Inequality in education: Can Italian disadvantaged students close the gap?

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1. Motivation and objectives

Studies in recent economic literature point towards demonstrating that peoples' individual competencies can influence not only their own future (both social and economic, i.e. earnings), but also macro-economic growth in general. In a recent and influential study, Hanushek and Woessmann (2011, p. 190) conclude that:

> "The results of growth modelling that employ measures of national cognitive skills strongly suggest that the basic human capital model is very relevant for aggregate outcomes. Variations in skills measured by international math and science tests are strongly related to variations in economic growth, and they solve many of the difficult measurement problems with the more traditional school attainment measures".

Therefore, policy-makers should focus their attention on the factors that are able to influence students' results positively. Since students' achievements can be considered as an indirect measure of human capital and, given that the latter is strongly associated to economic growth, it is therefore necessary to understand what is likely to affect achievement. Basically, in economic literature, the issue is studied along two directions: the (i) role of the family (socio-economic background) and (ii) school factors (see Sousa & Armor, 2010, who compared the relative influence of these factors in a sample of OECD countries using data from PISA, the OECD Programme for International Student Assessment). In particular, with regards to the influence of family background, ever since Coleman et al. (1966) published their study, educational scientists, sociologists and economists have acknowledged the importance of students' socio-economic status (SES) in determining their educational achievement. Subsequent literature very soon demonstrated that it is not only a student's own SES that matters, but also that of her/his classmates (known as the "peer-effect") (Bradley & Taylor, 1998; a summary is provided by van Ewijk & Sleegers, 2010). Therefore, a school's average performance, as measured through scores in standardised tests, is likely to be strongly affected by the composition of its student intake: the higher their SES, the better the school's results, with clear implications for policy- and management-related considerations. As a consequence, generating "adjusted" measures of schools' results became a very hot topic, and several methods were developed in economic literature to carry

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out the exercise. For instance, Ruggiero and Vitaliano (1999) and Stiefel, Rubenstein, and Schwartz (1999) proposed approaches to control for environmental harshness when assessing the efficiency of public schools – and, more generally, studies on school efficiency focused early on this issue, as Worthington (2001) demonstrated in his review. Value-added (VA) measures of schools' and teachers' effectiveness became popular, in part because they can explicitly look at the students' baseline results – which are strongly influenced by their socio-economic background – but were then criticised when they failed to pursue their objective (i.e. Ladd & Walsh, 2002).

Nevertheless, studying disadvantaged schools is an interesting topic per se. Although OECD PISA data systematically show a strong correlation between school-level SES and a school's average performance, and despite the evidence of high between-schools variance, little attention has been paid to schools that were able to obtain high grades in difficult situations. In the US economic literature, some effort was spent in this direction, evaluating the impact of several educational interventions that aimed at "closing the gap" between advantaged and disadvantaged students (Gregory, Skiba, & Noguera, 2010). A stream of US academic interest is concerned with "high-flying schools", defined as schools where students obtain high test scores despite the significant disadvan-tages in the population they serve (Harris, 2007). These studies highlighted that school factors can make a difference in helping disadvantaged students, and also that the school's contribution must be calculated appropriately, through adequate methods and research designs (for instance, employing value-added models). Therefore, understanding the mechanisms through which schools can reduce the inter-generational perpetuation of disadvantaged backgrounds is extremely important in the medium-long run, espe-cially as social inequalities tend to reproduce themselves into educational inequalities, and vice versa (Lauer, 2003).

Interestingly, this issue has not been given much consideration in Europe and, equally, little attention has been given to the study of "resilient students", defined as those who, despite their disadvan-taged backgrounds, are able to obtain high academic results (see OECD, 2010a). In this stream of studies, the focus was then only on individuals, not schools, and the main findings actually show that individual "motivation" is the strongest factor linked to the probability of being a resilient student (OECD, 2010b).

In academic literature, only educational sociologists and psychologists have put any effort into investigating the concept of academic resilience, and they found some interesting patterns in this field (Martin & Marsh, 2009). However, it can easily be the case that some organisational and economic variables (at school level) also have a place in influencing resilience. Introducing educational production functions (EPFs) can be an interesting approach, as they can be used to model the relationship between school factors and the probability of being a resilient student. In this perspective, the traditional attention of economists towards school resources (Hanushek, 1986) can be inserted into the specific research stream above, and the research hypothesis to be tested is whether (in the case of disadvantaged schools) resources can actually help students in overcoming their disadvantaged background. Accordingly, in this paper, we used the OECD-PISA 2009 set of data to change the perspective, and investigate not only the part played by a stu-dent's own characteristics, but also the influence of school-level variables over (disadvantaged) students' performance, specifically for schools in Italy. We focused on fifteen-year-old students, who, in Italy, are in the second year of upper-secondary schooling. Widening the setting, our research question is: are there particular factors in disadvantaged schools that are positively associated with student resilience (defined as the ability of disadvantaged students to obtain high achievement scores)?

In a first stage, we proposed an innovative statistical procedure to derive a sample of resilient students who attend disadvantaged schools. Our aim was to focus on a specific category of resilient students, namely those who do not benefit from a higher socio-economic background at either family or school level. We, therefore, only selected schools where the average socio-economic condition (as measured through the OECD indicator ESCS: Economic, Social and Cultural Status) is low. The main innovation consists in defining a threshold for the average ESCS of students at the school. This allows us to use a new and more precise group of potentially resilient students, disadvantaged students in disadvantages schools, while previous OECD analyses had not specifically looked at low-income students who also attend disadvantaged schools. Our choice was motivated by educational policies. Students from a disadvantaged background can be helped by attending a school where classmates are more socio-economically affluent; the consequent benefits, however, would not be related to "school factors", but to positive peer effects, which depend on the higher socio-economic composition of the students at the school. It follows that little policy or managerial improvement can be gained from this situation. On the contrary, by restricting our analysis to a group of disadvantaged schools, with common (disadvantaged) back-ground aspects, it was easier to identify school-level factors that relate explicitly to improving the achievement of disadvantaged students (resilience). In other words, there are certainly resilient students in non-disadvantaged schools, but this kind of resilience can be masked by the (more advantaged) socio-economic composition of the school as a whole and not be influenced by any school initiative. In a second stage, we performed a multilevel logistic model to investigate which aspects belonging to students, families and schools tend to give disadvantaged students a higher probability of becoming resilient. Taking advantage of the high number of variables included in the OECD-PISA 2009 dataset, we tested the statistical significance of a relevant number of school-level fac-tors. In terms of innovation, the paper places a relatively higher emphasis on "resilient schools" than on individuals/students. It is important to note here that by focusing only on low-income students, our subsample is non-representative of the entire population of students. As a consequence, the correlations between achievement scores and individual and/or school characteristics must be interpreted accordingly, that is to say, they are valid for this subsample of students only, not for all. In other words, the results of this study cannot be interpreted in the same way as those (see Woessmann, 2003) that analyse the determinants of achievement for all the students, but must be seen as factors that influence the achievement of the specific group of low-income students.

Our findings show that some school-level factors are indeed positively associated with the students' probability of becom-ing resilient. As these factors are related to the school's degree of autonomy, the implication policy-wise is that Italian schools should be allowed to enjoy more freedom in organising their own activities.

The remainder of the paper is organised as follows. Section 2 gives the background to our study. Section 3 describes the methodological approach and data. Section 4 contains the results, while Section 5 sets out the conclusion.

2. Background

2.1. Analysing resilient students

In line with the economic approach, we consider education as a productive process in which schools use their students' ability

and background to "produce" knowledge (educational production function):

$$y_{ij} = f[X_{1ij}, X_{2j}, \varepsilon_{ij}] \quad (1)$$

where y_{ij} is a measure of the achievement of the ith student at the jth school, X_{1ij} is a vector of the student's characteristics, and X_{2j} is a vector of the school's characteristics. Literature on the economics of education aims at estimating the coefficients of each variable in the X_{1ij} and X_{2j} vectors.

The present research is specifically linked to studies that investigated the impact of school-related factors (processes and resources) on a students' achievement. Such literature generally concludes that "overall resource policies have not led to discernible improvements in student performance" (Hanushek, 2006, p. 902; see also Hanushek, 2003). This result, which is in line with Coleman et al.'s (1966) pioneering study, has been questioned both theoret-ically and methodologically, especially within the British context and that of mainland Europe, given the predominance of US data in Hanushek's review: good summaries are provided by Vignoles et al. (2000), and Levačić and Vignoles (2002). Of particular interest is the contribution by Holmlund et al. (2010), who showed that increased resources in England from 2000 were related to higher achievement scores; moreover, such effect is greater for the most disadvantaged students. More generally, this paper shares similarities with studies that investigate the determinants of students' achievements in an international perspective. For instance, Hanushek and Woessmann (2011) listed many studies on the factors associated with higher test scores. The authors also conducted their own empirical exercise for several countries, using OECD-PISA and other international datasets for this purpose. In their synthesis, they summarise the latest thinking in this research line:

> "[. . .] Many dimensions of students' family background are important factors for their educational achievement. At the same time, it is hard to find evidence of substantial positive effects of most resource inputs, in particular class size and expenditure levels. Among school inputs, there is somewhat more indication of positive effects of measures capturing teachers' quality. [. . .] Instead the impact of schools comes through teacher quality and institutional structures that determine incentives. [. . .] In the school system, institutions that tend to be associated with higher achievement levels include accountability measures, school autonomy in processes and personnel decisions, private-school competition, and public financing" (p. 159).

The results from these international studies have been a source of the hypotheses advanced in this research, and many of the (groups of) variables cited here have also been tested as determinants of the students' results in our empirical exercise. Therefore, although our paper provides an insight into a specific group of students (those from a disadvantaged socio-economic background) in a specific country (Italy), the results are interpreted within a wider international comparison (see section on Discussion).

The present paper also relates to three other streams of literature investigating the effects of school-level variables on students' performance.

The first group of studies is known as "educational/school effectiveness" (Creemers & Kyriakides, 2008; Scheerens & Bosker, 1997). Contributions belonging to this group look at developing school-level indicators and relating them to a school's performance. In a survey of the results obtained on "educational effective-ness", Scheerens (2000, p. 46) stated that scholars agree on the role exerted by the following factors: (i) achievement orientation (high expectations), (ii) cooperation, (iii) educational leadership,(iv) frequent monitoring, and (v) time, opportunity to learn and

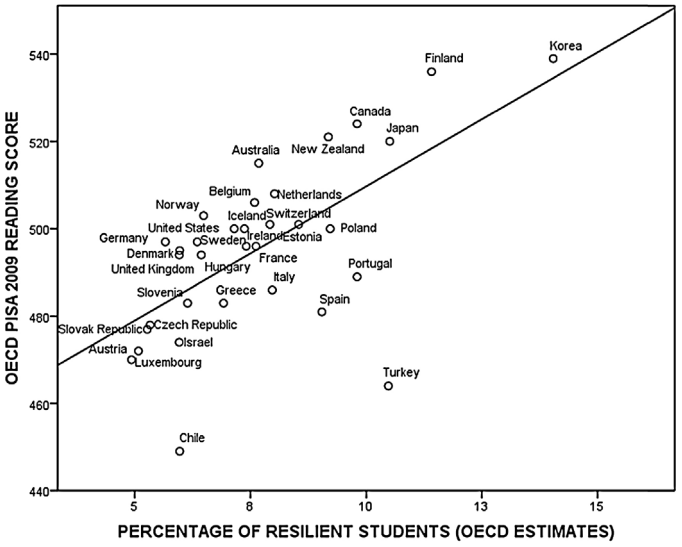

Fig. 1. Resilient students and students' achievement: a cross-country comparison – OECD-PISA 2009 data.

"structure" of the main instructional conditions. Our paper uses the OECD-PISA school questionnaire to pick up indicators that mirror many of these categories.

Another stream of the literature that influenced our approach is that of "disadvantaged schools". This set of studies suggests that the strategies required for schools in difficult or challenging circumstances are different to those for schools in more advantaged contexts (Muijs et al., 2004, p. 151). In their results, Levačić and Woods (2002) further claim to focus their attention on disadvantaged schools, as "[. . .] social disadvantage [. . .] also impacts negatively on the rate of improvement in examination results" (p. 208). In other words, such schools not only suffer a worse baseline starting point, but are also likely to improve less over time.

Lastly, the fact of concentrating research on resilient students provided the information to focus in particular on students from low socio-economic backgrounds who are able to overcome this disadvantage and do well at school. OECD reports (OECD, 2010a) and academic studies (i.e. Martin & Marsh, 2009) were especially useful in forming a picture of the type of students of interest for the analysis.

There is evidence that, in a country's educational system, a higher proportion of resilient students is associated with higher (average) student achievement. In Fig. 1, we highlight the relationship between (i) the percentage of resilient students[1] and (ii) the average OECD-PISA 2009 scores, which show a clear upward slope. Thus, from a policy perspective, it seems useful to investigate the factors associated to increases in the proportion of resilient students, as such factors will contribute towards increase the country's educational performance level overall.

The present paper updates existent literature in two ways. Firstly, we targeted the EPF (educational production function) approach to a particular category of students, arguing that EPFs can be heterogeneous across different types of students. While previous literature suggests that, on average, school-level factors have only a limited effect on students' performance (Hanushek &

[1] The percentage of resilient students for each country is estimated by OECD (for technical details, see OECD, 2011). OECD classifies a student as resilient if "*he or she is in the bottom quarter of the PISA index of economic, social and cultural status (ESCS) in the country of assessment and performs in the top quarter across students from all countries, after accounting for socio-economic background*".

Woessmann, 2011), we investigated whether these findings also hold true for the particular group of resilient students. Secondly, we pushed literature on educational effectiveness and resilient stu-dents a step further, by focusing not only on resilient students, but also by specifically investigating resilient schools, where there are (on average) worse socio-economic conditions. In this way, the paper explicitly controls for the potential confusing effect of the variables relating to the school's composition on the single students' performance – as our sample is composed of disadvantaged schools only.

2.2. The Italian educational system

In Italy, there are about 7.5 millions students, attending 33,000 schools, and about 670,000 people are employed as tenured teachers (year 2009/10; source: Ministry of Education, www.miur.it). The educational system is articulated into three main cycles: elementary (primary) – years 1–5, middle (junior secondary) – years 6–8, and high (upper secondary) – years 9–13. There are three different types of upper-secondary school, and students decide (through a self-selection mechanism) which to attend, choosing between: *Licei* (pl. of *Liceo*, schools with an academic focus that mainly cover humanities and scientific fields – and are attended by better-off students), technical schools and vocational schools. Private schools account for almost 8% of the system (although they are attended by less than 5% of Italian students), and are periodically accredited by the Ministry of Education.[2] Students (or families) are free to choose any school they want, and their choices are made most frequently at secondary schooling level. Despite such freedom of choice, in reality, as shown in previous studies, family back-ground matters a lot. For instance, students whose parents have a higher level of education are much more likely to enrol in a *Liceo* (Checchi & Flabbi, 2007).

In this section of the paper, it is important to discuss some aspects that are specific to the Italian educational setting. Italian public schools are not allowed much autonomy, in that the Ministry of Education strictly regulates a large part of their work. The slow process of devolving more functions to schools began during the 1990s, when two laws gave schools the freedom to organise their own teaching (laws n. 537/1993 and n. 59/1997). However, a school's actual autonomy is different to what is set out in these laws, since schools are constrained by their lack of power in choosing their teachers or managing the budget for their tenured staff. The mechanism to recruit teachers is still centralised, and the Ministry of Education has the responsibility of allocating teachers to schools. Currently, Italian schools manage facilities and integrative projects and have the possibility of collecting money from private or local institutions. However, Italian schools have tried to use their limited autonomy to bring about some level of innovation; a recurrent debate deals with the opportunity of giving schools more freedom in how they manage their activities, with the aim of engendering innovation and best practice. This paper contributes to this debate, in that it tries to provide some evidence about the important role of school-level factors. The point of view is distinctive, and relates to a specific aspect of the educational policies; by investigating whether there are school-level practices related to higher student performance in a specific subsample of (disadvantaged) students and schools, the paper tries to verify whether there is space for extending the role of school managers to implement effective practices aimed at improving student performance under difficult conditions and in difficult environments.

3. Methodological approach and data

3.1. A method to identify "resilient students" and the dataset

The analysis of resilient students in the Italian educational system draws upon OECD-PISA 2009 (reading scores).[3] The aim of the PISA project is to collect highly standardised data that can be used to compare the performance of 15-year-old students in the three main areas of reading, mathematics and science both within and between countries. Since its first cycle in 2000, PISA has been taking place every three years, with a growing number of participating countries and, in each of these cycles, one main area was studied in greater depth. In 2009, the survey involved roughly 475,000 stu-dents from 65 countries, including all the OECD economies, and its main focus was on measuring reading.

The average test scores of Italian students – 483 points in mathe-matics, 486 in reading and 489 in science – were consistently below the OECD averages[4] and the gap between Italian students and their peers in the highest performing countries, such as South Korea and Finland, is very significant. In particular, the level of reading for Italian 15-year-old students is below that of Korean and Finnish students by nearly one and a half years' schooling. Despite the low achievement of Italian students, the proportion of resilient students is higher than the OECD average (OECD, 2011): from a policy and management perspective, this specific evidence leads to analysing and identifying the factors that can improve the performance of socio-economically disadvantaged Italian students.

In literature, there is no single commonly used definition of "student resilience"; resilient students are generally defined as students who come from a disadvantaged socio-economic background and yet achieve a relatively high level of academic achievement. More specifically, OECD (2011) defines resilient students as "[those who] are among the best performers of all students of similar background internationally" (p. 1). In this paper, we propose a "relative" definition of resilience in a within-country perspective, in other words, we identify students who are resilient within the sample of students in a country (Italy) – considering the country's (Italy's) average level of achievement and socio-economic background. We consider our approach to be better suited to identifying the subgroup of disadvantaged and resilient students, because it explicitly accounts for the country's specificities.

The subsample of "resilient" students (RES) is compared with a complementary group of students defined as "disadvantaged low achievers" (DLA) – i.e. students with *both* a low socio-economic status and a low performance.

The identification of resilient students is based upon an index summarising the economic, social and cultural background of individual students, known as ESCS. It is a comprehensive measure of socio-economic background, which captures aspects relating to the students' family and home that describe their socio-economic background. It includes data about parental occupation and level of education, as well as information on home possessions, such as computers and books and Internet access (for additional

[2] Unfortunately, it has been demonstrated that the sample included in OECD-PISA is not sufficient for studying the impact of private schooling on Italian students (see Agasisti & Vittadini, 2012), so we could not analyse how attending a private school influences resilience. Future research, using alternative datasets, should address this point, as previous literature would indicate that private schooling helps in raising students' performance in several countries (Vandenberghe & Robin, 2004).

[3] The choice of reading instead of mathematics or science is due to the specific focus of the 2009 cycle of PISA.

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

information see OECD, 2012a, Appendix). Index values are standardised such that the mean is equal to zero and the standard deviation is 1 for all students in OECD countries. It is important to highlight the importance, conceptually, of this variable, which summarises many aspects of the students' family background, not just wealth; it is therefore possible to avoid the simplistic assumption that only income matters, as previous literature has already demonstrated that the link between a family's income and the achievement of the family children can be weak (Loken, 2010; Shea, 2000).

Central to our analytic exercise is to identify the group of resilient students within disadvantaged schools. Consistently with previous literature on the results of Italian students in OECD-PISA tests (Bratti, Checchi, & Filippin, 2007), a prerequisite of this identification procedure is to eliminate middle schools and regional vocational schools from the sample, as these schools are not comparable with the regular secondary schools attended by Italian students at 15 years old. The number of these schools is very low, 9.7% of the overall sample of Italian schools.

After this, the first step of the identification process con-sists of selecting schools with an average of ESCS index below the 33rd percentile of whole distribution. Within the subsample of disadvantaged schools, we dropped students with an ESCS indicator higher than the third quartile of the new distribution (broadly defined as that of students within disadvantaged schools) to ensure comparability across the students and that only disadvantaged students were considered. This subsample is then subdivided according to performance thresholds which are calculated by regressing student performance on the square of the ESCS index (to allow for non-linearity in this relationship). Specifically, we estimated the following[5]:

$$y_{ij} = \alpha_0 + \alpha_1 ESCS_{ij}^2 + \varepsilon_{ij} \quad (2)$$

where y_{ij} is the test score of the ith student in the jth school, and ESCS is the indicator of his/her socio-economic status.

Student performance levels were then defined by dividing regression residuals into equal thirds (see Section 3.4 for a discussion on the use of a different cut-off point). Students were divided into three groups – the successful, average and low-performers – by looking at their performance compared to that of peers from a similar socio-economic background. Students were defined as RES if they are disadvantaged students in the top third of the performance distribution after accounting for socio-economic background (i.e. by considering the values of the residuals from Eq. (2)). Similarly, disadvantaged students whose attainment, after accounting for socio-economic background, lies in the lowest third are defined as DLA. The students in these two groups were then compared, in order to study the determinants of resilience, at both individual and school levels.

At the end of the statistical identification procedure (which also dropped the schools where only four or less students were identified), the subsample of disadvantaged schools contains 340 schools, with a total of 4302 resilient and disadvantaged low-achieving students (50% being resilient and 50% low achievers).

It is therefore important to offer some cautious remarks about our dataset. OECD PISA is an important source of information for everyone involved in schooling and school systems, and offers a great wealth of valid and reliable data. At the same time, it does have some limitations and drawbacks, which limits its capacity of providing direct statistical estimates concerning the relation-ship of students and school factors with educational outcomes. In particular, students' performance depends on many factors, includ-ing all the education that they have acquired over their entire school career and their experiences outside school, rather than only over the period involving their current teachers. The learning environment considered by PISA may only partially reflect the actual learning environment experienced by the students earlier in their schooling, particularly in the Italian education system where 15-year-olds have only been at their current school for two or three years, and students progress through different stages in pre-primary, primary, lower secondary and upper secondary cycles. To the extent that the students' current learning environment differs from that of their earlier school years, the contextual data collected by PISA can only give an imperfect representation of the students' cumulative learning environment, and the effect of this environ-ment on their learning outcome is likely to be underestimated (OECD, 2010a).

On top of this, our study suffers from a typical limitation of international comparisons based on cross-sections of data, like the OECD PISA tests. Since students are not randomly allocated across schools, but families choose the type of education their children will receive (directly – choosing a particular school – or through resi-dential decisions), it is unlikely that the schools' characteristics are exogenous to the students' results; in other words, students who are more likely to be resilient can choose to attend schools that have some particular features that help them to boost academic results (consequently, schools attended by resilient students can be systematically different to the schools attended by disadvantaged low achievers). On the one side, the cross-sectional nature of OECD-PISA data prevents the researcher from using panel data to remove endogeneity. On the other side, the available information about students and schools is not sufficiently detailed for an instrumental variable (IV) approach, although it can suggest suitable instruments – that is, variables that are related to the schools' features, but unrelated to the students' results. The choice of working with the subsample of disadvantaged students, as described above, tends to reduce the size of the bias. More specifically, it is unlikely that disadvantaged students act strategically when choosing a school, while it is more plausible that these students share observable and unobservable background characteristics. Additionally, even if some students did choose a specific school, the procedure of selecting only "disadvantaged schools" for our analysis (i.e. those populated mainly by disadvantaged students) further reduces the risk that the (chosen) schools are structurally different in terms of student composition.

A residual source of potential endogeneity is the possibility that schools differ structurally for unobservable characteristics, and omitting some school characteristics may generate an endogeneity bias, since these variables will be absorbed by the error term, which will be correlated with the individual characteristics that are included. In a multilevel framework, this issue is defined as a level 2 endogeneity problem (Grilli & Rampichini, 2006). In order to overcome this type of endogeneity bias, a robust estimation approach, based on the technique developed by Mundlak (1978) for panel data, is therefore adopted (see Section 3.3).

Turning to information in the school questionnaires, as these are compiled by the head teachers, there may be several factors that influence how they answer the questions. Furthermore, the study of school resources requires a level of accuracy that may not be easily captured in surveys; for example, the head teacher's views on the adequacy of school resources is a weak variable, since there is not really any scale or measurable anchor. Observations are highly subjective and, in addition, what is asked covers no more

[5] The regression was conducted using SPSS (Statistical Package for the Social Sciences) macros, provided by OECD (2009), which incorporate plausible values and BRR (Balanced Repeated Replication) replicate weights to produce unbiased standard error estimates. In addition, the procedure of regressing on the square of ESCS index is coherent with the methodological approach suggested by OECD in selecting resilient students (see, for instance, OECD, 2010a).

Table 1
Descriptive statistics: student-level variables.

	Disadvantaged students – "low achievers"				Disadvantaged students – "resilients"				Italian students overall OECD PISA 2009 samples			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
Reading performance (expressed by plausible values)	330.31	40.46	133.85	388.54	531.45	36.19	446.43	668.39	486.000	96.000	41.32	731.520
Index of Economic and Cultural Status (ESCS)	−0.979	0.593	−3.312	−0.068	−0.979	0.575	−2.921	−0.07	−0.123	1.015	−3.959	3.020
Immigration status = native	0.892	0.310	0.000	1.000	0.974	0.160	0.000	1.000	0.936	0.245	0.000	1.000
Immigration status = second generation	0.017	0.130	0.000	1.000	0.008	0.089	0.000	1.000	0.013	0.114	0.000	1.000
Immigration status = first generation	0.090	0.287	0.000	1.000	0.018	0.134	0.000	1.000	0.042	0.200	0.000	1.000
Gender = male	0.722	0.448	0.000	1.000	0.389	0.488	0.000	1.000	0.514	0.5	0.000	1.000
Gender = female	0.278	0.448	0.000	1.000	0.611	0.488	0.000	1.000	0.486	0.5	0.000	1.000
Family structure = single parent	0.098	0.297	0.000	1.000	0.109	0.311	0.000	1.000	0.11	0.313	0.000	1.000
Family structure = nuclear	0.873	0.333	0.000	1.000	0.888	0.316	0.000	1.000	0.867	0.339	0.000	1.000
Family structure = mixed	0.029	0.169	0.000	1.000	0.004	0.06	0.000	1.000	0.01	0.101	0.000	1.000
Index of attitude towards computers	0.071	0.893	−2.441	0.861	0.359	0.707	−2.441	0.861	0.288	0.766	−2.441	0.861
Index of attitude towards school	−0.125	0.990	−2.989	2.009	0.021	0.883	−2.989	2.009	0.026	0.946	−2.989	2.009
Index of Joy/Like Reading	−0.466	0.694	−3.227	2.238	0.130	0.924	−3.227	3.495	0.063	0.943	−3.227	3.495
Teachers – get along well = strongly disagree	0.103	0.304	0.000	1.000	0.024	0.153	0.000	1.000	0.048	0.213	0.000	1.000
Teachers – get along well = disagree	0.151	0.359	0.000	1.000	0.118	0.323	0.000	1.000	0.130	0.337	0.000	1.000
Teachers – get along well = agree	0.545	0.498	0.000	1.000	0.614	0.487	0.000	1.000	0.598	0.490	0.000	1.000
Teachers – get along well = strongly agree	0.200	0.400	0.000	1.000	0.245	0.430	0.000	1.000	0.219	0.413	0.000	1.000

than 10–15% of school costs, as the bulk of resources (personnel) is left out. Although head teachers provide information about their schools, the data may be inaccurate, and matching the information with the students' reports is not straightforward. Caution is therefore required in interpreting the main results, bearing in mind that there are potential measurement problems and variables can be omitted.

3.2. Disadvantaged students in Italy: descriptive statistics about low achievers and resilient students

Table 1 gives descriptive statistics at individual level; the variables are then used in the multilevel model (Section 3.3). Here, we use them to describe the main aspects linked to the status of RES students. Immigrant status seems to play a major role; more than 10% of low achievers are first or second generation immigrants, while they represent only 2% of resilient students. This information suggests that, in Italy, immigrants are not completely integrated into society, and the achievement gap reproduces the social gap (Buchmann & Parrado, 2006; OECD, 2006). The proportion of boys in the low achievers group is in line with previous evidence of their relatively low achievement compared to girls, when looking at reading (the opposite holds for mathematics) (OECD, 2006). A factor that is particularly important in determining resilient status is an interest in reading (as measured by the variable JOYREAD); on average, resilient students are more interested in reading than the group of low achievers. Analogously, a positive attitude towards computers is specific to resilient students; the values of indicator ATTCOMP[6] are higher for resilient students and above the national average. We consider both these indicators as proxies for the students' motivation and/or innate ability. As pointed out in previous literature, motivation is one of the key individual-level factors associated with resilience; later on, we will show that our results are also in line with this evidence. A further element, which differentiates RES from DLA students, is the relationship between students and teachers. The OECD-PISA questionnaire asks students specifically to assess the statement "I get along well with most of my teachers"; the replies differ for the two subgroups (90% of RES students agree, compared to only 70% of DLA students).

When turning to the description of "resilient schools", we used the school composition as the main criterion. We have presented the descriptive statistics of schools according to the proportion of resilient students, divided into four quartiles (Table 2). The high differentiation between school types (*Licei*, technical and vocational schools) is coherent with the institutional nature of the Italian school system, defined by the self-selection of students – with the better and most advantaged students attending *Licei*. It is interesting to note that while *Licei* are virtually non-existent in the first quartile (where there are schools with a small proportion of resilient students), they account for 25% of the fourth quartile – where, in turn, there are no vocational schools. The indicator for available school resources (SCMATEDU)[7] is particularly low for the schools in the first quartile when compared with other groups and the national average. This suggests that school resources can be useful in helping students overcome social (and achievement) gaps. An even greater impact is that related to the time spent on extra-curricular (and co-curricular) activities. The reference indicator (EXCURACT)[8] varies significantly across the groups, with a marked

[6] The *index of attitude towards computers* (ATTCOMP) was derived from students' reports on the extent to which they agree with the following statements: (i) it is very important to me to work with a computer; (ii) I think playing or working with a computer is really fun; (iii) I use a computer because I am very interested; and (iv) I lose track of time when I am working with the computer. Higher values on this index indicate a more positive attitude towards computers.

[7] The index on the school's educational resources (SCMATEDU) was derived from seven items measuring school head teachers' perceptions of potential factors hindering instruction at their school (SC11). These factors are: (i) shortage or inadequacy of science laboratory equipment; (ii) shortage or inadequacy of instructional materials; (iii) shortage or inadequacy of computers for instruction; (iv) lack or inadequacy of Internet connectivity; (v) shortage or inadequacy of computer software for instruction; (vi) shortage or inadequacy of library materials; and (vii) shortage or inadequacy of audio–visual resources. As all items were inverted for scaling, higher values on this index indicate better quality of educational resources.

[8] The index of extra-curricular activities (EXCURACT) was derived from head teachers' reports on whether their schools offered the following activities to students in the national modal grade for 15-year-olds in the academic year of the PISA assessment (SC13): (i) band, orchestra or choir; (ii) school play or school musical; (iii)

Table 2
Descriptive statistics: school-level variables, quartiles by proportion of resilient students in the school.

	Subsample: all		1st quartile		2nd quartile		3rd quartile		4th quartile	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
School type: *Licei*	0.089	0.286	0.000	0.000	0.039	0.196	0.067	0.251	0.253	0.438
School type: technical schools	0.394	0.489	0.184	0.390	0.382	0.489	0.467	0.502	0.547	0.501
School type: vocational schools	0.517	0.501	0.816	0.390	0.579	0.497	0.467	0.502	0.200	0.403
Index of the school's teaching resources (SCMATEDU)	−0.287	0.930	−0.405	0.802	−0.429	0.741	−0.251	1.155	−0.062	0.944
Index of availability of computers (IRATCOMP)	0.604	0.414	0.587	0.454	0.638	0.424	0.606	0.417	0.586	0.361
Proportion of qualified teachers	0.771	0.224	0.738	0.174	0.760	0.240	0.790	0.242	0.798	0.231
Index of extra-curricular activities offered by school (EXCURAT)	−0.146	0.764	−0.324	0.730	−0.229	0.814	−0.074	0.762	0.046	0.705
Students/teachers ratio (STRATIO)	7.479	1.909	7.016	1.789	7.254	1.867	7.506	1.518	8.150	2.240
Index of teacher shortage (TCSCHORT)	0.191	0.830	0.127	0.820	0.127	0.871	0.073	0.848	0.439	0.738
Proportion of immigrant students	0.055	0.078	0.082	0.099	0.053	0.079	0.041	0.063	0.042	0.058
Achievement head teacher	0.169	0.375	0.197	0.401	0.158	0.367	0.200	0.403	0.120	0.327
Achievement Teachers	0.205	0.405	0.289	0.457	0.145	0.354	0.240	0.430	0.147	0.356
Assessments – Student promotion	0.854	0.353	0.789	0.410	0.816	0.390	0.867	0.342	0.947	0.226
Location: village	0.033	0.179	0.026	0.161	0.039	0.196	0.000	0.000	0.067	0.251
Location: small town	0.291	0.455	0.237	0.428	0.289	0.457	0.333	0.475	0.307	0.464
Location: town	0.500	0.501	0.539	0.502	0.461	0.502	0.547	0.501	0.453	0.501
Location: city	0.149	0.357	0.158	0.367	0.197	0.401	0.107	0.311	0.133	0.342
Location: large city	0.026	0.161	0.039	0.196	0.013	0.115	0.013	0.115	0.040	0.197
Care about student absenteeism: not at all	0.033	0.179	0.013	0.115	0.026	0.161	0.040	0.197	0.053	0.226
Care about student absenteeism: very little	0.225	0.418	0.171	0.379	0.171	0.379	0.213	0.412	0.347	0.479
Care about student absenteeism: to some extent	0.563	0.497	0.539	0.502	0.645	0.482	0.560	0.500	0.507	0.503
Care about student absenteeism: a lot	0.179	0.384	0.276	0.450	0.158	0.367	0.187	0.392	0.093	0.293
Macro-area: North West Italy	0.113	0.317	0.079	0.271	0.092	0.291	0.107	0.311	0.173	0.381
Macro-area: North East Italy	0.156	0.363	0.079	0.271	0.079	0.271	0.160	0.369	0.307	0.464
Macro-area: Central Italy	0.126	0.332	0.211	0.410	0.118	0.325	0.133	0.342	0.040	0.197
Macro-area: Southern Italy	0.288	0.454	0.303	0.462	0.382	0.489	0.227	0.421	0.240	0.430
Macro-area: Islands	0.318	0.466	0.329	0.473	0.329	0.473	0.373	0.487	0.240	0.430

difference between the first and the fourth quartile. Schools that involve students more in out-of-curriculum activities significantly help their students to achieve a higher performance. A possible reason for this is that students will spend less time in their disadvantaged family – and more time on cultural-related initiatives. Another school-level factor is the shortage of teachers (measured through the variable TCSHORT[9]): head teachers of schools with a low proportion of resilient schools report lower levels of teacher shortage – and, in reality, the student: teacher ratios are lower for them than for the other groups. Another factor is what head teachers report about their stance on student absenteeism, where their feelings are much stronger in schools with a higher proportion of resilient students, indicating that absenteeism is not a major factor in these cases. Lastly, the proportion of immigrants (measured at school level) decreases with the proportion of resilient students. It follows that immigrant students are less likely to be resilient and, if segmentation occurs (with high concentrations of immigrant students in some schools), it tends to decrease the students' resilience in that school.

3.3. Investigating the role of different variables on the probability to be a resilient student: the multilevel logit model

A multilevel logistic regression was used as the methodology to identify the main determinants of resilience. This technique is appropriate when the outcome variable for a regression analysis is dichotomous. In this case, the outcome denotes whether a disadvantaged student is resilient (RES) or a low achiever (DLA), and it is useful to reflect the hierarchal nature of an education system involving students in schools.

Specifically, a two-level logistic random intercept model is adopted in such models (Raudenbush & Bryk, 2002), giving a Bernoulli sampling model and a logit link function:

$$n_{ij} = logit(P_{ij}) = \log\left(\frac{P_{ij}}{1 - P_{ij}}\right) \tag{3}$$

the probability of being a resilient P_{ij} of student i from school j is modelled using the log of the odds of P_{ij}, i.e. the ratio of probability of success (resilient) to the probability of failure (low achiever), as a sum of linear function of the explanatory variables at student and school level:

$$n_{ij} = \beta_{0j} + \sum_{k=1}^{m} \beta_k x_{ij} + \sum_{t=1}^{s} \beta_t z_{tj} \tag{4}$$

school yearbook, newspaper or magazine; (iv) volunteering or service activities; (v) book club; (vi) debating club or debating activities; (vii) school club or school competition for foreign language, mathematics or science; (viii) <academic club>; (ix) art club or art activities; (x) sporting team or sporting activities; (xi) lectures and/or seminars; (xii) collaboration with local libraries; (xiii) collaboration with local newspapers; and (xiv) <country specific item>. Higher values on the index indicate higher levels of extra-curricular school activities.

[9] The index of teacher shortage (TCSHORT) was derived from four items measuring the head teachers' perceptions of potential factors hindering instruction at their school (SC11). These factors are a lack of: (i) qualified science teachers; (ii) a lack of qualified mathematics teachers; (iii) qualified <test language> teachers; and (iv) qualified teachers in other subjects. Higher values on this index indicate that the head teachers reported higher teacher shortage at a school.

The model has a random intercept (β_{0j}),which varies between schools and it is equal to:

$$\beta_{0j} = \gamma_0 + u_{0j} \quad (5)$$

where γ_0 is the average intercept and u_{0j} is a residual component normally distributed with zero mean and τ_{00} variance:

$$u_{0j} \sim N(0, \tau_{00}) \quad (6)$$

Then, the final equation of the model can be rewritten as:

$$logit(P_{ij}) = \log\left(\frac{P_{ij}}{1-P_{ij}}\right) = \gamma_0 + \sum_{k=1}^{m}\beta_k x_{kij} + \sum_{t=1}^{s}\beta_t z_{tj} + u_{0j} \quad (7)$$

The second level variance is expressed by τ_0^2, while the model does not include a separate parameter for the first level variance, because the level one residual variance of the dichotomous output variable is described by the Bernoulli distribution rather than being estimated separately (Hosmer & Lemeshow, 2000).

One of the main assumptions of the multilevel model is that the independent variables at each level are not correlated with random effects on the other levels. In other terms, any unobservable student characteristics included in the error term should not be correlated with the observable school covariates, and similarly, any unobservable school characteristics relegated to the error terms should not be correlated with the observable student characteristics. If these assumptions are violated, the coefficient estimates may be biased. In particular, the omission of some school characteristics may generate an endogeneity bias, since these variables will be "engaged" by the (second level) error term, which will be correlated with the included student variables. In the presence of level 2 endogeneity, $Cov(u_{0j};X_{ij}) \neq 0$ and $E(u_{0j}X_{ij}) \neq 0$ and thus the standard estimators are inconsistent for β.

For example, if a school level variable S is omitted in the model (33), the error term u^*can be written as

$$u^*_{oj} = \beta_j S_J + u_{0j}{}^{0j} \quad (8)$$

If the omitted variable S is correlated with X, then the error term will be correlated with X, yielding a biased estimate β.

In order to deal with this bias, the model will be transformed according to the Mundlak approach (1978). Starting from Mundlak approach, it is possible to model $E(u_{0j}|X_{ij})$ as a linear function of the cluster mean $X_{.j}$, so a remedy to this type of endogeneity is to include $X_{.j}$ to the model equation as a separate covariate, in order to eliminate the dependency between the covariate X and the error term u_{0j}.

Additionally, a Wald test on the slope of group means that $X_{.j}$ can be used to test whether this assumption holds for individual regressors.[10]

3.4. Estimation strategy

The first step of the estimation strategy consists in an intercept-only model – without covariates – to assess the size of the variation between schools in terms of resilience:

$$logit(P_{ij}) = \log\left(\frac{P_{ij}}{1-P_{ij}}\right) = \gamma_0 + u_{0j} \quad (9)$$

As a second step, student-level variables were added as predictors of student resilience. Two categories of student predictors were included: (i) attitudinal factors ("motivation"), which include Attitude towards computers, Attitude towards school and Joy/Like Reading and (ii) personal and family aspects: gender, immigration status and family structure.

Predictors of resilience at school level included variables in the categories of school context, school resources and school policies and practices. School context variables are largely beyond the control of school and include the school's category (*Licei*, technical or vocational school), the macro-area and the school location (village, small town, town, city or large city). The category of school resources includes an index on the school's teaching resources, an index on the availability of computers, the proportion of qualified teachers, the student–teacher ratio and the index of teacher shortage. School climate and school practices are generally within the control of the school and they include an index on extra-curricular activities, the head teacher's stance on student absenteeism, the use of standardised assessments to make decisions about whether students progress or not to the next school year (a distinctive factor in the Italian school system, where underperforming students have to repeat the year) and the use of achievement data to evaluate the performance of teachers and head teachers.

Finally, to test whether the adoption of a different threshold produces analogous results and to assess the robustness of the estimates, some variations to the selection method were applied (Appendix, model A3). Firstly we estimated a model for the probability of resilience but we changed the cut-off for selection and used the 25% and 75% percentiles (model A1). In addition we compared the resilients over all the disadvantaged students (instead of versus the DLA students only) and, also for this test, we considered two dif-ferent thresholds for the selection of resilients using both the 66th and the 75th percentiles (models A2 and A3). The results of these alternative models are very similar to those reported in the main model (Table 3). Most notably, the statistically significant variables are the same and the signs are all as expected, but a lower magni-tude of the coefficients is shown when the comparison is between resilients and all disadvantaged students (models A2 and A3). In this case, the differences between the two groups are "smoothed" and the coefficients are lower. In conclusion, these tests seem to confirm the robustness of the estimates and the validity of the selected cut-off points (33rd and 66th percentiles), which balance the theoretical need for a distinction between resilient and DLA students with the statistical need for a large enough sample size.

4. Results

The results obtained through the multilevel logit model presented in Section 3.3 are reported in Table 3. In each column, the different groups of variables included in the model are: (i) empty model, (ii) student characteristics, (iii) school types and school factors, and (iv) macro-area dummies.

The likelihood ratio test, which allows us to determine whether the between-cluster variance is equal to zero, gives a p-value <0.001 for each estimated model, suggesting that a multilevel approach is indeed required.[11]

Student-level variables show some well-known facts, in that personal features play a major role. In particular, immigrant status is associated with a lower probability of resilience (odds ratio

[10] Baltagi (2001) showed that this test is numerically equivalent to the Hausman test, see Grilli and Rampichini (2006) for methodological details.

[11] The intercept in the unconditioned model is not statistically significant; such result is due to the composition of our sample, where there are an equal 50% number of resilient and low-achieving students. The estimated variance of random intercept in the empty model is equal to 4.8, but when introducing student-level variables (model 2) it is even greater than it was in the empty model; this finding is explained as the fact of adding level one variables with a strong effect will tend to increase estimated level-two variance (Snijders & Bosker, 1999).

Table 3
The results from the multilevel logit model.

	Empty model		Model 2		Model 3		Model 4	
	Odds ratio	Std. err.	Odds ratio	Std. err.	Odds ratio	Std. err.	Odds ratio	Std. err.
Intercept	1.002	0.129	0.717	0.176	0.008***	0.013	0.011***	0.016
Attitude towards computers			1.378***	0.079	1.351***	0.078	1.360***	0.078
Attitude towards school			0.960	0.049	0.965	0.050	0.965	0.050
Joy/Like Reading			1.568***	0.096	1.546***	0.095	1.559***	0.096
Gender (0 = male, 1 = female)			0.261***	0.030	0.265***	0.032	0.264***	0.032
Immigration status (0 = native, 1 = immigrant)			0.208***	0.043	0.217***	0.045	0.215***	0.045
Family structure (0 = nuclear, 1 = other)			1.182	0.163	1.213	0.169	1.219	0.170
Student gets along well with most of his/her teachers = "Disagree"			2.269***	0.528	2.106***	0.492	2.094***	0.489
Student gets along well with most of his/her teachers = "Agree" or "Strongly agree"			3.625***	0.761	3.459***	0.728	3.442***	0.723
School type = liceo					0.595	0.291	1.121	0.505
School community = "Village" or "Small town"					1.239	0.331	1.086	0.272
School community = "City" or "Large city"					0.661	0.209	0.646	0.187
Index of quality of the schools educational resources (SCMATEDU)					1.510***	0.204	1.368**	0.169
Ratio of computers to school size					1.259	0.402	1.150	0.334
Proportion of qualified teachers					2.460*	1.236	3.055**	1.409
Student–teacher ratio					1.320***	0.087	1.290***	0.078
Index of teacher shortage (TCSHORT)					1.859***	0.258	1.718***	0.217
Extra-curricular activities offered by school (EXCURACT)					1.750***	0.273	1.340**	0.193
Achievement data are used in evaluation of the head teacher's performance					0.672	0.232	0.725	0.230
Achievement data are used in evaluation of teachers' performance					0.712	0.241	0.743	0.229
The learning of students is hindered by student absenteeism = "A lot"					0.283***	0.088	0.434***	0.123
Assessment used to make decisions about whether students proceed or not to the next school year					1.640	0.549	1.227	0.374
Attitude towards computers (school mean)					10.861***	6.977	5.610***	3.317
Attitude towards school (school mean)					0.233***	0.110	0.712	0.320
Joy/Like Reading (school mean)					6.615***	3.682	6.140***	3.120
Female students (school proportion)					0.135***	0.067	0.123***	0.056
Immigrant students (school proportion)					0.171	0.201	0.005***	0.006
Non-nuclear family (school proportion)					0.610	0.692	0.179*	0.187
Student gets along well with most of his/her teachers = "Disagree" (school proportion)					12.233	19.797	5.684	8.337
Student gets along well with most of his/her teachers = "Agree" or "Strongly agree" (school proportion)					26.464*	48.921	26.714*	44.867
Macro-area (reference = "South and Isles") North West							8.904***	3.615
North East							19.662***	7.551
Centre							4.011***	1.674
South							1.544	0.431
Missing dummies[a]	No		Yes		Yes		Yes	
Random effects	Estimate	Stand. Err.	Estimate	Stand. Err.	Estimate	Stand. Err.	Estimate	Stand. Err.
Intercept (s.d.)	2.187	0.121	2.274	0.127	1.753	0.103	1.537	0.944
Log likelihood	−2174.27		−1993.57		−1922.63		−1889.49	
LR test vs. logistic regression	1629.71		1507.79		859.91		628.04	
Prob > = chibar2	0.000		0.000		0.000		0.000	

[a] The missing data are replaced by the means (or medians) at school-level or country-level, for individual-level and school-level respectively. To control for possible bias introduced by this method, imputation dummies and imputation interactions are introduced in the model following the approach proposed by Fuchs and Woessmann (2007).

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

equal to 0.208). An important point to be discussed is that our results show that a high proportion of immigrant students make up the group of low performing students. The same holds for "disadvantaged schools", where there are higher proportions of immigrant students. This is likely to partially affect our results, as it drives the greatest part of the disadvantage factor and, inversely, the probability of resilience. As the descriptive statistics showed (Table 2), the proportion of immigrants (measured at school level) is inversely related to the proportion of resilient students in a school. This suggests that a high concentration of immigrant students has a negative peer effect, at least for students who come from a disadvantaged background.

What is interesting to observe is that two individual-level variables capturing motivation, "joy in reading" (JOYREAD) and "positive attitude towards computers" (ATTCOMP), are positively associated to the probability of being resilient; as discussed in previous studies conducted by OECD, such individual factors are important to overcome a disadvantaged background. On the contrary, the structure of the family (nuclear or non-nuclear) does not seem to be related to the probability of resilience. Lastly, the other student-level feature positively related to the probability of being a resilient student is that of teacher behaviour: "resilient students" are those who get along well with teachers. This effect is particularly strong: the odds ratio is around 3.62 points, and statistically significant. A potential interpretation is that, in these schools, teachers collaborate on important and challenging aspects, and helping disadvantaged students is probably one of these tasks; as a result, it looks as if the students get along well with them. More-over, a more favourable school climate – in which relationships between students and teachers, as well as among teachers, is a key element – has been demonstrated to be positively related to the students' results, especially for low-income children (Lowenstein et al., 2011).

When adding school-level variables (model 3), student-level variables maintain their statistical significance and estimated coefficients, while the second-level variance decreases steeply (40%overall, from 5.15 to 3.07), meaning that our school-level variables capture a large part of between-schools variations that influence the probability of a student becoming resilient. The most inter-esting results deal with the inclusion of school-level resources and characteristics, as our aim is to underline whether "resilient schools" show features that are positively associated with the prob-ability of being a resilient student – that is, resilient students benefit from the school they attend. In this perspective, we can investigate whether school-specific activities, like extra-curricular activities or school climate, differ across schools, and if they are correlated with the (resilient) students' results. If there is any influence of this kind, reflections about the desirable degree of school autonomy can be derived.

It is interesting to note that school resources seem partially correlated statistically with resilience: while the availability of computers (IRATCOMP) has no statistical significance, the index of the "quality" of teaching resources (SCMATEDU) is positively associated with resilience (odds ratio = 1.51).

Among the other factors debated in the descriptive statistics, the variable measuring extra-curricular activities (EXCURACT) is statis-tically significant and positively correlated with the probability of being resilient. As previously discussed, probably this variable cap-tures the ability of a school to make its students less dependent on their family's cultural influence; at the same time, it might be the case that this indicator is a proxy of the overall cultural life (and not only the curricular side) of the school. This finding is crucial in the argument of this paper; indeed, it sheds light on controllable factors that can be correlated positively with the students' achievement. More specifically, our results suggest that disadvantaged schools should invest their resources in extra-curricular activities, with the aim of (relatively) reducing the negative influence of family back-ground by involving students in free cultural activities. In addition, it is also likely that this variable captures some unobservable attitudes of the students towards more engagement with the school's environment. Confirming this intuition, OECD (2012b) shows that schools with higher levels of extra-curricular activities also report more positive attitudes towards school subjects, suggesting that there is a link between extra-curricular activity and engagement with curricular activity.

Some caution is required in interpreting the role of teacher shortage (TCSHORT) in influencing the likelihood of resilience. Indeed, this indicator is not based on objective data, but reflects the head teacher's perception and may be affected by measurement errors, which limit its validity and accuracy (White & Smith, 2005). The analysis seems to suggest that a greater shortage of teachers (TCSHORT) is positively related to the probability of resilience: a potential explanation can be that the availability of teachers is a key feature in making the school more capable of assisting disadvantaged students. It follows that head teachers who care more about this problem (declaring a high shortage/need of teachers) operate in resilient schools. Lastly, it can be noted that schools that are most affected by absenteeism are less likely to be resilient. These results are coherent with the role of other variables, such as EXCURACT: when students do not attend school regularly and spend less time in a favourable climate (the school as an educational community), it is more probable that they become a DLA than a RES student. This indicator is coherent with the explanation that the worst background family aspects (to which absenteeism is certainly related) can be attenuated by the proactive behaviour of school actors – in this case, the extent to which the schools care about absenteeism. Overall, the results associated with the variables obtained from the head teachers' answers point at confirming that leadership from the head teachers themselves is statistically related to the features of "resilient schools".

The inclusion of macro-area dummies (model 4) improves the model's explanatory power. The macro-area geographical factor is confirmed as one of the key explanations for students' perfor-mance in Italy, corroborating huge evidence in this sense (Agasisti & Vittadini, 2012; Montanaro, 2008). RES students are more likely to study in Northern Italy than in the South and, in particular, a stu-dent who goes to a school in the North-East macro-area has an odds of resilience that is 19.6 times greater than a student in a school in the South and Islands macro-area. As a consequence, the model shows that not only is a family's socio-economic background rele-vant, but that the wider territorial context also plays a central role in influencing students' performance and resilience. This creates circles of consequences that depend on the surrounding environment. Students from disadvantaged families can benefit from living in socially and economically developed areas; thus, a better welfare climate can help disadvantaged students in climbing the "social pyramid". On the contrary, depressed social environments add a negative "external" burden to the (already bad) situation of students from disadvantaged families living in these communities.

5. Concluding remarks

Overall, our study brings innovation to literature on the attain-ment of Italian students, by using OECD-PISA data in a new fashion. By focusing on a specific subgroup of students and schools, namely those who are most disadvantaged, we investigated the determinants of resilience, defined as the ability of overcoming a disadvantaged background. An important point that should be remembered here is that our results can be considered as directly applicable only to disadvantaged students. Thus, it can be the case that some features that can help low-income students to overcome their background are not relevant (or may even be damaging) for the "average" Italian student. In this perspective, the analyses pre-sented in this paper cannot be adopted straightforwardly in policies aimed at a greater effectiveness of the educational system, but are more for equity purposes – i.e. for giving more opportunities to disadvantaged students, which in turn can (indirectly) affect the average performance of the system itself.

From an economic perspective, the key message of this paper is that some "soft" management and organisational features of schools are just as important as resources associated with the

higher probability of low-income students being resilient. "Resilient schools" are defined by a better school climate and leadership. The policy implication is that reforms should promote the initiatives and aspects of schools that favour (i) better relationships between students and teachers, as well as (ii) the availability of (good) extra-curricular activities, together with (iii) the provision of adequate resources for teaching – to avoid teacher shortage and improve the quality of teaching.

Overall, the school-level variables, which turn out to be significantly related to the resilient status, confirm the importance of the quality of the teaching staff, a result that is both significant and increasingly confirmed within the economics of education. Our findings are in line with this evidence, as all the school factors that were statistically significant in explaining student performance are related to aspects which are connected to teachers (quality of teaching resources, teacher shortage, extra-curricular activities, etc.). In this sense, the results suggest that school factors can be useful in improving the achievement of disadvantaged students. These findings potentially confirm the results from international literature (Hanushek & Woessmann, 2011), which highlight how schools (at system level) can also influence test scores obtained by students in international standardised tests. Their focus on a single country (USA) prevents us from specifically investigating the role exerted of schools in the Italian context, but it does allow us to carry out a better investigation of some factors related to the schools' characteristics. At the same time, our findings depart from the traditional ones, as they refer to the specific group of disadvantaged students, so there is no previous evidence to be used as a comparison.

From a policy perspective, our results are particularly significant for the Italian context. As described in Section 2, Italian schools have a low level of autonomy; they cannot select their teachers, nor reg-ulate their teaching programmes and methods autonomously. The evidence presented in this paper confirms the necessity of increas-ing the level of school autonomy, as the aspects for which they are already independent (i.e. extra-curricular activities) are seen to be positively related to the students' performance. Policies inspired by School Based Management (SBM) approaches can be useful in this direction (i.e. Dimmock, 1993).

A specific point is related to the possibility that leadership at school-level can exert a positive impact on students' results. Relevant literature points at this evidence (see, for instance, Sammons et al., 2011, for the British case) and our findings are coherent in showing that, for instance, when the head teacher of a school cares about students' behaviour (specifically, absenteeism) their schools can increase the students' probability of being resilient.

Another key point is that geographical differences exist: schools in Northern Italy are more likely to impact positively on resilience. In the light of the fact that territorial differences are strikingly significant in explaining differences in student achievement, this finding is particularly worrying. Indeed, it means that being immersed in a positive economic and social envi-ronment – often linked to Italy's northern provinces – has an impact not only on the overall student performance, but also on the ability of less advantaged students to overcome their situation.

Summarising, this study underlines the importance of looking at the lower end of the distribution of educational opportunities, and it finds solutions for improving the performance of students who come from more disadvantaged backgrounds. While the bad news is already known, that is, that a disadvantaged family and/or territory background are extremely related to bad academic performance, the good news is that it is possible to detect many school factors that can positively help disadvantaged students. In this light, our study paves the way for future analyses of the school-level determinants for the achievement of low-income students in other countries; this could open new opportunities for studying the topic of resilient students in an international perspective, and for helping to pursue higher levels of equity and efficiency in educational systems.

Appendix.

See Table A.1.

Table A.1
Estimates based on alternative specifications for the method of resilient selection.[a]

	Model A1		Model A2		Model A3	
	Odds ratio	Std. err.	Odds ratio	Std. err.	Odds ratio	Std. err.
Intercept	0.005***	0.008	0.060**	0.082	0.019***	0.029
Attitude towards computers	1.447***	0.113	1.127***	0.049	1.147***	0.056
Attitude towards school	0.973	0.070	0.985	0.037	0.993	0.041
Joy/Like Reading	1.782***	0.153	1.444***	0.063	1.434***	0.067
Gender (0 = male, 1 = female)	0.195***	0.033	0.360***	0.031	0.373***	0.036
Immigration status (0 = native, 1 = immigrant)	0.141***	0.042	0.312***	0.051	0.294***	0.056
Family structure (0 = nuclear 1 = other)	1.180	0.229	1.197*	0.126	1.117	0.129
Student gets along well with most of his/her teachers = "Disagree"	2.421***	0.783	1.881***	0.343	1.857***	0.393
Student gets along well with most of his/her teachers = "Agree" or "Strongly agree"	5.160***	1.515	2.445***	0.404	2.542***	0.490
School type = liceo	1.149	0.724	0.949	0.312	1.414	0.510
School community = "Village" or "Small town"	1.203	0.422	0.924	0.170	0.963	0.196
School community = "City" or "Large city"	0.447**	0.176	0.634**	0.136	0.633*	0.151
Index of quality of the schools teaching resources (SCMATEDU)	1.413**	0.241	1.235**	0.110	1.255**	0.123
Ratio of computers and school size	1.299	0.542	1.025	0.216	0.989	0.232
Proportion of qualified teachers	3.729*	2.526	2.356**	0.792	2.391**	0.890
Student–teacher ratio	1.378***	0.121	1.169***	0.051	1.162***	0.056
Index of teacher shortage	1.848***	0.332	1.549***	0.144	1.547***	0.159
Extra-curricular activities offered by school (EXCURACT)	1.569**	0.311	1.180	0.121	1.204	0.137
Achievement data are used in the evaluation of the head teacher's performance	0.648	0.293	0.861	0.202	0.921	0.240
Achievement data are used in evaluation of teachers' performance	0.603	0.266	0.934	0.211	0.822	0.207
The learning of students is hindered by student absenteeism = "A lot"	0.327***	0.131	0.545***	0.118	0.507***	0.123
Assessment used to make decisions about whether students progress or not to the next year	0.850	0.361	1.101	0.252	0.926	0.234

Table A.1 (*Continued*)

	Model A1		Model A2		Model A3	
	Odds ratio	Std. err.	Odds ratio	Std. err.	Odds ratio	Std. err.
Attitude towards computers (school mean)	11.890***	9.911	4.581***	2.005	3.971***	1.941
Attitude towards school (school mean)	0.902	0.548	0.767	0.253	0.841	0.307
Joy/Like Reading (School mean)	9.109***	6.199	3.774***	1.386	3.712***	1.490
Female students (school proportion)	0.085***	0.052	0.281***	0.100	0.239***	0.095
Immigrant students (school proportion)	0.002***	0.003	0.022***	0.022	0.021***	0.024
Non-nuclear family (school proportion)	0.579	0.730	0.200*	0.183	0.553	0.559
Student gets along well with most of his/her teachers = "Disagree" (school proportion)	6.850	11.193	1.064	1.489	2.041	3.192
Student gets along well with most of his/her teachers = "Agree" or "Strongly agree" (school proportion)	29.649*	59.839	1.108	1.732	2.132	3.716
Macro-area = "North West Italy"	12.256***	6.694	5.585***	1.685	5.380***	1.783
Macro-area = "North East Italy"	44.323***	23.779	8.673***	2.389	9.072***	2.715
Macro-area = "Central Italy"	4.995***	2.939	2.624***	0.812	2.366**	0.816
Macro-area = "Southern Italy"	1.606	0.628	1.338	0.280	1.278	0.298

Random effects	Estimate	St. err.	Estimate	St. err.	Estimate	St. err.
Intercept (s.d.)	2.196	0.147	1.229	0.704	1.315	0.780

[a] In the model A1, the cut-off for the selection of resilient and disadvantaged low achieving students are the 75th and the 25th percentiles, respectively (instead of the 66th and 33rd). Models A2 and A3 analyse the probability of RES over all the disadvantaged students (instead of versus DLA students only) considering the 66th percentile (model A2) and the 75th percentile (model A3) of the residual distribution as a threshold for identifying the resilient students.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

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