Ready to learn: the role of childcare attendance on children's school outcomes in Italy

Gloria Di Caprera*

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Abstract

This work investigates the casual effect of childcare attendance on children's school achievements. We analyse data about children's school outcomes in mathematics and language focusing on pupils attending second and fifth grade in Italian primary school in conjunction with data providing public childcare coverage at provincial level. Using IV identification strategy, we show that childcare attendance leads to better school outcomes and early investment in education boosts both mathematics and language skills. For both school grades our results highlight a positive and significant effect of childcare attendance on children's school achievements which does not dissipate over time.

1 Introduction

Child development is considered to be the outcome of inputs from parents, formal and informal childcare providers, and schools. Especially when children are young, parental care is the most valuable input. When both parents work, formal childcare is the best substitute, especially for children belonging to low-income families (Del Boca, 2015).

In recent years, a growing attention has been put on the role played by childcare services in the every-day life of both parents and children. Childcare provision may help parents to reconcile work and family life and, in particular, can support mothers' participation to the labor market.

However, childcare services do not only represent a place for working parents to leave their children while working. The use of childcare services represents the very first investment in children education and socio-emotional skills development. Many studies have proved that interventions in education during early childhood, when children are aged 0-2 years, lead to better and long-lasting results with respect to the one made later on. Both cognitive and social abilities are more flexible in the very first stage of childhood and every delay in investment in education leads to a higher cost in remedying negative results

*University of Rome "Tor vergata". Ph.D. Candidate in *Economics Law and Institutions.* Via Columbia, 2 - 00133 Rome (Italy): Building B, Third floor, Corridor DEDI.

(Del Boca et al., 2012). Moreover, returns to early intervention in education are higher for young children belonging to low income families and having low educated parents (Carneiro and Heckman, 2003).

The choice of childcare arrangement does not only depend on the working status of parents, but also on costs, availability and selection criteria of childcare, as well as socio-cultural beliefs.

If childcare services are too costly or too far away, parents will opt for alternatives like informal childcare. Informal care is generally defined as care arranged by the child's parents and provided by relatives, friends, babysitters or nannies. However informal childcare is shown to contribute less to child cognitive development. The impact of grandparents care on children education, for example, is not the same gained through childcare institutions. Children looked after their grandparents while aged 0-2 are better in naming objects, but worse in mathematical and problem solving tests with respect to children looked after in formal childcare institutions (Del Boca et al., 2014).

Childcare services play a significant role in children's cognitive and non cognitive development and expand their provision is an explicit goal in many European countries (EU, 2002). Italy is characterised by very low availability of childcare provision for children aged 0-2 (Del Boca and Vuri, 2007). Childcare services are decentralized and the choice to invest in them is made by each municipality. For this reason Italian regions are characterized by considerable differences in availability and costs of the service. The Northern and Central part of Italy show the highest levels of public childcare availability and in some regions, like Emilia Romagna, the supply of childcare services is almost equal to the demand. South of Italy and the Islands report the lowest rate of public childcare availability. According to ISTAT (2014), in 2012-13 in Emilia Romagna the supply of professionally based public childcare services was equal to 27%, while in Calabria only 2.1 %.

In this paper we investigate the causal effect of investing in early education on children cognitive outcomes in Italy looking at its effects in the medium term. Relying our analysis on both second and fifth grade students of Italian primary school, we investigate the effect of early investment in education at two different stages of children's cognitive development, when they are 7 years and enrolled to second grade, and when they are ending the primary school, at 10 years old.

We contribute to the existing literature showing that benefits gained through childcare attendance on children's educational attainment do not dissipate over time and it holds both for mathematics and language outcomes. For second grade students having attended formal childcare services fosters school achievement in mathematics, while fifth grade students perform better in language test.

The papers is structured as follows. In Section 2 we propose a review of the existing literature on the link between childcare attendance and children cognitive development. In Section 3 we present the data and variables used for our empirical analysis. In section 4 we describe the empirical approach. Section 5 presents the results of our analysis. In section 6 we propose some sensitivity checks. Finally, section 7

concludes.

2 Previous research

In recent years a growing part of the economic literature has been devoted to investigate the link between early childcare use and children's cognitive and non cognitive outcomes. Psychologists and sociologists have focused their studies mainly on the effect of childcare use on children's emotional and social skills, finding a positive effect of childcare attendance on children's behaviour. Children benefit from childcare attendance when the childcare service is of a high quality (Andersson, 1992, Howes and Pullips, NICHD, 2000) and, in particular, children from disadvantaged families benefit more from professionally based childcare services (Love et al., 2003, Votruba-Drzal et al., 2004).

International studies have shown that educational qualities of childcare services are likely to improve individual social, cognitive and economic outcomes. In their seminal works Todd and Wolpin (2003) and Carneiro and Heckman (2003) show that investing in early education has a positive effect on school outcomes. In particular Carneiro and Heckman (2003) show that early intervention on children's education has a long lasting effect on both their cognitive and non cognitive skills and benefits of childcare are stronger for children belonging to low income families and having low educated parents. Using data gathered from a randomized schooling subsidy experiment in Mexico, Todd and Wolpin (2003) estimate a dynamic behavioral model of parental decisions about fertility and child schooling showing that the timing of the investment in education matters. Cross-country evidences, mainly based on longitudinal studies, show that cognitive achievement and socio-emotional attitudes are enhanced during childhood, while during adolescence school achievement, social competence and social behaviours are improved (Andersson, 1992, Barnett and Masse, 2007).

A number of studies conducted in the U.S show that there is a positive impact of childcare attendance on children's cognitive outcomes, but benefits gained through childcare attendance are limited to the short run (Loeb et al., 2007). Magnuson et al. (2007), using data from Early Childhood Longitudinal Survey, show that prekindergarten attendance increases reading and mathematics skills at school entry, but its effects on cognitive skills fade away in the long run and the education gap between children who attended prekindergarten and those who didn't largely reduces by the spring of first grade of primary school.

In Europe public childcare services are expanding rapidly and in some countries (like North Europe and France) the supply of public childcare services is almost equal to the demand. Datta Gupta and Simonsen (2011), analysing Danish children's school outcomes when they're aged 11, show that high-quality childcare services attendance improves children's cognitive abilities. Felfe and Lalive (2014) provide evidence of the effect of childcare attendance for West Germany children, showing that daycare attendance

benefits language and socio-emotional skills. Moreover, early center-based care helps more children with less educated mothers or foreign parents.

In Italy, while several papers have seen the role of childcare services on mothers' working status (referenze), the educational role played by childcare on children's cognitive outcomes has largely been neglected. Due to the shortage of data, only recently data about children's school outcomes of the different stages of their school path have been made available. Recently, Brilli et al. (2013) , have analysed test score of second grade students of Italian primary school, showing that students who attended daycare services perform better in language test, but not in mathematics.   Along with parents' working status and level of education, the choice to invest in early education is largely determined by the availability of formal childcare services, the costs and the selection criteria.

In countries where the provision of childcare services is mostly public, like in North Europe and Italy, the focus is on the availability of the service. For the Italian scenario, Del Boca et al. (2005) explore the factors determining the choice of using childcare services. Assistance provided by grandmothers and husbands, as well as rationing, play a significant role in households' choices. Brilli et al. (2013) find a positive and significant role played by childcare availability on children's cognitive development. Del Boca and Vuri (2007), analyse the characteristics of the childcare system in Italy demonstrating the importance of rationing in interpreting price effects and employment decisions.

3   Data sources and variables

We use data providing children's school outcomes at primary school and data about public child care availability at provincial level in Italy. Children's school outcomes are from INVALSI, the Italian Institute for the Evaluation of the Education System in Italy. Since 2008, INVALSI is in charge of the design and administration of standardized education tests in Italy providing a complete national survey of students' education achievements in both mathematics and language outcomes. We use data from the INVALSI National Evaluation Service (henceforth SNV) for the school year 2012-13. The SNV test consists of a multiple choice *questionnaire* aimed to assess students' skills in mathematics and Italian language and it is addressed to students attending second and fifth grade of primary school, third year of lower secondary school and second grade of high school. In our analysis, we focus on students attending Italian primary school. Since 2009, these tests are compulsory for all schools and students.

The outcome variables of our analysis are test scores in language and mathematics. INVALSI provides raw scores of both mathematics and language test and we standardized these by subject and grade to have zero mean and unit variance. In addition to test scores, INVALSI collects socio-demographic in-

formation about the students and their parents. The variables we take into account are individual-level covariates indicating gender, citizenship, childcare attendance as well as parents' working status and level of education. Table 1 provides provides some descriptive statistics for both grades. As we can see from table 1, the variable childcare attendance has a high incidence of missing values in both second and fifth grade (32% and 33% respectively). Table 2 and 3 show the characteristics of individuals belonging to the full sample and to the selected sample (the one without missing values of variable childcare attendance). Implementing t-test for all covariates, we show that the differences in characteristics across the two samples are small, and none of them is statistically significant. Thus, we cannot reject the null hypothesis saying that the difference in means of the variables is equal to zero. We conclude that missing values of variable childcare attendance are random, and we can use it in our analysis.

To overcome the problem of cheating behaviour during the test, INVALSI decided to randomly select a sample of institutions assigning them an external monitor during the test who had two main tasks: be present in the class during the test and monitor its correct implementation, report student answers on the dedicated answer sheets and transmit them to INVALSI[1] (Angrist et al., 2014). To improve the reliability of our analysis, we focus on students belonging to public institutions who took the SNV test under the supervision of the external inspector.

To measure child care coverage, we use data from Cittadinanzattiva, an Italian independent consumer organization whose main objectives are the promotion of civic participation and the protection of citizens' rights in Italy and in Europe. Cittadinanzattiva yearly runs surveys to monitor the supply of public services in Italy and, among others, since 2005 it provides information about the supply of public childcare.[2] Specifically, Cittadinanzattiva gathers data from the Italian Ministry of Interior about the total slots available in each municipality and then reports the total number of slots available for each province. So far, it is the only organization providing data about public child care at provincial level.

Following Brilli et al. (2013), the variable *Childcare coverage* has been constructed dividing the total number of slots available at the daycare center by the total number of population aged 0-2 in that year, multiplying the results by 100. [3]. To the purpose of our analysis we use data about public child care availability in Italy in 2007 for second year students and 2005 for fifth year students. According to the Italian education system, students attending second year of primary school are 7 years old, whereas fifth grade students are aged 10. This implies that for second year students we have data about child care availability in 2007, when the children were 2 years old, while for fifth grade students we should have needed data collected in 2004, but Cittadinanzattiva provides data only from 2005.

For fifth grade SNV 2012-13 the final sample is composed by a total number of 22602 students belonging

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[1]External examiners were selected by INVALSI and the Regional Schooling Authorities mainly among retired teachers and active teachers employed in non-primary school.

[2]The field of interest of Cittadinanzattiva are: Education, Health, Law and Justice, Environment and European policies

[3]To assess the denominator of this variable, the Italian population aged 0-2, we use "Geo Demo", a web-service held by ISTAT.

to 698 public and monitored institutions.

4 Empirical framework

In order to estimate the effect of childcare attendance on children's school outcomes we set up a linear regression model.

The basic regression equation is:

$$Y_{ip} = \alpha + C_{ip}\beta + X'_{ip}\delta + P'_{ip}\gamma + \epsilon_{ip} \tag{1}$$

where the dependent variable Y_{ip} is mathematics and language test score of student i in province p.[4] X'_{ip} represents children's observable characteristics (gender and citizenship of the student) while P'_{ip} represents parents' observable characteristics (mothers' employment status and fathers' level of education). The main variable of interest is C_{ip}, a dummy variable equal to 1 if student i living in province p attended day care services when aged 0-2 years. Finally, ϵ_{ip} indicates the error component, both at individual and provincial level, which is uncorrelated with any other variables included in the model.

Since childcare attendance, C_{ip}, is likely to be affected by endogeneity, we use Instrumental Variables method, where public childcare coverage availability at provincial level instruments childcare attendance. It is plausible that public childcare availability predicts daycare enrolment and has no independent effect on children's school outcomes other than its effect on daycare enrolment.

We estimate our empirical model by 2SLS, where equation (2) is the first stage regression:

$$C_{ip} = \pi_0 + Z_p\pi_1 + X'_{ip}\pi_2 + P'_{ip}\pi_3 + \xi_{ip} \tag{2}$$

In the first stage regression we can see the determinants of the endogenous variable, C_{ip}, and the role played by the exogenous covariates as well as the instrument in determining it. The first stage effect of the instrument is captured by π_1.

5 Results

Table 4 shows results obtained for second grade students, while table 5 reports results for fifth grade students. For comparison purpose, we show results from OLS and 2SLS estimates for both grades and for both mathematics and language outcomes, while in the Appendix we report results from first stage regressions.

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[4]In the SNV test, students are required to answer to a multiple choices *questionnaire*. The final test score is defined as the percentage of correct answers given, ranging from a minimum of 0 to a maximum of 100.

Looking at the OLS results for second grade, reported in the first and second column of table 4, we show that daycare attendance predicts a positive and statistically significant effect on mathematics test score and a positive, but not significant, effect on language outcome.

Looking at the other covariates, as expected, immigrants perform worse than their Italian counterparts. Having an employed mother or a father with a high level of education have a positive and significant impact on children's outcomes in both cognitive areas, while children whose father has a primary level of education perform worse in both cognitive areas.

First and second column of table 5 report results from the OLS specifications for fifth grade students. For fifth grade students, daycare attendance has a positive and significant effect on both outcomes of interest and the gains of early investment in education are larger for mathematics rather than language test.

Last two columns of table 6 report results of the 2SLS estimates. We instrumented the endogenous variable *childcare attendance* using *childcare coverage* as instrument.

We can see that having attended daycare services during early childhood has a positive and significant effect on both mathematics and language test scores. Children who attended childcare report a statistically significant 1.031 points higher in mathematics test and a statistically significant 0.678 points higher in language test. Also in this case, for second grade students the effect of daycare attendance on the outcomes is greater for mathematics rather than language.

Table 5, last two columns, show the IV specifications for fifth grade students. In this case, childcare attendance predicts a statistically significant 1.424 points higher score in mathematics test and a statistically significant 1.961 points higher language test score.

In the appendix we report the first stage regressions of our estimates. Table 8 shows first stage results for both grades. Results from the first stage indicate that childcare availability at provincial level positively and significantly predicts children's participation to daycare services. The linear regression of the first stage, show that childcare coverage predicts childcare attendance quite well and it is likely to be a valid instrument for our analysis.

Looking at the results, IV estimates highlight a much stronger effect of daycare attendance on children's cognitive outcomes than the corresponding OLS estimates. The positive and significant effect of daycare attendance on school performance covers both mathematics and language test scores and skills gained through early investment in education, not only do not dissipate in the medium run, but are also stronger for fifth grade students rather than for second grade students.

6 Robustness checks

We check for the validity of results estimating our empirical model always running OLS and IV specifications, but taking into account for sample and provincial heterogeneity in order to assess the robustness of pur analysis. In order to account for sample heterogeneity, we run the same model looking at the differences between female and male students in cognitive outcomes and returns to early education. We estimate equation 1 for both female and male sub-sample. Panel (a) of table 6 and table 7 show results obtained in running our model only for female sub-sample, while in panel (b) of table 6 and table 7 we show results obtained for the male sub-sample. For both grades results are confirmed: daycare attendance during childhood exert a positive and significant effect on both male and female students' school outcomes.[5]. Both the OLS and IV specifications confirm what obtained in the baseline model and also in this case 2SLS estimates highlight a much larger effect of childcare attendance on cognitive outcomes with respect to the OLS results.

For second grades we can see that also in this case having attended childcare services has a greater impact on mathematics test score rather than language and this is valid for both female and male students. In the case of fifth grade students, instead, childcare attendance during childhood has a larger effect on language outcome for both female and male students. The total coverage of public childcare services is heterogeneous among the Italian provinces (see Figure 1). In particular, figure 1 denotes a medium-high availability of public childcare coverage in the North and in the Center, while it denotes a low coverage of public childcare in the South and in the Islands.[6]

We wonder if our results are driven by differences of childcare coverage in Italian provinces.

We repeat the same analysis dropping provinces with childcare coverage higher than 90th percentile and provinces where child care coverage is lower than 10th percentile. Looking at panel (c) and (d) of table 6 for second grade and panel (c) and (d) of Table 7 for fifth grade, results are confirmed in any case: returns to investment in early education covers both cognitive areas and its positive and significant effect on children's cognitive outcomes does not fade away over time. Moreover, results obtained for both second and fifth grade suggest that benefits of childcare attendance are higher for children living in provinces where childcare provision is scarce.

Also after controlling for provincial heterogeneity we can see that childcare attendance leads second grade students to better perform in mathematics, while it leads fifth grade students to perform better in language. Looking at the results, also in this case 2SLS estimates denote a larger effect of childcare attendance on cognitive abilities rather than the OLS estimates. We can conclude that our results are

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[5]For second grade the female sub-sample is composed by 7163 students, while the male sub-sample is composed by 7543 students. For fifth grade the female sub-sample is of 7400 students and the male sub-sample of 7409 students.

[6]The Italian region with the highest level of public child care availability is Emilia Romagna and province of Modena reports the highest availability among other provinces, whereas province of Vibo Valentia, in Calabria region, reports the lowest availability of public child care coverage.

robust to the specifications used and to the sample choice adopted.

7   Conclusions

In this paper, using INVALSI National Survey of Evaluation (SNV) data for the school year 2012-13, we explore the effect of early investment in education for children aged 0-2 years on their cognitive development. We estimate the effect of childcare attendance on children's school outcomes for students attending second and fifth grade of Italian primary school. We find a positive and significant effect of childcare attendance on children's school achievements for both grades and in both mathematics and language outcomes. We address endogeneity problem of variable childcare attendance using an IV identification strategy. Using data from Cittadinanzattiva, we compute childcare coverage at provincial level in Italy for both grades and we use it as an instrument for childcare attendance. Results obtained show that children who attended daycare during early childhood report better school outcomes with respect to those who didn't. We show that the positive and significant effect of early education on children's cognitive development does not fade away in the long run and results of fifth grade estimates highlight a stronger effect of childcare attendance on children's cognitive outcomes with respect to results obtained for second year students. Moreover, we find that second grade students having attended childcare perform better in mathematics test, while fifth grade students perform better in language rather than mathematics. We show that benefits of childcare attendance on children's cognitive development are higher for disadvantaged children living in provinces where childcare provision in scarce. We check for the sensitivity of our results running several robustness checks. Taking into account for sample and provincial heterogeneity, our empirical results are confirmed for both grades of Italian primary school and in both mathematics and language outcomes.

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Figures and tables

Figure 1: Child care coverage across Italian provinces in 2007

(11.82,28.15]
(7.32,11.82]
(3.7,7.32]
[33,3.7]
No data
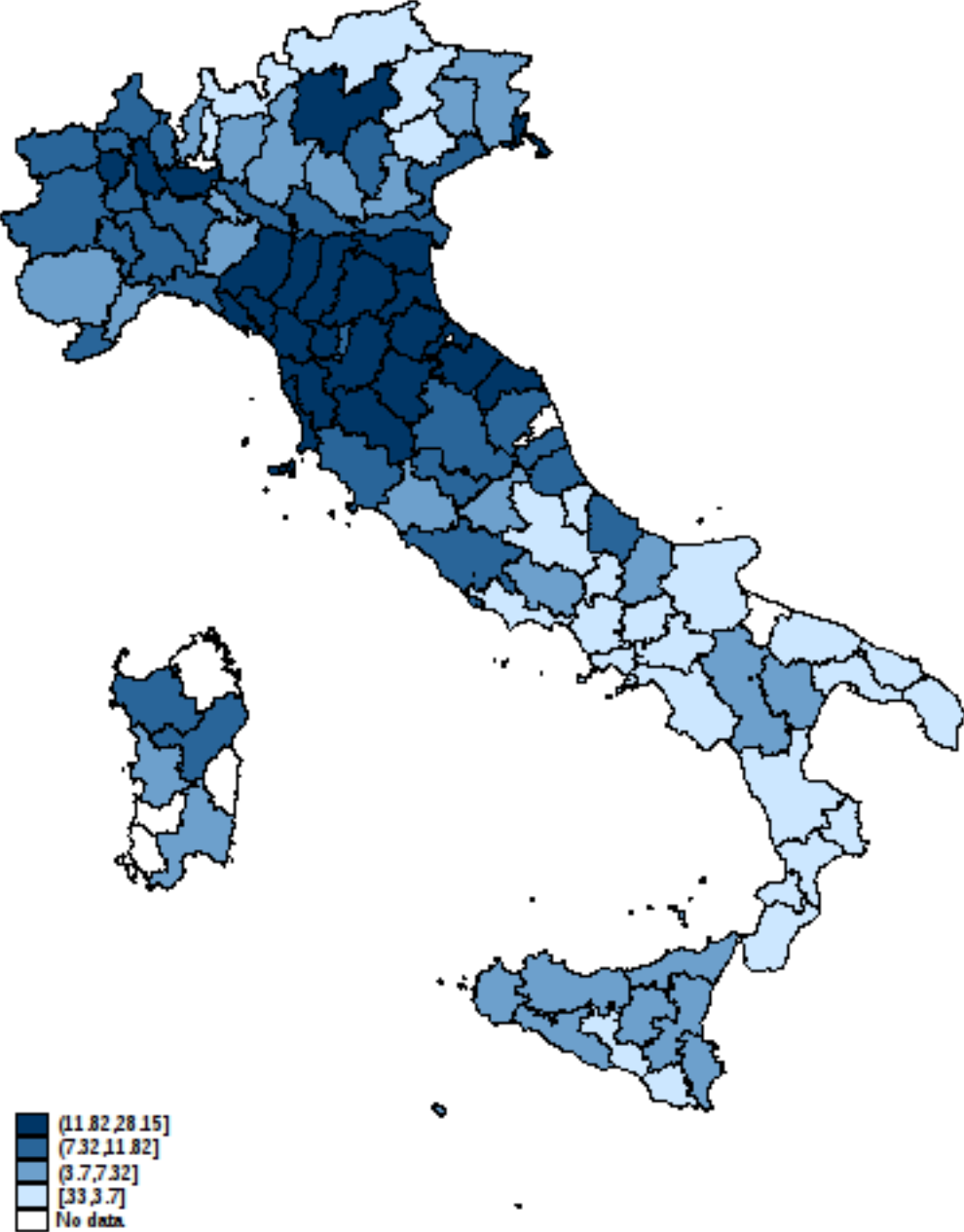
Source: Authors' re-elaboration from Cittadinanzattiva (2009)

Figure 2: Correlation between school outcomes and nursery attendance for Second Grade students

Mathematics
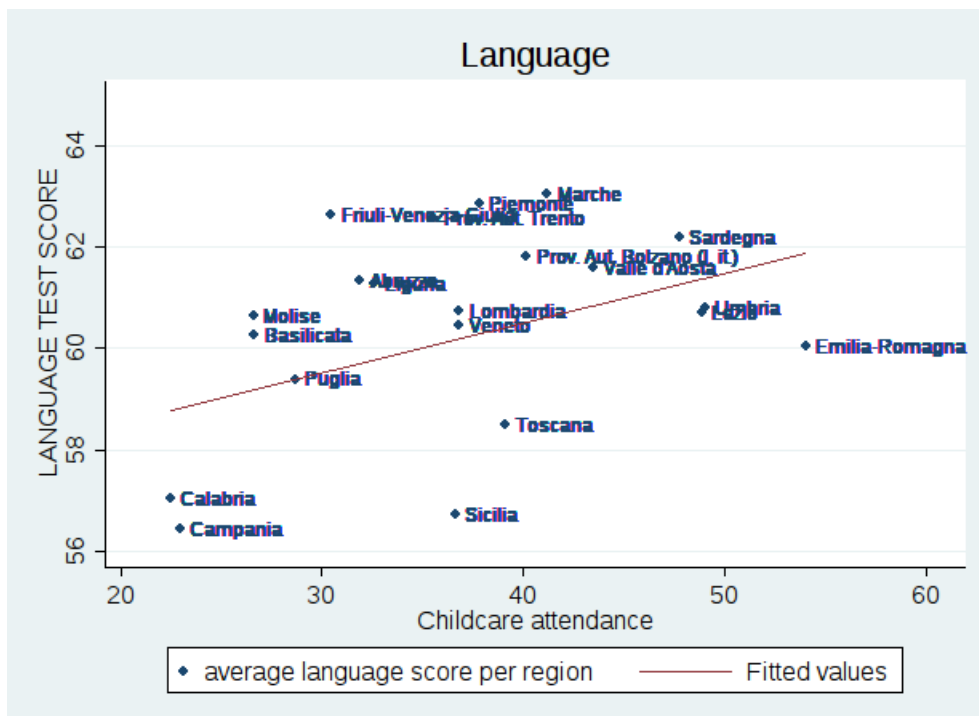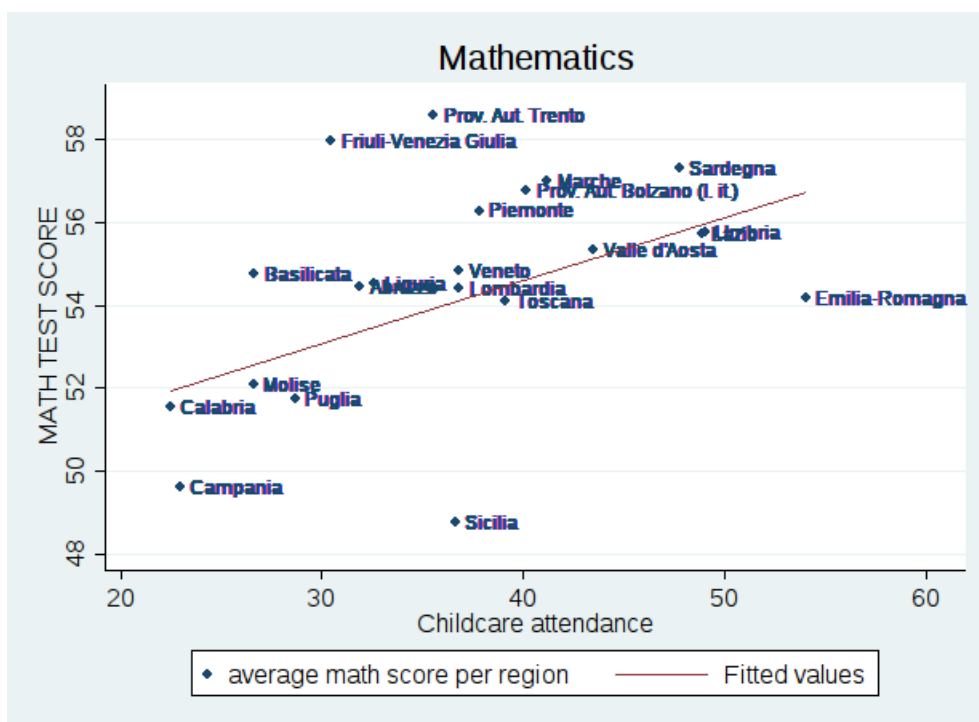
Language

Notes. Correlation coefficient for Mathematics: 0.4913; p-value: 0.0000; for Language: 0.4193; p-value: 0.0000 (2009)

Source: authors' re-elaboration from INVALSI 2012/13 and Cittadinanzattiva (2009)

Figure 4: Correlation between school outcomes and nursery attendance for Fifth Grade students

Mathematics
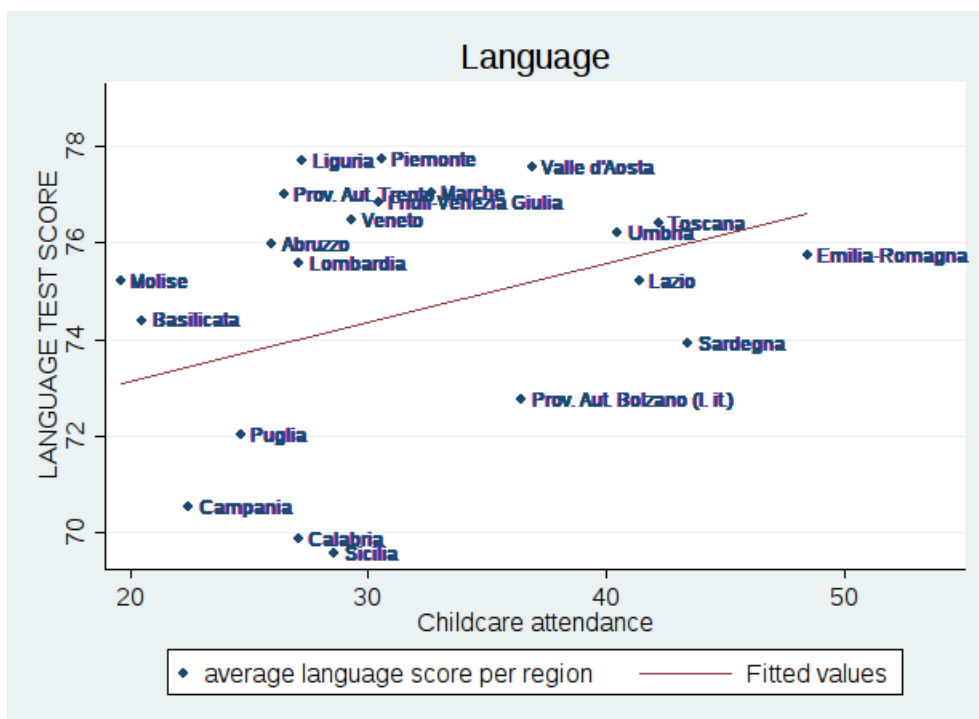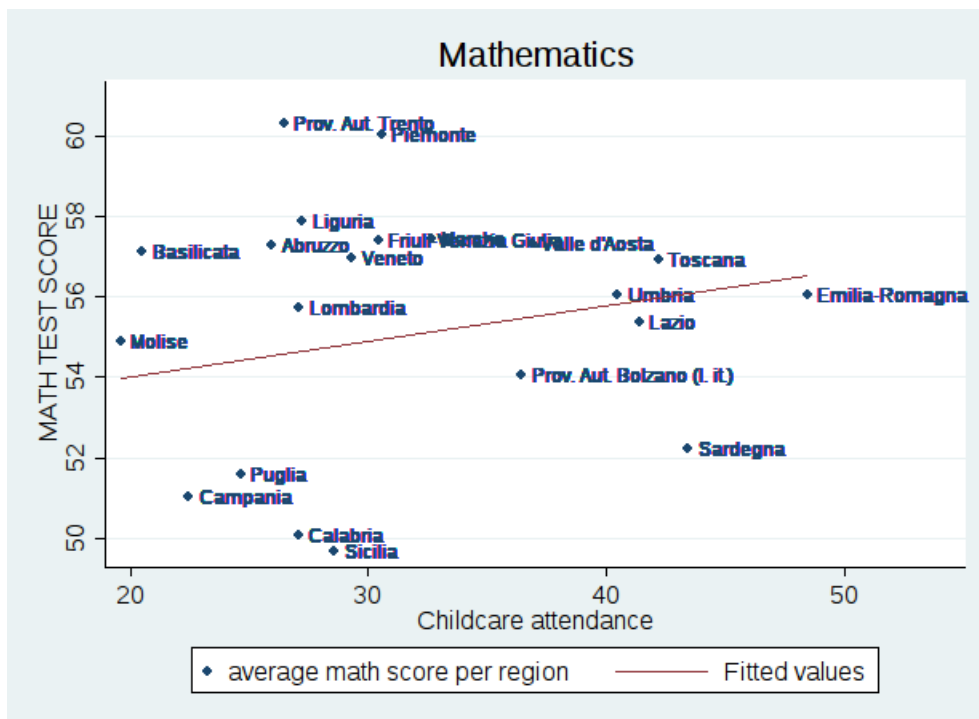
Language

Notes. Correlation coefficient for Mathematics: 0.2176; p-value: 0.0000; for Language: 0.3487; p-value: 0.0000
Source: authors' re-elaboration from INVALSI 2012/13 and Cittadinanzattiva (2009)

Table 1: Summary statistics

	Grade 2 (2012-2013)	Grade 5 (2012-2013)
	mean(sd)	mean(sd)
Mathematics test score	54.05	55.00
	(17.50)	(18.84)
Language test score	60.135	74.501
	(14.50)	(15.82)
Children Characteristics		
Childcare attendance	0.36	0.31
	(0.48)	(0.46)
Missing Childcare attendance	0.32	0.33
	(0.25)	(0.27)
Male	0.51	0.50
	(0.50)	(0.50)
Non Italian	0.09	0.10
	(0.29)	(0.30)
Parents Characteristics		
Unemployed or retired mother	0.05	0.05
	(0.24)	(0.23)
Housewife mother	0.30	0.33
	(0.47)	(0.47)
Employed mother	0.48	0.48
	(0.50)	(0.49)
Missing mother occupation	0.07	0.06
	(0.25)	(0.24)
Father primary education	0.40	0.42
	(0.50)	(0.50)
Father secondary education	0.36	0.34
	(0.48)	(0.47)
Father tertiary education	0.12	0.11
	(0.33)	(0.31)
Missing father education	0.07	0.07
	(0.25)	(0.25)
Childcare coverage	7.80	7.68
	(5.72)	(6.02)

Table 2: Mean difference between full sample and selected sample. Second grade

	Full Sample	Selected Sample	Mean Difference	Test statistics [*P-value*]
Outcome Variables	*mean*	*mean*	*mean*	*t-stat*
Mathematics test score	54.004	54.046	-0.042	-2.13
	(20.681)	(20.604)	(21.033)	[0.066]
Language test score	60.125	60.135	-0.010	-0.07
	(17.246)	(16.964)	(19.271)	[0.722]
Children Characteristics				
Male	0.513	0.514	-0.001	-0.28
	(0.50)	(0.50)	(0.007)	[0.930]
Non Italian	0.111	0.095	0.016	0.70
	(0.314)	(0.292)	(0.312)	[0.340]
Parents Characteristics				
Housewife mother	0.285	0.304	-0.019	-0.67
	(0.453)	(0.472)	(0.482)	[0.453]
Employed mother	0.465	0.484	-0.019	-1.78
	(0.50)	(0.50)	(0.38)	[0.135]
Father primary education	0.374	0.402	-0.028	-1.32
	(0.48)	(0.50)	(0.54)	[0.278]
Father tertiary education	0.105	0.124	-0.019	-1.28
	(0.302)	(0.334)	(0.375)	[0.217]
Instrument				
Childcare coverage	7.781	7.800	-0.019	-1.53
	(5.78)	(5.72)	(6.14)	[0.157]

Notes: Table shows means of characteristics in the full sample and in the selected sample. Standard deviations in parenthesis. A t-test of the difference in means is provided in the last column with associated level of significance in squared brackets.

Table 3: Mean difference between full sample and selected sample. Fifth grade

	Full Sample	Selected Sample	Mean Difference	Test statistics [P-value]
Outcome Variables	*mean*	*mean*	*mean*	*t-stat*
Mathematics test score	54.964	55.000	-0.036	-1.65
	(18.93)	(18.84)	(19.46)	[0.076]
Language test score	74.467	74.501	-0.034	-1.90
	(16.03)	(15.82)	(17.43)	[0.062]
Children Characteristics				
Male	0.5	0.5	0.000	0.10
	(0.5)	(0.5)	(0.520)	[0.930]
Non Italian	0.102	0.097	0.005	0.39
	(0.301)	(0.295)	(0.356)	[0.533]
Parents Characteristics				
Housewife mother	0.297	0.332	-0.035	-1.87
	(0.463)	(0.475)	(0.497)	[0.076]
Employed mother	0.464	0.483	-0.019	-1.47
	(0.503)	(0.495)	(0.517)	[0.078]
Father primary education	0.407	0.421	-0.014	-0.79
	(0.492)	(0.495)	(0.521)	[0.083]
Father tertiary education	0.093	0.112	-0.019	-1.65
	(0.296)	(0.313)	(0.362)	[0.13]
Instrument				
Childcare coverage	7.701	7.687	0.014	0.62
	(5.991)	(6.026)	(6.337)	[0.12]

Notes: Table shows means of characteristics in the full sample and in the selected sample. Standard deviations in parenthesis. A t-test of the difference in means is provided in the last column with associated level of significance in squared brackets.

Table 4: OLS and IV/2SLS results: second grade

	OLS		IV/2SLS	
	Mathematics	Language	Mathematics	Language
	(1)	(2)	(3)	(4)
Childcare attendance	0.045**	0.027	1.031***	0.678***
	(0.017)	(0.017)	(0.161)	(0.150)
Male	0.108***	-0.073***	0.094***	-0.083***
	(0.016)	(0.016)	(0.018)	(0.016)
Non Italian	-0.354***	-0.434***	-0.392***	-0.459***
	(0.027)	(0.028)	(0.031)	(0.029)
Employed Mother	0.271***	0.238***	0.177***	0.176***
	(0.025)	(0.026)	(0.031)	(0.029)
Housewife Mother	0.011	0.005	0.130***	0.084**
	(0.027)	(0.027)	(0.035)	(0.033)
Father low education	-0.254***	-0.220***	-0.200***	-0.184***
	(0.017)	(0.017)	(0.021)	(0.019)
Father high education	0.251***	0.275***	0.161***	0.215***
	(0.025)	(0.024)	(0.032)	(0.030)
Constant	-0.082**	-0.038	-0.429***	-0.192***
	(0.026)	(0.027)	(0.063)	(0.059)
F-excluded			202.46	202.46
Observations	14,706	14,706	14,706	14,706

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Exogenous excluded instrument: Childcare coverage. Sample size: students belonging to sampled public institutions.

Table 5: OLS and IV/2SLS results: fifth grade

	OLS		IV/2SLS	
	Mathematics	**Language**	**Mathematics**	**Language**
	(1)	(2)	(3)	(4)
Childcare attendance	0.057**	0.052**	1.424***	1.961***
	(0.018)	(0.017)	(0.214)	(0.240)
Male	0.169***	-0.167***	0.146***	-0.200***
	(0.016)	(0.015)	(0.019)	(0.021)
Non Italian	-0.281***	-0.389***	-0.385***	-0.537***
	(0.027)	(0.031)	(0.036)	(0.041)
Employed Mother	0.293***	0.314***	0.184***	0.154***
	(0.026)	(0.027)	(0.035)	(0.039)
Housewife Mother	0.052	0.062*	0.204***	0.266***
	(0.027)	(0.029)	(0.039)	(0.044)
Father Low Education	-0.260***	-0.279***	-0.194***	-0.186***
	(0.017)	(0.017)	(0.023)	(0.025)
Father High Education	0.313***	0.308***	0.213***	0.168***
	(0.026)	(0.022)	(0.035)	(0.040)
Constant	-0.158***	0.030	-0.569***	-0.534***
	(0.027)	(0.028)	(0.071)	(0.079)
F-excluded			140.76	140.76
Observations	14,890	14,890	14,890	14,890

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Exogenous excluded instrument: Childcare coverage. Sample size: students belonging to sampled public institutions.

Table 6: Robustness checks: Sample heterogeneity and provincial heterogeneity for Second Grade

	OLS		IV/2SLS	
	Mathematics	**Language**	**Mathematics**	**Language**
Panel (a): Sample of female students				
Childcare attendance	0.037	-0.000	0.929***	0.677***
	(0.024)	(0.227)	(0.024)	(0.221)
N. Observations	7,163	7,163	7,163	7,163
Panel (b): Sample of male students				
Childcare attendance	0.026	0.034	1.116***	0.678***
	(0.024)	(0.228)	(0.023)	(0.205)
N. Observations	7,543	7,543	7,543	7,543
Panel (c):Without childcare coverage lower than 10th percentile				
Childcare attendance	0.026	0.034	1.116***	0.678***
	(0.024)	(0.023)	(0.228)	(0.205)
N. Observations	13,724	13,724	13,724	13,724
Panel (d): Without childcare coverage higher than 90th percentile				
Childcare attendance	0.019	0.008	1.509***	1.250***
	(0.018)	(0.017)	(0.229)	(0.214)
N. Observations	13,541	13,541	13,541	13,541

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Controls: students' gender and citizenship, employed mother, housewife mother, father primary education, father tertiary education. Exogenous excluded instrument: childcare coverage. Sample size: sampled students belonging to public institutions.

Table 7: Robustness checks: Sample heterogeneity and provincial heterogeneity for Fifth Grade

	OLS		IV/2SLS	
	Mathematics	**Language**	**Mathematics**	**Language**
Panel (a): Sample of female students				
Childcare attendance	0.050*	0.193	1.196***	1.905***
	(0.025)	(0.25)	(0.024)	(0.28)
N. Observations	7,400	7,400	7,400	7,400
Panel (b): Sample of male students				
Childcare attendance	0.030	0.019	1.756***	2.067***
	(0.025)	(0.024)	(0.397)	(0.423)
N. Observations	7,409	7,409	7,409	7,409
Panel (c):Without childcare coverage lower than 10th percentile				
Childcare attendance	0.036*	0.033*	1.112***	1.434***
	(0.024)	(0.023)	(0.228)	(0.205)
N. Observations	13,504	13,504	13,504	13,504
Panel (d): Without childcare coverage higher than 90th percentile				
Childcare attendance	0.043**	0.036**	4.206***	5.697***
	(0.019)	(0.939)	(0.017)	(1.211)
N. Observations	13,599	13,599	13,599	13,599

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. Controls: students' gender and citizenship, employed mother, housewife mother, father primary education, father tertiary education. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Exogenous excluded instrument: childcare coverage. Sample size: sampled students belonging to public institutions.

Appendix

Table 8: First stage regression, Second and Fifth Grade

	FIRST STAGE	
	Second Grade	**Fifth Grade**
	Childcare Attendance	**Childcare attendance**
Childcare coverage	0.010***	0.007***
	(0.001)	(0.001)
Male	0.014*	0.017**
	(0.008)	(0.007)
Non Italian	0.016	0.054***
	(0.013)	(0.013
Employed Mother	0.082***	0.074***
	(0.012)	(0.012)
Housewife Mother	-0.107***	-0.095***
	(0.013)	(0.013)
Father low education	-0.056***	-0.049***
	(0.008)	(0.008)
Father high education	0.090***	0.074***
	(0.012)	(0.012)
Constant	0.285***	0.244***
	(0.013)	(0.013)
Observations	14,706	14,890

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Controls: students' gender and citizenship, mothers' employment status, fathers' level of education, childcare coverage at provincial level. Sample size: students belonging to sampled public institutions.

Table 9: Sample of Female students, First Stage Regressions

	FIRST STAGE	
	Second Grade	Fifth Grade
	Childcare Attendance	Childcare attendance
Childcare coverage	0.010***	0.009***
	(0.001)	(0.009)
Non Italian	0.023	0.054***
	(0.019)	(0.018)
Employed Mother	0.085***	0.076***
	(0.017)	(0.017)
Housewife Mother	-0.112***	-0.087***
	(0.018)	(0.018)
Father low education	-0.052***	-0.0622***
	(0.012)	(0.011)
Father high education	0.096***	0.074***
	(0.018)	(0.018)
Constant	0.282***	0.238***
	(0.018)	(0.018)
Observations	7,163	7,437

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Controls: students' gender and citizenship, mothers' employment status, fathers' level of education, childcare coverage at provincial level. Sample size: students belonging to sampled public institutions.

Table 10: Sample of male students, First Stage Regressions

	FIRST STAGE	
	Second Grade	**Fifth Grade**
	Childcare Attendance	**Childcare attendance**
Childcare coverage	0.010***	0.006***
	(0.001)	(0.009)
Non Italian	0.009	0.055***
	(0.019)	(0.018)
Employed Mother	0.079***	0.072***
	(0.017)	(0.017)
Housewife Mother	-0.102***	-0.103***
	(0.018)	(0.018)
Father low education	-0.059***	-0.036***
	(0.012)	(0.011)
Father high education	0.085***	0.075***
	(0.018)	(0.018)
Constant	0.301***	0.268***
	(0.017)	(0.018)
Observations	7,543	7,453

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Controls: students' gender and citizenship, mothers' employment status, fathers' level of education, childcare coverage at provincial level. Sample size: students belonging to sampled public institutions.

Table 11: Sample without Childcare Coverage Lower than 10th percentile. First Stage Regressions

| | FIRST STAGE | |
| | Second Grade | Fifth Grade |
	Childcare Attendance	Childcare attendance
Childcare coverage	0.009***	0.008***
	(0.007)	(0.001)
Male	0.011	0.016**
	(0.008)	(0.008)
Non Italian	0.016	0.053***
	(0.014)	(0.013)
Employed Mother	0.076***	0.069***
	(0.013)	(0.013)
Housewife Mother	-0.119***	-0.106***
	(0.014)	(0.013)
Father low education	-0.061***	-0.052***
	(0.018)	(0.008)
Father high education	0.089***	0.071***
	(0.013)	(0.013)
Constant	0.302***	0.250***
	(0.014)	(0.014)
Observations	13,724	13,585

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Controls: students' gender and citizenship, mothers' employment status, fathers' level of education, childcare coverage at provincial level. Sample size: students belonging to sampled public institutions.

Table 12: Sample without Childcare Coverage Higher than 90th percentile, First Stage Regressions

	FIRST STAGE	
	Second Grade	Fifth Grade
	Childcare Attendance	Childcare attendance
Childcare coverage	0.011***	0.005***
	(0.001)	(0.001)
Male	0.013	0.020***
	(0.08)	(0.008)
Non Italian	0.016	0.068***
	(0.014)	(0.014)
Employed Mother	0.082***	0.071***
	(0.012)	(0.012)
Housewife Mother	-0.105***	-0.092***
	(0.013)	(0.013)
Father low education	-0.056***	-0.053***
	(0.008)	(0.008)
Father high education	0.091***	0.073***
	(0.013)	(0.013)
Constant	0.279***	0.259***
	(0.014)	(0.014)
Observations	13,541	13,599

Notes: Significance levels: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. Robust standard errors in parenthesis. All outcomes are expressed as z-scores, with mean zero and standard deviation one. Controls: students' gender and citizenship, mothers' employment status, fathers' level of education, childcare coverage at provincial level. Sample size: students belonging to sampled public institutions.