Input Efficiency in Publicly Provided Education: The Case of Romania

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Abstract

How well does government do in directing society's resources in order to stimulate schooling achievement? The objective of this paper is to reveal on the one hand, the adjustments the schooling system went through during the transition process in Romania, regarding the organization, financing and the schooling outcome, and on the other hand to estimate the production function of the governmentally provided lower and upper level of secondary education. We found out that the most effective way of better performance in both lower and upper secondary education would be to increase the share of qualified teachers and lower student-teacher ratio.

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1. Introduction

Education is definitely not a pure public good, available and affordable without diminution to all. Instead, it appears to be a complex intermediate good that is partially produced by governments, through provisions that vary across jurisdictions and interacts with the endowments and actions of the society, students and families. Education has therefore a character of publicly provided private good. Paradoxically, it may be easier for government to control private schools through appropriate licensing, than the huge public system as Willmore (2002) points out. Such being the case, the distribution of school outcomes is not only an important concern judging the performance of government provisions for the system, but also an object of aggregate policy. The central objective of this paper is the estimation of the production function of cognitive abilities in the Romanian secondary education, both lower and upper levels.

Hanushek and Luque (2001), Murnane et al. (2000) each find that earnings advantages to higher achievement on standardized tests are quite substantial. There is also substantial evidence, noticed throughout the world that students who perform better in schools, either through grades or scores on standardized achievement tests, tend to go farther in school. Hanushek and Pace (1995) reported that variations in cognitive ability, as measured by standardized tests, are important in career success. However, matching the quality of cognitive skills with labor market expectations proves to be a real challenge as Edison (2003) investigated. The first step in approaching the challenge is to understand what

leads to any observed cognitive differences. The second step is to find out how public resources should be spent in order to gather maximal cognitive skills.

2. The schooling system in Romania

According to the enforced Romanian Education Law (84/1995), the compulsory education consists of four years of primary education and five years of secondary education (lower level). After this compulsory stage the upper secondary education follows within high schools or vocational schools or apprenticeship schools. Our target within this frame is the lower level secondary education and the high school.

2.1 The school network

The secondary education schools represent around half of total number of schools in Romania **(Table 1)**. In lower level secondary education schools are distributed both in rural and urban areas, with one third of them located in rural areas. The high schools represent about 6% of the total number of schools and they constantly increased during the 90s, while their specialization significantly diversified.

2.2 Students

The number of school age population strongly declined over the last decade, leading to a decline of students enrolled, by 15.6% in 2001 as compared to 1990. The students enrolled in the secondary education represent 51% of the total student enrollment in 2001, down from 56% in 1990. While the share of students enrolled in lower level of secondary education was roughly constant between 1990 and 2002, the share of students enrolled in upper level of secondary education declined from 27.4% in 1990 to 22.7% in 2001. **(Table 2)**

2.3 Teaching staff

There is a widespread opinion in Romania that the educational system owes to the quality of its staff. Much of this assessment relies on the international performance of selected students. It should be pointed that recent evaluations show the inconsistency of such an opinion.

2.3.1. Teacher's labor market

There are two procedures in order to get teacher's qualification. One is the concurrent model, according to which the specific pedagogical preparation is accomplished together with the general professional training. The other is the consecutive model where the special training is accomplished after graduation. The number of teachers in secondary education increased due to the growth of the number of teachers in the upper secondary level, mainly in high schools. The number of teachers in high schools increased from 51.7 thousands in 1990 to 64.7 thousand in 2001. **(Table 3)**

The average student/teacher ratio declined in all levels and forms of secondary education. In the lower level of secondary education the student/teacher ratio declined from 14 in 1990 to 12 in 2001. In the upper level of the secondary education the student/teacher ratio declined from 24 in 1990 to 14 in 2001, being lower than the average of 14.8 students per teacher in OECD countries. As a benchmark, this ratio ranges between 25.5 in South Korea and 9.2 in Austria or 9.5 in Hungary (OECD, 2000). While the student-teacher ratio corresponds to international standards in high schools, the student-teacher ratio in vocational schools and apprenticeship schools are much in excess.

2.3.2 Compensations

The wage issue is the crucial point of any incentive driven approach (Contreras et al, 2003). The average wage in education declined as compared to the average wage in the economy. While in 1998 the wage in education was equal to the average wage in the economy, in 2002 it was 5% below.

2.4 Financing

The Education Law stipulates the allocation of an amount of at least 4% of GDP for the education. Between 1990 and 1995 the expenditures allocated to education amounted to 2.5-3.5% of GDP, while during the following years this amount declined. Actually, during the last years of communist regime, and contrary to the common public perception, the figure was even worse, oscillating between 2 and 3% of the GDP (2.2 in 1989).

3. Measuring performance

Setting internationally compatible standards for the national educational system is important, but it is only a first step. Equally important are other related educational reforms, such as implementing performance based assessments and certification, incentive systems and professional development (Ananda et al, 1995). Measuring performance within the Romanian educational system is conceived as a tool for the creation of an institutional incentive frame, which we believe is unfortunately still lacking in nowadays Romania. One aim of the educational system is to deliver to each student the best-suited certified formation. Another aim is to transfer knowledge.

According to the international scoring systems PISA2000[1], TIMSS99[2] and PIRLS2001[3], Romanian students' achievement seem to be below the EU average and below other neighboring countries students' performance. **(Table 4)**

3.1 Test scores

Formally the lower and upper levels of secondary education are assessed by standardized exams. Standardized national exams for lower level of secondary education were organized for the first time in 1999. Before that, there were no such exams for lower secondary graduates, but there were admission exams in the upper level, organized by each school unit. Since 1999, the results from the standardized national exams are used for the admission in the upper level. The national assessment of the upper secondary education graduates was always in place. The importance of the scores increased over time, mainly due to the system of being admitted to the University.

3.1.1 Lower level of secondary education

The knowledge accumulated during the lower level of secondary education is assessed according to a standardized evaluation system. The evaluation is organized nationwide and consists of tests of Romanian language, Mathematics, History and Geography. The successful graduates of the eighth form are allowed to participate to the exam. The results

[1] The OECD Program for International Student Assessment (PISA) assesses the extent to which students near the end of compulsory education have acquired some of the knowledge and skills that are essential for full participation in society. Romania joined the program in 2000. Out of 32 participating nations from 27 OECD countries and 4 non-OECD countries (later on additional 10 countries joined), Romania was placed the 30th position, outscoring Mexico and Brazil.
[2] The Third International Math and Science Study (TIMSS) is a testing and data collection program conducted by the International Association for the Evaluation of Educational Achievement. Romania joined the program in 1995. The results in the table refer to the eighth graders in 1999. Out of 38 participating nations, Romania was placed on the 25th position.
[3] Progress in International Reading Literacy Study (PIRLS) assesses the achievement of 4th graders. Romania joined the program in 2001. Out of 35 participating nations Romania got the 27th position.

of the exams entitle students to continue the upper level of secondary school in high schools. The distribution of candidates to high schools is made according to the students' options and their score. If more students opted for a certain high schools than the available positions, then the accepted students would be those with the higher scores.

The average score registered by all participants to the exam (successful or not) ranges between 6.5-6.9 (minimum 5; maximum 10) during 1999-2000. This score was computed by aggregating schools' score distributions. Therefore the method underestimates the potential average score, if individual scores would have been available. For the period 2001 and 2003 these scores were available, and compared to them, it seems the underestimation goes up to 1 point. Regardless the method used for computation, the average scores is increasing both in urban and rural areas. In urban areas the average score gained 0.13 points between 1999 and 2002, while in rural areas it was 0.38 points. The differences between the average score in rural and urban areas decreased from 0.7 points in 1999 to 0.5 points in 2002. In urban area one can notice a decline of the minimum score and a rise of maximum score. The slight increase of variation coefficient indicates rising differences across counties.

3.1.2 Upper level of secondary education

The knowledge acquired during the high school is evaluated through a standardized evaluation system, national level. This exam tests the knowledge in Romanian language and literature, Mathematics or Science (the graduates from art, sport or humanities, might choose some other discipline), foreign languages, and other two optional disciplines. A

successful graduation (baccalaureate) exam allows the participation to the admission exams in higher education.

There are important differences between the graduates' scores in day and evening classes. Those who were enrolled day classes usually have higher scores and success rates. The difference between the average test score of day class graduates and evening class graduates is up to 1.5 points. The average success rate of day class graduates exceeds the average success rate of evening class graduates with 30%. The differences concerning the success rate between counties decreased considerably over time for day class graduates and to a much lesser extent for evening class graduates. The differences concerning the test scores between counties declined for day classes graduates and were roughly unchanged for evening class graduates.

4. Education production function

This section investigates the relationship between educational inputs and outputs through regression procedure, by estimating an education production function. The section presents the production function methodology, the data at hand and the results of the estimations for lower and upper secondary education during the years 1999 and 2002.

4.1 Theoretical framework

The available direct measures of outcomes in secondary education through national standardized test enable us to link them to resources devoted to education. In fact, this

means finding out whether there is a resource-output quality relationship and how efficiently resources are spent in producing output quality.

There are works for US, which found that the earnings advantages to higher achievement on standardized tests are quite substantial. We are not aware on similar works for Europe. But we assume that the situation should not be different. Bishop (1989) considers the measurement errors that are inherent in most testing situations and demonstrates that careful treatment of that problem has a dramatic effect on estimated importance of test differences. Murnane et al (2001) demonstrate that the results of increasing returns to measured skills hold regardless of the methodology. There is substantial evidence that students who do better in school tend to go farther in school. Hanushek and Pace (1995) found that college completion is significantly related to higher test scores at the end of high schools.

Our framework of analysis is a standard linear production function defined in terms of average achievement levels in counties[4] (Hanushek, 2002):

$$T_{it} = f(R_i^t, X_i^t) + \varepsilon_{it} \qquad (1)$$

where T_{it} is the average school performance in county i at time t, R_i^t represents school resources in county i at time t, X_i^t represents other inputs into schooling in county i at time t and ε_{it} is a stochastic term.

[4] Romania is divided into 42 counties of approximately similar size, excepting the capital regions and its neighborhood region.

We implicitly assume that each county has its own school, which captures the average characteristics of schools in that particular county.

The centralized feature of Romanian educational policy, which means a unique financing policy, a unique certification, hiring and pay policy, applied all over the counties allows us to avoid the model misspecifications originating from omitted measures of organizational or structural regional differences in school policies (Fortune et al, 1993).

4.2 Data

For this study for each level of secondary education two main data sets were built: one on test scores and the other on school inputs. For lower level of secondary education the test scores data was built upon two auxiliary data sets provided by the Ministry of Education. The fist auxiliary data set is school level data and covers the school years 1999-1998 to 2001-2002. This data set contains for each school with students taking the test information about potential and effective participants to exam and the distribution of scores obtained by all participants on average and separately on mathematics and literature. The score distribution (the scores range between 1 and 10) covers 6 intervals: one interval below 5 (for unsuccessful participants), and other five intervals such as between 5 and 5.99, between 6 and 6.99 and so forth until between 9 and 10 for successful candidates. The second auxiliary data set is individual level data containing for each student participant to the exam the average score. We aggregated the two auxiliary data sets at county level. For upper level of secondary education the test score data was built upon the county level data provided by the Ministry of Education, covering the

results for those enrolled between 1998-1999 and 2001-2002 school years. This data set contains information on the number of students registered for the exam, the number of participants to the exam, the success rate and the distribution of scores obtained by all participants using the same interval division described above.

The second data set on school inputs is provided by the National Statistical Institute, which conducts an exhaustive statistical research covering all school units at the beginning of each school year. The data set covers the school years between 1998-1999 and 2002-2003. The data refer to counties separately for urban and rural areas and contain information on number of school units, number of students, number of teachers, number of qualified teachers, number of full time teachers, number of classes, number of labs, gyms and workshops.

The data processing resulted into nine panel data sets. Seven balanced data sets for the lower secondary education and two data sets for upper secondary day education one for day education and one for evening education. Out of the seven balanced data sets for lower secondary education one refers to the whole country, three refer to the lower secondary urban education separately for boys and girls and the other three refer to the lower secondary rural education of boys and girls separately.

4.3 Estimations

We estimate for lower secondary education the country education production function, the rural and urban area production function, separately for boys and girls. For upper level secondary education we estimate the production function of day education and

evening education. The estimation procedures are panel estimations. It appears that most cases the regional fixed effects are identical across counties and the regional effect is uncorrelated with the other independent variables (the Hausman test does not reject the random effects model) and the favorite estimates come out from random effect models.

In all production functions estimation the dependent variable is the average test score reached by all participants to the exams in the county. The average test score for lower secondary level is computed as a weighted average of the graduation score and the average test score of three subjects (mathematics, Romanian language and literature and an optional subject). The average test score for upper secondary level is the average score of five subjects (written and oral exams).

The independent variables included in the estimations are:

- students/school ratio computed as the ratio between the enrollment in the lower/upper secondary education and the number of schools in the lower/upper secondary education in the county;

- student/teacher ratio computed as the ratio between the enrollment in the lower/upper secondary education and the number of teachers in the lower/upper secondary education the county;

- the share of qualified teachers in the lower/upper secondary education;

- the share of full time teachers in the lower/upper secondary education;

- the class size;

- the number of gyms, labs and workshops in schools

- time dummies.

For the upper secondary education two additional variables are included:

- the share of students enrolled in theoretical high schools
- the share of students enrolled in technological high schools;

The summary statistics of the above indicators are presented in **Table 5 and Table 6**. The most notable feature of these indicators is the stability of the differences across counties, during the analyzed period. This stability indicates the lack of important structural changes in the secondary education, both lower and upper level during 1999-2002. The results of the estimation are presented in **Table 7 and Table 8.**

4.4 Basic results

The explanatory power of estimators included in the production function of the test score differences across counties varies upon the cohort age, type of area and gender. The explanatory power of estimators is much higher for younger cohort (lower secondary

level graduates), for boy graduates and for rural graduates. Within urban graduates the explanatory power of estimators is larger for boys than for girls, while within rural graduates is larger for girls than boys. We group the estimation results into four categories: teacher effects, class size effects, scale effects and organizational effects.

4.4.1 Teacher effect

Teacher effect is proxied by several variables like the student-teacher ratio, the share of qualified teachers, and the share of full time teachers. The student-teacher-ratio has negative and significant effect on lower and upper level day secondary graduates' test score at country level, on lower level secondary boy graduates in urban area and lower level secondary girl graduates from rural area. The student-teacher ratio declined during the analyzed period from 13 to 10 in urban area and from 10 to 7 in rural area.

The share of qualified teachers increased over the period, but the large differences between rural and urban area remained. While the average share of qualified teachers in urban area is of 88%, the average share of qualified teachers in rural area is only 70%. The share of qualified teachers has large positive effects for all test score at each level of graduation. The largest effect however, they have on the results of boy graduates from rural area.

The share of full time teachers has negative and significant effect at country level for lower secondary education graduates and in urban area. The full time teacher has a full

load of 18 hours per week. The part time teachers are those with half of the full load. It can happen that a teacher in order to complete his load accepts teaching many subjects at the expense of the quality of teaching. The share of full time teacher is higher in urban area than in rural area. It is the same for upper and lower level of secondary education.

4.4.2 Class size effect

The class size of lower level secondary education declined in urban area from 23 in 1998 to 20 in 2002 and remained unchanged in rural area around 11 and in the upper level secondary education at around 22. There is no class size effect on the test scores either at lower or upper level of secondary graduates. The lack of support for the importance of class size could simply reflect the fact that

4.4.3 School size effect

The size of schools differs according to area and the level of secondary school. The largest schools with declining size though are in upper level of secondary education. The average size is of 500 students. In the lower level of secondary education the average school size is of 150 students. The schools from urban areas are larger with around 350 students, then the school from rural areas with only 90 students on average. Large schools have positive and significant effect in on test scores of graduates in urban area as well as on the test scores of girl graduates from rural area. Thus the fact that school size tends to be positively related to performance is not simply a reflection of schools in isolated or rural areas. With the current negative population growth we can expect further decline of

school population and of school size. Therefore an effective policy for raising the test scores could be merging small schools into big units.

4.4.4 Organizational effect

Schools have various endowments regarding gyms, labs and workshop. Schools from upper level education are the best equipped. The number of workshops per school has a negative and significant effect on lower level secondary graduates' test score in urban areas; on lower level secondary education boy graduates from rural area and on upper level secondary evening class graduates. The number of laboratories per school has a negative and significant effect on the lower level secondary education graduates' test score and a positive significant effect on the upper level secondary graduates. The number of gyms has negative and significant effect on lower level secondary graduates' test scores from urban areas both girls and boys and on upper level secondary graduates.

4.4.5 Family effect

The family effect was proxied by the share of county wage in average country wage. The wealth effect is negative and significant on lower level secondary girl graduates' test scores.

4.4.6 Peer effect

The peer effect might be present in the case of schools from upper secondary level. The schools with higher entry score might be considered better schools and therefore might be chosen by students with higher tests scores, and therefore they might obtain higher degree

at the graduation. This fame effect has positive and significant effect on graduates' test score from evening classes.

5. Conclusions

The output quality-resource relationship in Romanian secondary education is manifested through the number and quality of teachers. While the causality in the lower secondary education is more likely to be from resources to outcome, in the upper secondary education the causality could be either way, since the selectivity of enrolment might induce selectivity of teachers.

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Table 1: The school network in Romania (units)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total	28303	28951	29129	29376	29327	29536	29815	29084	29409	27633	24481	24304	23679
Primary + secondary lower level	13511	13985	13920	13945	13963	13985	13978	13847	13795	13154	12708	12627	12456
High schools	1198	1209	1238	1277	1276	1284	1295	1309	1315	1340	1367	1379	1388
Share of secondary schools in total (%)													
Lower level	47,7	48,3	47,7	47,5	47,6	47,3	46,8	47,6	46,9	47,6	51,9	51,9	52,6
Upper level	6,7	6,6	6,7	6,8	6,9	6,9	7,0	7,2	7,2	5,2	5,9	6,0	5,8

Notes: The figures include private schools for high schools from 1991, for vocational and post high schools from 1992 and for primary and secondary schools from 2000.

Source: Romanian Statistical Yearbook, 1991-2003

Table 2: Students enrollment in secondary education (thousands persons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Lower secondary	1465	1416	1359	1282	1181	1150	1141	1187	1272	1309	1321	1291	1207
Upper secondary	1361	1154	1048	1023	1046	1073	1055	1013	945,6	916,6	927,5	963,0	1011
Of which													
High school	995,7	778,4	714,0	722,4	757,7	787,2	792,8	765,9	718,0	694,4	687,9	710,7	740.4
Vocational	297,7	272,8	243,5	220,8	209,9	212,8	203,2	193,6	180,9	166,7	177,4	192,0	217,4
Apprenticeship	68,1	102,5	90,2	79,7	78,8	72,7	58,9	53,6	46,7	55,5	62,1	60,3	52,8

Source: Romanian Statistical Yearbook, 1991-2003

Table 3: Teaching staff in secondary education (thousands)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Lower secondary	103,5	109,1	103,9	103,1	103,2	102,6	103,6	102,4	104,4	102,3	102,3	105,9	97,6
Upper secondary	55,9	60,3	63,4	65,7	67,9	70,3	72,1	71,5	72,9	71,1	68,9	70,3	67
Of which in:													
High schools	51,7	55,0	58,2	59,5	60,5	62,4	64,5	63,7	66,1	67,2	64,0	64,7	61
Vocational schools	3,6	4,0	3,7	5,0	5,8	6,4	6,5	7,0	6,1	3,6	4,7	4,9	6
Apprenticeship schools	0,6	1,3	1,5	1,2	1,5	1,4	1,1	0,8	0,6	0,3	0,2	0,6	0,6

Note: Teaching staff includes the number of persons registered in the Staff Lists of the schools. Each teacher is registered once (at the unit where he has his pass). Foremen instructors who carry out training and vocational activity within the educational system are also included.

Source: Romanian Statistical Yearbook, 1991-2003

Table 4: Romania's performance in international student assessment programs

	PISA 2000			TIMSS 1999		PIRLS 2001
	Reading	Mathematics	Science	Mathematics	Science	Reading
Romania	428	426	441	472	472	512
CZ	492	498	511	520	539	537
Hungary	480	488	496	532	552	543
Poland	479	470	483			
Bulgaria				511	518	530
EU average*	498,4	493,9	493,6	518,6	529,2	542,4

* Slightly different countries participating.

Source: PISA 2000, TIMSS 1999, PIRLS 2001

Table 5: Summary statistics for the main school inputs and outputs in lower level of secondary school, by counties

	1998/1999			1999/2000			2000/2001			2001/2002			2002/2003		
Student-teacher ratio															
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Average	12.2	10.5	13	8.35	7.1	9.8	8.3	7.4	10	8.6	7.3	9.6	8.37	7.4	9.7
Min	9.4	7.4	9.4	6.41	5	7.9	6.4	5.7	7.9	6.7	5.6	7.8	6.61	5.6	7.6
Max	24	21.4	16	11.8	9.3	18.4	11.8	9.9	12.2	11.3	10.4	11.5	11.5	10	17.4
Coefficient of variation	0.19	0.21	0.12	0.13	0.13	0.17	0.13	0.13	0.1	0.11	0.14	0.09	0.12	0.13	0.15
Student-school ratio															
Average	157	83	395	157	88	391	163	93	396	161	95	378	152	93	354
Min	106	52	251	109	56	250	109	60	255	108	62	241	107	62	216
Max	579	119	579	420	131	530	569	139	569	535	144	535	387	135	770
Coefficient of variation	0.47	0.18	0.18	0.33	0.19	0.17	0.44	0.2	0.18	0.42	0.21	0.18	0.31	0.19	0.24
Student-class ratio															
Average	15.4	10.8	23	15.8	11.4	22.8	15.7	11.7	22.7	15.3	11.7	21.6	14.3	11.1	20
Min	10.2	7.2	13.8	10.6	7.7	13.7	10.7	7.2	13.5	10.5	8	13.1	9.7	7.7	12.4
Max	28.6	15.4	32.9	32.1	16.4	33.5	26.4	17.1	37.1	25.2	18	37.3	26	15.8	37.2
Coefficient of variation	0.22	0.21	0.22	0.25	0.2	0.22	0.22	0.22	0.25	0.21	0.22	0.5	0.21	0.21	0.27
Share of qualified teachers															
Mean	0.8	0.68	0.84	0.79	0.72	0.87	0.79	0.72	0.87	0.79	0.71	0.87	0.79	0.71	0.88
Min	0.6	0.44	0.68	0.46	0.47	0.41	0.64	0.53	0.68	0.61	0.55	0.45	0.61	0.55	0.68
Max	0.9	0.8	0.92	0.89	0.85	0.95	0.93	0.84	0.97	0.98	0.81	0.99	0.98	0.81	0.99
Coefficient of variation	0.11	0.18	0.06	0.1	0.19	0.1	0.08	0.1	0.08	0.09	0.09	0.12	0.09	0.09	0.09
Share of full time teachers															
Mean	0.88	0.86	0.84	0.89	0.9	0.87	0.89	0.88	0.89	0.88	0.86	0.9	0.88	0.86	0.9
Min	0.78	0.73	0.74	0.46	0.49	0.39	0.8	0.74	0.84	0.77	0.73	0.8	0.72	0.73	0.79
Max	0.99	0.97	0.93	0.97	0.98	0.96	0.95	0.97	0.97	0.99	0.97	1	0.99	0.97	1
Coefficient of variation	0.05	0.06	0.05	0.09	0.1	0.1	0.04	0.06	0.04	0.05	0.07	0.05	0.06	0.07	0.05
Gyms-school ratio															
Mean	0.4	0.31	0.69	0.39	0.31	0.69	0.38	0.32	0.66	0.4	0.33	0.66	0.4	0.33	0.67
Min	0.07	0.04	0.25	0.07	0.04	0.25	0.06	0.04	0.04	0.06	0.04	0.04	0.07	0.04	0.04

Max	0.67	0.59	1.03	0.67	0.6	1.03	0.7	0.6	1.06	0.75	0.64	1.06	0.78	0.64	1.06
Coefficient of variation	0.33	0.43	0.24	0.32	0.43	0.23	0.27	0.42	0.39	0.37	0.43	0.38	0.34	0.42	0.38
Labs-school ratio															
Mean	1.03	0.79	1.8	1.01	0.8	1.81	1	0.81	1.64	1.02	0.83	1.64	1.02	0.85	1.64
Min	0.55	0.38	1.2	0.55	0.38	1.16	0.52	0.39	0.14	0.52	0.39	0.14	0.5	0.42	0.16
Max	2.46	1.22	2.55	1.5	1.24	2.48	2.63	1.27	2.93	2.48	1.32	2.9	1.73	1.35	2.76
Coefficient of variation	0.3	0.26	0.18	0.24	0.26	0.17	0.35	0.26	0.3	0.32	0.27	0.32	0.25	0.27	0.31
Workshop-school ratio															
Mean	0.42	0.18	1.18	0.41	0.18	1.17	0.38	0.19	1.03	0.34	0.19	1.04	0.39	0.2	1.04
Min	0.21	0.01	0.56	0.21	0.01	0.52	0.15	0.01	0.41	0.16	0.02	0.4	0.17	0.02	0.41
Max	1.45	0.39	2.24	0.94	0.39	1.91	1.16	0.39	1.58	0.14	0.42	1.58	0.8	0.42	1.62
Coefficient of variation	0.49	0.5	0.27	0.36	0.5	0.24	0.43	0.49	0.28	0.42	0.5	0.27	0.33	0.5	0.29

Source: Romanian Statistical Yearbook, 1997-2003

Table 6: Summary statistics for the main school inputs and outputs in upper level of secondary school, by county

	1998/1999	1999/2000	2000/2001	2001/2002
Student-teacher ratio				
Average	10.5	10.4	10.8	11
Minimum	7.4	6.6	6.5	7.8
Maximum	13.5	14.2	14.6	14.5
Coefficient of variation	0.14	0.15	0.15	0.13
Students-school ratio(enrollment)				
Average	532	496	483	497
Minimum	340	294	306	318
Maximum	717	746	732	724
Coefficient of variation	0.16	0.18	0.18	0.18
Students-class ratio				
Average	22.4	21.7	21.2	21.5
Minimum	11.4	11.3	11.2	12.4
Maximum	31.8	30.8	28.8	28.5
Coefficient of variation	0.18	0.18	0.17	0.18
Share of theoretical enrolment				
Average	0.4	0.48	0.48	0.47
Minimum	0.31	0.4	0.37	0.35
Maximum	0.5	0.59	0.59	0.57
Coefficient of variation	0.11	0.09	0.1	0.1
Share of technological enrolment				
Average	0.51	0.44	0.44	0.44
Minimum	0.39	0.31	0.35	0.36
Maximum	0.61	0.55	0.54	0.55
Coefficient of variation	0.1	0.12	0.11	0.12
Share of qualified teachers				
Average	0.9	0.9	0.9	0.9
Minimum	0.55	0.55	0.7	0.6
Maximum	0.99	0.99	0.98	0.98
Coefficient of variation	0.08	0.08	0.06	0.08
Share of full time teachers				
Average	0.9	0.89	0.8	0.88
Minimum	0.79	0.79	0.66	0.81
Maximum	0.97	0.97	0.91	0.96
Coefficient of variation	0.04	0.04	0.05	0.04
Share of county wage in total wage				
Average	0.96	0.95	0.95	0.95
Minimum	0.79	0.77	0.78	0.8
Maximum	1.24	1.36	1.29	1.3
Coefficient of variation	0.1	0.13	0.13	0.14
Gyms-school ratio				
Average	0.89	0.88	0.89	0.85

Minimum	0.4	0.42	0.37	0.42
Maximum	1.35	1.21	1.26	1.22
Coefficient of variation	0.2	0.2	0.19	0.19
Labs-school ratio				
Average	4.35	4.26	4.45	4.49
Minimum	2.93	2.62	2.9	3
Maximum	6.5	6.5	6.8	7.56
Coefficient of variation	0.16	0.17	0.18	0.2
Workshops –school ratio				
Average	3.77	3.69	3.61	3.53
Minimum	2.55	2.54	1.93	2.15
Maximum	6	5.71	4.86	4.78
Coefficient of variation	0.19	0.19	0.21	0.18

Source: Romanian Statistical Yearbook, 1997-2003

Table 7: DETERMINANTS OF LOWER SECONDARY SCHOOL PERFORMANCE (dependent variable test scores)

Independent variables	Lower secondary		Urban area						Rural area					
			Total		Girls		Boys[1]		Total		Boys		Girls	
	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics
Enrolment per schools	0.0005	1.19	0.0007	1.88	0.0002	1.06	0.0003	1.65	-0.0006	-0.31	0.0015	1.0	**0.003**	**2.09***
Student-teacher ratio	-0.038	-2.26*	**-0.04**	**-1.84**	-0.02	-1.3	**-0.04**	**-3.65***	0.019	0.76	-0.02	-1.05	**-0.058**	**-2.08***
Share of qualified teachers	**0.83**	**4.78***	**0.71**	**2.47***	**0.61**	**4.09***	**0.65**	**5.81***	**1.04**	**5.62***	**1.06**	**6.04***	**0.94**	**4.63***
Share of full time teachers	**-0.4**	**-2.01***	**-0.93**	**-2.46***	-0.06	-0.24	-0.04	-0.19	-0.32	-1.42	-0.0028	-0.01	0.1	0.05
Class size	0.007	0.98	0.0001	0.019	0.0006	0.21	0.0018	0.7	-0.0001	-0.008	-0.0055	-0.53	-0.007	-0.68
Workshop-school ratio	-0.06	-0.5	**-0.2**	**-2.63***	-0.02	-0.005	-0.006	-0.16	-0.11	-0.73	**-0.24**	**-2.12***	-0.0003	-0.0029
Labs-schools ratio	0.04	0.68	0.04	0.83	0.025	1.06	0.033	1.78	-0.11	-1.35	**-0.13**	**-2.16****	**-0.13**	**-2.13***
Gyms-school ratio	**-0.22**	**-2.19***	0.12	1.16	**0.098**	**1.95**	**0.11**	**3.61***	-0.16	-1.07	-0.04	-0.36	-0.2	-1.65
County wage-total wage ratio	-0.15	-1.1	0.005	0.026	**-0.21**	**-1.97**	-0.06	0.64	-0.08	-0.53	-0.04	-0.37	0.02	0.15
Year dummies	Yes		Yes		yes		yes		Yes		Yes		yes	
Region fixed effects	NO		NO		NO		No		NO		NO		Yes	
Region random effects	Yes		yes		yes		No		Yes		Yes		no	
Constant	7.66	30.5*	8.2	19.46*	7.37	23.8*	7.29	27.1*	7.04	24.29*	6.7	22.8*	7.49	62.2*
R^2 (within)	0.37		0.15		0.17		0.54		0.19		0.52		0.54	
R^2 (between)	0.98		0.93		0.61		0.89		0.96		0.55		0.7	
R^2 (Overall)	0.88		0.65		0.36		0.72		0.88		0.45		0.58	
Hausmann test (p-value)	18.09(0.15)		2.64 (0.9978)		3.59(0.98)		23.4 (0.0093)		9.37(0.7444)		14.42 (0.21)		9.51 (0.57)	
Number of observation, period covered	205, 1999-2003		205, 1999-2003		120, 2001-2003		120, 2001-2003		200, 1999-2003		120, 2001-2003		120, 2001-2003	

Notes .The dependant variables are the test scores registered by all participants in exams whether successful or not. Coefficients on year dummies are not reported. The estimates are panel estimates. The significant coefficients at 5% significance level are indicated by an * in the column of t-statistics.[1]OLS heteroscedastic consistent estimates.

Table 8: DETERMINANTS OF UPPER SECONDARY SCHOOL PERFORMANCE
(dependent variable test scores)

Independent variables	Day class		Evening class	
	coefficient	t-statistics	coefficient	t-statistics
Enrolment per schools	-0.0014	-1.02	-0.0014	-1.16
Share of enrolment in technological schools	-4.92	-1.46	**-7.71**	**-2.72***
Share of enrolment in theoretical schools	-2.04	-0.6	**-5.03**	**-2.02***
Student-teacher ratio	**-0.12**	**-2***	-0.07	-1.76
Share of qualified teachers	0.6	0.58	0.23	0.29
Share of full time teachers	-1.7	-0.92	-2.33	-1.39
Workshop-school ratio	-0.19	-1.85	**-0.23**	**-2.54**
Labs-school ratio	**0.53**	**4.08***	**0.58**	**5.33***
Gyms-school ratio	**-1.13**	**-2.37***	**-0.93**	**-2.35***
Class size	0.06	1.59	0.05	1.56
Entry score	0.51	1.06	**0.68**	**1.92**
County wage-country wage ratio	-1.3	-1.63	-0.37	-0.58
Year dummies	Yes		Yes	
Region fixed effects	NO		NO	
Region random effects	Yes		Yes	
Constant	6.95	1.42	**7.58**	**1.96**
R^2 (within)		0.2		0.48
R^2 (between)		0.35		0.21
R^2 (Overall)		0.19		0.84
Hausman test (p-value)		8.16 (0.917)		2.52 (0.999)
Observations, covered period		*160, 1999-2002*		*168, 1999-2002*

Notes: The significant coefficients at 5% significance level are indicated by * in the column of t-statistics.