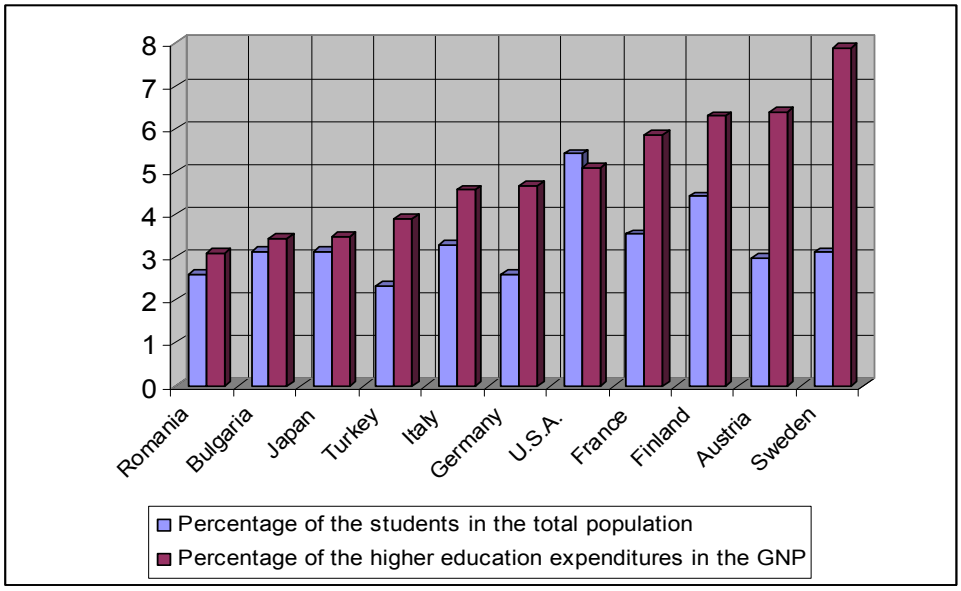
"Everything that can be counted doesn't necessarily count;
everything that counts can't necessarily be counted"
Albert Einstein

Studying the efficiency of the education system in systemic view, assumes taking into consideration the efforts (inputs) and effects (outputs), as well as the connections between the two.

If we are speaking of the inputs in the educational macro system, this refer almost exclusively to society's efforts, represented by the necessary costs in performing education. They are easy to evaluate, could be found in expenses in the state budget allocated for the education system. This indicator, represented both in absolute value and relative value (percentage out of the Gross National Product) is quite relevant for the level of development for a country's education system. It was observed that in developed countries with an efficient education system, there is a high level of expenditure for education relative to GDP. For example, we present the graph for the level of development in different countries in 2004.

Taking a good look at this graph we could observe that Romania is situated on the last place in respect to the percentage of the GNP (Gross National Product) allocated for education, and among the last places from the point of view of student percentage out of total population. Besides all this inputs in the education system, there are individual efforts, made by each person member of the society in order to take part in the education system. Could take the form of monetary nature (expenditures and taxes that an individual have to take during the school) or of non-monetary nature (intellectual efforts to acquire knowledge). It is obvious that the second category can not be quantified in money, although it is the most important effort done by a student.



Source: Annual Statistic of Romania, 2004

Graphic no. 1

If we analyze the outputs (effects) of the education macro system, we shall notice that are:

- economic development and growth reflected in the increase of the country's GDP (Gross Domestic Product);
- the modernization of the society and also of the individual;
- the improvements in the level of civilization and living standards;
- improvements in the level of human development, reflected in the increase of the index of human development.

Of course all this effects of the education macro system are not exclusively the result of the educational process; it must be said that are other factors that contribute to the obtaining of this effects – historical factors, demographical, traditional, geographical etc. More than that, it is difficult (if not impossible) to tell what is the education's contribution, in percentage, in obtaining the above mentioned results.

This is why we consider it useful to focus our attention in making some correlations between the inputs and outputs of the educational macro system, between education and different macroeconomic phenomena.

For this purpose we will use a series of coefficients and special indicators:

- number of students at 100 000 people;
- Gross Domestic Product per student;
- the elasticity of the GDP according to the expenditure in education;
- human development index.

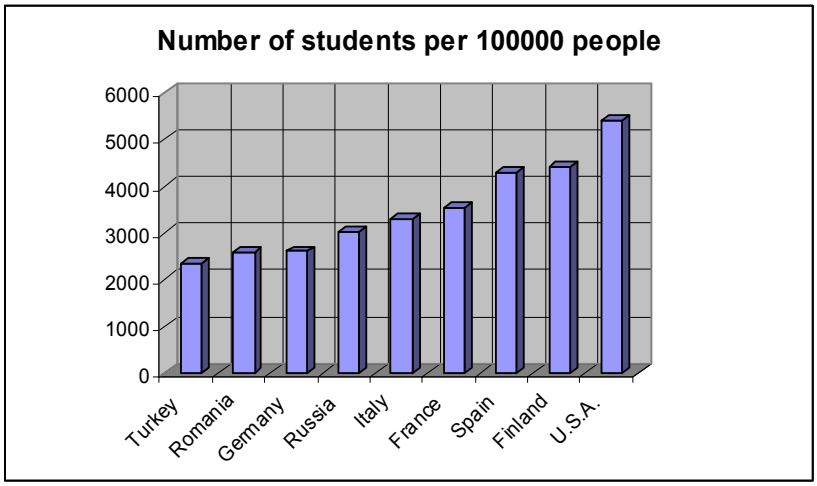
A. Number of students per 100000 people

This indicator is a structural one, being assimilated under the category of efficiency indicators. The calculation formula is:

$$A = \frac{NS}{N} * 100000$$

where A is the number of students at 100 000 people;
NS is the number of students;
N is the total population.

For example, we present the graph referring to the number of students at 100000 people, for different countries on the globe.



Source :Annual Statistic of Romania, 2004

Graphic no. 2

Analyzing this graphic we can observe that in general, countries that are considered to be developed have a larger number of students corresponding to 100000 people. More than that, the most developed state of the world (USA), has also the biggest student proportion out of total population. Evidently, we must notice that in these countries (USA, France, Italy, Spain) an important part of the students are foreigners. This thing does not change the problem here, because we do not analyze the capacity of the American, French, Italian, Spanish individual to graduate a faculty or university on the detriment of a foreign person, but the capacity of the education system in that country to produce highly trained individuals.

B. Gross Domestic Product per student

The second indicator for evaluating the efficiency of the education at he macro systemic level makes a connection with the degree of civilization and the welfare of a society (as an effect indicator) and its educational potential (as an effort indicator). There is no doubt that de level of civilization and welfare are quite general terms from the statistical point of view. A close notion is the economical growth, which can be expressed, under the given conditions, with the help of Gross Domestic Product (GDP) or Gross National Product (GNP). It is obvious that both forms of expressing national production can be used, but we consider the Gross Domestic Product as being closer to the purpose of this paper, because the educational system in Romania is preparing both Romania students and foreign

students. More than that, lately it was noticed a significant increase in the number of foreign students which had not returned to the origin countries, contributing in this way at the Romania's GDP.

So the computing formula for this indicator is:

$$B = \frac{GDP}{NS}$$

where : B is the GDP per student;
GDP – Gross Domestic Product;
NS – Number of Students.

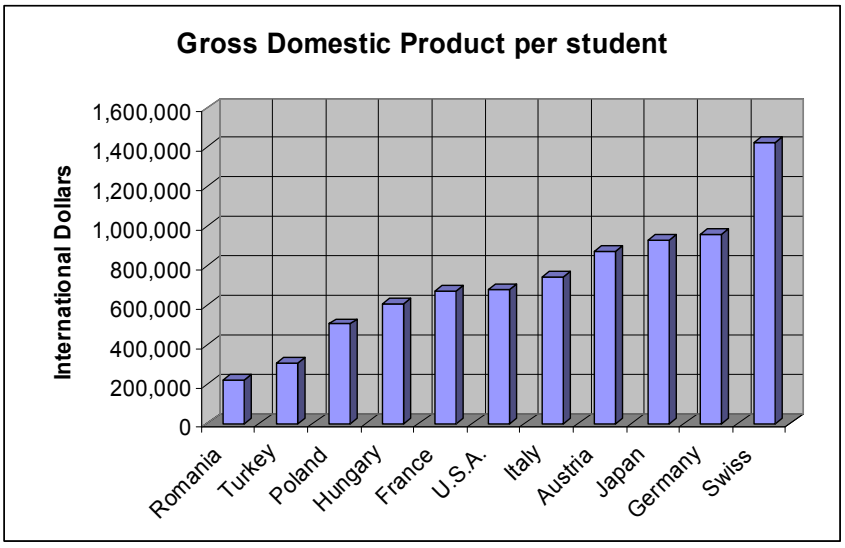
In order to compare the statistical data and economic performances of different countries (for example GDP per student), information are written in a common currency - international dollar[1]. GDP per student (per capita), expressed in international dollars, takes into consideration the price differences between countries, and this is why it reflects better the individual living standard.

If we divide the numerator and also the denominator of the fraction to the total population of one country, we get another expression of the indicator:

$$B = \frac{p}{s}$$

where B is the macro systemic efficiency of the academic educational system
p – GDP per capita
s – student share from total population

For exemplification, we present next the graphic showing GSP per student in some countries:



Source: Annual Statistic of Romania, 2004

Graphic no. 3[2]

[1] In theory, 1 international dollar has the same purchasing power as 1 American dollar in the US economy.
[2] Source: Annual Statistics of Romania, 2004; Human Development Report, 2004 (United Nations programme for Development)

Analyzing this graphic, we may conclude that countries which are considered to be developed from the economic point of view, have a GDP per student above 600000 international dollars. Mid of the table position for the US could be explained by the fact that this country has the largest number of students, a big proportion being from abroad. Consequently, after graduating from university, this foreign students return to the country of origin, not participating to the formation of the USA's GDP. A more detailed situation of this indicator is presented in appendix 1.

This way of expressing the efficiency of the academic system with the help of the indicator GDP per student has two main disadvantages:

- the effects generated by the persons with academic education do not reflect only in the GDP. As it is known, this indicator assesses results obtained in the economic sector of a country, but many of this highly educated persons have studies in the social sector, cultural (health, education, public administration) so do not have a direct impact on GDP;
- GDP is both the result of all persons with academic education and of those who did not graduate an university.

With all these reserves in computing this indicator, it is obvious that there is a strong connection between the GDP and the number of students. No matter this strong connection, it is difficult to say for each country how close to the truth it is.

We shall analyze next the intensity of the connection between the GDP and the number of students over 21 with the aid of correlation coefficient. General computation formula for this correlation coefficient is the following :

$$r = \frac{\sum (X - \overline{X}) * (Y - \overline{Y})}{\sqrt{\sum (X - \overline{X})^2} * \sqrt{\sum (Y - \overline{Y})^2}}$$

where : r is the correlation coefficient between the GDP and the number of students;
X – statistic series for the number of students;
Y – statistic series for the GDP;
$\overline{X}$ and $\overline{Y}$ – are the medium values of these series.

According to the information presented in the Annual Statistic it was constructed in table no. 1:

The mean values used in this table ($\overline{X}$ and $\overline{Y}$) where computed this way:

$$\overline{X} = \frac{34916221}{21} = 1662677 \text{ respectiv } \overline{Y} = \frac{24020704}{21} = 1143843$$

So, the correlation coefficient will have the value of:

$$r = \frac{1295647872 \quad 55181}{\sqrt{1860471070 \quad 58515} * \sqrt{9218447232 \quad 2120}} =$$

$$= \frac{1295647872 \quad 55181}{1309605069 \quad 90643} =$$

$$= 0.98934$$

Computing the correlation coefficient between GDP and number of students

Table no. 1

Country	Number of students (X)	GDP internat. mil. $ (Y)	X - $\overline{X}$	Y - $\overline{Y}$	(X- $\overline{X}$)(Y- $\overline{Y}$)	(X- $\overline{X}$)^2	(Y- $\overline{Y}$)^2
Austria	241000	209859	-1421677	-933985	1327824512789	2021166033920	872327115721
Belgium	358000	255645	-1304677	-888198	1158811309043	1702182571349	788895194069
Bulgaria	263000	50506	-1399677	-1093337	1530319060062	1959096237539	1195386107489
Canada	1763000	834776	100323	-309068	-31006521939	10064666111	95522731916
Czech Republic	207000	144229	-1455677	-999614	1455115073954	2118996082873	999227839807
Denmark	175000	150969	-1487677	-992874	1477075704085	2213183423063	985798381129
Swiss	148000	210978	-1514677	-932865	1412989663306	2294246991349	870237509797
Finland	226000	122406	-1436677	-1021437	1467475511610	2064041349635	1043333932024
France	2062000	1389912	399323	246069	98260848112	159458706206	60549809423
Germany	2132000	2039492	469323	895649	420348457590	220263899539	802186950144
Greece	363000	174797	-1299677	-969046	1259446747189	1689160799444	939049798887
Italy	1893000	1411764	230323	267921	61708274082	53048596587	71781561344
Japan	3918000	3628451	2255323	2484607	5603591904821	5086480975158	6173274291033
Netherlands	469000	429719	-1193677	-714124	852433077372	1424865235063	509972545836
Poland	720000	361656	-942677	-782187	737349770582	888640285444	611816381817
United Kingdom	1821000	1416789	158323	272946	43213540965	25066112016	74499392708
Romania	582221	128883	-1080456	-1014960	1096619906088	1167385579538	1030143972571
Spain	1684000	792116	21323	-351727	-7499805459	454662206	123711804464
U.S.A.	14262000	9710534	12599323	8566691	107934500475317	158742935258587	73388188103483
Turkey	1434000	438799	-228677	-705044	161227536348	52293257444	497087382720
Hungary	195000	118425	-1467677	-1025418	1504982209267	2154076335444	1051481515739
Total	**34,916,221**	**24,020,704**	**0**	**0**	**129564787255181**	**186047107058515**	**92184472322120**

The result interpretation will begin from the possible values for the correlation coefficient. By this way:

- $0 \le r \le 0.25$, the series are not correlated
- $0.25 \le r \le 0.50$, series are lean correlated
- $0.50 \le r \le 0.75$, compared series are medium correlated
- $0.75 \le r \le 1$, series are strongly correlated, and as the correlation coefficient approaches 1, the correlation is more determined.

In conclusion, the correlation between the GDP and the number of students, for 21 countries in 2001 is very strong, approaching the determination value.

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