UNIFACTORIAL ANALYSIS OF CORRELATIONS BETWEEN PUBLIC EXPENDITURE ON EDUCATION AND RELATED INDICATORS OF PRODUCTIVITY, AT MACROECONOMIC LEVEL

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Abstract: Given the fact that the educational system evolves in accordance with the requirements of economic and social development stages of each country, this paper aims to identify factors that influence productivity in education, more precisely an unifactorial analysis of correlations between Public expenditure on education (total% of GDP) as a macroeconomic indicator for the level of development of the Romanian economy (resultant variable) and some indicators of its influence. Collection and selection of statistical data / indicators, involved identifying key online databases, and existing bibliographic sources. As methodology was used Fisher's exact test analysis of variance variable outcome, and Student test for checking the significance of the model parameters, the results obtained allowing relevant economic interpretations and with significant impact in future research.
Keywords: educational expenditures, productivity, econometrics
JEL Classification: C01, H52, I21

1. Introduction

Numerous researches and theoretical approaches (empirical) of the educational process in Romania, have generated inevitably increases in the volume of literature which sometimes generate dilemmas, induced by the difficulties and discontinuities of changes implied by the reform process. The current context of economic crisis, put a number of issues and questions particularly to academic environment, concerned with the assignment to prepare graduates able to integrate to the labor market.

Education will be a factor of economic growth only under certain conditions of market regulation, namely, unless the market absorbs productive educational offer and society a showcase, but for these requirements is necessary to implement a government strategy with long-term vision, which implies the need for effective public expenditure on education. In other words, functionally, a major requirement is the institutional organization such as to ensure on the one hand, the formation of high quality human resources and, on the other hand, their absorption as beneficial in the labor market, economic and social system, both sides must be oriented towards optimal correlation, mutually (meaning that not only education is "market-oriented", but also

economical, social and legislative reality itself, are open to absorb innovations promoted by educational services). Indicators such as education level, health of the population, living standards reflect the structure and direction of economic and social progress or regression of the country, topic discussed and developed by Lobonț (2013: 39-40) [2].

1.2. Methodological issues

This paper presents an empirical analysis carried out in order to highlight the main factors influencing public expenditure on education as a leading indicator of stimulating education and hence the economy of a country. Such research shows its relevance and necessity given the recent economic developments, which have worsened conditions for resources allocated to education, particularly in Romania (Jivan and Weisz, 2014).

The selection of indicators was limited by the unavailability of statistical data for some period of time, and correlation results were grouped by the economic logic: positive / negative on the one hand, strong / moderate / poor on the other.

Thus, for the analysis, have been used econometric methods such as Fisher's exact test and Student's test and from theoretical point of view according to Sipoș and Preda (2006: 78-79), Mateia (2013) and Chilarescu (2014), the two tests mentioned, in the case of the single factor linear, study the link between factorial variable X and the resultant variable Y using stochastic function of the form:

$$y = \alpha + \beta \cdot x + \varepsilon \, ,$$

wherein α and β are known as *parameters or unknown model coefficients* and represents the unknown values that are to be estimated, and ε is the random variable (residual or disruptive).

Because regression function used is stochastic, α and β parameters are not unique values, but have contained of environments, which are estimated using specific methods provided by mathematics and statistics. Of the two parameters, the sign and value of the parameter β, is of major importance in describing the interdependence between the dependent variable and factor.

Regression analysis in the case of the linear single factor consisting in estimating the parameters α și β, by determining the two estimators $\hat{\alpha}$ and $\hat{\beta}$ which must be calculated so that the difference between the real values of the resultant variable (yi) and the estimated values using the calculated parameters ($\hat{y}_i = \hat{\alpha} + \hat{\beta} \cdot x_i$) be as small as possible ($y_i - \hat{y}_i = min\,im$).

From a theoretical point of view, Sipos and Preda (2006: 91-94) consider that, in order to perform the empirical analysis of the correlations in the linear unifactorial model, two statistical test methods can be applied as follows:

1. Fisher Test to verify the variation of the resultant variable accordong to the relation:

$$F_c = \frac{s_{y/x}^2}{s_{\varepsilon}^2}$$

2. Student Test to estimate the significance of the model parameters, the average of the estimator of each parameter, assuming an undistorted estimation, is the actual parameter size, and the variance of the estimator of each parameter, in the case of an efficient estimation, depending on the scattering of the random variable and the dispersion of the values of the factorial variables[1].

1.3. Research results

The indicators were chosen for the period 2000-2010 (see Table 1, 2 and 3) and depending on the factors influencing *Public expenditures on education* (such as the demographic, economic, social and political) focusing on the correlation between: indicators related to school Units by level of education, children enrolled in kindergartens, teaching staff, etc., indicators related to the degree of civilization (minor persons definitively convicted by the courts, persons definitively convicted under rehabilitation centers, rate crime), indicators related to population and its health (total number of infant deaths, resident population) and resultative indicator *Public expenditures on education (total% of GDP).*

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[1]Taken entirely from Şipos, C. , Preda, C. (2006). *Econometrics.* Mirton Publishing. Timişoara, pp. 91-94.

Table 1. Statistical data used

Years	Public expenditures on education (total% of GDP)	School units (total)	School laboratories (total)	Classrooms and school classrooms in higher education (total)	Children enrolled in kindergartens (persons)	The degree of inclusion in education of the population of school age: 3-6 years (%)	The degree of inclusion in education of the population of school age: 19-23 years and over (%)	School population (total persons)	The teaching staff in higher education (total persons)
2000	2.86468	24481	20620	6229	611036	66.1	32.9	4565279	27959
2001	3.25094	24304	21103	6450	616014	72.3	36.4	4554466	28674
2002	3.50999	23679	22065	6989	629703	76.6	41.09	4496786	29619
2003	3.44506	18012	22459	7323	636709	81.35	43.05	4472493	30137
2004	3.27684	14396	22435	7477	644911	82.12	45.33	4403880	30857
2005	3.47503	11865	22689	7051	648338	79.65	51.77	4360831	31543
2006	3.86059	8484	23448	7518	648862	78.84	59.59	4345581	30583
2007	4.24614	8230	23730	7471	650324	79.2	72.5	4404581	31964
2008	4.24295	8221	25047	7882	652855	79.8	78.3	4324992	31973
2009	4.23975	8224	25755	7784	666123	81	76.4	4176866	31103
2010	3.52577	7588	26031	7970	673736	81.8	70.1	4029226	29746

Sursa: http://statistici.insse.ro/shop/?lang=ro

Table 2. Statistical data used (continuation)

Years	Definitively convicted minors (total persons)	Persons definitively convicted under rehabilitation centers (total persons)	The number of infant deaths (total)	Resident population (total persons)	Graduates in higher education (total persons)	Teaching staff in higher education (total persons)
2000	6738	359	7000	22435205	76230	27959
2001	6726	319	7000	22408393	93467	28674
2002	7005	398	6000	21794793	103402	29619
2003	6820	319	5000	21733556	110533	30137
2004	6341	167	4000	21673328	108475	30857
2005	6796	195	4000	21623849	112244	31543
2006	6145	204	3000	21584365	125499	30583
2007	5019	212	3000	21537563	232885	31964
2008	3624	163	3000	21504442	214826	31973
2009	3035	163	3000	21469959	191291	31103
2010	3263	179	3000	21431298	186900	29746

Sursa: http://statistici.insse.ro/shop/?lang=ro, http://data.worldbank.org/country/romania

Table 3. Statistical data used (continuation)

Years	GDP / capita (current prices)	GNP / capita (current US $)	GDP/ person employed (constant 1990 PPP $)	Inactive population (total thousands)	The employed population (total thousands)	Active population (total thousands)	Unemployment rate%
2000	3609.7	1662.217535	6350	10613	10508	11283	10.5
2001	5263.5	1833.81266	6782	10711	10440	11151	8.8
2002	6974.9	2116.312063	7933	11735	9234	10079	8.4
2003	9084	2756.332583	8352	11839	9223	9915	7.4
2004	11413.5	3533.266078	9215	11735	9158	9957	6.3
2005	13362.8	4651.692261	9746	11790	9147	9851	5.9
2006	15967.6	5789.244137	10442	11556	9313	10041	5.2
2007	19315.4	8170.143463	11061	11557	9353	9994	4
2008	23934.6	9949.354828	11872	11572	9369	9944	4.4
2009	23341.4	8068.95673	11315	11560	9243	9924	7.8
2010	24435.9	8139.146673	11348	11482	9240	9965	7

Sursa: http://statistici.insse.ro/shop/?lang=ro**,** http://data.worldbank.org/country/romania

Table 4. Econometric strong positive correlations concerning
Public expenditure on education (total% of GDP)

No. position intensity	Variable factor (influence)	Correlation Report (Multiple R)	Coefficient of determination (R Square)	T state corresponding to α	T state corresponding to β	F	The econometric model for the period 2000-2010 (y = α + β·x + ε)
1.	The degree of inclusion in education of the population of school age: 3-6 years	0, 816	0, 666	3, 31	4, 24	18, 021	Public expenditure on education (total% of GDP) = -27667, 6 + 0, 0470 · The degree of inclusion in education of the population of school age: 3-6 years

The fact that the intensity of the two indicators is strong, it led to maintaining in multifactorial correlations of the indicator *Public expenditure on education (total% of GDP)* and development of research and its effects on the results of professional education and vice versa.

Table 5. Correlations econometric moderate position on Public expenditure on education (total% of GDP)

No. position intensity	Variable factor (influence)	Correlation Report (Multiple R)	Coefficient of determination (R Square)	T state corresponding to α	T state corresponding to β	F	The econometric model for the period 2000-2010 $(y = \alpha + \beta \cdot x + \varepsilon)$
1.	Graduates in higher education	0, 630	0, 398	1, 68	2, 43	5, 95	Public expenditure on education (total% of GDP) = -142698, 5 + 1, 3740 · Graduates in higher education
2.	The degree of inclusion in education of the population of school age: 19-23 years and over	0, 670	0, 449	0, 77	2, 71	7, 348	Public expenditure on education (total% of GDP) = -76953, 45 + 4709, 713 The degree of inclusion in education of the population of school age: 19-23 years and over
3.	Classrooms and school classrooms in higher education	0, 740	0, 548	2, 31	3, 30	10, 920	Public expenditure on education (total% of GDP) = -797703 + 0, 0470 · Classrooms and school classrooms in higher education
4.	School laboratories	0, 643	0, 413	1, 65	2, 52	6, 357	Public expenditure on education (total% of GDP) = --649362 + 42, 4865 · School laboratories
5.	Teaching staff in higher education	0, 760	0, 578	2, 94	3, 51	12, 362	Public expenditure on education (total% of GDP) = -1757466 + 68, 9477 · Teaching staff in higher education
6.	GDP / capita	0, 648	0, 420	3, 12	2, 55	6, 528	Public expenditure on education (total% of GDP) = -195056, 3 + 9, 9658 · GDP / capita
7.	GNP/capita	0, 611	0, 373	3, 50	2, 31	5, 374	Public expenditure on education (total% of GDP) = -213598, 9 + 23, 9581 · GNP/capita
8.	GDP / person employed	0, 724	0, 525	0, 63	3, 15	9, 965	Public expenditure on education (total% of GDP) = -86392, 5 + 44, 6064 · GDP / person employed
9.	Inactive population	0, 680	0, 463	2, 36	2, 78	7, 774	Public expenditure on education (total% of GDP) = -1885742 + 193, 8206 · Inactive population

From Table 5 it can be seen that between factorial variables *Graduates in higher education, The degree of inclusion in education of the population of school age: 19-23 years and over, Classrooms and school classrooms in higher education, School laboratories, Teaching staff in higher education, GDP / capita, GNP / capita, GDP / person employed, Inactive population* and and the resultative variable Public expenditure on education (total% of GDP), have resulted in positive moderate correlations, because the ratios of correlation (between 0 61 and 0, 760) and the coefficient of determination falls in range of 0, 60 and 0, 80, which means that the connection between the factorial variables mentioned and variable dependent Public expenditure on education (total % of GDP) is moderate.

We can say that of all indicators presented in Table 5, the teaching staff in higher education is one with the largest impact on the level of public expenditure on education (total% of GDP).

Regarding weak econometric correlations position, worth mentioning that I noticed one between Graduates (no. total) as factorial variable and the dependent variable *Public expenditure on education (total% of GDP)*, and the second between The school dropout rate as factorial variable and Public expenditure on education (total% of GDP) as the dependent variable.

Interpretation of these results lead to the idea that the number of graduates and School dropout rate are those that positively influence the national economy (public expenditure on education).

Table 6. Econometric moderate negative correlations on
Public expenditure on education (total% of GDP)

No. position intensity	Variable factor (influence)	Correlation Report (Multiple R)	Coefficient of determination (R Square)	T state corresponding to α	T state corresponding to β	F	The econometric model for the period 2000-2010 (y = α - β·x - ε)
1.	Active population	0, 756	0, 572	4, 12	-3, 46	12, 036	Public expenditure on education (total% of GDP) = 2117643 - 174,72 · Active population
2.	School Units	0, 645	0, 416	7, 30	-2, 53	6, 422	Public expenditure on education (total% of GDP) = 491287, 1 - 10, 7747 · School Units
3.	Employedpopulation	0, 707	0, 500	3, 63	-3, 00	9, 012	Public expenditure on education (total% of GDP) = 1924597 – 167,549· Employed population
4.	Unemployment rate	0, 726	0, 528	6, 50	-3, 17	10, 077	Public expenditure on education (total% of GDP) = 637133,7 - 43608, 5 · Unemployment rate
5.	The number of infant deaths	0, 694	0, 482	6, 91	-2, 89	8, 399	Public expenditure on education (total% of GDP) = 556946,6 - 50,398 · The number of infant deaths
6.	Resident population	0, 760	0, 578	3, 72	-3, 51	12, 327	Public expenditure on education (total% of GDP) = 5886245 - 0,2551·Resident population

Table 6 shows moderate negative correlations between factorial variables: *Active population, School Units, Employed population, Unemployment rate, The number of infant deaths, Resident population* and

dependent variable Public expenditure on education (total% of GDP). Note that these correlations have no economic logic.

Table 7. Synthesizing the results of correlations between *Public expenditure on education (Total% GDP)* and other economic and social indicators

	Strong correlation (positive)	Weak correlation (positive)	Strong correlation (negative)	Wea correlation (negative)
Dependent Variables	Factorial Variables			
1. Dropout rate	GDP / person employed, Graduates	Public expenditure on education (total% of GDP)	Unemployment rate, The number of infant deaths	School population Employed population Minors convicted
2. Number of immigrants	-	-	-	Public expenditure on education (total% of GDP), Graduates in higher education
3. Public expenditure on education (total% of GDP)	The degree of inclusion in education of the population of school age: 3-6 years	Graduates (total), School dropout rate	-	Immigrants, Persons convicted in penitentiaries and rehabilitation centers
4. Life expectancy at birth (years total)	GDP / capita, School laboratories	Public expenditure on education (total% of GDP)	Persons convicted in penitentiaries, Minor persons definitively convicted	Active population

Source: Weisz J. (2016), Empirical macroeconomic research: unifactorial and multifactorial correlations regarding Romanian education, Eurostampa Publishing, Timisoara, pp. 179-180.

We see from the above table that the indicator *Public expenditure on education (total% of GDP)* influence, even if weak intensity, School dropout rate, Number of immigrants and life expectancy at birth. On the other hand indicator analyzed as dependent variable, we can say that is influenced by The degree of inclusion in education of the population of school age: 3-6 years, Graduates, School dropout rate, Immigrants, Persons convicted in penitentiaries and rehabilitation centers.

1.4. Conclusions

Taking into account the complexity of direct influencing and the reverse between various indicators and Public expenditure on education (total% of GDP), relevant is that the material effort by society for education strongly influences our economy, namely the increasing number of laboratories school should be a priority measure to reduce the dropout rate. Of course this is the quantitative side in calculating productivity at general level, but contributes to output educational quality as offering as many opportunities for practical study, students especially increase opportunities to obtain high performance impact to the whole economy. As demonstrated methodologically, in the moderate correlations resulted crucial role of the degree of civilization (expressed by indicators such as number of final convictions or crime rates, etc.) that influence Public expenditure on education (total% of GDP) in the period under review.

Overall, although that is ignored too often by those responsible in this respect, the effects of the national educational system and the degree of civilization of a country's economy can not be disregarded because it is far more difficult to stop the wave effects than adopting measures effective government to prevent or reduce these effects, especially on long-term.

German philosopher Immanuel Kant said that "Education is the most important and difficult question what was given him to solve." Therefore, in Romania education must be a national priority, requiring development in the context of interaction between the requirements of economic and social development and human resource development. Today the role of education is as important as ever, focusing more on value, creativity, competence and quality.

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