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Organisation and Efficiency of Education Systems: some empirical findings

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ABSTRACT :

Using a sample of countries chosen for their similar level of development, this article shows the extent to which the organisation of primary and secondary education differs from one country to another, notably with respect to the way in which systems differentiate and select pupils for specialised curricula. It also explores the question of whether an education system that sorts pupils at a very early age is more cost-effective than a system that does not sort pupils during compulsory education. The stylised description of national education systems is based on various sources of information. The data used in the cost analysis come from the Organisation for Economic Cooperation and Development (OECD) and the United Nations Educational, Scientific, and Cultural Organisation (UNESCO). Due to data limitations, the analysis of system performance is based on student achievement only in mathematics and science. The data are drawn from the Third International Mathematics and Science Study (TIMSS) conducted in 1994-1995 by the International Association for the Evaluation of Educational Achievement (IEA).

Introduction

Numerous studies have examined the quantitative aspects of national education systems and synthesised their relative positions with respect to conventional statistical indicators (see, for example, Wolhuter, 1997). In this article, we follow a different approach because we are more interested in the qualitative dimensions of education systems and the effect that the organisation of systems has on the cost and quality of schooling.

Indeed, the structure of education systems differs widely across countries. The duration of basic, secondary, and post-secondary education varies from one country to another. At each level of education, schooling systems are more or less diversified. Furthermore, there are differences in the way and the age at which they sort and select students into separate schools or separate curricula.

The key question of this article is the extent to which one kind of organisation is more efficient than another. In order to try to answer this question, we describe the education systems of 29 countries with a similar level of development [1]. Our analysis is restricted to primary and secondary education, because it is still difficult to describe in detail the structure of higher education in a great number of countries. After examining the education systems of these countries, which can be divided into two broad categories, we compare their costs and their performance measured through student achievement in mathematics and science.

The Organisation of Education Systems

Table 1 shows some of the characteristics of primary and secondary education systems in the sample of countries considered. The data come from various sources (Organisation for Economic

Co-operation and Development (OECD), 1996; Postelthwaite, 1995; the European Commission, 1996). The information refers to the most recent year for which the organisation of the education system in each country is known. The structure of schooling systems is described using the criteria of the International Standard Classification of Education (ISCED). ISCED is designed to be universally valid and invariant to the particular circumstances of a national education system. However, using this system of classification to describe the organisation of education systems at an international level may introduce some biases, as the countries may classify differently a similar type of diploma. Yet, in our case the bias is probably small because we focus only on primary and secondary education. At each level of education, the number of streams shows the number of choices available for pupils. This number does not take into account options that pupils can follow within a stream; in fact in many countries, the number of streams corresponds to the number of institutions that pupils may attend during their schooling. Of course, this number underestimates the degree of diversity in education; the bias is probably even greater for second-cycle secondary education than for first-cycle secondary education. The age of entry into a level of education does not necessarily mean that pupils can choose the different streams that are available for that level at that age; in fact, in some countries the choice at level 2, for example, is made after a student enters the level. Finally, in Table 1, as in what follows, special needs education is not taken into account. The data show that during the last three decades, compulsory schooling lengthened, sometimes markedly. In fact, while on average the duration of compulsory education grew by about 1 year, in some countries it increased by 3-5 years. No countries lag behind, and indeed countries are in a much more similar situation today than they were 30 years ago. However, considerable differences persist in the organisation of their education systems.

TABLE I. Characteristics of education systems

	Mean	Minimum	Maximum
Duration of compulsory education			
1960	8.04	4.00	10.00
1995	9.24	8.00	11.00
Duration of common curriculum			
	7.00	4.00	10.00
Primary (ISCED1)			
Age of entry	6.17	5.00	7.00
Duration	5.61	4.00	8.00
Lower secondary (ISCED2)			
Age of entry	11.24	10.00	13.00
Duration	3.22	2.00	6.00
Upper secondary (ISCED3)			
General			
Age of entry	15.07	13.00	16.00
Duration	3.24	2.00	5.00
Number of streams	1.76	1.00	7.00
Vocational			
Age of entry	15.27	13.00	18.00
Duration	3.16	1.00	7.00
Number of streams	2.15	1.00	5.00

The 9 years that pupils spend on average in compulsory education are structured in very different ways. Primary education, which most students enter at the age of 6 years, lasts about 6 years in most countries, but only 4 years in some countries and in others 8 years.

The differences observed at the primary level explain some of the differences that exist in the structure of lower secondary education between countries. Generally, the longer the primary education, the shorter the first level of secondary education, but the correlation between the duration of both stages is far from being complete [2].

On average, lower secondary education lasts 3 years, but it lasts for only 2 years in some countries and 6 years in others. At this stage of education, the number of educational programmes that pupils may attend varies widely between countries. Whereas in about half the countries pupils all follow the same curriculum, in the other half pupils are sorted and differentiated very early in different streams. In these countries, pupils may choose between two and four general streams; in a large number of countries pupils may also enter into technical or vocational education at the beginning of lower secondary education.

Entry into upper secondary education takes place generally at 15 years of age. This level is more diverse than the previous one; pupils can choose between one and seven general streams or between one and five technical streams. Countries that provide the most technical streams at this stage generally also have the most technical streams at level 2. On average, the second stage of general and vocational secondary education lasts 3 years. However, large differences exist between countries, with the duration of schooling varying from 2 to 5 years for general and from 1 to 7 years for vocational upper secondary education.

These first elements of comparison show that education systems are structured in very different ways and, in particular, that countries select their pupils for specialised courses at a more or less early age. To describe better these differences, we construct three indicators for each country. The first, I_1 , is computed by dividing the duration of the common-core syllabus [3] by the total duration of compulsory education; the lower the value of I_1 , the lower the duration of the common-core curriculum in proportion to the duration of all compulsory education. I_2 and I_3 relate the minimum theoretical age at which pupils can be sorted into general or vocational streams (of level 2 or 3) compared with the theoretical age at which they can exit from compulsory education. When I_1 and I_2 are equal to 1, the systems do not differentiate pupils during compulsory education, but they do differentiate them during post-compulsory education, in which case, $I_1 = I_2 \leq I_3$

From these results, it appears that in almost half the systems, compulsory education is organised on the basis of a common-core curriculum from the time of entry into primary education to the end of compulsory education [4]. In these so-called non-differentiated systems, pupils spend on average 6 years in primary education and 3-5 years in secondary education (Table II). Specialisation in general or technical streams only occurs at the end of compulsory education. At that moment, pupils may choose between one and three general streams and between one and four vocational streams; these studies at level 3 last between 1 and 5 years. The fact that pupils cannot enter vocational education until the end of their compulsory education may explain why demand for vocational education is comparatively weaker in non-differentiated systems than in differentiated ones [5]. The absence of selection into the different streams of the upper level of secondary education (see Organisation and Performance of the Systems, below) implies that pupils have less incentive to enrol in vocational and technical education, which have lower rates of return in the labour market.

In differentiated systems [6], the period of compulsory education is longer on average (9.6 years compared with 8.8 years). Pupils follow a common-core curriculum lasting between 50 and 60% of the total duration of their compulsory education. At the end of these 5 years of common-core curriculum, pupils enter secondary education. Here they are sorted into three general streams. With a few exceptions, pupils are enrolled in technical education before the end of their compulsory education. Most often, pupils enter lower secondary vocational education at around 12 years of age, after taking 1-2 years of general education at this level, but in certain countries, pupils can enter

vocational education at the same age as general education level 2. In more than half these countries, pupils leave compulsory education with training at level 3; general and vocational education are more diversified at this level in differentiated than in non-differentiated systems (Table II).

TABLE II. Organisation of systems according to the relative share of the common-core curriculum

	Mean	Minimum	Maximum
<i>Non-differentiated system ($I_1 = 1$)</i>			
Duration of compulsory education	8.85	8.00	10.00
Duration of common-core curriculum	8.85	8.00	10.00
Primary (ISCED1)			
Age of entry	6.38	6.00	7.00
Duration	5.84	4.00	8.00
Lower secondary (ISCED2)			
Age of entry	12.00	10.00	13.00
Duration	3.29	3.00	5.00
Upper secondary (ISCED3)			
General			
Age of entry	12.00	10.00	13.00
Duration	3.14	2.00	4.50
Number of streams	1.76	1.00	3.00
Vocational			
Age of entry	15.76	14.00	18.00
Duration	2.69	1.00	4.20
Number of streams	2.15	1.00	4.00
I_2	1.00	1.00	1.00
I_3	1.02	1.00	1.13
<i>Differentiated systems ($I_1 < 1$)</i>			
Duration of compulsory education	9.56	8.00	12.00
Duration of common-core curriculum	5.50	4.00	7.00
Primary (ISCED1)			
Age of entry	6.00	5.00	7.00
Duration	5.43	4.00	6.00
Lower secondary (ISCED2)			
General			
Age of entry	11.38	10.00	13.00
Duration	5.44	4.00	6.00
Number of streams	3.19	1.00	8.00
Vocational			
Age of entry	12.06	11.00	13.50
Duration	2.88	1.50	4.00
Number of streams	1.00	0.00	3.00
Upper secondary (ISCED3)			
General			
Age of entry	15.00	13.00	16.00
Duration	3.33	1.50	5.00
Number of streams	2.38	1.00	7.00
Vocational			
Age of entry	15.13	13.00	18.00
Duration	3.55	2.30	5.80
Number of streams	3.06	1.00	5.00
I_2	0.74	0.63	0.87
I_3	0.87	0.67	1.13

I_1 = duration of common-core curriculum/duration of compulsory education;
 I_2 = theoretical minimal age of entry into a general stream/theoretical age of exit from compulsory education; I_3 = theoretical minimal age of entry into a technical stream/theoretical age of exit from compulsory education.

TABLE III. Unit costs as a percentage of gross domestic product (GDP) per capita in public and private secondary education

	Mean	Coefficient of variation	Minimum	Maximum
Non-differentiated systems ($I_1 = 1$)	25.97	21.6	17.4	33.6
Differentiated systems ($I_1 < 1$)	25.58	23.9	10.5	35.1
All systems	25.75	22.4	10.5	35.1

Source: OECD (1996).

Organisation and the Cost of Systems

Many studies have attempted to explain the differences in educational costs between countries (see, for example, Schultz, 1988; Ram, 1995). In these studies, the organisation of the education system is not considered a major element of educational expenditure. However, given that education systems are structured in very different ways, the question is whether, all things being equal, one type of organisation is, on average, more expensive than another.

To answer this question, we compare the expenditure per pupil in secondary education in our sample of countries. In order to take into account the differences in prices of the factors that enter into the production of education, unitary expenditure is expressed as a percentage of gross domestic product (GDP) per capita. The cost data are taken from OECD (1996); they refer to 1993 and cover both public and private educational institutions. From these data, it appears that unit costs are, on average, very similar in both types of systems; they represent nearly 26% of GDP per capita (Table III). However, differences between countries are large, mainly among those with a differentiated education system.

In order to shed more light on the differences, Figure 1 shows the relationship between unit costs and the degree of differentiation of systems as measured by the I_1 index. As we can see, some of the non-differentiated systems have very high expenditure per pupil (Denmark, Switzerland, Finland), while others have relatively low unit costs (Greece, Portugal, Japan). In non-differentiated systems, unit costs are twice as high in some countries as in others. In differentiated systems, they can be three times as high, and it is clear that the more differentiation, the higher the unit costs.

These cost differences are due not only to the way schooling systems are organised but also to the technical characteristics of the process of education and probably also to the way schooling systems are managed. To illustrate the analysis on these points, we regress the unit cost of education, expressed as a percentage of GDP per capita, on the degree of differentiation of the systems (I_1 index), their pupil/teacher ratio, and their degree of decentralisation, approximated by the share of public expenditures on education financed by the central administration (Table IV). The data are taken from OECD (1996). According to these data, the share of funding by central administration is 51% on average. However, differentiated systems seem, on average, to be more centralised than the others: in the former, 56% of funding is by the central administration compared with 47% in the latter. The pupil/teacher ratio in secondary education is on average 14, but it is slightly larger in differentiated systems (14.8) than in non-differentiated systems (13.0).

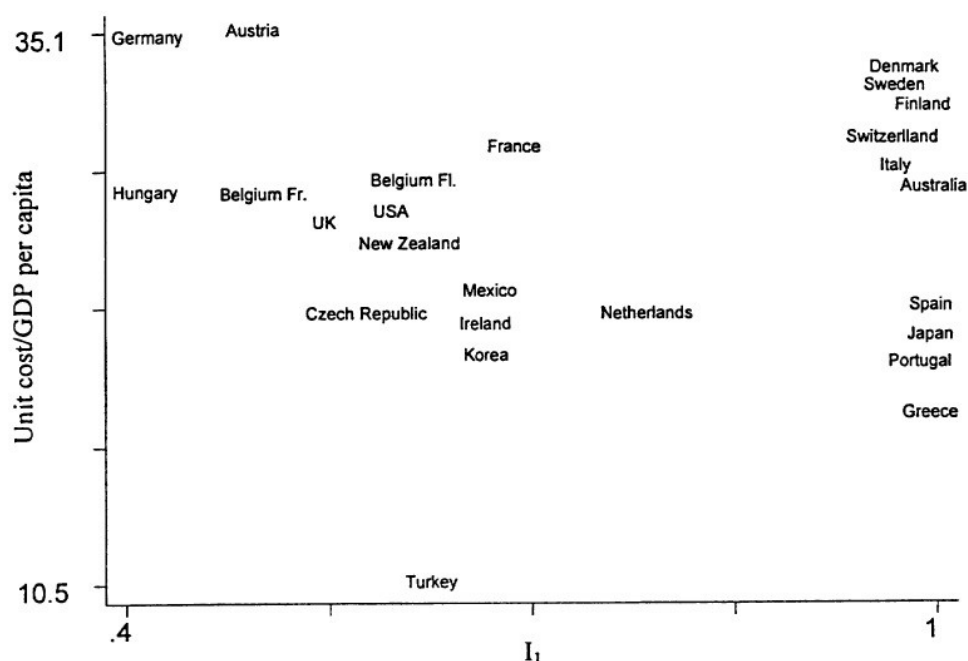


FIG. 1. Relationship between unit costs and the degree of differentiation of systems.

As far as the management of education systems is concerned, Table IV shows that centralised systems have lower expenditure per pupil than decentralised systems. It seems that, other things being equal, management on a regional or local level gives rise to high administrative costs, which may reduce the share of funds allocated to teaching expenditures. This is true of both differentiated and non-differentiated systems.

In addition, organising the curricula according to a common-core curriculum is significantly less expensive than differentiating pupils into streams. Indeed, all else remaining the same, differentiated systems, because of their greater diversity, are capable of fewer economics of scale. However, because the results do not take into account the performance of the systems, it is difficult to say whether non-differentiated systems are underfinanced and are less efficient than the others or whether, in fact, they operate more efficiently.

TABLE IV. Adjustment of unit costs of education systems

	Coefficient	<i>t</i>
Constant	48.242	9.81
I_1	- 7.747	2.26
Pupil/teacher ratio	- 1.008	4.39
Degree of centralisation	- 0.056	2.52
R^2	0.711	—

Results corrected for heteroscedasticity by the Hubber method.

Organisation and Performance of the Systems

For the last 10 or so years, numerous studies have tried to analyse the academic achievements of pupils (see, for example, Hanushek, 1986). Although there is no theoretical framework that defines precisely all the significant variables in the process of education, these empirical studies generally recognise the influence of at least three factors: the personal characteristics of pupils, including their level of performance in the previous grades, their social characteristics, and the environment in which learning takes place (characteristics of the school, qualifications of teachers, pupil/teacher ratio, teaching equipment, teaching methods, and so forth).

Most of these studies analyse the influence of these factors for one given type of organisation of education system, because they deal with only one country. Although these factors play a role at the international level, it is clear that the differences observed in the pupils' performance can also be explained by the organisation of the education system. For example, differences in performance at the international level can be explained by the duration of primary and secondary education, the timing of selection and specialisation of pupils into streams, the size of the private sector, or the level of decentralisation of the education system.

To estimate the effect that differentiation has on school performance, we analysed the results obtained in standardised mathematics and science tests by pupils in grade 7 and grade 8; that is, by pupils who are theoretically 13 and 14 years old. These results were obtained in 1994-1995 by the International Association for the Evaluation of Educational Achievement (IEA) in its Third International Mathematics and Science Study (TIMSS). Twenty-four countries are included in our analysis; among these, 12 have differentiated education systems (Austria, the Czech Republic, France, Germany, Hungary, Ireland, Korea, The Netherlands, New Zealand, Sweden, England and Wales, and USA), and 12 have non-differentiated education systems (Australia, Canada, Denmark, Greece, Iceland, Japan, Norway, Portugal, the Russian Federation, Scotland, Spain, Switzerland). Theoretically, when they took the tests, the pupils in differentiated systems had all completed the common-core syllabus and been sorted into several streams, while in non-differentiated systems, they all had completed the same curriculum.

On average, pupils in differentiated systems perform better than pupils in non-differentiated systems; for example, in grade 7, pupils in the first system achieved a score of 502, while the second achieved only 477 (Table V). However, these average test scores mask a large diversity (Figure 2). Some non-differentiated systems achieve relatively high results (Japan, Switzerland, the Russian Federation), while others may achieve very weak results (Portugal, Greece, Spain). Among differentiated schooling systems, the differences between countries are smaller; nevertheless, there is a 20% gap in the scores between countries with the best and the worst performances.

Assuming that the distribution of abilities is homogeneous over all countries, the observed differences may be explained by the internal characteristics of each kind of system. Due to lack of appropriate data, it is not possible to measure these characteristics precisely and fully. However, existing information makes it possible to determine the effect that certain aspects of the differentiation of systems have on school achievement, notably the selection practices, the pupil/teacher ratio, the instructional time, the size of the private sector, and the degree of centralisation of the system.

TABLE V. Mathematics tests scores by type of system

	Mean	Coefficient of variation	Minimum	Maximum
<i>Seventh year</i>				
Non-differentiated systems ($I_1 = 1$)	477	7.9	423	571
Differentiated systems ($I_1 < 1$)	502	5.9	472	577
All systems	489	7.4	423	577
<i>Eighth year</i>				
Non-differentiated systems ($I_1 = 1$)	514	7.2	454	605
Differentiated systems ($I_1 < 1$)	534	5.8	500	607
All systems	523	6.8	454	607

As far as selection procedures are concerned, systems that sort and differentiate pupils into streams appear to be more selective than others (Table VI). Indeed, in 75% of differentiated systems, pupils enter lower secondary school according to their academic performance, while in only 13% of non-differentiated systems do school results play a role. In the latter, however, parents are more often involved in the selection procedures, taking part in the process of selection in 13% of cases compared with only 5% in differentiated systems. In the second level of secondary education, the same criteria are generally applied in each type of system, but compared with the previous level of education, differentiated systems accord a larger place to parental choice. Due to these selection practices, repeating a grade and dropping out are quite rare in non-differentiated systems. However, in differentiated systems, repeating a grade and dropping out are more frequent, especially in the first level of secondary education, where the choices that affect most pupils' future are made (Table VI). If the mode of selection in differentiated systems results in higher test scores, these systems have a lower level of equity than non-differentiated ones. Indeed, as indicated in Table VI, the social characteristics of the pupils play a role in 62% of differentiated systems and 13% of non-differentiated systems insofar as selection processes are concerned in lower secondary education. In both types of system, the weight of social factors is more important in upper secondary education, but social factors once again play a greater role in differentiated systems.

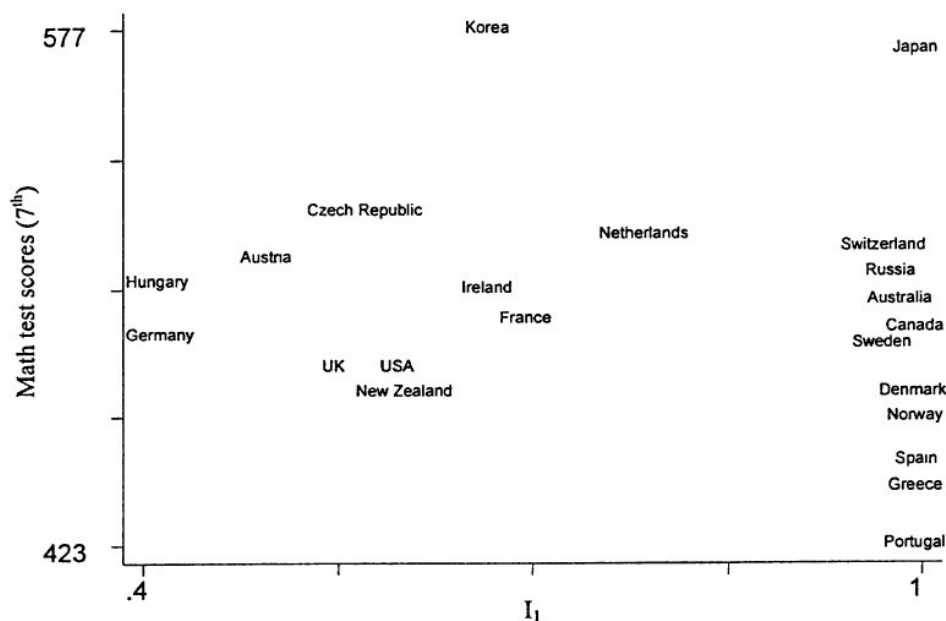


FIG. 2. Relationship between mathematics test scores and the degree of differentiation of the system.

TABLE VI. Breakdown of systems according to the type of selection of pupils and rates of repeating and dropping out (percentages)

	Non-differentiated system ($I_1 = 1$)	Differentiated system ($I_1 < 1$)
Type of selection		
<i>Lower secondary education</i>		
Based on results obtained in primary education	13	75
Based on the school's criteria	0	63
Based on parental choices	13	5
<i>Upper secondary education</i>		
Based on results obtained in lower secondary education	13	63
Based on school's criteria	13	75
Based on parental choices	63	63
Class repetition and drop out rates		
<i>Lower secondary education</i>		
Class repetition: never or almost never	75	43
Class repetition: sometimes or frequently	25	57
Drop out: never or almost never	50	66
Drop out: sometimes or frequently	50	34
<i>Upper secondary education</i>		
Class repetition: never or almost never	38	86
Class repetition: sometimes or frequently	62	14
Drop out: never or almost never	28	13
Drop out: sometimes or frequently	72	87
Role of social characteristics in the differentiation of pupils		
<i>Lower secondary education</i>		
Social characteristics play a role	13	62
Social characteristics play no role	87	38
<i>Upper secondary education</i>		
Social characteristics play a role	88	100
Social characteristics play no role	12	0

Source: Schooling, Training, and Transition Survey, conducted in 1997, which interviewed a group of international experts belonging to 16 countries.

Beyond these aspects, the two systems differ quite clearly in the instructional time that pupils receive annually in the different levels of education. Taking together the duration of compulsory education and the annual number of school hours in each level of studies, students receive on average 7515 hours of instruction in differentiated systems and only 7200 hours in non-differentiated systems [7]. The differences between the two systems are mainly at the first level of secondary education. At age 13 years, pupils from differentiated systems have received on average 20 more hours of education. However, between certain countries the difference can be as much as 240 hours a year.

It is generally assumed that the most efficient schools are those where school heads have autonomy in the hiring and assignment of teachers, teachers have autonomy in the choice of pedagogical practices, and all the relevant actors-heads, teachers, and students-face explicit incentives for good performance. Private schools usually have more autonomy in areas that matter for student achievement. If true, this may explain the better performance of differentiated systems. In fact, in differentiated systems 21% of primary pupils and 19% of secondary students are enrolled in private schools, whereas only 8 and 11%, respectively, are enrolled in private schools in non-differentiated systems [8].

Many empirical studies have shown that the pupil/teacher ratio has a significant impact on student performance. In this respect, there are considerable differences between education systems. Although on average there are 17 pupils per teacher in all countries, this ratio is much higher in differentiated systems than in non-differentiated systems (18 compared with 14) [9].

In order to show the extent to which the characteristics of the two systems affect pupils' achievement, in Table VII we regress the mathematics test scores in grades 7 and 8 on the following

variables: the differentiation index of systems, the pupil/teacher ratio, the instructional time from the first year of primary education up to the age when pupils took the tests, the percentage of pupils enrolled in the private sector, and the degree of decentralisation of systems, estimated on the basis of the share of central government funding. The test scores in the 7th and 8th grades are adjusted within the framework of a fixed-effect model. To take into account the correlation between the results obtained in each grade, the variance-covariance matrix is corrected for heteroscedasticity by clustering observations by country (see, for example, Greene, 1997). Given the availability of data, the estimation covers 14 countries, yielding 28 observations. Among these, seven countries have differentiated and seven have non-differentiated education systems; the countries belonging to each type of system have performance profiles similar to those described in Table V.

Differentiated systems obtain better results than non-differentiated systems, all things being equal. The effect of the structure of the system is far from negligible, because the timing of differentiation of pupils into streams explains about 15% of the difference in scores between pupils. The generally accepted idea that non-differentiated systems are the best way to maximise the production of knowledge is probably false. Apparently, their only advantage is to reduce social inequalities at an early age. However, this advantage may only be apparent, because even if they do reduce inequalities of access to education, they do not compensate for social inequalities that occur within the process of education itself.

The results in Table VII also show that the pupil/teacher ratio has a negative impact on pupils' scores. This result is similar to those obtained by other studies (see, for example, Hanushek, 1986). The total number of school hours, which differs widely across countries, has no significant effect on achievement in mathematics. In fact, according to regression results, the instructional time in primary education explains the good performance of certain countries more than the instructional time in secondary education. These results probably confirm the importance of basic education and the need for pupils to acquire the basics of reading, writing, and arithmetic. Regarding the organisation of education systems, these results should encourage countries with a relatively short period of basic education to lengthen it slightly. Combined with an early differentiation of pupils in the first level of secondary education, such a measure could maximise student performance.

Furthermore, the regression results indicate that countries where private education is more widespread perform significantly better than countries where it is more limited. The result showing the private sector to be more efficient is similar to those found in other contexts with individual data (see, for example, Psacharopoulos, 1987; Jimenez et al., 1991). This finding should convince countries to reconsider policies that reduce the role of the private sector in the field of education. However, the empirical evidence based on our regressions is only preliminary, because we do not take into account the fact that pupils in the private sector have different characteristics from pupils in the public sector. In other words, we do not exclude the possibility of significant selectivity effects in the adjustment of student tests scores (see, for example, Heckman, 1979).

TABLE VII. Adjustment of mathematics test scores in grades 7 and 8

	Coefficient	<i>t</i>	Coefficient	<i>t</i>
Constant	569.315	9.11	620.496	14.81
I_1	- 83.024	2.66	- 187.817	2.17
Pupil/teacher ratio	- 5.438	2.05	- 5.633	3.08
Instructional time (up to 13 or 14 years of age)	0.009	0.73	n.a.	n.a.
Instructional time in primary level	—	—	0.012	1.52
Instructional time in secondary level (up to 13 or 14 years of age)	—	—	0.004	0.91
Size of private sector	0.609	2.06	0.796	3.68
Degree of centralisation	- 0.057	0.27	0.118	0.37
Adjusted R^2	0.392	—	0.452	—
F	10.82	—	18.76	—
Number of observations	28	—	28	—

Note: Fixed-effect model corrected for heteroscedasticity by clustering observations by country.

Finally, centrally managed education systems perform as well as decentralised ones. The idea that decentralised systems are more efficient from the point of view of student achievement seems erroneous. Decentralised organisation, which is becoming more common, combines two disadvantages: it is relatively expensive, and it is not as efficient as other organisations in relationship to student achievement.

Conclusions

In this article we used aggregate data to measure the degree of differentiation of schooling systems for a sample of countries chosen for their similar level of development. Obviously, comparative analysis in this field poses some problems. In particular, it is possible that the degree of differentiation on which the analysis is based somewhat underestimates the reality. Furthermore, owing to data limitations our results cover the scholastic achievement of pupils in one particular subject, when it is known that not all systems accord the same importance to the subject in question. Despite these problems, the analysis has clearly shown that primary and secondary education systems are structured very differently across countries. The age of entry into and duration of basic education vary from one country to another. However, much greater differences exist in secondary education. In some countries, pupils follow the same curriculum to the end of their compulsory education; in others, they are differentiated and sorted into different streams very early on. The particularities that appear in this respect have repercussions for the cost of systems. The analysis shows that, all things being equal, differentiated systems have significantly higher unit costs than non-differentiated ones. However, they also seem to be considerably more efficient, at least as far as learning mathematics is concerned. These results suggest that basic education should be slightly reinforced when it covers only a comparatively short period of time, because a good grasp of basic arithmetic, and undoubtedly also of reading, guarantees high achievement in secondary education and probably further on, given that educational attainment is clearly cumulative. Combining this with early selection of pupils into streams could markedly improve the internal efficiency of systems, at least in as far as student achievement in mathematics and science is concerned.

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NOTES

[1] The countries are Australia, Austria, Francophone Belgium, Flemish Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Mexico, The Netherlands, New Zealand, Norway, Poland, Portugal, the Russian Federation, Spain, Sweden, Switzerland, Turkey, the UK and the USA.

[2] The rank correlation coefficient between the duration of primary education and the duration of the first cycle of secondary education is 0.70.

[3] This number is calculated from the time that pupils enter primary education up to the age when a first choice is suggested to them.

[4] Australia, Canada, Denmark, Finland, Greece, Italy, Japan, Norway, Poland, Portugal, the Russian Federation, Spain, Sweden, and Switzerland.

[5] In non-differentiated systems 52% of secondary pupils are in vocational education compared with 56% in differentiated systems (1992 data).

[6] Austria, Francophone Belgium, Flemish Belgium, the Czech Republic, France, Germany, Hungary, Ireland, Korea, Mexico, The Netherlands, New Zealand, Turkey, the UK and the USA.

[7] Calculated on the basis of International Bureau of Education (1997), OECD (1996) and UNESCO (1996). Of course, these estimates only have a relative value, because they are based on the hours of study observed in specific years of each cycle of schooling, and obviously there is no evidence that teaching time is identical in the different years of study that make up the same cycle of education.

[8] Percentages calculated on the basis of UNESCO (1996).

[9] Calculated on the basis of OECD (1996).

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