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THE EFFECTS OF SCHOOL COMPETITION ON THE ACHIEVEMENT OF ITALIAN STUDENTS

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The effects of school competition on the achievement of Italian students

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In this paper we study the impact of the degree of school competition on achievement of Italian students. Specifically, competition is measured as the number of schools available to students in a given area. The aim is to evaluate whether an increase in school choice improves the quality of education. Using the third cycle of the Programme for International Student Assessment (PISA 2006) we investigate with simple Least Squares regression models, controlling for a range of individual and schools characteristics, if secondary school students with a wider range of schools choices perform better than those students whose choice is more limited. We find a significant positive correlation between students' academic performance and the degree of local schools competition. Moreover, we show that students achieve much better outcomes if schools operating in more competitive environments also experience a higher pressure on academic standards coming from parents.

Keywords: educational production function, school competition, students achievement, PISA.
JEL classifications: J24, I2, I21, H72.

1. Introduction

The effects of schools competition on students achievement represent a relevant topic in the educational literature. However, they have been mainly analyzed in the US where school choice may take several forms such as vouchers, charter and magnet schools (Hoxby, 2000, 2003, 2004; Rouse, 1998; Witte, 1999; Epple and Romano, 1998; Goldhaber et al., 1999; Belfield and Levin, 2002).

Specifically, a voucher is a publicly funded coupon that can be targeted at particular groups, for example, poor families or families of children at poorly performing schools. Students take the voucher to the chosen schools (which may be a public or private school) that receive a revenue equal to the amount of the voucher (Hoxby, 2003a).

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Like vouchers, charter and magnet schools represent a subsidized alternative to traditional public schools requiring an examination process or a lottery system in selecting students who apply to them. These types of schools, surviving through their ability to attract sufficient numbers of students, can offer true competition to the regular public schools, because they can draw students away from poorly performing regular publics.

A large amount of the evidence on the effects of school choice and competition on students outcomes predominantly explore the various alternative to traditional open enrollment (school voucher, charter schools and magnet schools) that, increasing the degree of competition faced by local public schools, can improve both schools performance and students' opportunities (Hoxby, 1994, 2000, 2003c; Gibbons *et al*. 2008). A necessary condition for these forms of choice to improve students' outcomes is that those gaining access to desirable schools better experience academic performance than they otherwise would.

The existing literature on the relationship between school choice and students achievement mainly comes from contexts in which competition is induced by private schools. Most of studies evaluate the competition effects of private school enrollment and performance relative to public schools (Hoxby, 2004; Epple and Romano, 1998) showing that an increase in school choice is related with more efficient public schools, a greater sorting of students by ability and positive peer effects. However, evidence focusing on the impact of school choice according to student ability participating at the program is mixed. The impact of school competition depends on which students take advantage of the choice. From this perspective, Epple and Romano (1998) find that educational benefits seem to be quite unequal: disadvantaged students benefit disproportionately from this educational mechanism since those who participate are both more able and more advantaged. In particular, it emerges that typically only a small percentage of students take benefit of school choice and that these students tend to be characterized by better socio-economic background (Coleman *et al*., 1993; Lankford *et al*., 1995; Buddin *et al*., 1998; Goldhaber *et al*., 1999).

Another stream of research exploits randomized voucher lotteries, offered to a limited number of low-income students, to study the direct effects of attending private schools. Voucher recipients are selected from a pool of eligible applicants by a random lottery and successful applicants carry with them the coupon to the school of their choice. Unclear results have been reached also on this stream of literature: whereas some studies do not find improvement in achievement for voucher students (Witte *et al*., 1995; Green *et al*. 1997; Witte, 1998; Rouse, 1998), other researches find evidence of a positive impact of the voucher program on students' performance (Cullen *et al*., 2003; Cullen *et al*., 2005; Angrist *et al*., 2002; Hoxby, 2003). Specifically Cullen *et al*. (2003) and Cullen *et al.* (2005), using evidence from the lotteries used

to allocate students to oversubscribed schools in the Chicago state school system, show that students assigned randomly into supposedly better high-schools experience modest advantage in terms of academic benefit. Moreover, Angrist *et al*. (2002) using evidence from a Colombia's program providing vouchers to low-income families, find that lottery winners benefit from higher educational attainment and reduced grade repetition. Also, according to the findings of Hoxby (2003), students achievement generally rises when they attend voucher or charter schools. As a consequence, since public schools respond to the threat of losing students who use vouchers to attend private schools, the average school quality across both sectors rises in response to an increase in competition.

As regards competition among public schools, Hoxby (2000 and 2006, among others), exploits variation in the number of school districts across US metropolitan areas to investigate the impact of inter-district choice. She shows that greater choice among public schools leads to greater productivity of these schools, both in terms of better students' educational attainment and lower expenditure per student.

The Italian educational literature, analyzing the determinants of students' performance, is still in its infancy and mainly focused on the role of family background and on school level peer effects affecting students' performance in PISA test scores (Checchi 2004) and on the causes of the existence of regional disparities in secondary students' outcomes (Checchi, 2004; Tramonte, 2004; Bratti, Checchi, Filippin, 2007; Montanaro, 2007).

The current paper contributes to investigate the effects of local school competition on students' performance (focusing on the Italian public school system). The degree of competition is based on the number of schools available for students in a given neighbourhood. Even though public schools are almost free and serve students from both low and high-income families, they enjoy vary degrees of market power that may increase the quality of schools. In a public, free and compulsory educational system as the Italian one, the mechanism through which local school competition influences school quality can be explained by the fact that public funds assigned to each school are related to the number of students enrolled in the school. Therefore, schools offering a lower quality than others bear high costs since the lower the number of students in these schools is, the smaller are the public resources devoted to them. Thereby public schools with a declining number of students enrolled face the threat of shutting down and its teaching staff reassigned to different schools, even in a different geographical area.

The aim of this study is to investigate whether the degree of competition existing among Italian public schools in a given area improves students' performance as measured by their secondary educational test scores. As far as we know, there are no other studies on the effects of schools competition on students achievement in Italy.

We use the third cycle of the Survey Programme for International Student Assessment (hereafter indicated as *PISA*), that is a three-yearly survey of the knowledge and skills of 15-year-olds. It is the product of collaboration among participating countries through the Organisation for Economic Co-operation and Development (OECD), and draws on leading international expertise to develop valid comparisons across countries and cultures. More than 400,000 students from 57 countries making up close to 90% of the world economy took part in PISA 2006. The main focus of the 2006 wave is on science but the assessment also includes reading and mathematics and the survey collects data on student's attitudes, family background, school characteristics and institutional factors.

PISA target population is defined in terms of age (15 years old students) and not in terms of grade level. The survey does not focus on curricular competences but on knowledge and skills that can be used in every day life, helping the individual to fulfil his/her potential in the "knowledge society".

The comprehensiveness of PISA dataset allows researchers to include a number of variables that reduces the potential bias due to the omission of relevant variables typical of this type of studies.

For the purpose of the analysis we define the dependent variable, *Test Scores*, as the mean of students' performance in the fields of Reading, Mathematical and Scientific literatures. To analyze the effect of school choice that is, the degree of competition among schools available to students in a given area, on student's scholastic achievement, we estimate a number of simple Least Squares Regression models controlling for a wide range of individual characteristics, family background and school variables aiming at reducing the potential bias due to the omitted variable. The indicator we use to investigate the degree of competition among schools is based on the reported number of schools of a given type available to students in a given area.

Our main result is that students in secondary schools with a wide range of school choice in a given neighbourhood get benefits from the availability of school choice, achieving better academic outcomes than those living in areas with no nearby schools. Moreover, it emerges that students' performance is particularly high in contexts in which a high degree of school competition is combined with parents placing very high pressure on school to set higher academic standards.

As expected, we also find the existence of regional disparities in students' performance across Italian macro-area: students living in the Centre, South or Islands perform much worse than those in North-Western Italy. Additionally, the size of the city in which a student lives, capturing different socio-economic and cultural background, significantly affects his/her

achievement: test scores of students living in large cities and metropolitan areas are significantly better than those attending schools located in small towns. Moreover, students attending scientific and technical schools perform better than professional schools. Females have lower achievement compared to males. It emerges a positive correlation between students' performance and household's socio-economic background.

The paper is organized as follows. Section 2 describes the *PISA* dataset we use and gives some descriptive statistics. Section 3 reports and discusses several specifications analyzing the effects of school competition on students' academic outcomes. Section 4 concludes.

2. The Data

The data source we use for our empirical analysis is the survey on the *Programme International Student Assessment* (*PISA*) developed every 3 years by the Organization for Economic Cooperation and Development (OECD). PISA is a system of international assessments focusing on 15-year-olds' capabilities in reading literacy, mathematics literacy, and science literacy. Each country includes assessments of all three subjects, but assesses one of the subjects in depth. We use in this paper the third wave of *PISA* which refers to data collected in 2006 mainly focused on measuring performance on science literacy. The *PISA* contains a rich set of information on students', parents' and schools characteristics[1]. The latter are collected through a questionnaire completed by school principals.

The Italian sample includes 21,773 students at the age of 15 tested in 806 schools. It is stratified for macro-geographical areas (North West, North East, Centre, South and Island) and for type of secondary schools attended (Lyceums, Technical schools and Vocational institutes). We define the dependent variable, *Test Scores*, as the mean of students' performance in the fields of Reading, Mathematics and Science.

The question we use to define our variable of interest as judged by schools principals is the following: "Which of the following statements best describe the schooling available to students in your location?" The possible answers are listed below: 1) there are two or more other schools in this area that compete for our students; 2) there is one other school in this area that competes for our students; 3) there are no other schools in this area that compete for our students. Using this question, we define two dummy variables: 1) *competition coming from two or more schools* and 2) *competition with another school* (the omitted category is absence of competition).

[1] PISA data are freely available at *www.pisa.oecd.org*.

In an important number of cases, information on parents' and schools backgrounds are missing values. Our final sample includes 18,265 observations.

Table 1 presents descriptive statistics for the main variables used in the analysis. The mean value of *Test Scores* is 479.26 with a standard deviation of 89.53. As regards the degree of competition among schools, about 66% of the schools in our sample are involved in competition with two or more other schools while 13% of them compete with another school. About 20% of schools face no competition. Students attending private schools are 6.4%. The average school size (given by the total number of boys and girls enrolled) is 662.83. The variable *Parents Pressure* represents the parental pressure on schools with regards to academic standards. On the basis of schools statements we define two dummy variables: *Very High Pressure* if many parents press on school to achieve higher academic standards and *Normal Pressure* coming from a minority of parents, whereas *Absence of Parents Pressure* is the reference category. About 20% of parents places very high pressure on school to set higher academic standard while 23% of them does not exert any pressure on school.

Table 1. Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Obs
Test Scores	479.263	89.527	76.333	732.618	21773
Mathematics Scores	473.628	92.290	7.563	895.225	21773
Reading Scores	477.008	102.626	1.020	1078.888	21773
Science Scores	487.153	93.266	95.989	800.566	21773
School Characteristics					
Competition with two or more schools	0.661	0.473	0	1	21106
Competition with one other school	0.131	0.338	0	0	21106
Absence of competition	0.207	0.405	0	1	21106
Private school	0.064	0.244	0	1	21622
School size	662.831	419.982	9	2536	20810
Parents pressure: very high	0.200	0.400	0	1	20919
Parents pressure: normal	0.567	0.495	0	1	20919
Parents pressure: absent	0.232	0.422	0	1	20919
Student Characteristics					
Female	0.498	0.500	0	1	21773
Lyceum	0.397	0.489	0	1	21773
Technical school	0.321	0.467	0	1	21773
Vocational and Other schools	0.282	0.450	0	1	21773
Grade (school year level)	9.847	0.408	9	11	21597
Immigrate student	0.107	0.309	0	1	21773
Total hours self study per week	12.861	6.971	0	32	20907
North West	0.226	0.418	0	1	21773
North East	0.389	0.488	0	1	21773
Centre	0.038	0.190	0	1	21773

South	0.144	0.351	0	1	21773
Islands	0.204	0.403	0	1	21773
Village (< 3,000 people)	0.024	0.152	0	1	21300
Small town (3,000-15,000)	0.236	0.425	0	1	21300
Town (15,000-100,000)	0.487	0.500	0	1	21300
City (100,000-1,000,000)	0.211	0.408	0	1	21300
Large city (over 1,000,000)	0.042	0.201	0	1	21300
Family Background Characteristics					
Parents education (in years)	12.388	3.465	0	18	21554
Father white collar	0.529	0.499	0	1	21095
Father blue collar	0.426	0.495	0	1	21095
Father unemployed	0.044	0.206	0	1	21095
Mother white collar	0.534	0.499	0	1	21773
Mother blue collar	0.156	0.362	0	1	21773
Mother unemployed	0.310	0.463	0	1	21773
Index of home possessions	0.000	1.634	-10.837	2.426	20844
Books at home (0-10)	0.083	0.276	0	1	21525
Books at home (11-25)	0.166	0.372	0	1	21525
Books at home (26-100)	0.329	0.470	0	1	21525
Books at home (101-200)	0.202	0.401	0	1	21525
Books at home (201-500)	0.137	0.344	0	1	21525
Books at home >500	0.083	0.275	0	1	21525

Data source: *PISA* 2006.

Females make up 50% of the sample. Students mainly came from three different types of high schools: Lyceums (about 40%), Technical (32%) and Vocational/Other schools (about 28%)[2]. The average number of hours studied per week is 12.86.

Students living in the North-West constitute 23% of the population, those residing in the North-East are 39% while 4% lives in the Centre, 14% in the South and 20% on the Islands[3]. Schools are located in five different types of community: village or rural area (below 3,000 inhabitants) that make up 2.4% of the sample, small town with 3,000 to about 15,000 inhabitants (24%), town with 15,000 to about 100,000 inhabitants (49%), city with 15,000 to about 100,000 inhabitants (21%) and large city with over 1,000,000 inhabitants (4.2%).

Education of parents represents the number of years of schooling. It is set at 0 for no educational qualification; 5 for elementary school; 8 for middle school; 11 for some high school; 13 for high school; 18 for university. The average number of years of parents schooling

[2] The Italian secondary school system can be described as tripartite, with an academic oriented generalist education provided by high schools (5 years, called *licei*, with further division in humanities, sciences, languages, pedagogy), a technically oriented education provided by technical schools (5 years, called *istituti tecnici,* with further differentiations according to the type of job), and a vocational training offered by local schools organized at regional level (5 years, called *istituti di formazione professionale*).

[3] North-West includes the following regions: Piedmont, Lombardy, Liguria; North-East includes Veneto, Trento and Bolzano, Friuli Venezia Giulia, Emilia Romagna; Centre includes Tuscany, Lazio, Marche, Umbria; South includes Campania, Apulia, Molise, Basilicata, Calabria; Islands includes Sicily and Sardinia.

in the sample is 12. Nearly 33% of families has 26-100 books, 17% has 11-25 books and 8% has less than 10 books.

3. An Empirical Analysis of the Relationship between School Competition and Student Achievement

In this Section in order to analyze the relationship between students' academic achievement and the degree of competition among schools, we estimate a number of Least Square Regressions. We adopt an "incremental" approach by estimating different specifications in which we progressively add new control variables.

Our estimates are based on the following educational production function:

$$(1) \qquad Y_{ij} = \beta_0 + \beta_1 X_{ij} + \beta_2 Schools\_Competition_j + \beta_3 F_{ij} + \beta_4 S_j + \beta_5 E_{ij} + \varepsilon_{ij}$$

where Y_{ij} is the *Test Scores* achieved by student *i* at school *j*, X_{ij} is a vector of individual characteristics, $Schools\_Competition_j$ describes the availability of schools to students, a measure of the number of competitors of school j, F_{ij} is a vector of variables capturing family background characteristics, S_j is a vector of school characteristics, E_{ij} describes the time spent per week studying or doing homework by students and ε_{ij} is an error term.

Results of our estimations are reported in Table 2. In the second part of the analysis (Table 3), to better evaluate our findings we show further specifications in which we separately use *Mathematics*, *Reading* and *Science* literacy scores as dependent variables instead of the mean of the three fields. In all equations sample weights provided in the PISA dataset are used. The reported standard errors are robust to the heteroskedasticity and corrected for the potential clustering of the residual at the school level.

In order to evaluate whether an increase in school competition improves students' performance, we use the two dummy variables capturing the degree of competition for each school as judged by the school principals: 1) *competition coming from two schools or more*; 2) *competition with one other school* (absence of competition represents the reference category).

Table 2. Determinants of Students Test Scores. Ordinary Least Squares Regression.

Variables	(1)	(2)	(3)	(4)
Competition with two or more schools	4.304**	5.150***	5.073***	5.488***
	(1.942)	(1.925)	(1.925)	(1.940)
Competition with one other school	2.033	2.050	2.992	2.908
	(2.918)	(2.644)	(2.582)	(2.599)
Female	-11.335***	-11.059***	-11.122***	-11.063***

	(1.400)	(1.424)	(1.423)	(1.450)
Lyceum	99.941***	97.843***	98.070***	86.453***
	(1.955)	(2.091)	(2.080)	(2.296)
Technical school	58.348***	57.386***	57.630***	52.948***
	(1.903)	(1.903)	(1.891)	(1.976)
Grade	42.602***	40.878***	40.894***	36.324***
	(1.814)	(1.867)	(1.864)	(1.929)
Immigrate student	-10.696***	-10.934***	-10.885***	-8.347***
	(2.316)	(2.362)	(2.362)	(2.396)
Total hours self study per week	1.168***	1.126***	1.120***	0.949***
	(0.100)	(0.101)	(0.101)	(0.102)
North East	15.774***	14.959***	14.998***	13.847***
	(1.654)	(1.645)	(1.644)	(1.637)
Centre	-24.310***	-26.520***	-26.501***	-26.823***
	(2.598)	(2.605)	(2.601)	(2.622)
South	-64.410***	-66.607***	-66.523***	-58.806***
	(1.810)	(1.850)	(1.851)	(1.933)
Islands	-77.655***	-79.257***	-79.248***	-72.476***
	(2.022)	(2.051)	(2.051)	(2.136)
Small town (3,000-15,000)	20.192***	20.499***	20.703***	22.494***
	(5.446)	(7.633)	(7.586)	(8.546)
Town (15,000-100,000)	23.495***	22.830***	23.027***	25.669***
	(5.364)	(7.571)	(7.521)	(8.499)
City (100,000-1,000,000)	25.139***	23.052***	23.130***	25.008***
	(5.450)	(7.663)	(7.613)	(8.587)
Large city (over 1,000,000)	29.734***	28.399***	28.010***	28.562***
	(5.982)	(8.030)	(7.977)	(8.910)
Private school		-32.760***	-32.437***	-34.230***
		(4.079)	(4.093)	(4.109)
School size		0.009***	0.009***	0.007***
		(0.002)	(0.002)	(0.002)
Parents pressure: very high		7.724***	7.003***	5.387**
		(2.314)	(2.319)	(2.328)
Parents pressure: normal		4.740***	3.373*	1.924
		(1.790)	(1.897)	(1.934)
High parents pressure(competition with two or more schools)*			8.989**	7.630*
			(4.354)	(4.397)
Parents education (in years)				0.788***
				(0.216)
Father white collar				11.345***
				(3.617)
Father blue collar				11.145***
				(3.594)
Mother white collar				10.692***
				(1.800)
Mother blue collar				11.253***
				(2.237)
Index of home possessions				2.185***
				(0.584)
Books at home (11-25)				9.566***
				(3.273)
Books at home (26-100)				16.985***
				(3.223)
Books at home (101-200)				25.448***
				(3.513)
Books at home (201-500)				33.907***
				(3.705)
Books at home >500				35.148***
				(4.271)
Constant	-14.489	-3.914	-3.378	5.599
	(18.452)	(19.812)	(19.770)	(21.242)

Observations	20906	19879	19879	18265
R-squared	0.461	0.475	0.475	0.491
Pseudo R-squared	-116593	-110673	-110668	-101003

Notes: Ordinary Least Squares Regressions. The dependent variable is *Test Scores*. Standard errors (robust to heteroskedasticity) are reported in parentheses. The standard errors are corrected for the potential clustering at the school level. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. Sample weights are used. Data source: *PISA* 2006.

Column (1) shows the estimated coefficients in a model in which we only use individual characteristics, macro-geographical variables and city size dummies.

The main findings are as follows. Estimation results show that the presence of two or more other schools that compete for students in a given area produce an increase of student test scores, implying that in an area with more intense competition, students increase their performance of about 4.3 points. The coefficient is significant at the 5% level. This finding suggests that a greater degree of competition among schools, implying a larger choice amongst potential students, may raise schools productivity through an increase in teachers' effort and school efficiency. As a consequence, students tend to perform better if they are enrolled in schools that serve more competitive markets. However, it seems that the competition with another school is not sufficient to increase student's performance, in fact the coefficient is not significantly different from the reference category. In this case the competition threat associated with one extra school available to students is weaker.

Controlling for individual factors it emerges that female students have lower educational achievements. The difference with respect to male students amounts to about 11 points. This difference changes only slightly in the specifications including further controls. Additionally, students attending a Lyceum (Scientific and Humanities High schools) perform much better (99.94) than those coming from Vocational and Other schools (reference group). Besides, students attending Technical schools perform better than those in Vocational schools even if the impact on test scores is not as strong as those of students in Scientific/Humanities schools (58.35). The advantage of students attending Lyceum may capture both an effect of students' ability or family socio economic conditions (typically, Italian students with better family background enrol in Lyceum). The variables related to students' socio-economic background will be discussed afterwards.

In column (1) we also include a variable accounting for the total hours spent per week in self study. It is derived from students' reports on the amount of time they devote to do their homework on Reading, Mathematics, Science and in other subjects. One more hour devoted to self study leads to a better students' performance (1.16 points), significantly at the 1% level.

Since our measure of competition may also capture urban density, exploiting the available data that are rich in geographical details, we also control for macro-regional dummies

and for the size of the cities. In particular, geographical dummy variables may capture broader socio-economic conditions of different regional labour markets. Individuals living in areas with a bad functioning labour market (South and Islands in Italy) experience higher unemployment rate. The presence of this factor and the distortions affecting labour markets (see De Paola and Scoppa, 2007) may discourage students to invest in human capital. As expected, the coefficients on the macro-area dummies (South and Islands) show a huge negative sign. Students living in the South perform about 64 points worse compared to the North-West (reference category), while even worse educational achievements are obtained by students in Islands (-73.65). On the other hand, it is interesting to note that the performance of students in North-East Italy is by far the highest (+15.77) one. All coefficients are significant at the 1% level and the magnitude remains almost the same across the different specifications. Given the centralised structure of the Italian educational system, the presence of these large geographical differences across macro-areas in student achievements is particularly striking.

In column (1) we also add as control variables City Size dummies to take into account the fact that larger cities tend to be associated with a greater endowment of human capital and, as a consequence, more prone to generate externalities favouring the accumulation of skills. All coefficients of city-size dummies show positive and significant effects on students' performance (the reference category is Small town with 3,000 or less inhabitants). Test Scores of students attending schools located in town, cities, large cities and metropolitan areas differ significantly from the performance of students attending schools located in villages. Living in a city (100,000-1,000,000 inhabitants) increases the educational achievement by 25.14 points compared to the reference category. The finding of a considerable positive effect is stronger in metropolitan areas (equal to 29.73) even if it is plausible to think that in small towns a limited number of schools is available whereas in large cities students are able to choose from a wide range of schools. Therefore, it is difficult to attribute the effect of large cities on student's performance to the degree of competition, since small and large cities differ for a number of contextual and socio-economic factors.

In model (2) of Table 2 we take into account some school characteristics. Students attending private schools show worse performance than those in public schools. The effect is huge (being student in a private school reduces educational achievement of 32.76 points) and significant at the 1 percent level. The finding can be illustrated in terms of characteristics of private schools in Italy, perceived as remedial schools for low skilled students from more advantaged social background (see Brunello and Rocco, 2008).

In addition, it emerges that students enrolled at schools with larger size have better educational achievements (an increase of 100 in the school size improves students' tests scores

of 0.9 points). The coefficient is significant at the 1 percent level. However, this effect should be interpreted with caution since it could represent the presence of an inverse causality relationship among school size and student's performance due to the fact that schools of better quality attract students.

In column (2) we also include two dummy variables: *Very High Parents' Pressure* and *Normal Parents' Pressure*, taking into account the pressure of parents on school with regards to academic standards. From our analysis it emerges that both coefficients of Parental pressure improve students' performance. The positive coefficient indicates that in a context in which parents place very high pressure on school to set a higher academic standard, students test scores significantly increase by 7.72 points compared to the reference category (*Absence of Parents Pressure*). Similarly, pressure coming from a minority of parents on school has a positive effect on students test scores (4.74 points). Both coefficients are significant at the 1 percent level. Since parental pressure on academic standard increases student's performance, in column (3), we interact the dummy *Very High Parent Pressure* with our variable of interest (*Competition with two or more schools*). Results show that in contexts in which schools operate in more competitive markets and also parents put pressure on school to set a higher academic standard, students achievement significantly increases. Therefore, the degree of competition is particularly useful when parents are interested in their children education.

In the last specification (column 4) we include several controls for family background. It is common that students with better socio economic background tend to have better educational resources and obtain higher academic outcomes. In fact, in our analysis the educational level (in years) achieved by students' parents is strongly positively related to the students' educational performance.[4] Besides, the dummy variables accounting for parental occupational conditions (White collar/Blue collar classification) have a strong and highly significant effect on student's performance (the base category is father/mother not employed).

As expected, the household possessions, derived from students' reports on the availability of resources in their home (for example a quiet place where to study, a desk to study, number of software, Internet connection, classic literature, books of poetry, a dishwasher, DVD or VCR player etc.) have a positive effect on students' performance. The coefficient is statistically significant at the 1% level[5].

[4] To take into account human capital externalities among peers, we have also included in the analysis the average years of schooling of parents of all the students enrolled at the school but the coefficient does not turn out as a significant determinant of students test scores (not reported).

[5] The variable *Family Wealth* was not included in estimations to avoid problem of collinearity because of the very high correlation with the index of home possessions (0.62). However, including Family Wealth instead of Home Possession leads to very similar results.

Finally, it emerges that the cultural capital measured by the number of books at family home, is positively associated with student test scores. The dummy variables accounting for the number of books at the student's home are five.[6] An increase in the number of books is associated with better students' performance. Students having more than 500 books at family home achieve much better academic outcomes (35.15 points) than those who have lower books availability at home (0-10 books (reference category)).

Notwithstanding the fact that, in the latter specifications, we are controlling for a host of factors which are correlated with student educational attainment, we find evidence that attendance at a school that faces more competition improves student achievement. In particular, the competition threat associated with two or more extra schools available to students in a given area, increases students test scores of about 5.5 points, significantly at the 1 percent level. A possible interpretation of this finding is that a greater degree of school competition, leading to a greater choice amongst potential students, also tends to improve schools productivity in terms of efficiency and, as a consequence, students educational achievement.

To better evaluate our findings we show in Table 3 further specifications in which we separately use Mathematics, Reading and Science literacy scores as dependent variables instead of Test Scores. In these specifications we consider all the variables entered in the model 4 of Table 2 to study the relationship between student's academic performance (respectively in Mathematics, Reading and Science) and the degree of competition among schools.

Table 3. Determinants of Students Test Scores. Ordinary Least Squares.

Variables	*Mathematics literacy* (1)	*Reading literacy* (2)	*Science literacy* (3)
Competition with two or more schools	6.964***	7.075***	2.427
	(2.132)	(2.515)	(2.114)
Competition with one other school	1.287	3.340	2.033
	(3.971)	(5.287)	(2.918)
Female	-33.448***	21.999***	-21.738***
	(1.565)	(1.844)	(1.588)
Lyceum	76.154***	102.373***	80.832***
	(2.438)	(2.942)	(2.487)
Technical school	51.269***	59.621***	47.953***
	(2.071)	(2.616)	(2.108)
Grade	38.813***	34.957***	35.201***
	(2.059)	(2.553)	(2.084)
Immigrate student	-6.247**	-8.127**	-10.667***
	(2.618)	(3.182)	(2.746)
Total hours self study per week	0.962***	0.908***	0.976***
	(0.110)	(0.125)	(0.114)
North East	16.683***	9.741***	15.116***
	(1.773)	(1.903)	(1.798)
Centre	-31.542***	-23.108***	-25.820***

[6] 0 to 10 books at the student's home (reference category), 11 to 25, 26 to 100, 101 to 200, 201 to 500 and more than 500.

	(2.763)	(3.343)	(2.944)
South	-54.360***	-59.881***	-62.177***
	(2.125)	(2.368)	(2.072)
Islands	-72.783***	-72.404***	-72.240***
	46.142***	32.189**	37.239***
Small town (3,000-15,000)	(2.531)	(8.467)	(2.643)
	45.777***	41.680***	39.367***
Town (15,000-100,000)	(1.057)	(4.923)	(2.233)
	46.223***	38.300***	39.023***
City (100,000-1,000,000)	(3.266)	(1.994)	(1.919)
	59.552***	42.039**	40.900***
Large city (over 1,000,000)	(4.967)	(13.269)	(6.294)
	46.142***	32.189**	37.239***
Private school	-36.846***	-25.637***	-40.208***
	(4.801)	(4.766)	(4.266)
School size	0.005**	0.008***	0.009***
	(0.002)	(0.002)	(0.002)
Parents pressure: very high	9.341***	5.423*	1.399
	(2.531)	(2.851)	(2.575)
Parents pressure: normal	-0.215	6.087**	-0.099
	(2.048)	(2.543)	(2.080)
High parents pressure(competition with two or more schools)*	7.570*	5.045	10.275**
	(4.554)	(5.861)	(4.780)
Parents education (in years)	0.840***	0.824***	0.699***
	(0.232)	(0.287)	(0.236)
Father white collar	8.781**	14.794***	10.460***
	(3.909)	(4.885)	(4.036)
Father blue collar	7.729**	14.514***	11.192***
	(3.872)	(4.895)	(3.971)
Mother white collar	10.176***	10.313***	11.588***
	(1.937)	(2.264)	(2.004)
Mother blue collar	11.169***	11.993***	10.597***
	(2.385)	(2.889)	(2.407)
Index of home possessions	2.388***	1.790**	2.377***
	(0.611)	(0.760)	(0.627)
Books at home (11-25)	9.089***	14.146***	5.464
	(3.318)	(4.326)	(3.511)
Books at home (26-100)	14.201***	22.784***	13.969***
	(3.221)	(4.216)	(3.434)
Books at home (101-200)	21.636***	29.460***	25.250***
	(3.559)	(4.522)	(3.792)
Books at home (201-500)	32.579***	33.356***	35.785***
	(3.819)	(4.711)	(4.015)
Books at home >500	35.399***	30.634***	39.411***
	(4.480)	(5.377)	(4.599)
Constant	4.226	-37.202	49.774**
	(22.736)	(27.828)	(22.757)
Observations	18265	18265	18265
R-squared	0.435	0.441	0.444
Pseudo R-squared	-102557	-104766	-102644

Notes: Ordinary Least Squares Regressions. The dependent variables are *Mathematics Test Scores* (column 1), *Reading Test Scores* (column 2), *Science Test Scores* (column 3). Standard errors (robust to heteroskedasticity) are reported in parentheses. The standard errors are corrected for the potential clustering at the school level. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at the 1, 5, and 10 percent level. Sample weights are used. Data source: *PISA* 2006.

As regards our variable of interest, the estimated effect of the degree of competition between two or more schools increases the performance of students on Mathematics and

Readings subjects of about 6.96 and 7.07 points respectively (significantly at the 1 percent level). However, the existence of this intense competition among schools does not appear to be a relevant determinant of students test score in Science literacy. Moreover, it emerges that competition with another school does not significantly differ from the reference category (*Absence of Competition*).

Some of the estimated coefficients change in size but they are broadly similar to previous specifications. The coefficients of city-size dummies show positive and significant effects on students achievement in Mathematics, in Reading and in Science. Students attending schools located in a city (100,000-1,000,000 inhabitants) perform in Mathematics about 46 points (38 and 39 points in Reading and Science) better than those attending schools located in villages (the reference category). The effect of a considerable positive effect is stronger for students living in metropolitan areas (equal to 60, 42 and 41 points respectively).

4. Concluding Remarks

In this study we have attempted to explore the effects of schools competition on the test scores of 15 years old students in Italy as reported in the PISA 2006 survey. Specifically, we have investigated if secondary school students with a wider range of school choices perform better than those whose choice is more limited. Thereby, we have used the number of schools available to students in a local area to gauge the degree of competition.

Controlling for a wide range of individual and school characteristics, our results show a positive association between the degree of school competition and student academic performance: students enrolled in schools operating in more competitive environments (two or more other schools in a given area that compete for students) achieve better performance than those who have less choice (since there are no other schools competing in the area or competition is limited to only another school). This aspect appears to be mainly relevant for students' performance in Mathematics and Reading subjects. Although, the Italian educational system is public and free, competition among schools improves students' performance. The mechanism through which local school competition influences school quality can be explained by the fact that public funds are related to the number of students enrolled in a given school. Thereby, schools offering a lower educational quality compared to others lose students and with a lower number of students enrolled, they obtain a smaller percentage of public funds.

Furthermore, from our analysis it appears that students achievement increases if schools operating in more competitive markets also bear a higher pressure coming from parents with regards to academic standards.

As regards other relevant findings of our investigation, it emerges that students in Southern Italy perform significantly worse than those in the North. A possible cause of this result may be due to the presence of distortions affecting labour market that may discourage students to invest in effective skills. Moreover, the performance of students living in cities and metropolitan areas are significantly better than those attending schools located in small towns. Perhaps, this result is also due to the fact that students attending school in larger cities get benefit from the availability of school choice, achieve better academic outcomes than those who live in areas with no nearby schools. However, other explanations cannot be excluded since larger cities are also endowed with better human capital and with better resources for educational purposes.

In accordance with the existing literature, we also find support by the fact that family background such as parents' education, parental occupational status and home possessions related to both family wealth and culture capital are positively correlated with students' performance.

From a policy perspective, the findings that students tend to do better if they are enrolled in schools operating in more competitive contexts highlight the general effectiveness in terms of allocative efficiency in the use of resources. Thereby, implementing systematic competition within local public schools promotes the quality of education and improves student outcomes, constituting an efficient form of discipline for low quality neighbourhood schools. With greater choice, students may be able to enrol at a school that better suits their preferences and schools tend to improve their productivity since if they are not efficient they risk to lose students and public funds.

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