DO ITALIAN STUDENTS PERFORM WORSE THAN THEIR OECD FELLOWS? A DECOMPOSITION ANALYSIS OF EDUCATIONAL GAPS

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Abstract*. The paper aims at comparing Italy with four OECD countries in order to investigate the determinants of educational achievement which lead countries with similarities in educational systems to reach different outcomes. Using OECD PISA data, a common educational production function is estimated by survey regression; also decomposition analysis is carried out in order to evaluate how much of the score gaps is accounted for by the dissimilar endowments in characteristics rather than the different capability of national educational systems of transforming these characteristics into skills. Main results highlight the significant disadvantage in terms of endowment of Italian students which is partly balanced out by the returns of Italian educational process.*

Keywords*: Human capital, Educational economics, Educational production, Achievement gap*

1. INTRODUCTION

Away back in the eighteenth century the relationship between economic growth and human capital has been one of the central issues of economic debate. Over the last decades, a widespread literature (Lucas, 1988; Barro, 1991; Krueger and Lindahl, 2001) has given evidence of a positive impact of education in determining the economic performance at a macro level. In particular, the research sheds light on how education may improve the human capital inherent in the workforce and, thus, in the labour productivity (Mankiw *et al.*, 1992), or increase the innovative capacity of an economy (Aghion and Howitt, 1988; Romer, 1990), or also enhance the transmission of knowledge to implement new technologies (Nelson and Phelps, 1966; Benhabib and Spiegel, 1994).

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All the while, at a micro level, several studies (Behrman and Birdsall, 1983; Card and Krueger, 1992) have proved how skills, knowledge, abilities and other attributes embodied in individuals and relevant to economic activity may significantly influence their current and potential earnings. As illustrated by Gokcekus and Muedin (2008), individual earnings depend on productivity levels which, in turn, depend on measurable/unmeasurable skills and competences necessary to perform jobs as well as on the different ways in which they are nurtured. As they say, what people know, and not just how many years of schooling they complete, is the key to understand how education investments improve productivity (Hanushek *et al.*, 2008).

Consequently, beyond the more objective measures of education (i.e., enrolment rates in schools or years of school attainment), also the quality of education – how well students are taught and how much they learn – may be powerfully related to economic outcomes. Currently, the growing importance of the quality of education – by which the achievement of universal participation in education could be dependent (UNESCO, 2005) – leads many governments to improve their national school systems in order to provide the best education to their students (Wößmann *et al.*, 2007). Over the last years, cognitive skills, regarded as any mental skills used in the process of acquiring knowledge, are frequently adopted to assess the role of the quality of education in the economic development. In this light, the degree to which educational systems actually develop cognitive achievement may be viewed as a measure of their quality.

As argued in literature (Ammermüller, 2007; Fuchs and Wößmann, 2007), cognitive skills may be measured by student performance tests, which might also reflect the outcome of some non-cognitive skills (Borghans *et al.*, 2008). Although achievement tests, produced by standardised international assessments (i.e., PISA, TIMMS, PIRLS), cannot completely measure individual attitudes and motivation, their results may be the starting point to investigate the causal relationship between education and economic outcomes and, more specifically, to explore the determinants of educational performance. For that matter, in addition to student characteristics and their individual potentialities, the large amount of learning, that takes place in more informal environments of families or communities, cannot be neglected when analysing the educational process. Indeed, several economists and sociologists (Atkinson *et al.*, 1983; Erikson and Goldthorpe, 2002) agree with the idea that the family of origin, regarded as a channel through which cultural values and orientations can be passed on to individuals, plays a crucial role for understanding the intergenerational transmission of advantages and/or disadvantages. As they say, cultural and human capital, in terms of knowledge, abilities, skills and talents, if

transmitted across generations, may enhance the offspring's ability to perform specific tasks (Becker, 1991; Jæger and Holm, 2007). Moreover, as stressed by OECD (2007), the degree to which settings of different types encourage the creation of human capital also largely depends on specific institutional features of each country (i.e., how national educational systems are organised, resources' availability and quality, institutional strategies of accountability and autonomy) as well as on internal demand for skills and so on peculiarities of national labour markets.

As regards the strong relationship between economic growth and human capital, it is interesting to focus on the Italian educational system characterised by a poorer performance in international student assessments. In fact, despite the quite high investment in education and the good level of GDP per capita, Italy ranks in low position of international students classification. In this light, the aim of the paper is to analyse the educational gaps between Italy and a set of other OECD countries with some similarities in their educational systems in order to investigate the dynamics which lead similar countries to achieve different levels of educational outcomes. More precisely, in a cross-country perspective, we intend to look over the performance of Italian students compared to their peers in other advanced economies in order to disentangle the determinants of the educational differentials.

In the first step, a cluster analysis is performed to identify the set of countries comparable to Italy in terms of access and output of educational institutions, financial and human resources invested in education, school accountability and autonomy. Within the cluster of similar countries, those which significantly perform better and worse than Italy in terms of achievement test scores are considered. Then, by using data from the last edition (2009) of OECD Programme for International Students Assessment (PISA), a common educational production function allows to investigate the determinants, both at student and school level, of educational achievement in each country. In the second step, decomposition analyses are carried out in order to evaluate how much of the score gap between Italian students and their colleagues in the selected countries is accounted for by the dissimilar endowments in characteristics rather than the different capability of national educational systems of transforming these characteristics into skills.

The paper is structured as follows. Section 2 introduces the PISA study and gives early evidence of performance gaps across countries. Section 3 deals with the main results of a cluster analysis performed on OECD countries according to some similarities in their educational systems. Section 4 offers an insight into the survey regression models to estimate the educational production functions for each country; evidence is then argued by an internationally comparative approach. Section 5 discusses the meaning and contribution of each student and school-level

determinant to the overall score gaps between countries, after that some theoretical aspects of the three-fold Oaxaca-Blinder and Juhn-Murphy-Pierce decomposition methods are illustrated. Some concluding remarks can be found in Section 6.

2. DATA SOURCES

The analysis draws upon the 2009 edition of PISA (Programme for International Student Assessment), the main current reference source for assessing how far students near the end of compulsory education have acquired some of the knowledge and skills that are essential for full participation in society (OECD, 2010a). More precisely, the aim of PISA is to collect highly standardised data that can be used to compare competencies of 15-year-old students in the three main domains of reading, mathematics and science both within and between countries. Since the first cycle in 2000, PISA has been taking place every three years with a growing number of participating countries and each of these cycles looks in depth at a major domain. In 2009, the survey has involved roughly 475,000 students from 65 countries, including all OECD economies, and its main focus is on measuring performance in reading literacy with an optional assessment of the reading of electronic texts. OECD's PISA not only allows to evaluate students' performance but also to gather data about their families and socio-economic background together with several school characteristics. In particular, school data are collected through a questionnaire filled in by the head of each school that entered PISA national samples[2].

Briefly, in line with results by the previous editions, PISA 2009 underlines the lower performance of Italian 15-year olds in relation to their counterparts from most of the developed countries involved in the survey. Italian students reached average test scores – 483 points in mathematics, 486 in reading and 489 in science – consistently below the OECD averages[3] and the gaps between Italian students and their peers in the best performer countries, such as Korea and Finland, are extremely high. In particular, Italian 15 year-olds perform in reading lower than Korean and Finnish students by an amount equivalent to nearly one year and a half of schooling. This low achievement of Italian students, which conflicts with the high level of education expenditure per pupil (OECD, 2009a), leads to analyse the determinants of their poor performance.

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[2] For further information about the PISA sampling design see the OECD PISA Technical Report (OECD, 2009b).

[3] According to PISA 2009 results, only seven OECD countries (i.e., Czech Republic, Slovak Republic, Israel, Luxembourg, Austria, Turkey and Mexico) perform significantly worse than Italy on the reading scale.

3. A SEGMENTATION OF OECD EDUCATIONAL SYSTEMS

A way to investigate the high gap characterising Italian students is to compare Italy to a set of countries with a similar educational system and, at the same time, with different student performance. Therefore, the aim is to explore the dynamics which lead countries with similarities in their educational systems to reach different levels of outcomes.

In order to obtain a set of OECD countries comparable to Italy, a number of features of educational systems are considered. In particular, a cluster analysis is performed to group the OECD countries[4] according to nine indicators (Tab. 1) representing several specific macro categories of educational systems.

The choice of these dimensions is inspired by the categorisation of educational indexes used by the OECD in the annual Report "Education at a Glance". More precisely, the following categories are considered:

1. *Access and output of educational system*, which includes the ratio of population aged 25-64 with at least upper secondary education, the number of 25-64 year-olds in employment as a percentage of population aged 25-64 with ISCED-3 level (International Standard Classification of Education), the number of full-time and part-time 15-19 year-old students in public and private institutions relative to population aged 15-19;
2. *Financial resources invested in education*, expressed by the annual expenditure per student (secondary education) for all services relative to GDP per capita and by the expenditure on educational institutions (primary, secondary and post-secondary non-tertiary education) as a percentage of GDP, from public and private sources;
3. *Organization of schools (autonomy and accountability)*, including an index of relative level of responsibility of school staff in allocating resources[5], an index of relative level of responsibility of school staff in matters concerning curriculum

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[4] Greece and France are excluded because of the amount of missing data for the reference years (2006-2009) and four other countries (Belgium, Greece, Spain and the United Kingdom) are also leaved out as data on expenditure per student are not available separately for upper secondary level of education.

[5] An index of the relative level of responsibility of school staff in allocating resources (*RESPRES*) was derived from six items measuring the school principals' report on who has considerable responsibility for tasks regarding school management of resource allocation ("Selecting teachers for hire", "Firing teachers", "Establishing teachers' starting salaries", "Determining teachers' salaries increases", "Formulating the school budget", "Deciding on budget allocations within the school"). Higher values on the scale indicate relatively higher levels of school responsibility in this area.

Table 1: Indicators of educational systems by OECD countries

	Access and output of educational system			Financial resources invested in education		Schools autonomy and accountability				PISA 2009 reading score
Country	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	
Australia	69.94	80.38	82.34	23.50	3.51	0.15	-0.08	0.42	0.61	515
Austria	81.04	74.40	79.03	28.89	3.56	-0.12	-0.52	0.07	0.15	470
Belgium	69.58	75.10	94.44	25.94	4.10	-0.16	-0.35	0.32	0.19	506
Canada	87.07	74.95	80.20	22.10	3.47	-0.72	-0.39	0.47	0.52	524
Chile	67.97	68.71	73.71	15.75	3.85	-0.17	0.33	0.80	0.77	449
Czech Rep.	90.90	78.25	90.09	23.04	2.76	0.95	1.23	0.64	0.04	478
Denmark	75.00	79.51	83.25	26.64	4.26	-0.06	0.14	0.40	0.38	495
Finland	81.07	77.04	87.90	22.16	3.64	-0.13	-0.35	0.31	0.08	536
France	69.96	76.73	85.75	29.33	3.90	m	m	m	m	496
Germany	85.33	59.27	88.08	22.61	3.02	-0.24	-0.53	0.25	0.29	497
Greece	61.07	66.44	79.68	m	m	-1.25	-0.77	0.12	0.03	483
Hungary	79.70	70.13	88.82	22.52	3.17	0.05	0.70	0.44	0.15	494
Iceland	64.13	76.75	84.36	22.99	5.09	0.40	-0.01	0.38	0.02	500
Ireland	69.45	74.58	89.69	21.12	3.48	-0.01	-0.43	0.22	0.54	496
Italy	53.31	74.77	80.05	25.81	3.09	0.14	-0.63	0.14	0.36	486
Japan	m	74.41	m	26.04	2.80	1.07	-0.23	0.79	0.04	520
Korea	79.14	70.65	86.85	29.58	3.97	0.80	-0.45	0.81	0.39	539
Luxemb.	67.94	71.06	73.55	21.74	3.08	-0.71	-0.13	0.33	0.36	472
Mexico	33.55	75.76	50.14	15.83	3.75	-0.90	-0.32	0.56	0.34	425
Netherlands	73.29	84.46	89.29	25.88	3.69	1.05	1.31	0.13	0.14	508
N. Zealand	72.05	82.76	75.43	21.96	4.05	0.82	0.12	0.71	0.69	521
Norway	80.70	82.31	87.39	22.35	3.69	-0.56	-0.22	0.74	0.18	503
Poland	87.15	68.47	93.07	22.01	3.42	0.35	-0.20	0.74	0.14	500
Portugal	28.25	80.81	77.28	30.19	3.51	-0.95	-0.45	0.39	0.55	489
Slovak R.	89.93	78.16	85.52	15.88	2.55	0.12	0.56	0.60	0.12	477
Spain	51.23	75.45	80.39	27.74	2.93	-0.41	-0.40	0.17	0.44	481
Sweden	85.04	83.08	86.99	24.86	4.07	0.21	0.90	0.88	0.37	497
Switzerland	86.81	74.78	84.41	33.45	3.99	-0.74	-0.31	0.27	0.28	501
Turkey	30.31	57.72	47.16	m	m	-1.05	-0.74	0.70	0.31	464
U.K.	69.63	82.55	71.39	25.44	4.25	0.66	0.33	0.60	0.50	494
U.S.A.	88.70	72.83	79.88	24.34	4.04	-0.19	0.38	0.84	0.73	500
OECD	**70.97**	**74.91**	**81.20**	**24.12**	**3.61**	**0.00**	**0.00**	**0.46**	**0.32**	**500**

(a) Population aged 25-64 with at least upper secondary education (2008). Source: OECD, 2010a

(b) Employment rates Number of 25-64 year-olds in employment as a percentage of the population aged 25 to 64 with ISCED 3A (2008). Source: OECD, 2010a

(c) Full-time and part-time students in public and private institutions 15-19 year-olds as a percentage of the population aged 15 to 19 (2008). Source: OECD, 2010a

(d) Annual expenditure by secondary educational institutions per student for all services relative to GDP per capita (2007). Source: OECD, 2010a

(e) Expenditure on educational institutions as a percentage of GDP (2007). Source: OECD, 2010a

(f) Index of relative level of responsibility of school staff in issue relating to curriculum and assessment (2009). Source: OECD PISA 2009

(g) Index of relative level responsibility of school staff in allocating resources (2009). Source: OECD PISA 2009

(h) Proportion of schools which provide information to parents on child performance relative to national or regional benchmarks (2009). Source: OECD PISA 2009

(j) Proportion of schools which use achievement data in decisions about instructional resource allocation. Source: OECD PISA 2009

and assessment[6], the proportion of schools providing information to parents on their children's performance relative to national or regional benchmarks, the percentage of schools which use achievement data in their decisions about instructional resource allocation.

The cluster analysis[7] has allowed to determine six different groups of countries and it classifies Italy in the same cluster of Australia, Canada, Ireland, Luxembourg, Spain and Portugal (Fig. 1). Unfortunately, some salient features of educational systems are left out from the selection algorithm since not available for all OECD countries. It implies that the results of segmentation don't fully reflect all the characteristics of the formal educational system of each country. Nevertheless, the clusters obtained may be worthwhile as for to the data availability.

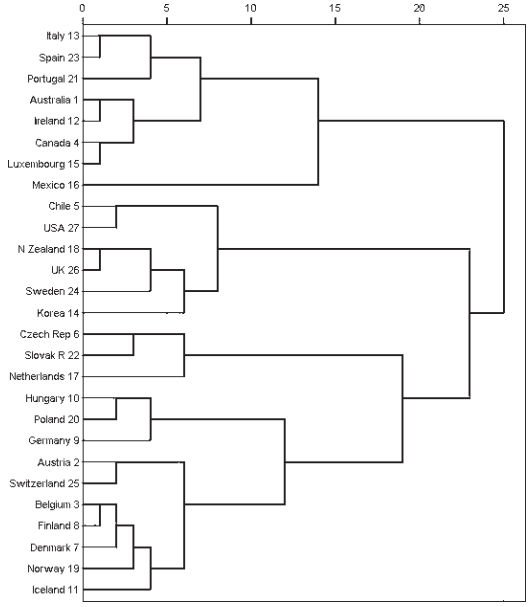

Figure 1: Dendrogram of cluster analysis of 27 OECD countries by educational system indicators.

6 The index of the relative level of responsibility of school staff in issues relating to curriculum and assessment (RESPCURR) was computed from four PISA items measuring the school principal's report concerning who had responsibility for curriculum and assessment ("Establishing student assessment policies", "Choosing which textbooks are used", "Determining course content", "Deciding which courses are offered"). Higher values indicate relatively higher levels of school responsibility in this area.

7 Data have been standardised through z scores. The segmentation of OECD countries is computed through a Ward hierarchical clustering which is based on the analysis of variance to evaluate the distances among clusters. This method allows to aggregate the observations minimising the sum of squares of any two (hypothetical) clusters that can be formed at each step (Ward, 1963).

Countries within the cluster including Italy show similar patterns in terms of investment in education and access of educational system. They incur low levels of expenditure on educational institutions (from 2.9% of GDP for Spain to 3.5% for Australia) and their proportion of 15-19 years olds in public and private institutions is consistently below the OECD average (81%), except for Ireland (90%). Other similarities are observed for the ratio of population with at least upper secondary education which varies from 51% (Spain) to 70% (Australia) and it is lower than OECD average (71%), except for Canada (87%). Moreover, these countries show large proportions of schools which use achievement data in their decisions about instructional resource allocation (from 36% for Italy and Luxembourg to more than 60% for Australia).

The main results of the cluster analysis demonstrate how countries with similarities in their educational systems can show quite different educational outcomes. Taking into account the cluster where Italy is included, it is worth to note how Canada (524 points), and Australia (515) score significantly above the OECD average (493) on the PISA reading scale, Ireland (496) and Portugal (489) perform as well as the OECD average whereas Italy (486), Spain (481), and Luxembourg (472) are significantly below. Since the mean score of Italy is not significantly different from that of Iberian countries (OECD 2010b), Spain and Portugal are excluded from the comparative analysis.

At this stage, a common educational production function for the five selected countries (i.e., Australia, Canada, Ireland, Italy and Luxembourg) is estimated and a comparison between Italy and each other country is performed in order to inspect the main determinants of educational gaps.

4. A METHODOLOGICAL OVERVIEW: THE EDUCATIONAL PRODUCTION FUNCTION

An analytical comparison of educational outcomes across countries presupposes knowledge of the process by which education is produced. A widespread literature (Hanushek, 1996; Ammermüller, 2007; Wößmann *et al.,* 2007) analyses the mechanism of educational process controlling simultaneously for differences in individual, family and school characteristics that may influence student achievement. The theoretical framework of this approach is based on the educational production function (EPF) which combines student-level data related to individual characteristics with student, family and school background information. More formally, to estimate the educational production function for each country at the student level, the following model (1) is adopted:

$$Y_{ij} = \beta_0 + \beta_1 S_{ij} + \beta_2 B_{ij} + \beta_3 C_j + \beta_4 I_j + \nu_j + \varepsilon_{ij} \qquad (1)$$

where Y_{ij} is the reading achievement score of the *i-th* student in the *j-th* school; S_{ij} and B_{ij} are the vectors of student-level variables reflecting personal characteristics and family background, respectively; C_j consists of variables related to school context and resources, while I_j refers to some institutional factors; finally, v_j and ε_{ij} are the error terms at the school and student level, respectively. Given the hierarchical structure of PISA data where students (level-one units) are nested in schools (level-two units), the weighted cluster robust linear regression models (WCRLR) are tested in order to control for the interdependence of error terms between students within the same school (Deaton, 1997). In other words, as students share common characteristics which cannot be totally controlled for, individual observations within each cluster (school) are not independent. Therefore, ignoring the cluster design and treating dependent observations as independent by using standard formulas would result in standard errors that are too small (White, 1980).

In our EPF specification (the means of selected variables are reported in table 2), the first dimension of individual-level variables (S) concerns student characteristics, that is gender, citizenship and grade of schooling; the second one (B) involves family background, encompassing the family structure, the highest parental education level and the number of books owned at home. Moreover, the category of school context and resources (C), which may also play an important role in explaining educational outcomes, is expressed by an index of quality of schools' educational resources (SCMATEDU)[8], the ratio of the numbers of computers for instruction to school size as a proxy for the quantitative level of the school's facilities, the proportion of teachers with at least the ISCED 5A qualification (PROPQUAL), an index of school disciplinary climate (DISCLIMA)[9] and, finally, a measure of school socio-economic context, computed as the average at the school level of students' indices of economic, social and cultural status (ESCS)[10].

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[8] The index on the school's educational resources (SCMATEDU) summarises principals' responses to seven questions on the adequacy or shortage of educational resources. The index is inverted so that positive values on the index reflect a better quality of educational resources. Details about the computation of this index are reported in OECD (2012).

[9] The index of disciplinary climate (DISCLIMA) is derived from students' reports on how often the followings happened in their lessons: i) students do not listen to what the teacher says; ii) there is noise and disorder; iii) the teacher has to wait a long time for the students to "quieten down"; iv) students cannot work well; v) students don't start working for a long time after the lesson begins. As all items are inverted for scaling, higher values on this index indicate a better disciplinary climate (OECD, 2010a). Details about the computation of this index are reported in OECD (2012).

[10] The index of Economic, Social and Cultural Status of students (ESCS) includes information about parental occupational status and highest educational level, as well as information on home possessions, such as computers, books and access to the Internet (for additional

Table 2. Means for selected variables by country

Variable	Definition	Australia	Canada	Ireland	Italy	Luxembourg
Gender	0=male; 1=female	0.511	0.497	0.494	0.486	0.493
Grade	0=national modal grade, 1=Lower than national modal grade	0.105	0.148	0.025	0.184	0.122
	2=Upper than national modal grade	0.186	0.011	0.384	0.032	0.362
Immigrant	0=native;1=immigrant	0.230	0.240	0.079	0.055	0.401
Famstruc	0=nuclear , 1=non nuclear family	0.204	0.178	0.163	0.121	0.172
Highest educational level of either parents (HISCED)	Reference.= Isced 0,1	0.004	0.008	0.023	0.016	0.095
	Dummy 1=ISCED 2,3	0.017	0.025	0.079	0.226	0.084
	Dummy 2=ISCED 3,4	0.410	0.246	0.369	0.437	0.289
	Dummy 3=ISCED 5,6	0.568	0.721	0.528	0.321	0.533
Book at home	Reference= Less than 26 books	0.188	0.212	0.277	0.302	0.231
	Dummy1=26-100 books	0.310	0.333	0.325	0.298	0.250
	Dummy2=101-200 books	0.211	0.206	0.180	0.194	0.179
	Dummy3=more than 200 books	0.290	0.249	0.218	0.206	0.340
SCMATEDU	Index of quality of schools' educational resources	0.440	0.393	-0.343	-0.091	0.298
IRATCOMP	Ratio of computers for instruction to school size	0.980	0.738	0.562	0.433	0.681
PROPQUAL	Proportion of teachers who have an ISCED 5A qualification	0.949	0.916	0.946	0.764	0.908
DISCLIMA	Index of disciplinary climate	-0.079	-0.081	-0.030	0.032	-0.201
ESCS (sch.avg)	Student index of economic, social and cultural status	0.330	0.501	0.041	-0.124	0.198
Private	0=public school; 1=private school	0.403	0.075	0.615	0.058	0.148
Ass_year	Students in the school are assessed using standardised tests at least yearly	0.604	0.738	0.380	0.326	0.535
Ass_comp	Student achievement data used to compare the school to district or national performance	0.634	0.745	0.846	0.911	0.901
Budget	School autonomy in budget allocation	0.069	0.335	0.291	0.110	0.220
Instructional	School autonomy on assessment policies	0.403	0.075	0.615	0.059	0.148
Assess	School autonomy in instructional decisions	0.085	0.246	0.229	0.072	0.140

information see OECD (2012)). Index values are standardised such that the mean is equal to zero and the standard deviation equals one across all students in OECD countries. Therefore, a negative value on this index means that the student's socio-economic background is below that of the OECD average student; the lower ESCS, the lower is the overall socioeconomic status of the student.

The last set of school variables (I) allows to evaluate the role played in this field by some institutional factors; in particular, the contribution of accountability policies and school autonomy to explain educational performance and the influence of school ownership (public or private).

School accountability is expressed by the frequency of standardised assessment, namely whether students in that school are assessed using standardised tests at least yearly, and by a measure of the use of student achievement data to compare the school to district or national performance. Also, the level of school autonomy is measured by three dummies which indicate whether the school have influence on decision making about budgeting, instructional content and assessment practices.

4.1 DETERMINANTS OF EDUCATIONAL ACHIEVEMENT: SOME EMPIRICAL EVIDENCE

As illustrated in Tab. 3, effects of individual and school-level variables on student performance are estimated by weighted survey regressions on student reading test scores separately for each country under study[11]. Firstly, we focus on some determinants of student performance at individual level. Generally, our evidence[12] points clearly to strong relationships for each country between educational achievement and the measures of student characteristics and family background. Coherently with other empirical researches (Ammermüller, 2007; Fuchs and Wößmann, 2007), student background, as expression of the inequality of educational opportunities (Wößmann, 2008; Schütz *et al.*, 2008; Martins and Veiga, 2010), features the most of the highly significant variables of the educational production functions with a great impact on student performance. As in a household context

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[11] For each country, the proportion of missing values is less than 5% for most of the variables considered for the educational production functions. Therefore, a simple imputation approach has been used to deal with missing data. For continuous variables, missing values at the student level have been replaced by the weighted school average and by the country average for missing values at the school level. For categorical variables, missing values have been imputed by the modal value of school and by the modal value of country for student variable and school variable, respectively. It is known that such imputation methods generally produce biased estimates of coefficients (Jones, 1996) and underestimation of standard errors. However, given the low presence of missing data, this bias may be considered negligible.

[12] The EPF estimation based on PISA data could suffer from some drawbacks linked to the lack of information on previous investments in education and students' ability as well as to the omission of unobserved factors like test taking motivation. These shortcomings could affect the empirical results and they lead to be circumspect about interpreting results. Nevertheless, PISA data are largely used in the international literature due to their several unique advantages (Hanushek and Wößmann, 2011) which enable to understand the determinants of educational achievement in a cross country perspective.

parents may spread principles, ideals and resources to their children, family background may be viewed as a further crucial input in the educational production as well as a critical predictor of intergenerational mobility in a society. The family of origin is undoubtedly a channel through which human, social and financial resources, together with cultural values and orientation, can be passed across generations. Anyway, the mechanisms of transmission typically vary over families within a same country and, even more so, across countries where structural and institutional disparities exist. In this light, our empirical findings denote a pattern of differences in terms of student performance by family status. In almost all countries, it is clear how students who live with both biological parents perform better than students from other family structures, except for Italy, probably due to the low incidence of single-parent family in this country. These results seem to corroborate the idea that children growing up in alternative families, such as sole-parent family or step-family, usually exhibit worse performance (Schiller *et al.*, 2002; Hofferth, 2006) and lower educational expectations (DeLeire and Kalil, 2002), possibly because of the potential lower levels in such families of those parental resources which are crucial for children's educational success. The direct relationship between parental education and children's performance is large enough in each country and it gradually increases as one moves to higher levels of education. As they say, student performance tends to improve when the educational level of parents is higher. For example, Australian students, whose parents have completed at least the upper secondary education, score 36 points higher than students with the lowest educated parents and this difference raises to 44 points if the parental education is at the tertiary level. This pattern does not matter for Italy and Luxembourg where parents with a medium educational level seem to steer better their children than parents with a different educational level, both lower and higher. The penalty for less favorable parental education levels is lower for Luxembourg which is roughly 15 points. Moreover, by considering the number of books in the students' home as a powerful proxy for the social and economic background of students' families (Wößmann, 2003, 2008), it is worth to note how student performance steadily enhances as the quantity of books increases. As they say, a large amount of books may denote a family environment that highly stimulates education success and that promotes children's effort (Mullis *et al.*, 2000); it also proxies for the socio-economic background of the parents since books are goods that have to be paid for (Schütz *et al.*, 2008).

Table 3: Estimation of educational production functions: coefficients[1] of weighted[2] survey regressions by country

Variables	Australia	Canada	Ireland	Italy	Luxemb.
Gender (*ref.*= male)	29.59***	29.49***	30.96***	27.1***	32.98***
Immigrate (*ref.*= native)	7.29***	-2.28	-12.00*	-12.23***	-18.51***
Grade (*ref.*= national modal grade)					
Grade Lower	-36.96***	-40.09***	-75.53***	-45.45***	-33.86***
Grade Higher	23.67***	54.35***	26.27***	-1.42	51.76***
Family structure (*ref.*= nuclear)	-8.08***	-8.65***	-8.25***	2.00	-8.68***
Highest parental educational level (*ref.*= ISCED 0,1)					
ISCED 2,3	26.95*	20.18*	16.88	10.22	7.05
ISCED 3,4	36.24***	21.97***	30.61***	19.64***	15.41***
ISCED 5,6	44.58***	27.09***	30.61***	6.12	7.84
Books at home (*ref.*= [0–25])					
[26–100]	29.46***	22.57***	32.94***	19.24***	26.85***
[101–200]	51.09***	46.14***	63.33***	23.07***	39.21***
[>200]	70.75***	60.42***	76.03***	37.65***	51.51***
Quality of schools' educational resources (SCMATEDU)	-1.48	0.90	5.31***	8.67***	1.44
Ratio of computers for instruction to school size (IRATCOMP)	-4.77	-4.68	1.030	5.62	7.76
Proportion of teachers with at least ISCED 5A (PROPQUAL)	24.77***	3.07	14.01***	1.64	70.14***
School average of the index of disciplinary climate (DISCLIMA)	27.84***	17.41***	16.78***	32.31***	1.88
School average of the index of economic, social and cultural status (ESCS)	65.00***	37.98***	40.94***	58.06***	61.23***
School ownership (*ref.*= public)	-4.09	15.36***	1.95	-38.43***	3.55
Standardised tests at least yearly (*ref.*= none)	5.90*	10.48***	-10.65*	-4.57	36.52***
Achievement data to compare the school to district or national performance (*ref.*= not used)	-3.89	2.12	-8.95	4.85	-4.37
School autonomy in budget allocation (*ref.*= no autonomy)	3.74	-2.83	21.83***	7.97	13.76*
School autonomy in instructional decisions (*ref.*=no autonomy)	0.92	-1.55	14.99***	-2.43	12.83
School autonomy on assessment policies (*ref.*= no autonomy)	-2.32	6.84***	-11.35	1.77	1.19
Constant	378.16***	429.91***	381.44***	456.00***	278.71***
R^2	0.29	0.22	0.32	0.45	0.48

1. *Significant at 10%, ** Significant at 5%; ***Significant at 1%
2. All observations are weighted with the students' weight.

Moreover, a common evidence for every country is the positive influence of gender on reading achievement; girls outperform boys, especially in Ireland and Luxembourg where the difference in test scores is more than 30 achievement points in favor of females[13]. Also, the educational performance significantly improves as the grade level is higher; students in higher grades perform better in the reading test than students in national modal grade, except for Italy. The immigration status of students plays an important role in influencing the reading performance as well: native students perform better than their immigrant counterparts, except for Australia, where immigrants even outperform natives, and Canada, where there are not significant differences in performance. These results are rather consistent with some previous studies (Buchmann and Parrado, 2006; OECD, 2006a), which highlight how achievement differences between natives and immigrants exist in continental Europe and confirm the better social and labour market integration of immigrants in settlement countries as Australia and Canada where immigration policies favour the better qualified (OECD, 2005).

Secondly, school context, available resources and institutional settings are surely some of the main determinants of quality of the educational systems. As these school factors necessarily influence the actors of educational process and their behavior, they may also act on student performance. Generally, our analysis validates a common result of other cross-country studies (Lee and Barro, 2001; Wößmann, 2003) given by the strong association between students' socio-economic background and their educational achievement. Indeed, the average (over individuals within the same school) index of economic, social and cultural status (ESCS) is positively significant for each country (from 38 points for Canada to 65 points for Australia) and, all the while, students' scores are directly affected by the disciplinary climate (DISCLIMA), except for Luxembourg. In terms of school context and resources, our findings point to a vague relationship between the differences in the quality of school material resources and student performance – the variable SCMATEDU is positively significant for Ireland and Italy for which the size of its effect is, however, relatively small – and a more clear direct association between the differences in the quality of teaching staff. The level of school facilities, expressed by the ratio of computer to school size, have no effect on performance in each of the five countries and this evidence seems to suggest that an increase of investment in school facilities does not guarantee better performance. The variable PROPQUAL

[13] This significant advantage of females may be the result of the broader societal and cultural context or of educational policies and practices (OECD, 2006b). Anyway, in recent years, many studies are focusing on the relation between the structure of the brain and differing educational outcomes for males and females.

is statistically significant for all countries, except for Canada and Italy, and the size of its effect varies from around 23 points for Australia to 74 points for Luxembourg, that is the strongest relationship to student performance. In other words, in Italy, the school endowments give only small insights into a further explanation of students' test scores, while in most of the selected countries (i.e., Australia, Ireland and Luxembourg), students in schools whose teachers have on average a higher educational level perform better than otherwise, in line with Ammermüller *et al.* (2005) on TIMMS data for countries of Eastern Europe.

As explained by Fuchs and Wößmann (2007), in a range of countries the influence of institutional settings of education systems (i.e., school ownership, public/private financing, external or teacher-based standards and examinations, centralisation vs school autonomy in curricular, budgetary, personnel and process decision) on student performance tends to be neglected in most of the discussions about education policies, which often focus on the implicitly assumed positive link from institutional factors to student performance. Nevertheless, coherently with some previous researches (Wößmann *et al.*, 2007; OECD, 2010a), our results highlight how the impact of institutional factors is often ambiguous and not consistently significant. This may reflect the lack of variability of these factors within the educational system of each country; therefore, cross-country comparisons are more suited for analysing these effects and to support the view that institutional settings play a key role in determining student performance. Also, focusing on the influence of school autonomy, some studies on international student achievement test (Bishop and Wößmann, 2004; Fuchs and Wößmann, 2007) suggest that school autonomy in decision-making areas as budget allocation, instructional program and assessment policies may lead to better student performance. These hypotheses are partially confirmed by our findings which shed light on how school autonomy plays a different role depending on the country and the kind of decision-making area. In particular, autonomy in budget allocation is positively related to achievement for Ireland and Luxembourg, while autonomy in instructional decisions and on assessment policies seems to have a significant direct impact on student performance only for Ireland and Canada. As regards accountability policies, empirical results reveal that Australian, Canadian and Luxembourgian students perform better in school where standardised assessments are used more than once a year, while the use of assessment to compare school to district or national performance appears to be non influential. Finally, the causality of school ownership, public or private, and student performance is not very clear because wide divergences across countries exist. In Australia, Luxembourg and Ireland, achievement differences between public and private schools are statistically irrelevant; by contrast, Italian students

who attend private school perform worse than their peers in public school, while the opposite evidence is observed for Canada where the differences are significant in favour of private schools.

5. DECOMPOSING THE GAP: THREE-FOLD OAXACA-BLINDER AND JUHN-MURPHY-PIERCE METHODS

Once the educational production functions have been estimated for each country, we proceed to disentangle the score gap between Italy and each other country (i.e., Australia, Canada, Ireland and Luxembourg) into more components in order to assess the contribution of each factor to difference in outcomes. As already illustrated, although these countries are quite similar in terms of various characteristics of their educational systems, their 15-year-old students show significant differences in test scores. In particular, focusing on reading achievement, PISA 2009 results show significant positive differences in test scores between Australian, Canadian and Irish students and their peers in Italy, on the one hand, and a significant negative difference between Luxembourgian and Italian students, on the other hand. More precisely, the achievement gap is approximately 30 points if compared to the PISA top performing countries (i.e., Australia and Canada); this educational differential is very relevant because in the light of PISA data a gap of 34 points is equivalent to a loss of one year of education.

In the first step, in order to explain the difference in mean outcomes and its main determinants, the three-fold Oaxaca-Blinder decomposition method is tested. Based on the linear model of educational production functions, the mean performance gap ($\Delta_{j,ITA}$) can be expressed as the difference in the linear prediction at the group-specific means of the regressors (Jann, 2008):

$$\Delta_{j,ITA} = E\left(Y_j \mid X_j\right) - E\left(Y_{ITA} \mid X_{ITA}\right) = E\left(X_j\right)' \beta_j + E\left(X_{ITA}\right)' \beta_{ITA} \qquad (2)$$

In order to explore how much of the mean gap is accounted for by differences in the predictors, the formula (2) may be decomposed into three main effects (Winsborough and Dickinson, 1971; Jones and Kelley, 1984; Daymont and Andrisani, 1984):

$$\Delta_{j,ITA} = \left[E\left(X_j\right) - E\left(X_{ITA}\right)\right]\beta_{ITA} + E\left(X_{ITA}\right)'\left(\beta_j - \beta_{ITA}\right) + \left[E\left(X_j\right) - E\left(X_{ITA}\right)\right]'\left(\beta_j - \beta_{ITA}\right) \quad (3)$$

The first component, obtained as difference in the average for each predictor weighted by the slope of the production function for Italy, represents the share of score gap that can be explained because of different average characteristics between the two countries under consideration. This component is called endowments or

characteristics effect since it reflects the more or less favorable endowment in observable characteristics (*i.e.*, higher educated parents, better school contexts, having more school resources or more favorable institutional settings), measured by the explanatory variables, of Italy (country of reference) compared to each other country. Therefore, the endowment effect measures how much students from the j_{th} country would score differently if they had experienced the same educational production process as Italian students. The second component, obtained as difference in the slopes, weighted by the average of Italian characteristics, amounts to the proportion of score gap related to different production processes, in terms of transformation of inputs into educational achievement, between the two countries under consideration. This component is called return effect since it reflects the more or less efficiency of Italy in producing performance compared to each other country. In other words, the return effect measures how much students from the j_{th} country would score differently if they had the average characteristics as Italian students. The third summand, called interaction or characteristics-return effect, is the residual part of the decomposition and captures the leverage produced by both effects happening simultaneously. Standard errors of individual components are computed according to Jann (2008), which extends the earlier method developed in Oaxaca and Ransom (1998) to deal with stochastic regressors.

In the second step, in order to get the distinct advantage of analysing the whole distribution for the decomposition, and not only at the mean as the Oaxaca-Blinder method, the Juhn-Murphy-Pierce (1993) technique is adopted. The latter allows to decompose the raw gap at different points of the score distribution and, consequently, to perform an analysis at the quantile level. Also, it deals explicitly with the residuals from the estimations of the production function, which are equal to zero at the mean but not at specific points of the distribution (Ammermüller, 2007). Briefly, the Juhn-Murphy-Pierce (JMP) approach computes the decomposition of score differences into characteristics, return and residual effects.

In a theoretical framework, let $F^{ITA}(\cdot)$ and $F^{J}(\cdot)$ be the cumulative distribution functions of residuals from the production functions for Italy and the j_{th} country, and let p_i^{ITA} and $p^J{}_i$ be the residual distributions for the two countries, respectively:

$$p_i^{ITA} = F^{ITA}\left(u_i^{ITA} \mid X_i^{ITA}\right) \tag{4}$$

$$p_i^{j} = F^{j}\left(u_i^{j} \mid X_i^{j}\right) \tag{5}$$

For each country, residuals of educational production functions can be expressed as:

$$u_i^{ITA} = F^{ITA(-1)}\left(p_i^{ITA} \mid X_i^{ITA}\right) \tag{6}$$

$$u_i^j = F^{j(-1)}\left(p_i^j \mid X_i^j\right) \tag{7}$$

where $F^{ITA(-1)}(\cdot)$ and $F^{j(-1)}(\cdot)$ are the inverse of the cumulative distribution functions.

By considering Italy as reference country, the first component, characteristic effect, is expressed by the difference between the following two distributions:

$$Y_i^{ITA} = X_i^{ITA}\hat{\beta}^{ITA} + F^{ITA(-1)}\left(p_i^{ITA} \mid X_i^{ITA}\right) \tag{8}$$

$$Y_i^j\left(1\right) = X_i^j\hat{\beta}^{ITA} + F^{ITA(-1)}\left(p_i^j \mid X_i^j\right) \tag{9}$$

where the first equation is the actual distribution for Italy with varying quantities, prices and residual[14], while the second one shows the hypothetical outcomes of students from the j_{th} country assum-ing that they experienced the Italian production process and drew their residuals from the Italian residual distribution. The second component, return effect, is given by the difference between the two hypothetical distributions with varying prices and fixing quantities and residuals:

$$Y_i^{ITA}\left(1\right) = X_i^{ITA}\hat{\beta}^j + F^{j(-1)}\left(p_i^{ITA} \mid X_i^{ITA}\right) \tag{10}$$

$$Y_i^{ITA}\left(2\right) = X_i^{ITA}\hat{\beta}^{ITA} + F^{j(-1)}\left(p_i^{ITA} \mid X_i^{ITA}\right) \tag{11}$$

where the distribution $Y_i^{ITA}(1)$ shows the scores of Italian students if they experienced the same educational production process as students from the j_{th} country and residuals from the corresponding residual distribution; $Y_i^{ITA}(2)$ assumes that Italian students transformed their characteristics into test scores by the Italian returns, but the residual distribution is the same as for students from the j_{th} country. The last component, residual effect, is computed on the basis of difference between the residuals of the two educational production functions fixing quantities and prices:

$$Y_i^{ITA}\left(3\right) = X_i^{ITA}\hat{\beta}^{ITA} + F^{j(-1)}\left(p_i^j \mid X_i^j\right) \tag{12}$$

$$Y_i^{ITA} = X_i^{ITA}\hat{\beta}^{ITA} + F^{ITA(-1)}\left(p_i^{ITA} \mid X_i^{ITA}\right) \tag{13}$$

Briefly, in a compact view of the JMP approach, the gap between two countries is

[14] This terminology refers to the literature in labor economics. Changes in quantities mean changes in the vector of characteristics and changes in prices mean changes in the vector of coefficients.

decomposed by:

$$\Delta Y_q = \left(X_q^j - X_q^{ITA}\right)\hat{\beta}^{ITA} + \left(\hat{\beta}^j - \hat{\beta}^{ITA}\right)X_q^{ITA} + \left(u_q^j - u_q^{ITA}\right) \quad (14)$$

where the subscript q specifies the value at the q_{th} quantile.

5.1 MAIN DRIVERS OF EDUCATIONAL GAPS

Oaxaca-Blinder decomposition (Tab. 4) highlights a significantly positive endowment effect which implies that Italian students have less resources at their disposal than Australian and Canadian colleagues. This "endowment" advantage is not verified for Luxembourg for which the total gap in test scores, although less considerable, is significantly negative. All the while, the disadvantage for Italy, in terms of endowment, is partly rewarded for the overall return effects; indeed, the significant negative differences related to the coefficient effects for all countries, except for Canada, stand for a higher efficiency of the Italian educational system, which appears to be able to better exploit the smaller amount of available resources.

Table 4: Three-fold Oaxaca-Blinder decomposition of test score gaps between Italy and each other country. Standard errors in brackets.

	Australia -Italy	Canada -Italy	Ireland -Italy	Luxemb. -Italy
Total Gap (Δ)	27.86***	37.06***	8.98*	-15.81*
	(4.15)	(3.48)	(5.01)	(7.44)
Endowment Effect (E)	14.62***	33.31***	-11.48	8.19
	(5.46)	(4.12)	(7.32)	(9.67)
Return Effect (R)	-15.14***	5.21	-23.31***	-73.25***
	(4.64)	(4.41)	(4.91)	(9.63)
Interaction Effect (I)	28.38***	-1.46	43.77***	49.25***
	(6.43)	(5.69)	(7.73)	(9.18)

*Significant at 10%; **Significant at 5%; ***Significant at 1%.

In order to identify those factors which are quantitatively more significant to make differentials across countries, each component by Oaxaca-Blinder decomposition is computed for each explanatory variables (Tab. 5). As regards the first category of student characteristics, it is interesting to note how being immigrant and/or with lower grades significantly influences the educational gaps of Italian students. In particular, seeing that immigrant students usually perform poorer than their native counterparts in almost all countries (Tab. 3), the lower share of immigrants in Italy (Tab. 2) significantly reduces the score gap. By the contrary, the significant return effects for immigrants in Australia and Canada may reveal more positive conditions for immigrant students in these countries, as discussed in Section 4.1.

Table 5. Three-fold Oaxaca-Blinder decomposition of test score gaps between Italy and each other country (standard errors in brackets).

	Australia-Italy			Canada-Italy		
Variables	***Endow***	***Return***	***Interact***	***Endow***	***Return***	***Interact***
Gender (*ref.*= male)	0.651	1.217	0.06	0.269	1.164	0.024
	(0.45)	(1.33)	(0.07)	(0.31)	(1.20)	(0.03)
Grade						
Grade Lower	3.443	1.538	-0.643	1.639	0.971	-0.193
	(0.49)	(0.77)	(0.33)	(0.53)	(0.70)	(0.15)
Grade Higher	-0.218	0.811	3.865	0.029	1.803	-1.16
	(0.70)	(0.19)	(0.91)	(0.09)	(0.32)	(0.25)
Immigrate (*ref.*= native)	-2.139	1.065	3.414	-2.249	0.543	1.83
	(0.78)	(0.31)	(1.01)	(0.82)	(0.28)	(0.95)
Family structure (*ref.*= nuclear)	0.167	-1.212	-0.841	0.115	-1.281	-0.615
	(0.15)	(0.33)	(0.24)	(0.10)	(0.37)	(0.18)
Highest parental educational level (*ref.*= ISCED 0,1)						
ISCED 2,3	-2.129	3.764	-3.485	-2.04	2.241	-1.987
	(1.44)	(3.48)	(3.229)	(1.38)	(3.08)	(2.73)
ISCED 3,4	-0.517	7.25	-0.437	-3.768	1.018	-0.447
	(0.27)	(6.32)	(0.42)	(1.30)	(5.49)	(2.41)
ISCED 5,6	1.509	12.379	9.484	2.448	6.751	8.39
	(1.65)	(4.67)	(3.604)	(2.67)	(4.09)	(5.08)
Books at home (*ref.*= [0–25]						
[26–100]	0.245	3.041	0.13	0.659	0.991	0.114
	(0.13)	(0.97)	(0.081)	(0.14)	(0.80)	(0.09)
[101–200]	0.391	5.436	0.475	0.324	4.475	0.324
	(0.13)	(0.73)	(0.168)	(0.13)	(0.62)	(0.13)
[> 200]	3.123	6.858	2.745	1.599	4.717	0.966
	(0.43)	(0.78)	(0.457)	(0.36)	(0.68)	(0.25)
Quality of schools' educational resources (SCMATEDU)	4.589	0.905	-5.372	4.265	0.693	-3.823
	(1.20)	(0.43)	(1.48)	(1.09)	(0.36)	(1.32)
Ratio of computers for instruction to school size (IRATCOMP)	-3.024	0.368	0.458	-1.715	0.408	0.288
	(3.35)	(3.09)	(3.848)	(1.90)	(2.97)	(2.10)
Proportion of teachers with at least the ISCED 5A qualification	0.302	17.686	4.261	0.249	1.094	0.217
	(1.09)	(10.11)	(2.459)	(0.90)	(6.04)	(1.20)
School average of the index of disciplinary climate (DISCLIMA)	-3.649	-0.15	0.504	-3.717	-0.501	1.714
	(1.08)	(0.26)	(0.848)	(0.92)	(0.35)	(0.72)
School average of the index of economic, social and cultural status (ESCS)	26.059	-0.825	3.112	36.042	2.39	-12.466
	(2.56)	(0.89)	(3.337)	(2.93)	(0.79)	(3.42)
School ownership (*ref.*= public)	-13.229	2.009	11.82	-0.664	3.147	0.93
	(4.01)	(0.79)	(4.386)	(0.62)	(0.89)	(0.86)
Standardised tests at least yearly (*ref.*= none)	0.089	7.545	-0.204	-0.73	10.848	2.402
	(0.16)	(3.59)	(0.358)	(0.56)	(3.62)	(0.86)
Achievement data to compare the school to district or national performance (*ref.*=	1.324	-2.895	-2.384	1.962	-0.906	-1.106
	(0.92)	(1.68)	(1.417)	(1.35)	(1.60)	(1.95)
School autonomy in budget allocation (*ref.*= no autonomy)	-2.248	-3.878	1.193	-1.37	-9.893	1.856
	(2.35)	(8.22)	(2.534)	(1.44)	(8.16)	(1.55)
School autonomy in instructional decisions (*ref.*=no autonomy)	-0.039	0.233	0.053	-0.42	0.062	0.153
	(0.12)	(0.69)	(0.172)	(1.187)	(0.52)	(1.31)
School autonomy on assessment policies (*ref.*= no autonomy)	-0.076	-0.456	0.175	0.392	0.565	1.124
	(0.22)	(1.00)	(0.395)	(1.14)	(0.67)	(1.33)
Constant		-77.839		-26.09		
		(21.55)		(18.27)		

Table 5. Three-fold Oaxaca-Blinder decomposition of test score gaps between Italy and each other country (standard errors in brackets) (*continued*)

Variables	Ireland-Italy			Luxembourg-Italy		
	Endow	*Return*	*Interact*	*Endow*	*Return*	*Interact*
Gender (*ref.*= male)	0.182	1.884	0.026	0.174	2.865	0.038
	(0.81)	(1.98)	(0.12)	(0.90)	(1.68)	(0.19)
Grade (*ref.*=national modal grade)						
Grade Lower	7.118	-5.449	4.711	2.697	2.098	-0.687
	(0.52)	(1.80)	(1.56)	(0.74)	(0.96)	(0.36)
Grade Higher	-0.499	0.895	9.745	-0.468	1.72	17.534
	(1.61)	(0.20)	(2.00)	(1.51)	(0.28)	(2.83)
Immigrate (*ref.*= native)	-0.299	0.012	0.005	-4.229	-0.343	-2.172
	(0.13)	(0.41)	(0.18)	(1.57)	(0.32)	(2.05)
Family structure (*ref.*= nuclear)	0.085	-1.233	-0.435	0.103	-1.284	-0.548
	(0.08)	(0.51)	(0.19)	(0.09)	(0.54)	(0.25)
Highest parental educational level (*ref.*= ISCED 0,1)						
ISCED 2,3	-1.488	1.498	-0.97	-1.442	-0.714	0.448
	(1.01)	(2.91)	(1.88)	(0.98)	(1.99)	(1.24)
ISCED 3,4	-1.331	4.789	-0.744	-2.908	-1.845	0.626
	(0.51)	(5.25)	(0.82)	(1.03)	(3.84)	(1.30)
ISCED 5,6	1.264	7.883	5.058	1.289	0.555	0.364
	(1.38)	(3.90)	(2.53)	(1.41)	(2.97)	(1.94)
Books at home (*ref.*= [0–25]						
[26–100]	0.524	4.078	0.373	-0.92	2.266	-0.364
	(0.21)	(1.25)	(0.18)	(0.25)	(1.45)	(0.25)
[101–200]	-0.323	7.811	-0.563	-0.35	3.131	-0.245
	(0.18)	(0.86)	(0.33)	(0.26)	(1.07)	(0.20)
[> 200]	0.423	7.954	0.431	5.009	2.872	1.844
	(0.53)	(1.01)	(0.54)	(1.22)	(1.18)	(0.87)
Quality of schools' educational resources (SCMATEDU)	-2.197	1.247	3.544	3.356	0.645	-2.801
	(0.94)	(0.57)	(1.49)	(1.67)	(0.40)	(1.83)
Ratio of computers for instruction to school size (IRATCOMP)	-0.732	2.875	0.866	-1.399	5.783	3.331
	(0.82)	(4.47)	(1.36)	(1.66)	(3.75)	(2.58)
Proportion of teachers with at least the ISCED 5A qualification	0.297	9.458	2.239	0.235	52.38	9.843
	(1.07)	(6.98)	(1.67)	(0.85)	(16.58)	(3.44)
School average of the index of disciplinary climate (DISCLIMA)	-2.062	-0.522	0.991	-7.592	-1.024	7.152
	(1.26)	(0.41)	(0.78)	(1.67)	(0.73)	(3.04)
School average of the index of economic, social and cultural status (ESCS)	9.26	2.037	-2.73	18.418	-0.377	1.005
	(2.56)	(0.95)	(1.37)	(5.87)	(0.97)	(2.61)
School ownership (*ref.*= public)	-21.383	2.363	22.469	-3.436	2.457	3.753
	(6.39)	(0.80)	(6.90)	(2.50)	(0.81)	(2.73)
Standardised tests at least yearly (*ref.*= none)	0.091	-4.381	0.121	-1.234	29.61	11.09
	(0.20)	(4.74)	(0.28)	(0.94)	(8.42)	(3.24)
Achievement data to compare the school to district or national performance (*ref.*= not used)	0.237	-4.571	-0.674	0.99	-3.055	-1.882
	(0.27)	(2.39)	(0.72)	(0.81)	(2.71)	(1.88)
School autonomy in budget allocation (*ref.*= no autonomy)	-0.559	12.691	-0.972	-0.121	5.303	-0.088
	(0.63)	(12.74)	(1.07)	(0.47)	(10.03)	(0.36)
School autonomy in instructional decisions (*ref.*=no autonomy)	-0.389	1.209	2.787	-0.171	1.059	1.074
	(1.10)	(0.67)	(1.63)	(0.51)	(0.78)	(1.28)
School autonomy on assessment policies (*ref.*= no autonomy)	0.317	-1.461	-2.354	0.192	-0.065	-0.063
	(0.92)	(0.97)	(1.64)	(0.58)	(1.02)	(1.00)
Constant		-74.54		-177.28		
		(20.84)		(24.19)		

These results seem to prove the lower integration levels of immigrants in the Italian educational system. Similarly, the larger share of students in lower grades in Italy, that negatively impacts on the average performance, leads to an unfavourable effect in test scores. At the same time, the return effect associated to students in lower grade suggests a less favourable treatment of these students within the Italian educational system. Within the category of family background, parental education also plays a crucial role in determining the score gap of Italian students. For each country the educational production functions show that children's performance gradually improves as the parental education level increases (Tab. 3); this influence is lower for Italy as highlighted by the return effect (Tab. 5).

As regards the category of school context and resources, although the school endowments poorly offer insights into the explanation of Italian students' scores (Tab. 3), a notable evidence is the negative impact of the quality of educational resources on the gap of Italian students; indeed, a comparison with each other country shows a lower quality of Italian school resources and a lower efficiency of transforming this quality into scores. The strong direct relationship between students' socio-economic background – whose average level for Italy is lower than the other countries – and educational achievement significantly leads to increase the score gaps of Italian students, especially compared to Australia and Canada. In this light, in terms of return effect, it is worth stressing that the Italian educational system penalises those students coming from a family with a lower socio-economic background. Moreover, school disciplinary climate, which proxies how well students and teachers get along, positively affects student outcomes. In particular, the most constructive learning environment for Italian students (Tab. 3), which can be also considered as a key pre-condition for teachers' success, leads to a favourable effect in terms of differential in test scores. Nevertheless, this endowment advantage, in terms of better classroom climate, is not borne out of the efficiency of Italian education system to convert the more productive climate into higher performance. Finally, the modest relevance of institutional factors into the explanation of score gaps across countries is essentially due to their low variability within the national educational systems, as already discussed in Section 5.1. Anyway, the influence of school ownership on the gaps is quite ambiguous. In particular, focusing on the endowment component, educational differentials between Italian students and their colleagues from Australia and Ireland decreases as in Italy the proportion of private schools is lower (Tab. 2). In the opposite direction, the gap increases in terms of return effect because the Australian and Irish educational systems are able to guarantee better performances for students from private schools. This evidence is clearly validated by the educational production functions (Tab. 3) as well as by some

other empirical analysis (OECD, 2007). The results given by the Oaxaca-Blinder decomposition are enriched by performing an analysis at the quantile level in order to decompose the gap along the entire score distribution. In this light, the Juhn-Murphy-Pierce (JMP) approach (Tab. 6) is adopted and some evidence about the comparison between Italy and each other country are discussed. First, by comparing Australia with Italy, it is clear that Australian test scores are substantially larger than Italian ones at all quantiles of the distribution. In particular, the gap size increases twice as much when going up the score distribution, shifting from over 20 points for the lowest performing students to a little less than 40 points for the highest percentiles. Also, this educational gap is almost entirely explained by differences in characteristics at the bottom of the distribution, while the component related to the educational process mainly drives the gap at the higher quantiles. Second, the gap steadily decreases along the distribution in the comparison of test scores between Italian and Canadian students. Consistently to the Oaxaca-Blinder decomposition (Tab. 4), the endowment effect, which is constantly positive all along the distribution, explains the score difference to a large extent. Finally, the marginal influence of return and residual effects is coherent with the Oaxaca-Blinder decomposition, too.

Third, focusing on the gap between Irish and Italian students, results by JMP approach highlight how the total gap decreases starting from the 10th percentile. At the bottom of the score distribution, the gap is explained by both characteristics and return effects. All the while, moving to the top of the distribution, characteristics and return effects work in opposite directions. Indeed, although Italian students take advantage in terms of resources, it is notably countered by the return component. The Italian educational system seems not to be able to convert the given endowments into good performance for students when comparing with Ireland and this evidence is stronger for the better students.

Fourth, as regards Luxembourg, the higher favorable gap for Italian students at the lowest quantiles tends to decrease until close to zero as one moves up the score distribution. In particular, JMP results shed light on how the educational gap between these two countries is mostly explained by differences in their national educational processes, extending to the entire distribution the evidence by Oaxaca-Blinder approach (Tab. 4). Also, the better return effects for all percentiles validate the hypothesis of a higher efficiency of the Italian educational system which allows Italian students to outperform their colleagues from Luxembourg, although the latter have more resources at their disposal.

Table 6: The Juhn-Murphy-Pierce decomposition of test score gap

		p5	p10	p25	p50	p75	p90	p95
Australia-Italy	**Δ**	20.2	25.82	27.19	26.35	29.37	33.76	38.45
	E	42.77	36.4	26.49	10.75	1.98	-1.83	-3.24
	R	-1.85	2.96	7.17	13.9	19.62	23.97	26.48
	U	-20.72	-13.54	-6.47	1.7	7.77	11.63	15.2
Canada-Italy	**Δ**	46.02	45.76	42.82	33.75	32.71	33.45	33.36
	E	57.75	53.32	45.25	29.52	21.95	16.36	16.37
	R	2.37	3.86	2.51	3	4.37	7.01	6.05
	U	-14.1	-11.42	-4.94	1.23	6.39	10.08	10.94
		p5	**p10**	**p25**	**p50**	**p75**	**p90**	**p95**
Ireland-Italy	**Δ**	6.58	13.74	11.48	9.46	7.68	7.55	9.45
	E	12.18	9.48	-1.64	-14.52	-23.72	-25.83	-25.2
	R	7.59	10.81	15.83	22.48	27.01	26.72	24.48
	U	-13.19	-6.55	-2.71	1.5	4.39	6.65	10.16
Luxembourg-Italy	**Δ**	-35.67	-27.35	-20.65	-15.67	-8.58	-4.21	-1.78
	E	18.95	16.94	12.17	7.31	2.89	5.08	3.23
	R	-48.03	-42.92	-31.58	-23.24	-13.3	-12.36	-8.44
	U	-6.59	-1.37	-1.23	0.26	1.83	3.07	3.44

Note: Δ=Total Gap; E=Endowment Effect; R=Return Effect; U=Residual Effect

6. CONCLUDING REMARKS

Education may be one of the main determinants of earnings and other non-market benefits like health and social mobility on the individual level and, at the same time, it is one of the first places to look in searching for the factors of income distribution and economic growth on an aggregate level. In other words, education and its quality, generally measured by test scores, are strongly related to individual productivity and to socio-economic outcomes. In particular, results of international standardised assessments, such as TIMSS (Trends in International Mathematics and Science Study), PIRLS (Progress in International Reading Literacy Study) and PISA, may be regarded as indicator for the level of human capital provided by a country's educational system and, therefore, a starting point to analyse the national school systems and their outcomes.

In this light, the paper was aimed to contribute to the literature in the economics of education by analysing the determinants of educational gap between Italy and four OECD countries with some similarities in their schooling systems but

significant differences in terms of educational performance. Results of OECD PISA 2009 show that Italian students perform significantly worse than their Australian, Canadians and Irish colleagues and these differentials range from 10 to 40 points on the reading scale, while the educational gap between Italy and Luxembourg amounts to 16 points in favour of Italian students. Estimating educational production functions separately for each country has revealed that student characteristics and family background have the greatest impact on educational success of students. By the contrary, the influence of school resources and context is less evident and does not consistently contribute to explain the mechanism of educational processes. Similarly, the analysis at a country level has provided little evidence about the role played by institutional factors, like school autonomy and accountability, in line with other studies where the educational production functions are separately estimated for each country. By contrast, a cross-country approach would be likely more suited for analysing the effects of these institutional factors.

Focusing on the gap between Italy and each other country, a common result is the significant disadvantage in terms of endowment of Italian students compared to their peers in the other countries. The returns of Italian educational process partly balance out the negative endowment effect and so the analysis shows a higher efficiency of the Italian educational system which appears to be able to better exploit the smaller amount of available resources. Nevertheless, it is worth to note the negative impact of the quality of educational resources on the gap of Italian students; indeed, the decomposition not only reveals a lower quality of Italian school resources but also a lower efficiency of transforming these resources into scores.

Moreover, as regards the countries which mostly outperformed Italy, a first look at the comparison with Australia seems to suggest that the endowment and return components nullify each other at the mean and the gap is explained by the interaction term which captures the leverage produced by both of the previous effects happening simultaneously. Anyway, the analysis along the entire distribution through Juhn-Murphy-Pierce (JMP) approach provides a more differentiated picture. Indeed, if the characteristics effects almost entirely explain the educational gap at the bottom of the distribution, the component related to the educational process mainly drives the gap at the higher quantiles. Looking upon Canada – the other country which strongly outperforms Italy with a gap of 30 points steadily decreasing along the score distribution – both the Oaxaca-Blinder decomposition and the JMP approach have allowed to attribute this differential to more and better resources for Canadian students, while no relevant difference seems to subsist between the educational processes of the two countries.

In the light of these findings which provide some insights into the determinants of educational performance and the ways in which their effects may cause educational gaps, the main question is now whether and which education policies could actually contribute to improve the Italian school system and then the quality of human capital. This study has confirmed the lower equity of Italian school system expressed by the strong relationship between the social background of students and their educational achievement. Such a system tends to advantage students with higher socio-economic origins instead to help pupils coming from a needy background to improve their outcomes. Therefore, a reorganization of educational investments could be required in order to readdress the available financial funds to schools which operate in poorer territorial contexts. Indeed, higher financial endowments along with a fuller economic school autonomy and a higher accounting capacity would allow schools to implement programmes more suited to the social, economic and cultural backgrounds in which they operate. However, each education policy also requires a strong political and cultural mobilisation, especially in the poorer regions of Southern Italy, which could strengthen the relations among social parts and alert public opinion expectations.

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