

Resilient students: what are the factors behind the success of disadvantaged students?

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Abstract

The relationship between socio-economic status and school achievement is well documented and extensive literature indicates that students from more advantaged backgrounds perform better at school tests. Despite this relationship, international assessments have highlighted that in practically all OECD countries there are a relevant number of “resilient students”, i.e. students from a disadvantaged socio-economic background who achieve relatively high levels of performance in terms of education. In this paper, we use micro-data provided by INVALSI to focus on individual, class and school-level characteristics that help disadvantaged students to become resilient. Our results highlight the importance of individual factors, while the variability between classes or schools is quite modest. At the individual level, the main factors behind resilience are the student’ ESCS index and the nationality. At class level, there is a significant peer effect, as identified by the class average test score. Some variables on the characteristics of teachers have been tested on a regression estimated on the sample database but no statistically significant effect was found.

JEL codes: I20, I21, I24

Keywords: equality in education, resilient students, socio-economic status, students outcomes

1. INTRODUCTION

Since the paper by Coleman (1966), the relationship between socio-economic status (SES) and school achievement has been well documented and extensive literature indicates that students from more advantaged backgrounds perform better at school and have more chances to complete their education successfully². A wide literature has also demonstrated that it is not only a student’ own SES that matters, but also the one of classmates, according to the so-called “peer-effect”³.

Despite this relationship, several international (OECD, 2010, 2011; Agasisti et al., 2018) and Italian studies (Agasisti and Longobardi, 2014; Agasisti et al., 2016) have highlighted the existence of a relevant number of “resilient students”, i.e. students from a disadvantaged family who achieve relatively good results at school. According to OECD (2010), the proportion of resilient students can be considered a proxy of the equality of an educational system, since in an equitable school the impact of the family and of more generally of the socio-economic background on learning outcomes should be small; in contrast, in systems where the success of students depends to a large extent on their family or peers background, the educational opportunities are distributed inequitably.

For this reason, there has been a growing literature focussing on factors behind the school success of disadvantaged students, not only at the individual level but also at class and school level. Several studies show that a high level of family disadvantage (Agasisti et al. 2018) is amongst the main individual determinants of resilience, while gender and a foreign citizenship play an heterogeneous role

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² See Fadda et al. (2023) for a recent review of Italian studies.

³ A summary of this stream of literature is provided by van Ewijk & Sleegers (2010).

according to countries and the subject of the test used to measure resilience (OECD, 2011; Agasisti and Longobardi, 2014). Personality traits also emerge as important factors behind the success of disadvantaged students, as resilient students are more motivated and confident about their capabilities than their disadvantaged low-achieving peers and also have more ambitious aspirations (Borman and Rachuba 2001; OECD, 2011; Agasisti and Longobardi, 2014).

As regards school practices and resources, OECD (2011) finds very little evidence of an association with the probability of resilience, while Agasisti and Longobardi (2014) and Agasisti et al. (2018) highlight the importance of some school factors, for example the existence of extracurricular activities and school leadership, while class size and the student-computer ratios are far less relevant. Researchers also generally agree about the importance of having caring and supportive teachers (Borman and Rachuba, 2001; Agasisti and Longobardi, 2014), as well as high performing peers (Agasisti et al., 2016).

Our paper analyses the factors behind the success of disadvantaged students at the end of Italian lower secondary school, a critical stage in the educational path of young people. Indeed, it is in lower secondary education that gaps between school outcomes widen, determining the segmentation of students between upper secondary tracks and impacting permanently on future career prospects (Fondazione Agnelli, 2011; Gavosto and Romano, 2021). For this reason it is crucial that lower secondary school guarantees all students equal education opportunities despite the different family background.

The remainder of the paper is organized as follows. Section 2 describes the data and methodology used, also providing some descriptives; Section 3 contains the results and Section 4 concludes.

2. DATA, METHODOLOGY AND DESCRIPTIVES

2.1 Data

In this paper, we use data from the standardized tests conducted by INVALSI, which evaluates the Italian, Math and English competences of all Italian students in Grades 2, 5, 8, 10 and 13. The assessments consists in an annual census administered in Spring and participation is compulsory for all students attending the cited grades. INVALSI also provide sample data for a subgroups of students attending classes and schools where the test is administered under the supervision of external observers in order to limit cheating phenomena.

Our analysis relies on INVALSI Grade 8 Math and Italian data for the school year 2020/21. Main estimates are conducted on the census dataset but some estimations are carried out also on the sample dataset, which can be merged with information coming from teachers' questionnaires, which are also surveyed by INVALSI.

The s.y. 2020/2021 census Italian Grade 8 dataset is composed of 520,462 students; the Math dataset of 523,032 students. Around 2% of total students are also included in the sample dataset, which can be merged with the teacher dataset.

2.2 Methodology

Our analysis consists of two different steps.

The first step consists in the identification of resilient students, using two different definitions according to the literature; a second step consists in the estimation of the main determinants of the probability of being resilient, using a multilevel logistic regression model through which it is also estimated the probability of being resilient for different students' profiles.

The identification of resilient students starts with the detection of the group of students that can be considered disadvantaged, usually those with an economic, social and cultural status (from now, ESCS) index amongst the bottom 25% or 33% in a country.

In literature several definitions of resilient students have been proposed and they can be broadly divided into two main streams: those based on absolute performance standards (a certain proficiency level considerate adequate for a specific grade) and those based on performance relative to the individual ESCS level. The first type definition is adopted, among others, by Agasisti et al. (2018) while the second one is used by OECD (2010) and Agasisti and Longobardi (2014).

We identify disadvantaged students as those with an ESCS index within the bottom 25% at the national level and test on our data both types of definitions of resilience, following Agasisti et al. (2018) for the first one and OECD (2010) for the second one.

The definition of Agasisti et al. (2018) is based on the level of proficiency and considers resilient those students able to achieve at least Level 3 in PISA test. Coherently, we use Level 3 in INVALSI test, a level which corresponds to adequate skills in Grade 8 according to ministerial indications. According to this approach, 36% of Grade 8 disadvantaged students are resilient in Italian, as show in Table 1.

Table 1
DISTRIBUTION OF GRADE 8 STUDENTS BY QUARTILE OF ESCS INDEX AND LEVEL OF PROFICIENCY AT THE ITALIAN INVALSI TEST.

		Quartiles of ESCS index			
		1	2	3	4
Skill level in Italian	<1	0,2%	0,0%	0,0%	0,0%
	1	30,8%	14,7%	9,4%	4,4%
	2	32,8%	26,8%	21,4%	13,9%
	3	23,6%	32,2%	32,8%	29,8%
	4	10,0%	19,3%	24,6%	31,0%
	5	2,6%	7,1%	11,8%	20,9%
Total		100%	100%	100%	100%

The second approach in the definition of resilience identifies resilient students as those coming from a disadvantaged socio-economic background and performing much better than would be predicted by their background. To identify these students, OECD (2010) estimates a regression of PISA test scores on the individual ESCS index, in order to establish a relationship between performance and socio-economic background across students; the residuals from this regression are then used to identify resilient students as those disadvantaged ones with a residual performance amongst the top quarter of students' residual performance. According to this approach, 24% of our Grade 8 students are resilient in Italian test.

The two definitions are compared in Tables 2 and 3, which show that 35% of those considered resilient according to the first definition are not resilient according to the second one; instead, only the 2% of those considered resilient according to the second definition are not resilient according to the first definition.

Table 2.
DISTRIBUTION OF GRADE 8 STUDENTS BY RESILIENCE, ACCORDING TO TWO DIFFERENT DEFINITIONS (ROW PERCENTAGES)

		OECD (2010) definition		
		Non resilient	Resilient	Total
Agasisti et al. (2018) definition	Non resilient	99%	1%	100%
	Resilient	35%	65%	100%
Total		76%	24%	100%

Table 3.
DISTRIBUTION OF GRADE 8 STUDENTS BY RESILIENCE, ACCORDING TO TWO DIFFERENT DEFINITIONS (COLUMN PERCENTAGES)

		OECD (2010) definition		
		Non resilient	Resilient	Total
Agasisti et al. (2018) definition	Non resilient	83%	2%	64%
	Resilient	17%	99%	36%
Total		100%	100%	100%

We choose the first definition because it is based on an absolute and not relative measure of competences, which are those considered adequate for Grade 8 by ministerial indications.

The same definition has been used to identify resilient students in Math, which represent 33% of disadvantaged students.

The second step of our analysis is aimed at investigating which aspects belonging to students, families and schools increase the probability of becoming a resilient student. The methodology consists in a two-level random intercept model (Raudenbush & Bryk, 2002; Goldstein, 2003) to properly take into account the hierarchical structure of the data, i.e. students nested into classes and schools; considering that our dependent variable is dichotomous, we opted for a multilevel logistic regression approach.

We tested two different types of multilevel models, one with the class and one with the school as second level unit, according to the following specification.

Let Y_{ij} be the binary response, i.e. $Y_{ij} = 1$ if the i -th student of the j -th school/class is resilient and zero otherwise, where $i = 1, \dots, n_j$ denotes the number of students (level 1 units) nested within the second level unit (or cluster) j , i.e. the school/class, $j = 1, \dots, J$ and J is the total number of considered schools/classes. Given the success probability $\pi_{ij} = P(Y_{ij} = 1 | \mathbf{x}_{ij}, u_j)$, the model is specified as follows:

$$\text{logit}(\pi_{ij}) = \log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \boldsymbol{\beta}\mathbf{x}_{ij} + u_j \quad (1)$$

where \mathbf{x}_{ij} is the vector of covariates for the i -th student of the j -th cluster (including a constant term for the intercept) and $\boldsymbol{\beta}$ is the vector of fixed parameters (including the intercept). The residuals u_j , representing the second level variance, are assumed to be independent and identically distributed across clusters with a normal distribution and common variance; model fitting is performed using the *melogit* procedure of Stata (StataCorp, 2023).

The model has been estimated both for the Italian score and for the Math score.

The covariates included in the model are individual, class and other types of characteristics, as shown in Table 4.

Students covariates considered in our model are:

- female, a dummy taking value 1 if the student is female and 0 if male;
- semester of birth, a dummy taking value 1 if the student is born in the second semester of the year and 0 otherwise;
- Nationality and country of birth, a categorical variable taking value 1 if the student is native, 2 or 3 if he/she is a first generation foreigner born in the EU or outside the EU, 4 if he/she is a second generation foreigner;
- ESCS, a proxy variable of socio-economical status, built by INVALSI through a principal component analysis of three indicators: the employment status of pupil's parents, the level of education of pupil's parents and the possession of a range of specific goods⁴. The ESCS variable has been standardized with mean equal to 0 and standard deviation equal to 1⁵;
- Books at home, a categorical variable which assumes the following values: less than 10 books, between 11 and 25 books, more than 26 books.

Class covariates are:

- Class size, calculated on the basis of students who have taken the test⁶;
- Full-time, a dummy variable taking value 1 if the students attends a full-time class (34 hours or more) and 0 otherwise;
- Average ESCS index in the class, a compositional variable which measure the average socio-economic status of the peers.

Other variables included in the model are:

- geographical area of the student, a categorical variable taking the following values: North, Centre, South;
- number of students for each PC available in the school, a variable which can proxy the available resources at school level.

Using the sample dataset containing information on teachers, we tested the following covariates:

- age of teacher, a categorical variable taking the following values: less than 49, between 49 and 60, more than 60 years;
- working seniority of teacher, a categorical variable taking the following values: 1 year, 2-3 years, 4-5 years, more than 5 years;
- type of contract, a dummy taking value 1 if the teacher has an open-ended contract and 0 otherwise;

⁴ More specifically, these "goods" concerns: a quiet place to study, a personal desk for homework, encyclopedias, internet connection, burglar alarm, a room exclusively devoted to the student, more than one bathroom, more than one car in the family, more than one hundred books.

⁵ For a description of the index see: <https://www.invalsiopen.it/indicatore-escs-valutazione-equa/>.

⁶ The real number of students of the class is not available in the dataset.

- perception of the school readiness for Remote Teaching, a dummy taking value 1 if the teachers considers the school enough or very prepared for Remote Teaching;
- personal difficulties during Remote Teaching, a dummy taking value 1 if the teacher has often or always encountered some kind of difficulties in doing Remote Teaching.

Table 4.
COVARIATES USED IN THE MODEL

Individual variables	Class variables	Other variables	Teacher variables (sample dataset)
Sex	Full time/part time	Geographical area	Age
Semester of birth	Average class score (Quartiles of)	Number of students per pc (quartiles of)	Working seniority
Nationality and country of birth	Class size		Type of contract (fixed-term or permanent)
ESCS index			Perception of the school readiness for Remote Teaching
Number of books at home (Quartiles of)			Personal difficulties during Remote Teaching

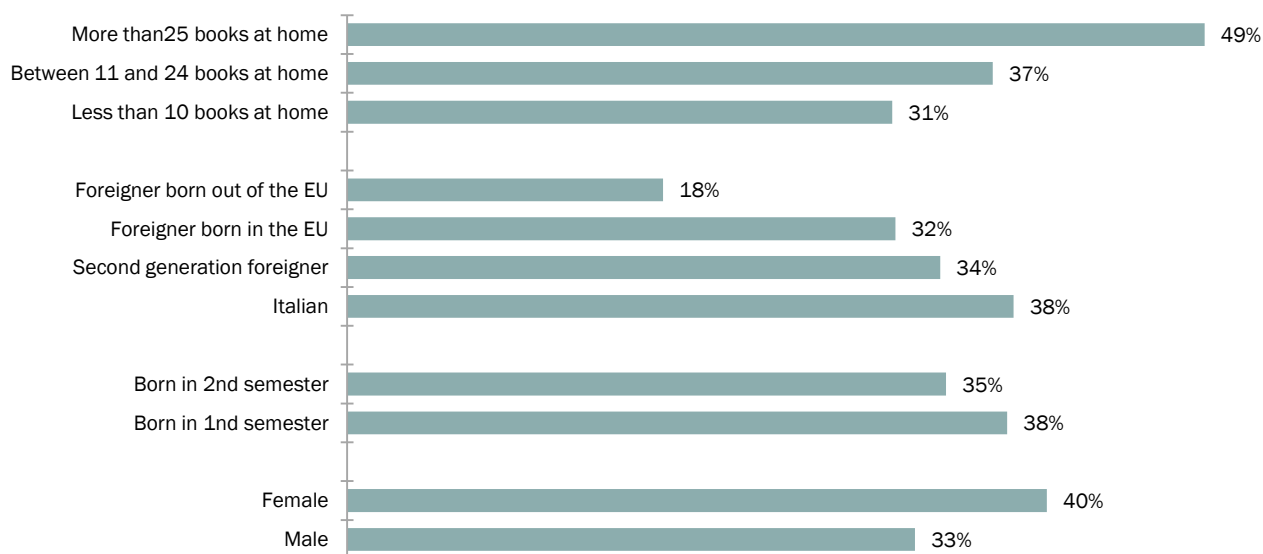
2.3 Descriptives⁷

As already said, according to our definition of resilience, 36% of Grade 8 disadvantaged students are resilient in Italian, although this percentage changes considerably with some personal characteristics. In particular, Figure 5 shows that the percentage of resilient students is higher among females (40%), those born in the first semester of the year (38%) and among natives (38%); resilient students are less frequent among males (33%) and foreigners, especially first generation ones, born out of the EU (18%). The resilience of students varies also in relation to the cultural background of the family measured through the number of books at home.

The percentage of disadvantaged students who can be considered resilient shows a high variability across regions (Figure 6), ranging from 47% of Valle d'Aosta to 27% of Calabria; most Northern regions have percentages of resilience higher than the national average, while Southern ones have often lower percentages.

The percentage of resilient students greatly varies also according to the personal ESCS index, as shown in Figure 7, indicating that those who are less disadvantaged more frequently manage to overcome their social background and achieve a satisfying level of competences in Italian.

Figure 5.
PERCENTAGE OF RESILIENT STUDENTS AMONG GRADE 8 DISADVANTAGED STUDENTS, BY CHARACTERISTICS



⁷ Descriptives refer to the Italian dataset but the ones based on the Math dataset are available on request.

Figure 6.
PERCENTAGE OF RESILIENT STUDENTS AMONG GRADE 8 DISADVANTAGED STUDENTS, BY REGION

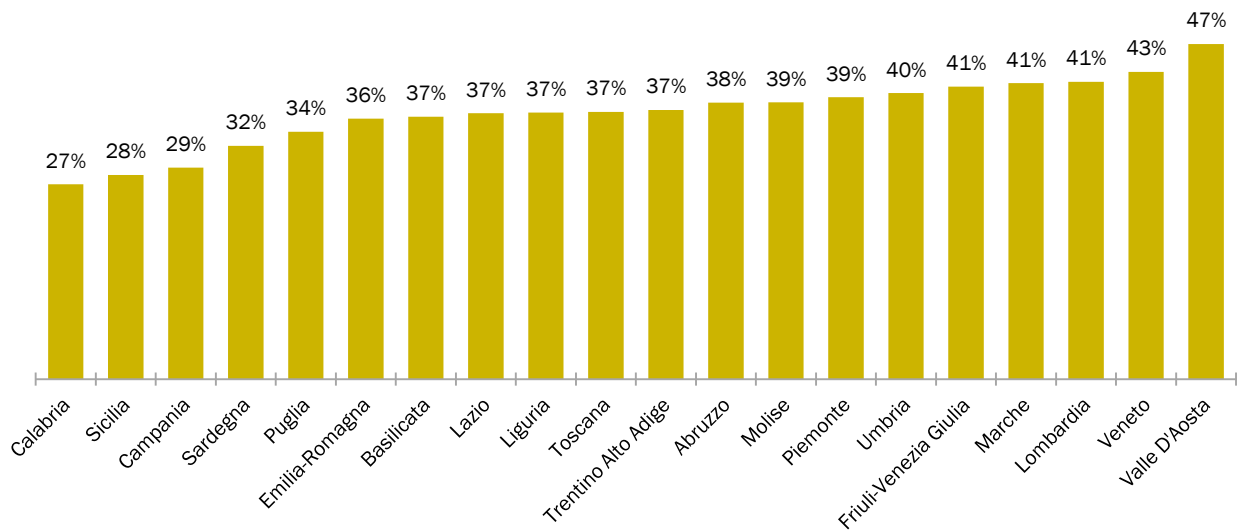
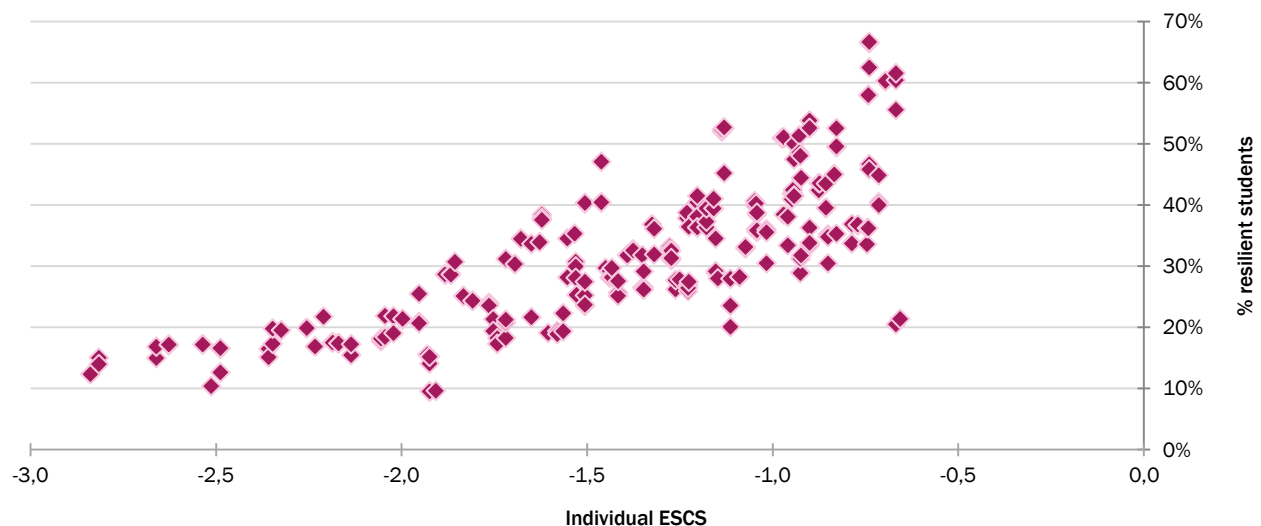


Figure 7.
PERCENTAGE OF RESILIENT STUDENTS AMONG GRADE 8 DISADVANTAGED STUDENTS (AXIS Y) AND INDIVIDUAL ESCS (AXIS X)



3. RESULTS

The model is first estimated without covariates (intercept-only model or empty model) in order to assess the Intraclass Correlation Coefficient (ICC), that is the proportion of variation in the probability of becoming a resilient student attributable to schools/classes. According to the estimated ICC, class explains 8.6% and school 5.5% of variability. The likelihood-ratio test, which compares the random intercept model to ordinary logistic regression, is highly significant for both models, confirming a “class effect” and a “school effect”, which can change the resilience probability of a student.

The final specification uses class as second level unit and results are presented in Table 8. Once controlled for exogenous variables, the likelihood-ratio test is still highly significant, pointing out unexplained second level variability, which however appears to be much smaller than in the empty model (1.5% vs 5.6%).

The analysis of results highlights the importance of individual characteristics in explaining the probability of a disadvantaged student of being resilient. The origin of a student plays a major role, with all foreigners having a significantly lower probability of resilience; however, the gap is smaller for second

generation foreigners (-9%) and increases for first generations ones, especially those born outside the European Union (-24%). The multilevel model confirms the importance of the economic, social and cultural status of a student, measured by the ESCS index; those who are less disadvantaged among the disadvantaged are more likely to appear resilient performing well in Italian. Also the gender of a student has a role in influencing his probability of resilience and disadvantaged females have a +8% probability of succeeding in reading; the variable concerning the semester of birth highlights the benefit of being older in a class instead of younger (-3%). The last individual variable which has a statistically significant impact on the probability of resilience notwithstanding the inclusion on the ESCS index is the number of books at home.

At the class level, a small but statistically significant effect is found for full time classes, which can help disadvantaged students overcoming their background though more time spent at school and out of the family. A higher effect is the one of peers, measured by the quartiles of class average test score; attending a class where the mean score is in the top quarter increases by 32% the probability of being a resilient student.

The effect of school resources, as measured by the number of students per pc, is very small but statistically significant; if less students share a school pc, the probability of resilience for disadvantaged students increases.

Finally, the area of residence maintains a role also after the inclusion of the ESCS index and other personal characteristics; in particular, attending a school in the South decreases the probability of resilience by 8% compared to the North.

Table 8.
RESULTS OF THE MULTILEVEL LOGISTIC REGRESSION ON RESILIENCE IN THE3 ITALIAN TEST (MARGINAL PROBABILITIES)

	dy/dx	Std. Err.	z	P>z	[95% Conf.	Interval]
Female	0.080	0.00	24.84	-	0.07	0.09
Born in 2nd semester	- 0.029	0.00	- 8.86	-	- 0.03	- 0.02
Foreigner born in the EU	- 0.112	0.01	- 7.50	-	- 0.14	- 0.08
Foreigner born out of the EU	- 0.244	0.01	- 43.79	-	- 0.25	- 0.23
Second generation foreigner	- 0.094	0.00	- 20.06	-	- 0.10	- 0.08
ESCS index	0.134	0.00	31.22	-	0.12	0.14
Less than 10 books at home	- 0.027	0.00	- 6.52	-	- 0.03	- 0.02
More than 25 books at home	0.076	0.00	18.74	-	0.07	0.08
Full time class	0.011	0.01	2.07	0.04	0.00	0.02
2nd quartile of class avg test score	0.137	0.00	31.73	-	0.13	0.14
3rd quartile of class avg test score	0.223	0.00	45.54	-	0.21	0.23
4th quartile of class avg test score	0.322	0.01	56.33	-	0.31	0.33
1st quintile of students per pc	0.012	0.01	2.32	0.02	0.00	0.02
2nd quintile of students per pc	0.013	0.01	2.53	0.01	0.00	0.02
3rd quintile of students per pc	0.003	0.01	0.58	0.56	- 0.01	0.01
4th quintile of students per pc	- 0.002	0.01	- 0.33	0.74	- 0.01	0.01
School located in the Centre	- 0.025	0.00	- 4.96	-	- 0.03	- 0.01
School located in the South	- 0.079	0.00	- 18.71	-	- 0.09	- 0.07

Table 9 provides the probability of being resilient for three different students profiles. The higher probability of being resilient (83%) is the one of an Italian female born in the first semester, with over 25 books at home and top ESCS index amongst disadvantaged ones, in a top performer class of the Centre; the probability decreases to 37% for an Italian male born in the second semester, with 15 books at home and average ESCS index amongst disadvantaged ones, in a medium performer class of the Centre; finally, a foreign male born in the EU in the second semester, with less than 10 books at

home and low ESCS index amongst disadvantaged ones, in a low performer class of the South, has a very little probability of being resilient (4%).

Table 9.
Predicted probability of resilience for typical profiles of disadvantaged students

Italian female born in the first semester, with over 25 books at home and top ESCS index amongst disadvantaged ones, in a top performer class of the Centre	0.83
Italian male born in the second semester, with 15 books at home and average ESCS index amongst disadvantaged ones, in a medium performer class of the Centre	0.37
Foreign male born in the EU in the second semester, with less than 10 books at home and low ESCS index amongst disadvantaged ones, in a low performer class of the South	0.04

The logistic multilevel model has also been estimated for Math⁸, where the percentage of resilient students is slightly lower (33% vs 36%). The estimation of the empty model has highlighted the fact that between class variance in the probability of being resilient is higher (12.2%) than in Italian (8.6%), pointing to a major role of class variables, such as the teacher. Also the residual between classes variables in the full model is much higher in the Math model (6%) than in the Italian model (1,5%) pointing to a greater impact of non observable characteristics at the class level, such as those related to teachers style of teaching and other characteristics.

As regards to covariates, gender has the opposite effect in the probability of resilience: female are less likely to be resilient (-6%) in Math compared to their male counterparts. The origin of the student impacts less on Math resilience and second generation foreigners have the same probability of being resilient as Italian students; a significant disadvantage still exists for first generation foreigners, especially those born out of the European Union.

Among class variables, full time has a slightly higher effect on Math resilience (+2%) strengthening the idea that longer time spent at school can have some benefit on disadvantaged students.

The estimation of the multilevel model on the sample dataset, using teacher covariates, has not provided statistically significant results for the new variables tested, not providing any evidence on the role of teacher's characteristics and readiness for Distance Teaching in the probability of becoming a resilient student.

4. CONCLUSIONS

This paper tried to identify the main determinants of the resilience of some disadvantaged students, who manage to overcome their family background achieving good levels of school competences. Our results highlight the importance of individual factors, while the variability between classes or schools is quite modest. At the individual level, the main factors behind resilience are the student' ESCS index and their nationality. At class level, there is a significant peer effect, as identified by the class average test score. The area of residence has a statistically significant effect on resilience even after the inclusion of the other variables, confirming the well-known North-South divide. Some variables on the characteristics of the teachers have been tested on a regression estimated on the sample database, but no statistically significant effect was found. One should not interpret this as meaning that these factors are irrelevant, but rather that there is no empirical support in the INVALSI sample dataset for these hypotheses.

In this sense, further research is needed to deepen the understanding of the role that teachers play in the success of disadvantaged students. The use of the census dataset merged with administrative data in the characteristics of teachers, provided by the Ministry of Education, could be an option. Further research could also concern the adoption of a dynamic perspective, following students from lower to upper secondary school, in order to understand whether the resilience is a persistent phenomenon across the educational path of some disadvantaged students.

⁸ Results available upon request.

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