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Impact of Early Childcare on Immigrant Children's Educational Performance

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Abstract

This paper investigates the impact of attending early childcare on immigrant children's cognitive outcomes. Our analysis makes use of administrative data on the entire population of students in the fifth grade collected by the Italian Institute for the Evaluation of the Educational System (INVALSI) for school years 2014/2015 to 2016/2017, matched to unique administrative records on early childcare availability at the municipal level. Our identification strategy exploits cross-sectional and time series variations in the provision of early childcare services across Italian municipalities as an instrument for individual attendance. Our results indicate that the effect of early childcare attendance differs between native and immigrant children. Estimates show a positive and significant effect on the language test scores of immigrant children, with the effect being mostly driven by children with low-educated mothers and by children who, at home, speak a language highly dissimilar to Italian. Unlike immigrants, native students are negatively impacted by early childcare attendance. Effects are stronger on math test scores for children with highly educated mothers and in municipalities with a relatively low *public* supply of early childcare.

Keywords: Childcare, Cognitive skills, Immigrant children, IV.

JEL Classification Numbers: J13, J15, H75, I20, I28.

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1 Introduction

In recent years, immigrant inflows to OECD countries have increased substantially, leading to the presence of a rising number of immigrant children in European school systems. According to estimates from the Migration Policy Institute Europe (see [Ahad and Benton \(2018\)](#)), by the early 2020s, more than one-quarter of the school-aged population in Europe will have a migrant background.

Children who are migrants or who have immigrant parents face significant educational barriers, such as a lack of language proficiency or limited knowledge of the school system in their host countries. These barriers may lead to a substantial educational disadvantage relative to native students, as documented in recent economic literature (see, for example, [Alesina et al. \(2018\)](#), [Dustmann et al. \(2012\)](#)). Performance gaps at school translate into persistent differences in literacy levels, dropout rates and, eventually, labor market outcomes between immigrant students and their native peers, thus perpetuating inequalities and slowing the integration of migrants into their host countries. Therefore, addressing the needs of diverse learners and fostering the school performance of immigrant students are key challenges for European school systems writ large.

This paper investigates the effect of early childcare on second-generation immigrant children’s cognitive outcomes. Our focus on early education traces back to the findings of Heckman and coauthors, who suggested that ability gaps between individuals and socioeconomic groups open up at early ages for both cognitive and noncognitive skills. Given the high degree of brain plasticity at this stage of development, investments made early in life show higher returns as well as dynamic complementarities with respect to investments made later in life ([Heckman and Mosso \(2014\)](#), [Cunha and Heckman \(2007\)](#) and [Heckman and Masterov \(2007\)](#)). This is particularly true for children from disadvantaged backgrounds taking part in targeted interventions ([Blau and Currie \(2006\)](#)). However, existing evidence on the effects of untargeted, publicly provided early childcare programs is less conclusive, relatively scarce and not specifically focused on children with an immigrant background.

This paper aims to fill this gap and estimates the causal impact of early childcare on native and second-generation immigrant children’s school performance. We address the endogeneity of childcare attendance due to the nonrandom selection of children into childcare services by exploiting the exogenous variation in public supply of early childcare services across Italian municipalities and over time as an instrument for individual participation.

Our analysis makes use of administrative data from the Italian Institute for the Evaluation of the Educational System (henceforth INVALSI) on three cohorts of primary school students attending fifth grade in the 2014/2015 to 2016/2017 school years, merged with unique administrative records on publicly available early childcare slots at the municipal level, collected by [Antonelli and Grembi \(2011\)](#). The INVALSI dataset contains information on children’s test scores in language and math, along with several pieces of information on school, family and student characteristics, including whether each student attended early childcare.

We believe that our focus on Italy is particularly appropriate for two reasons; Italy only recently became a destination for international migration, and it is one of the OECD countries with the greatest educational disparities between native and immigrant students ([OECD \(2012\)](#)). Moreover, despite the gradual increase in public expenditure on childcare by municipalities, Italy is still characterized by a strong excess demand for early childcare service and by a striking territorial divide in childcare provision (see [Del Boca et al. \(2016b\)](#)), which can be exploited for identification. Combined, these features contribute to an invaluable setting for our analysis. This

paper contributes to the existing literature along several dimensions. First, while an extensive number of studies examine interventions geared toward children aged 3-5 years, only a few focus on children aged 0-2 years (i.e. early childcare), and the evidence they provide is mixed. Some studies find positive effects (Felpe and Lalive (2018) and Drange and Havnes (2019) Cornelissen et al. (2018), among others), while others find negative or no effects (Herbst (2017); Carta and Rizzica (2018) and Fort et al. (2020)). Second, we focus on students with an immigrant background and, in particular, on second-generation immigrants, which is a growing and relatively underinvestigated group. Third, thanks to the rich set of information available in our dataset, we make use of two alternative measures of students’ performance: INVALSI standardized test scores and oral grades assigned by teachers. The two measures are likely to capture different dimensions of students’ abilities, providing an additional understanding of the impact of early childcare attendance. We can also perform several tests of heterogeneity and thus identify some of the channels at work, such as the role of linguistic distance of immigrants’ native language from Italian and the differential impact of residing in a municipality with a relatively higher (lower) share of publicly authorized spots.

Our results indicate that the effect of early childcare attendance differs between native and immigrant children. For native students, we document a negative effect of early childcare attendance on language and math test scores. In line with Fort et al. (2020), children with highly educated mothers are the population most harmed in this context, possibly due to their easier access to high-quality alternative modes of care. For immigrant children, we find a positive and significant effect of early childcare attendance on language test scores, especially for those with low-educated mothers and those who speak at home a language that differs significantly from Italian. This result suggests that attending early childcare is an effective tool for fostering immigrant children’s achievements, which helps to close existing gaps with respect to native children.

In terms of policy implications, our analysis sheds light on the potential target(s) for policy interventions, uncovering (i) which group of immigrant students might benefit the most from early childcare attendance and (ii) one of the crucial mechanisms behind the resulting effect. In fact, positive effects are primarily enjoyed by immigrant children coming from less-advantaged families, and linguistic distance plays a key role in explaining the positive impacts observed. This role should be taken into account when designing and implementing policies aimed at the successful integration of migrants into society.

The remainder of the paper is structured as follows. In Section 2, we provide a summary of the existing literature on early childcare and children’s outcomes, together with an underlining of our paper’s contributions. In Section 3, we describe the Italian system of public early childcare. Next, we present our data and provide some relevant descriptive statistics in Section 4. In Section 5, we illustrate our identification strategy and discuss the threats to its validity. We then present and comment on our results in Sections 6, and we provide several robustness checks in Section 7. Finally, in Section 8, we offer some concluding remarks and discuss the possible policy implications of our findings.

2 Literature review

This paper draws on and contributes to two strands of literature. First, it relates to the large body of literature on the impact of early life experiences and early interventions on children’s cognitive skills. Second, it adds to the literature on the educational gap between native and immigrant students (Cornelissen et al. (2018), Drange and Telle (2015)).

The existing literature on early interventions and cognitive outcomes has mainly focused on in-

interventions geared toward children aged 3-5 and has typically found that childcare has positive effects on child development, especially for children from disadvantaged backgrounds (see [Havnes and Mogstad \(2015\)](#), [Felfe et al. \(2014\)](#), and [Berlinski et al. \(2009\)](#), among others). Research on the effects of childcare on younger children (0-2 years old)—which we call *early childcare*—is scarcer, and the evidence is mixed. Desirable effects on cognitive and social skills from attending early childcare are stronger and more robust in countries with high quality and a large availability of early childcare services, as in northern European countries. For example, by using administrative data from a large West German state, [Felfe and Lalive \(2018\)](#) develop a marginal treatment effect framework to assess the impact of early childcare on children’s school readiness. They find that early childcare is particularly beneficial for children with low-educated mothers or foreign-born parents. [Drange and Havnes \(2019\)](#), exploiting a randomized lottery employed in the city of Oslo to allocate slots to childcare, show that children enrolled early in day care facilities perform better on both language and math tests taken when they are 7 years old, with the effect being driven by children from economically disadvantaged families.

However, the evidence of desirable effects is hardly equivocal. For example, evidence of negative effects emerged in various studies evaluating the universal early childcare expansion that occurred in Quebec during the 1990s. Among these, the work of [Baker et al. \(2008\)](#) stands out; exploiting a difference-in-differences strategy to compare children’s outcomes before and after the reform, the authors found childcare utilization to be detrimental to children’s behavioral and health outcomes following the policy change. These negative outcomes were confirmed in a subsequent study by the same authors, which also found little impact on cognitive test scores ([Baker et al. \(2019\)](#)). Similar results have been found by other studies, such as [Herbst \(2017\)](#), [Havnes and Mogstad \(2015\)](#) and [Herbst \(2013\)](#) for children from more advantaged families.

Our paper contributes to this literature by studying the impact of early childcare in Italy. Early childhood interventions in Italy have received research attention only recently, thanks to the increasing availability of reliable data on children’s educational outcomes in the past few years. The findings are also mixed in this case. [Brilli et al. \(2016\)](#) find a positive impact of early childcare availability on children’s language cognitive outcome, with the effect being driven by areas with a higher level of rationing. The same conclusions are reached by [Del Boca et al. \(2016a\)](#), who, implementing an instrumental variable approach, provide evidence that early childcare attendance has a positive effect on children’s later educational achievements. [Carta and Rizzica \(2018\)](#), exploiting a reform that introduces the possibility of entering the fully subsidized preschool service earlier, argue that entering preschool at a younger age has no significant effect on children’s cognitive outcomes at age 7. In contrast, implementing a regression discontinuity design, [Fort et al. \(2020\)](#) find that early childcare has a detrimental effect on cognitive and noncognitive outcomes of girls coming from more affluent families.

Our focus on immigrant children is the second contribution to the existing literature. Despite the growing share of immigrant students in all OECD countries, very few studies have investigated the impact of early childhood programs on children with an immigrant background. In this group, [Cornelissen et al. \(2018\)](#) evaluate the heterogeneous impact of a universal childcare program in Germany by exploiting variation in attendance as a result of a reform that led to a large expansion staggered across municipalities. They detect a pattern of reverse selection on gains: children more (less) likely to attend these services benefit the least (most) from attendance. In particular, they find that early childcare attendance works as an ‘equalizer’: children with immigrant ancestry are less likely to attend early childcare but experience the largest gains in terms of overall school readiness in comparison to native children. The results are driven by students coming from families with fewer resources. In the same vein, the study of [Drange and Telle \(2015\)](#) shows that a targeted intervention that provides 4 hours of free childcare in some

districts of Oslo succeeded in increasing childcare enrollment and improved immigrant children’s cognitive development, especially for girls and children coming from a disadvantaged background.

Our paper contributes to the scarce literature on the impact of early childhood programs and focuses on immigrant children, a fast-growing and little-investigated group. Further, given the richness of our data, we are able to test whether the effect is heterogeneous along various dimensions, such as gender, parents’ education and immigrant children’s linguistic distance to the host country language. To the best of our knowledge, no other studies have investigated the role of linguistic distance in shaping immigrant children’s early education experience. Additionally, our data contain information concerning individual early childcare attendance. Unlike many existing papers in the early education literature that focus on intention-to-treat effects ([Carta and Rizzica \(2018\)](#), [Del Boca et al. \(2016a\)](#) and [Havnes and Mogstad \(2011\)](#), among others), we are able to identify the causal effect of early childcare *attendance* rather than the effect of early childcare *eligibility*.

3 Background

3.1 Immigrant children in Italy

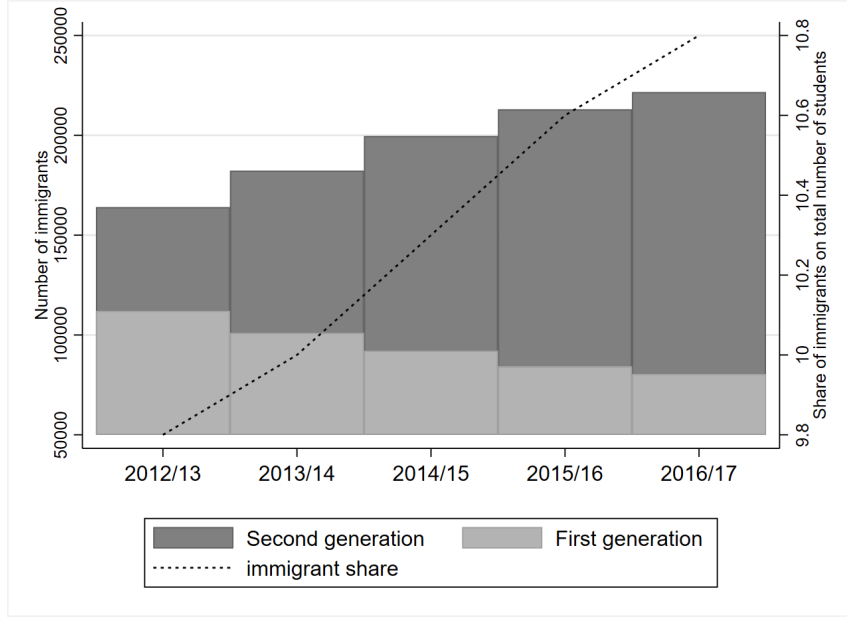
Over the past three decades, Italy has become subject to a massive inflow of immigrants. In 2017, the share of immigrants represented 10% of the total population, and their number increased by more than 30% between 2009 and 2017, rising from 4.5 million to 5.9 million. Most immigrants come from Eastern European countries, and the main countries of origin are Romania, Albania, Morocco, China and Ukraine.¹ They are typically characterized by low educational levels and are mostly concentrated at the bottom of the native wage distribution. Relative to Italians, they tend to have a lower socioeconomic background ([Frattini and Vigezzi \(2018\)](#)).

The surge in migration has deeply affected the Italian educational system. In the 2016/2017 school year, immigrant children represented 10.8% of students in Italian primary schools, which is the educational stage that absorbs the highest number of students without Italian citizenship.² Figure 1 shows the number of immigrant children in Italian primary schools by generational status from school years 2012/13 to 2016/2017. Overall, the figure points to the continued and stable growth in the numbers of nonnative students, particularly those of second-generation status. In the five school years considered, second-generation immigrant students (the focus of our analysis) rose from 182,315 to 221,643 units, with an increase of 27%, representing 76.6% of the total number of primary school students without Italian citizenship in the 2016/17 school year.

¹Istat, “Demografia in cifre” (www.demo.istat.it).

²Miur, “Portale dei dati sulla scuola” (www.dati.istruzione.it).

Figure 1: Number and share of immigrant children in primary school by generational status (s.y. 2012/13 - 2016/17).



Source: elaboration on MIUR data - Statistical office.

3.2 Early childcare in Italy

Formal education in Italy is compulsory from age six, when children start primary school, until age 16. For children younger than six, the provision of childcare is split into two stages: early childcare that is offered for children between three months and three years of age and preschool that is available for children aged three to six years. There is no legal entitlement to childcare provision, and while access to preschool services is almost universal and provided free of charge, early childcare is highly rationed and exhibits substantial cost variability across all Italian regions.

Furthermore, early childcare service is decentralized at the municipal level, provided by both public and private entities, and, in contrast to preschool and formal schooling, is not under the responsibility of the Italian Ministry of Education. Municipalities handle the direct provision of the service and, depending on the available budget and local (social and political) preferences, they decide the number of slots to offer and the eligibility requirements used to allocate such slots.³ The other tiers of government are responsible for more general issues. Regions establish the criteria for construction standards, management and appropriateness of personnel qualifications. The central government is only responsible for the definition of common standards and resource allocation among regions. Both municipalities and families contribute to meeting the total cost of public early childcare, and fees are means-tested against family income. On average, children spend 30.6 hours per week in early childcare, and the minimum qualification requirement for educational staff is an upper secondary school diploma or a master's degree in pedagogy. The past decade has seen a gradual increase in public expenditure on childcare by municipalities, which has led to a general increase in public provision of childcare. However, the supply of childcare is still very rationed. In fact, despite the growth in the number of childcare

³There is a high degree of variability in the criteria established by each municipality to assign the available slots. In addition to the absolute priority given to children with disabilities, some municipalities place a greater emphasis on families with disadvantaged socioeconomic conditions; others place a greater emphasis on parents' employment status (e.g., whether one or both parents are employed) and/or family's composition (i.e. whether the child is an orphan or has siblings). For further details, see [Del Boca et al. \(2016b\)](#).

users in Italy over the last decade, the supply of early childcare spots accommodates only 22.8% of the potential demand of 0- to 2-year-old children, with relevant differences across municipalities. We exploit this heterogeneity for our identification strategy. Further details are provided in subsection 4.2.

4 Data

4.1 INVALSI data

Our analysis draws on administrative data from INVALSI, the national agency that carries out yearly testing of students' competences in language and math. Standardized tests are administered every year to the entire population of students in the second, fifth, eighth and tenth grades. We focus our analysis on students who attended fifth grade (the last year of primary school) in school years 2014/2015 to 2016/2017, the most recent years for which data are available. The tests administered by INVALSI are standardized and compulsory for all Italian schools and students attending the grades of interest. Like all standardized tests, they must satisfy two conditions: first, all students must answer the same questions during the same time interval, and second, the correction and grading of the test must follow standardized procedures that are established a priori and independently of those making the corrections. In other words, tests are anonymously and externally evaluated. These features of the INVALSI tests make students' results fully comparable across all Italian schools and guarantee the objectivity of the tests.

All students take the test in language and math in their own classroom on two different dates, typically in late May. The language test aims to assess students' proficiency in reading comprehension, which involves grammatical, lexical and pragmatic competences. The math test evaluates students' knowledge and mastering of mathematics-specific content such as geometry, probability and algebra. Both tests consist of multiple-choice and open-ended questions. Test scores are adjusted by a cheating factor directly provided by INVALSI, taking into account the probability that a student's class was involved in cheating behavior during the test.⁴ INVALSI also provides grades assigned by teachers in math and language at the end of the first term. Grades are distinguished as either written or oral, and we regard oral grades to be particularly interesting. In contrast to INVALSI test scores, they are nonblind grades that reasonably take into account more than just the cognitive skills of students since teachers' assessments are relative and likely to be affected by the behavior of the class and the students.

Together with these test scores, INVALSI provides detailed information on families', students' and schools' characteristics. This additional information is collected by means of a "family questionnaire" sent to each family before the test, a "student questionnaire" compiled by each student in the fifth and tenth grade on the same day of the language or math test and a number of general information queries concerning students' performances and characteristics, as provided by the school administrative staff. Among these questions, we have information as to whether each child attended early childcare and preschool programs.

Additionally, in our analysis, we use information on a rich set of other individual and family characteristics, such as parents' education and working status; students' gender, month of birth and citizenship (native and second-generation immigrant children); and a synthetic index of Economic, Social and Cultural Status (ESCS index).⁵ In our robustness checks, we also add a set of school and class characteristics, such as their average size and their square, and the

⁴For further details see [Quintano et al. \(2009\)](#).

⁵The ESCS index is built by applying principal component analysis using the information provided by students and schools about families' cultural resources, such as internet connection and number of books, and parents' educational levels and working status. By construction, the index has a null mean and unit standard deviation.

share of female, immigrant and retained students per class. The granularity of our data allows us to distinguish between Italian and non-Italian students. In Italy, this distinction is made according to the *Ius sanguinis* principle, according to which citizenship is determined by having one or both parents who are Italian citizens and not by place of birth. Concerning immigrant students, we can distinguish between first-generation immigrant children, foreign-born students whose parents were also foreign-born, second-generation immigrant children, and students born in Italy whose parents were foreign-born. This study focuses on second-generation immigrant children only. The available data do not allow us to properly take into account first-generation immigrant children’s age at arrival and, therefore, to assess whether they had the chance to attend early childcare in Italy.

4.2 Data on early childcare provision

We match INVALSI data with unique administrative records on early childcare slots available at the municipal level, collected by [Antonelli and Grembi \(2014\)](#) and [Antonelli and Grembi \(2011\)](#). Administrative records were collected using municipal final balances provided by the Ministry of the Interior. They measure the availability of all early childcare public spots directly and indirectly provided by Italian municipalities for the years 2005, 2006 and 2007, when the students in our sample were aged 0 and their parents could apply for admission to childcare facilities. In particular, the dataset contains information on the number of early childcare public spots provided by each municipality, normalized by 10,000 residents. Using municipality and cohort identifiers, we assign to each student observed in INVALSI the actual childcare provision available at the time of his birth. Information is available for approximately 700 Italian municipalities with populations of residents above the 10,000 threshold.⁶ In our INVALSI dataset, approximately 70% of the observed students live in municipalities with a population greater than or equal to 10,000 residents; in those same municipalities, the largest share of the immigrant population residing in Italy is concentrated. Table 1 compares descriptive characteristics and average test scores for the 700 municipalities included in our restricted sample and the whole sample. The table shows that students who live in the larger municipalities included in our sample tend to come from a more advantageous background, as measured by the ESCS index and by parents’ education and are more likely to have attended early childcare programs. Moreover, in the municipalities in our sample, the socioeconomic and cultural status of schools (measured by the school ESCS index) is substantially higher. The two samples are instead remarkably similar in terms of share of female, share of immigrant students and average test scores in language and math.

This implies that a student with a strictly positive individual value on the ESCS index has a socioeconomic-cultural background that is more favorable than the Italian average. The index is provided at the individual, class and school level.

⁶For municipalities under the 10,000 threshold, it was not possible to proceed with the integration of some relevant pieces of information.

Table 1: Comparison of descriptive statistics in our restricted sample (municipalities with at least 10.000 inhabitants) and in the whole sample

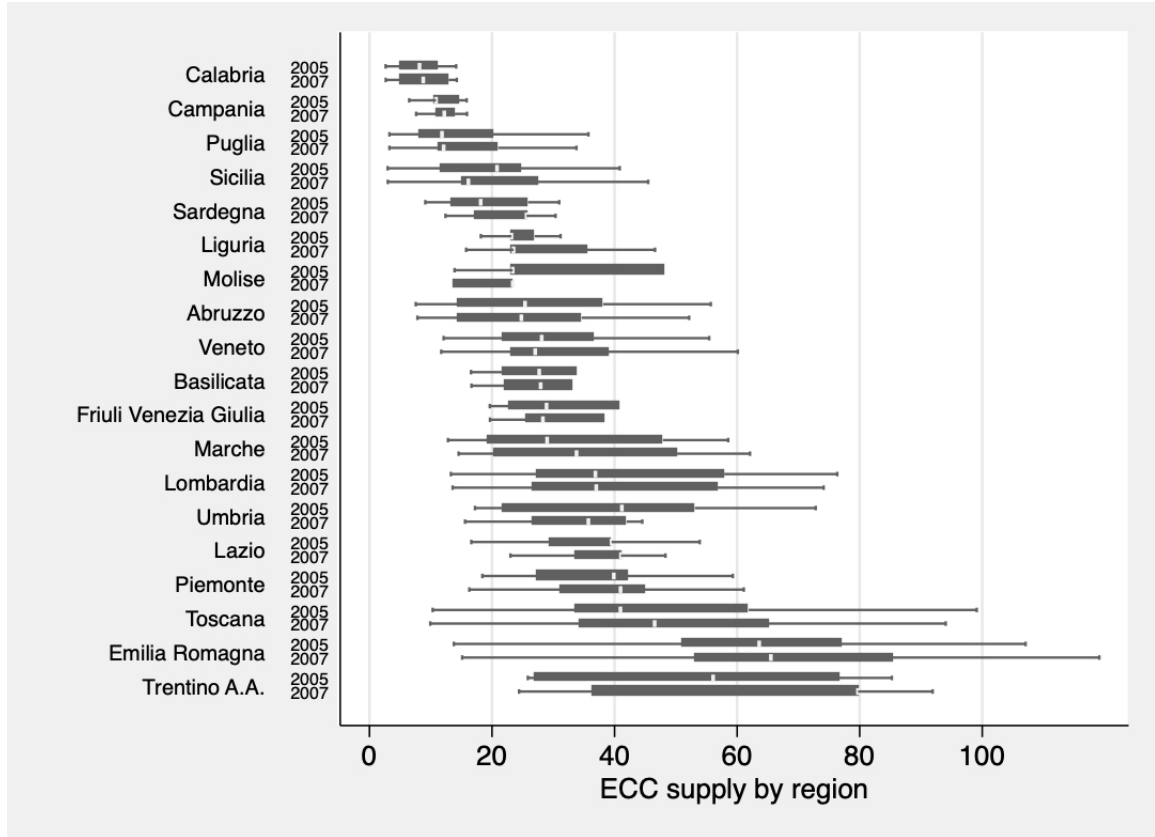
	Our restricted sample	Whole sample
Female	0.49	0.49
Immigrant	0.09	0.08
Early childcare (0-3) attendance	0.42	0.35
Preschool (age 3-6) attendance	0.88	0.9
Regular	0.91	0.91
Father compulsory education	0.33	0.38
Father high school	0.46	0.45
Father college degree	0.22	0.16
Mother compulsory education	0.26	0.3
Mother high school	0.48	0.49
Mother college degree	0.26	0.21
Student ESCS	0.14	0.03
Test score - ITA	209.83	208.9
Test score - MAT	211.68	211.77
School ESCS	0.12	0
Population	397494.5	220546.3

Notes: the table reports the mean value of a set of characteristics in our restricted sample (made of 700 municipalities with at least 10.000 inhabitants) and in the whole INVALSI. See Table A4 for variable definitions and sources.

As we will discuss in the next section, we use detailed information on early childcare supply at the municipal level as an instrument for individual early childcare attendance. The instrument is particularly suitable in the case of Italy, which is characterized by low availability of public childcare slots, with a national average coverage rate of approximately 15%, albeit highly differentiated across regions. These data are well behind the 2002 European target of childcare slots for at least 33% of children under three years of age. Therefore, despite various policy initiatives implemented since the end of the 1990s that aim to increase childcare availability, the demand for public childcare is higher than the supply in all Italian regions. In fact, the data on waiting lists reported by [Cittadinanzattiva \(2011\)](#) indicate that the shares of children who submitted an application but were not given a slot ranged from 12% in Lombardia to more than 40% in Sicilia. This means that many Italian households are still confronted with availability constraints.

Figure 2 shows the median values (and interquartile ranges) of early childcare supply in different Italian regions in 2005 and 2007. The picture indicates that there is substantial heterogeneity across regions, with the lowest supplies in Calabria and Campania and the highest in Emilia-Romagna and Trentino Alto Adige. Such territorial differences display different trends over time. In fact, while some regions between 2005 and 2007 increased their supply of early childcare spots, others reduced it. Molise is the most striking example, with a decrease in supply of approximately 30%. Crucially, Figure 2 highlights that the supply of childcare is heterogeneous not only across regions but also within regions across different provinces and municipalities. Noticeably, the standard deviation relative to the mean shows that there is substantial variation within most of the regions in our analysis. There are many factors that might explain territorial differences in early childcare supply over time, ranging from variability of funding at the central and local level as well as political variables such as policymakers' preferences. In sections 5.3 and 7, we address at length whether these elements might threaten our identification assumptions.

Figure 2: Public early childcare (ECC) supply across regions - 2005 and 2007.



Notes: the variable *early childcare supply* is defined as the number of municipal early childcare public spots normalized by 10,000 residents. The white line shows the median value of ECC by region, while the boxes represent the interquartile range. Source: [Antonelli and Grembi \(2014\)](#) and [Antonelli and Grembi \(2011\)](#).

Overall, our final dataset covers 449,269 students (414,382 natives and 34,887 immigrants) in approximately 700 municipalities and 3,405 schools located in 20 Italian regions. For each school year in the analysis, the share of the immigrant population residing in these municipalities is approximately 54% of the total immigrant population residing in Italy.⁷

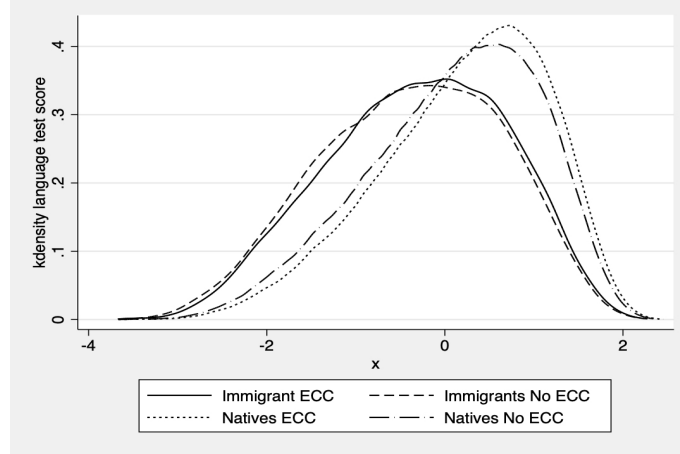
Table A4 in the Appendix lists and defines all of the variables included in our empirical analysis.

4.3 Descriptive evidence

As a preliminary descriptive analysis, in Figures 3 and 4, we provide the kernel density estimation of the probability density function of the language and math test scores, respectively. Each figure reports the distribution of standardized test scores in language (Figure 3) and math (Figure 4) by immigrant status and early childcare attendance. The figures highlight the substantial achievement gap between native and immigrant students. In fact, the distribution for Italian children is left-skewed and has a higher mode compared to the distribution of immigrants, which in turn appears rather symmetric and with a higher variance. As expected, these differences are more pronounced in the language test score distribution. For both native and immigrant students, there seems to be a positive difference between the performances of children who attended early childcare and those who did not, which is a first signal of positive selection into the service.

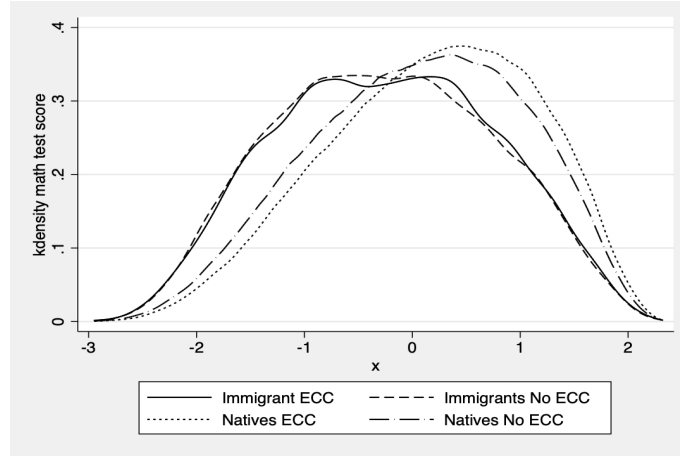
⁷This percentage is calculated by merging our data with yearly data on the number of immigrant residents per municipality, available at “<http://dati.istat.it/>”.

Figure 3: Kernel density language test score by early childcare attendance.



Source: INVALSI

Figure 4: Kernel density math test score by early childcare attendance.



Source: INVALSI.

Table 2 presents descriptive statistics of children in our sample. Columns (2)-(5) refer to native children, while columns (6)-(9) refer to immigrant children. Columns (2) and (6) report values for children who attended the early childcare service (ECC), the treated group, while columns (3) and (7) refer to children who did not attend the service (No ECC), the control group.

For both native and immigrant children, we find significant differences in all of the observable characteristics included in our analysis (columns (3) and (6)), which further confirms that the process behind service attendance is likely to be endogenous. On average, children enrolled in early childcare come from a more advantageous background than children not enrolled, independent of citizenship. They are more likely to have a working mother, parents with a high educational level and higher values for the ESCS index. This may be due to the specific access criteria applied by municipalities that tend to favor families with both parents working full time. In terms of observable individual and parental background characteristics, this descriptive evidence thus suggests children's positive selection into early childcare, which seems to be less pronounced for immigrant children than native children.

Table 2: Descriptive statistics and balancing test.

Variable	Natives			Immigrants		
	(1) ECC	(2) No ECC	(3) p-value	(4) ECC	(5) No ECC	(6) p-value
Background characteristics						
Female	0.482	0.501	0.000	0.492	0.504	0.023
Father compulsory education	0.243	0.350	0.000	0.343	0.431	0.000
Father high school	0.477	0.459	0.000	0.481	0.438	0.000
Father college graduate	0.278	0.190	0.000	0.174	0.129	0.000
Mother compulsory education	0.152	0.264	0.000	0.344	0.441	0.000
Mother high school	0.488	0.504	0.000	0.449	0.405	0.000
Mother college graduate	0.359	0.231	0.000	0.206	0.153	0.000
Father employed	0.956	0.941	0.000	0.872	0.881	0.014
Mother employed	0.810	0.620	0.000	0.523	0.357	0.000
Preschool	0.978	0.940	0.000	0.969	0.907	0.000
Regular students	0.979	0.976	0.000	0.952	0.936	0.000
ESCS students	0.512	0.196	0.000	-0.300	-0.458	0.000
Outcome variables						
Language test score	0.210	0.089	0.000	-0.320	-0.387	0.000
Math test score	0.173	0.048	0.000	-0.242	-0.265	0.032
Language oral grade	0.252	0.138	0.000	-0.387	-0.438	0.000
Math oral grade	0.239	0.111	0.000	-0.279	-0.317	0.001
Observations	178,607	235,775		15,254	19,633	

Note: the table reports means of covariates by citizenship and by child's early childcare service (ECC) attendance. Column (3) and (6) report the p-value of the t-statistic for equality of means in the treated and control groups. See Table A4 for variable definitions and sources.

5 Empirical strategy

We start our analysis by estimating the following linear model that links a child's cognitive outcomes (Y_{imt}^j) to his or her early childcare attendance ($Earlychildcare_{imt}$) while controlling for a set of individual, family and municipality characteristics as well as cohort fixed effects, province fixed effects and province-specific trends across cohorts:

$$Y_{imt}^j = \gamma_0 + \gamma_1 ECC_{imt-10} + \mathbf{X}'_{imt}\gamma_2 + \boldsymbol{\Phi}'_{mt}\gamma_3 + \eta_t + \lambda_{im} + \eta_t \times \lambda_{im} + \epsilon_{imt} \quad (1)$$

where i indexes individuals, m indexes municipalities, t indexes cohorts, and j language/math test score/oral mark), ECC is the main explanatory variable indicating whether or not the child attended the childcare service and $\mathbf{X}$ is a vector of sociodemographic variables. Specifically, we control for preschool attendance, gender, quarter of birth, study regularity and parents' education. The choice of individual control variables is motivated by the literature related to children's human capital production function (Cunha and Heckman (2007), Todd and Wolpin (2003)). Crucially, the vector $\boldsymbol{\Phi}$ controls for some key municipality characteristics such as population size and taxable income. Importantly, we add a vast array of fixed effects. We include province fixed effects, λ_{im} , to control for province-specific, time-invariant unobservable characteristics that might systematically affect early childcare attendance as well as school attainment and cohort fixed effects, η_t , to control for common shocks across cohorts. Eventually, we include

province dummies interacted with a cohort time trend, $\eta_t \times \lambda_{im}$, to control for province-specific supply or demand shocks affecting childcare attendance over time. Finally, ϵ_{imt} is the residual idiosyncratic error term. The parameter of interest is γ_1 , which captures the impact of early childcare attendance.

We alternatively consider four dependent variables: language and math standardized INVALSI test scores and language and math oral grades assigned by teachers. Test scores are defined as the percentage of correct answers and range from 0 to 100, while grades assigned by teachers range from 0 to 10, where 6 is the passing grade.⁸ To increase comparability across cohorts, we standardized language and math test scores as well as oral grades to have means equal to 0 and standard deviations equal to 1 in each cohort and subject. All specifications are run separately for natives and second-generation immigrant students.⁹

5.1 Identification: the IV Approach

Clearly, the problem with estimating this linear regression by OLS is the nonrandom sorting of children into early childcare. In fact, parents voluntarily decide to enroll children in the service based on their (un)observable characteristics and preferences. Therefore, comparing the outcomes of children who did or did not attend the service would result in biased estimates, even when conditioned by a rich set of control variables.

The literature addressed this endogeneity issue using different strategies. The most common methodologies rely on a difference-in-differences approach that exploits reforms in the provision of childcare (see, for instance, Baker et al. (2008), Havnes and Mogstad (2011) and Felfe et al. (2014)), a regression discontinuity design around the admission threshold Fort et al. (2020)) or instrumental variable methods that exploit some sources of exogenous variation in the probability of individual childcare attendance (Del Boca et al. (2016a), Felfe and Huber (2017), and Drange and Havnes (2019)).

Given the absence of a major reform affecting early childcare service in Italy, we implement an instrumental variable strategy. In particular, we exploit cross-sectional and longitudinal variation in the early childcare supply across Italian municipalities as an instrument for determining children’s probability of attending the care service. In a context where childcare provision is highly rationed, childcare availability clearly affects the probability of individual attendance and is arguably exogenous to children’s characteristics and to unobservables in the model (we will discuss this point in more detail in Section 5.3). This approach is consistent with the evidence of Del Boca and Vuri (2007), which shows that early childcare attendance in Italy is mostly driven by the supply—rather than demand—for the service. However, our instrument does not affect parents who are not interested in enrolling their children in the early childcare service.

Our instrumental variable is defined as the number of early childcare publicly provided spots normalized for 10,000 residents. Equation (2) describes the first stage of our IV model:

$$ECC_{imt-10} = \beta_0 + \beta_1 COVER_{mt-10} + \mathbf{X}'_{imt} \boldsymbol{\beta}_2 + \boldsymbol{\Phi}'_{mt} \boldsymbol{\beta}_3 + \eta_t + \lambda_{im} + \eta_t \times \lambda_{im} + \omega_{imt} \quad (2)$$

where $COVER_{mt-10}$ is the public childcare coverage at the municipal level at time $t-10$ and ω_{imt} is the error term.

⁸Due to the high number of missing observations, we are not able to use teachers’ written scores.

⁹To test the hypothesis that regressor slopes are different across native and immigrant students, we ran a Chow test that strongly rejected the data poolability assumption, which suggested that, in our framework, separate regressions provide a better fit.

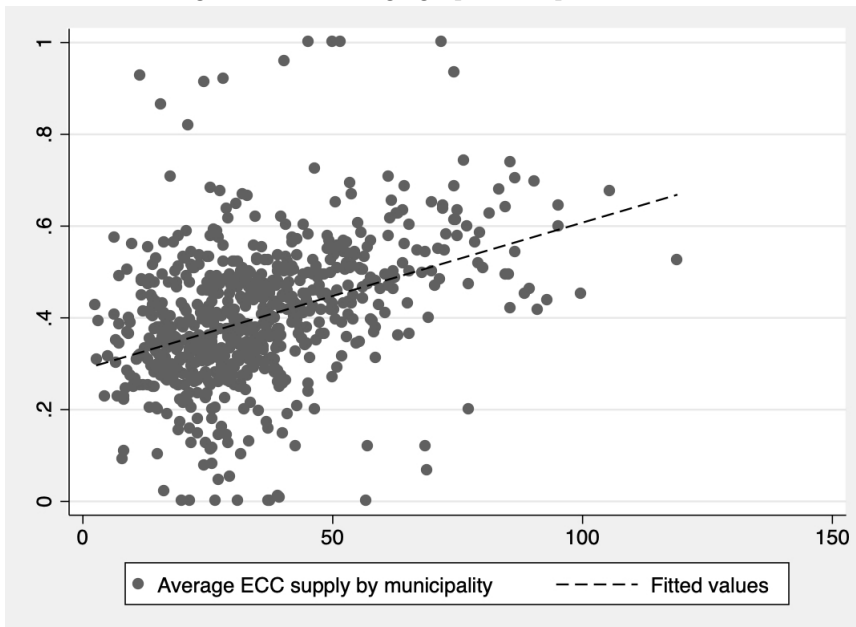
We contribute to the existing IV literature in this field by adopting a tighter identification strategy that exploits variation in the instrument not only across local areas (the main variation used in previous studies) but also across cohorts, thus enabling us to control for time-constant, unobserved area characteristics. Moreover, our instrument is defined on a much finer geographical aggregation compared to existing studies in the literature (see, for instance, [Del Boca et al. \(2016a\)](#), which instrumented early childcare with the regional supply of childcare).

5.2 First Stage Results and Characterization of Compliers

In Figure 5, we report a graphical representation of the first stage that illustrates the relationship between the supply of early childcare spots and the average early childcare attendance by municipality. The existence of a positive linear relationship between the two variables clearly emerges, which suggests that our instrument is valid. In our case, it implies that there are at least some parents whose enrollment decision is affected by the public early childcare supply of their municipality. We will further check the validity of our IV by examining the first stage of the instrument to be significantly different from zero. In section 6, tables of results provide the first-stage instrument coefficient estimates, as well as the first-stage F-statistics. Overall, our instrument proves to capture relevant variation in early childcare attendance, the endogenous variable.

If the number of municipal early childcare public spots increases by one per 10,000 residents, the probability of attending early childcare increases by 0.2 percentage points. This implies that if we move from a municipality at the 25th percentile of the distribution with a supply of 22 public slots per 10,000 residents to a municipality at the 75th percentile with a supply of 45 slots per 10,000 residents, the probability of attending childcare increases by 4.6 percentage points ($0.2 \times (45 - 22)$). This corresponds to an increase of approximately 10 percent relative to the mean value of childcare participation in our sample.

Figure 5: First stage graphical representation.



Notes: each dot in the figure shows the early childcare supply (ECC) by municipality.

Our coefficient of interest (γ_1 in equation (1)) identifies the LATE, the effect of attending early childcare on compliers. In our context, compliers are those parents encouraged to enroll their

children in the early childcare service in response to a greater availability of spots. Since our coefficient identifies a LATE, it is important to assess the extent to which the characteristics of compliers are different from those of the rest of the sample. Obviously, it is not possible to precisely identify compliers since they are not distinguishable from “always takers” in the data (because treatment status under the counterfactual treatment assignment is not observable).

However, we can profile compliers following the strategy proposed by Angrist and Pischke (2008), who exploit variation in the first stage across covariate groups to estimate the relative likelihood that compliers (compared to the entire sample) will have a particular characteristic (see Brunello and Rocco (2019) for an application). Specifically, we learn whether a characteristic is more common among compliers relative to the overall sample by calculating the ratio of the first stage for children with that characteristic and the overall first stage. Whenever the ratio is greater than one, it implies that compliers are more likely to exhibit the characteristic. Table 3 reports the results of this exercise and shows these ratios for natives, immigrants and the overall sample of students. Our estimates reveal that for both the immigrant and native samples, compliers tend to be older (more likely to be born in the first and second quarters of birth) and are more likely to have working mothers and who have completed secondary education. These characteristics possibly reflect the selection criteria in public childcare that typically favor families where both parents work full time. At the same time, it appears that compliers are more likely to have a lower socioeconomic background, as captured by the ESCS index. This evidence suggests that wealthier families have the economic resources to enroll their children in the expensive services provided by the private sector and are therefore more likely to be “always takers” rather than “compliers” (in our context, “always takers” are those who would send their children to childcare services independently of the public supply by enrolling them in private non-subsidized services).

Table 3: Characteristics of compliers

Characteristic	Natives (1)	Immigrants (2)	Entire sample (3)
Female	1.05***	1.09***	1.06***
First quartile of birth	1.08***	1.02***	1.06***
Third quartile of birth	0.91***	1.16***	0.94***
Mother with high education	1.01***	1.13***	1.01***
Father with high education	0.98***	1.05***	0.98***
High ESCS	0.70***	1.02***	0.71***
Working mother	1.26***	0.83***	1.21***
Working father	1.21***	1.14***	1.20***

Notes: the table shows the ratio of the first stage for a number of characteristics to the overall first stage. For details on the procedure see Angrist and Pischke (2008). See Table A4 in Section 8 for variable definitions and sources. Robust standard errors are given in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.3 Instrument Validity

Our estimates identify the *causal* effect of early childcare attendance on children’s cognitive outcomes if the supply of early childcare spots at the municipal level (our instrument) is uncorrelated to unobserved factors specific to each location that may affect both childcare attendance and performance at school. In other words, for the instrument to be valid, the variation in childcare supply across municipalities and the intensity of its expansion must be as good as random. The exclusion restriction implies that the variation in public childcare availability across municipalities and over time affects children’s outcomes only through their childcare attendance. While it seems plausible to assume that the public supply of early childcare does not have a direct effect on cognitive outcomes, a major concern is the existence of an association between the instrument and some potential determinants of early childcare participation and school performance.

In particular, there are three key reasons why the exclusion restriction might not hold. First, municipalities might differ along several dimensions other than the supply of early childcare spots. Second, immigrant families might choose to settle down in a municipality where the supply of early childcare spots is higher. Third, the availability of early childcare and the quality of its provision to immigrant children might be negatively affected by an active policy of local politicians to hinder immigrant families from residing in their municipality. We address each point in turn.

Regarding the first concern, we include in our specification a set of controls at the municipal level to capture several dimensions of heterogeneity between municipalities at the time when children in our sample were born. In particular, we control for a time-varying measure of taxable income¹⁰ to capture heterogeneity in economic resources and for population size to account for differential demographic trends. Further, we include in the model province fixed effect¹¹ to capture all unobservable characteristics shared by municipalities within a fairly homogeneous area. We also add province-by-cohort fixed effects to account for differential trends in childcare provision across provinces and for any other province-specific, time-varying shock. Our specification is therefore very restrictive, as it leverages variation only within provinces in the same cohort. It is also important to note that since we are only considering municipalities with more than 10,000 inhabitants, we can reasonably expect that within narrow geographical areas such as provinces, municipalities of a similar size will have comparable social, economic and cultural characteristics. Therefore, we argue that once we include the abovementioned controls, the remaining variation in the instrument can be considered as good as random.

To increase confidence in the exclusion restriction of our IV strategy, we perform some additional tests. First, in Panel A of Table 4, we test whether the municipal supply of childcare (our IV) is correlated with pretrends of our main outcomes of interest (average school performance in math and language) and other predetermined sociodemographic municipal characteristics that may influence child development and school performance. In particular, we regress the average supply of early childcare spots at the municipal level on the predetermined municipal average of language and math test scores (computed from previous waves of INVALSI) and on a set of variables computed using 2001 census data and aggregated at the municipal level (share of migrants, share of less-educated residents, unemployment rate, population size and taxable income). The table indicates that once we control for province fixed effects (column (2)), there is no significant correlation between the supply of early education and the predetermined characteristics of the municipality that might directly and/or indirectly affect students' educational performance. The only exceptions are taxable income and population size (which are in fact controlled for in our estimating equation). Second, to also account for the *longitudinal* variation exploited by our instrument, in Panel B of Table 4, we empirically check whether the *variation* in the supply of early education over the period 2005-2007 is correlated with the *variation* in the aforementioned municipal characteristics across the 2001-2011 census years. In this way, we test whether the evolution of the supply of early childcare spots and of the socioeconomic characteristics of the municipalities are conditionally correlated. Again, after the inclusion of province fixed effects (column (2)), all the coefficients on the municipal characteristics are small in size and never statistically significant at conventional levels. This result suggests that changes in childcare supply are not correlated with observable changes in socioeconomic conditions that might potentially affect school performance. All in all, these tests corroborate the evidence that once we control

¹⁰Data at the municipal level for the years 2005-2007 are drawn from the Ministry of Economy and Finance "Analisi Statistiche - Open data dichiarazioni" www.finanze.gov.it

¹¹We cannot include municipality fixed effects because, since we are using only three adjacent years, our instrument does not exhibit enough within-municipalities over-time variation.

for province fixed effects, observable municipal predetermined characteristics are orthogonal to the level and variation of our instruments over time.

Table 4: IV validity test

	(1)	(2)
Panel A: dep var	Average ECC supply	
Average initial performance in language test scores - INVALSI	0.200 (4.519)	1.460 (4.088)
Average initial performance in math test scores - INVALSI	-1.886 (3.618)	-2.842 (3.108)
Initial level of education (share of nongraduated)	-0.442* (0.234)	-0.341 (0.279)
Initial unemployment rate	-1.368*** (0.252)	-0.369 (0.345)
Initial share of foreign-born	1.673*** (0.576)	-0.082 (0.638)
Initial population size	-0.000*** (0.000)	-0.000*** (0.000)
Initial average income	0.000*** (0.000)	0.000*** (0.000)
Observations	705	705
Panel B: dep. var	Δ (Average ECC supply)	
Δ level of education (share of nongraduated)	-0.056 (0.160)	-0.056 (0.214)
Δ unemployment rate	0.189 (0.154)	0.164 (0.246)
Δ share of foreign-born	-0.067 (0.124)	0.044 (0.167)
Δ population size	0.000 (0.000)	-0.000 (0.000)
Δ average income	0.000 (0.000)	0.000 (0.000)
Observations	662	658
Province fixed effect	<i>no</i>	<i>yes</i>

Notes: the table reports estimated coefficients of predetermined municipal characteristics on the average supply of early childcare spots. In Panel A both the dependent variable and the municipal characteristics are expressed in levels. In Panel B the same variables are expressed in variation. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The second concern regards the possible endogenous sorting of migrants across municipalities if migrants settle in more developed or dynamic areas, where the availability of early childcare is also higher. In this case, the exclusion restriction would be violated because our instrument would be correlated with labor market opportunities and immigrant concentration in the area, which in turn may affect children's educational performances. To address this concern, we first argue that once we control for a set of variables at the municipal level, the remaining variation in childcare availability can be considered random, as suggested in Table 4, which indicates that childcare availability is not systematically correlated with labor market opportunities. Nevertheless, one can think that migrant families decide to settle down in a specific municipality just because of the greater availability of early childcare spots. This hypothesis is not supported by the existing literature that shows that the main drivers of immigrants' location decisions are employment opportunities in the area and the presence of coethnic immigrants, while it found weak evidence

of the so-called welfare magnets hypothesis, according to which immigrants are attracted to areas with a relatively generous welfare system (see, for example, [Damm \(2009\)](#) and [Giulietti \(2014\)](#) for a review). In addition, we provide a more formal test of this evidence in the Italian context by showing that the change in the share of migrants residing in each municipality is not affected by the local provision of childcare. Specifically, we regress the variation in the municipal share of migrants between 2001 and 2011 computed using census data on the average supply of early childcare spots over the 2005-2007 period while controlling for changes in taxable income and observed population size. Results are reported in Table 5. Once province fixed effects are included (see columns (2) and (4)), we observe no correlation between the share of migrants and the average supply of early childcare spots, supporting the exogeneity of our instrument. In other words, immigrants' location choices seem to be unrelated to the public provision of early education.

Table 5: Instrument validity test: test for endogenous sorting of migrants

	(1)	(2)	(3)	(4)
$\Delta(\text{Immigrants' share in municipal population})$				
Δ (Average ECC supply)	0.006 (0.015)	0.004 (0.011)		
Average ECC supply			0.036*** (0.006)	-0.005 (0.006)
Controls for changes in pop. size and income	<i>yes</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>
Province fixed effects	<i>no</i>	<i>yes</i>	<i>no</i>	<i>yes</i>
Observations	662	658	684	684

Notes: the table reports the estimated coefficient of the variation in the municipal average supply of early childcare spots on the municipal variation in the share of migrants, while controlling for changes in taxable income and population size. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Regarding the third concern of local anti-immigrant active policies, during the last two decades, right parties in Italy, especially in the North, strongly supported anti-migration positions, while left parties were in favor of more inclusive policies (see also [Bracco et al. \(2018\)](#)). One may argue that different attitudes toward immigrants could have had spillover effects on various social and economic aspects of immigrant families residing in the municipality. In our context, different orientations toward immigrants might translate into different school environments as well as more (less) inclusive policies for immigrant children during early childhood. To address this issue and capture potential heterogeneity in municipalities' political orientation, in Table 12 we add a control for mayor's political faction.¹²

6 Results

6.1 The effect of early childcare attendance on standardized test scores

The results of our main specification are reported in Table 6, which shows the impact of early childcare attendance on INVALSI standardized test scores in language (columns (1)-(4)) and math (columns (5)-(8)) for both native and immigrant students. In all specifications, we control for province and cohort fixed effects, for province linear time trends and for all control variables

¹²The indicator on mayor's political faction is defined as a dummy variable coded equal to 1 if the incumbent mayor is endorsed by left parties, or equal to 0 if s/he is supported by right parties or by ad hoc unitary lists without a neat political orientation. This is the same variable used in [Bracco et al. \(2018\)](#) and kindly provided to us by the authors.

discussed in section 5. For the sake of brevity, we do not include the coefficients of control variables in our main tables of results. Table A1 of the Appendix reports the regression coefficients for the full set of the control variables. Reassuringly, their sign is consistent with the evidence from previous studies, underpinning the goodness of our model. In particular, having highly educated parents has a positive and significant impact on children’s outcomes, as does attending preschool. Interestingly, being born earlier (we control for children’s quarter of birth) also has a positive and significant effect on children’s results.

Focusing on our variable of interest, OLS estimates suggest that early childcare is associated with a higher performance of natives in both language and math (columns (1) and (5)). For immigrant students, instead, early childcare seems to have no significant impact on language test scores (column (3)) and a negative effect on math performance (column (7)). Given the endogeneity of childcare attendance, these OLS estimates cannot be interpreted as causal. The positive coefficients of childcare attendance on test scores of natives simply reflect the positive selection into childcare services already observed in Table 2. Parents with higher education are in fact more likely to be employed in high-paying jobs; therefore, they tend to have greater incentives to enroll their children in early childcare and are more likely to obtain a slot if employment status constitutes a preferential criterion for access to public childcare. At the same time, children of more educated parents are more likely to grow up in stimulating and favorable environments that lead them to perform better than children coming from more disadvantaged families, independent of attending early childcare programs. This nonrandom sorting of children into childcare leads the OLS estimates to be upward biased. For immigrant students, the negative sign of the childcare coefficient on math test scores is less straightforward to interpret and suggests a negative selection into early childcare, which is probably caused by unobservable characteristics that we are not able to control.

Once we take the endogeneity of childcare into account by using an IV approach that exploits the exogenous variation in childcare supply across municipalities and over time, we find that early childcare attendance has a negative and significant impact on both language and math test scores of native students. This finding is consistent with part of the literature on early interventions that documents negative impacts on native children taking part in early childhood programs (Fort et al. (2020), Herbst (2017), Havnes and Mogstad (2015), Herbst (2013), Cascio and Schanzenbach (2013)). In the next section, we better characterize this evidence by investigating which group of native students is driving the effect and how our results relate to the existing literature. Turning to immigrant students, interestingly, our IV estimates suggest a positive and significant impact of early childcare on language test scores, while no effect is detected on math test scores (see columns (4) and (8)). Immigrant children thus appear to benefit more than their native peers from early childcare programs, perhaps because of the greater disadvantages they face on average. We believe that this finding is particularly thought-provoking and relevant from a policy perspective, as it suggests that early childcare may be a useful instrument for improving linguistic skills and thus for facilitating the integration of immigrant children. In terms of magnitude, our estimates indicate that early childcare utilization increases the language test scores of immigrant children by approximately 60% of a standard deviation. To appreciate the size of this effect, consider that one standard deviation in immigrant test scores corresponds to 17.5 percentage points in the original variable that gives the percentage of correct answers (mean value=62.2). Therefore, an increase of approximately 0.6 standard deviation (an increase of approximately 10 percentage points) is similar to moving language test scores from the median (score=64.2) to the 75th percentile (score=75.8). Ten percentage points is also almost the difference between the median values of language test scores for second-generation immigrant (54.7) and native (65) students, which suggests that the effect is sizable and almost capable of

closing the linguistic gap between second-generation immigrants and natives.

In Panel B, we report first-stage estimates, which show that the public municipal supply of early childcare strongly determines children’s service attendance, both for native and nonnative students. First-stage F-statistics indicate that the instrument is not weakly defined, thereby implying that it is able to predict relevant variation of the endogenous variable.

Table 6: Effects of early childcare attendance on children’s test scores at grade 5.

	LANGUAGE				MATH			
	Natives		Immigrants		Natives		Immigrants	
	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
Panel A: Second Stage								
Early childcare	0.018*** (0.002)	-0.165* (0.087)	-0.005 (0.011)	0.577** (0.239)	0.040*** (0.003)	-0.505*** (0.093)	-0.043*** (0.011)	0.140 (0.239)
Panel B: First Stage								
Early childcare supply		0.002*** (0.000)		0.002*** (0.000)		0.002*** (0.000)		0.002*** (0.000)
First stage F-stat		483.38***		78.65***		473.85***		73.00***
Observations	414,382	414,382	34,887	34,887	400,829	400,829	33,696	33,696

Notes: entries in the table are the estimated coefficients of early childcare attendance on INVALSI standardized language (columns (1)-(4)) and math (columns (5)-(8)) test scores. Columns (1),(3),(5) and (7) report OLS estimates, while columns (2),(4),(6) and (8) report IV estimates. Columns (1)-(2) and (5)-(6) report estimates for native students, and columns (3)-(4) and (7)-(8), for immigrant students. All specifications include province fixed effects, cohort fixed effects and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, studies regularity and parents’ educational levels. Municipality-level control variables include taxable income and population size. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; ***p<0.01, **<0.05, *p<0.1.

6.2 Heterogeneous effects

The results reported in Table 6 are averaged on several individual characteristics. Thus, they could mask substantial heterogeneity in the effect of early childcare across different subgroups of the population. We proceeded by exploring whether children from various backgrounds experience early childcare attendance differently. In particular, we investigate whether the impact differs by children’s social and economic background, by gender and by the high (low) share of *public* supply of early childcare spots.

In Table 7, we report IV estimates of the impact of early childcare on INVALSI language and math test scores for children with highly and less-educated mothers, respectively, for native and immigrant children. We define a mother as being highly educated if she has an educational level equal to or higher than a high school diploma. The mother’s educational level serves as a proxy for children’s social and economic background as well as the "quality" of the most likely care alternative to early childcare attendance: the mother. In Table 13, we show that our results also hold when using alternative proxies for children’s social and economic background. Table 7 suggests that parental background does not play a role in shaping the effect of childcare programs on language test scores of native students, but interestingly, it highlights that, for immigrant students, the impact of early childcare is not homogeneous across parental backgrounds. In fact, when we run separate regressions by parental education, we find that the impact of early childcare is positive and significant only for immigrant children with low-educated mothers, and the size of the effect is higher than that for the whole sample of migrants (see column (6)). These results are

in line with previous studies emphasizing that childcare attendance is particularly beneficial for children from disadvantaged backgrounds because they would probably experience lower-quality care in the absence of formal childcare due to worse and less stimulating home environments (see Havnes and Mogstad (2011), Drange and Havnes (2019), Felfe and Lalive (2018), Cornelissen et al. (2018)).

Table 7: Heterogeneous effects by mother’s educational level, language and math.

LANGUAGE						
	Natives			Immigrants		
	(1) Whole Sample	(2) High Edu	(3) Low Edu	(4) Whole Sample	(5) High Edu	(6) Low Edu
Panel A: Second Stage						
Early childcare	-0.165* (0.087)	-0.096 (0.095)	-0.068 (0.173)	0.577** (0.239)	0.278 (0.268)	0.845** (0.429)
Panel B: First stage						
Early childcare supply	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.002*** (0.000)
First stage F-stat	483.38***	375.91***	152.88***	78.65***	56.34***	28.27***
Observations	414,382	324,911	89,471	34,887	20,960	13,927
MATH						
Panel A: Second Stage						
Early childcare	-0.505*** (0.093)	-0.495*** (0.103)	-0.208 (0.177)	0.140 (0.239)	0.300 (0.278)	-0.167 (0.409)
Panel B: First stage						
Early childcare supply	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.002*** (0.000)
First stage F-stat	473.85***	368.52***	149.33***	73.00***	52.60***	26.06***
Observations	400,829	315,591	85,238	33,696	20,318	13,378

Notes: the table shows IV estimates in which the dependent variables are the INVALSI standardized language and math test scores. Columns (1)-(3) refer to native students, while columns (4)-(6) refer to immigrant students. Columns (2) and (5) refer to students with a high-educated mother (i.e. education level higher than a lower secondary school diploma), while columns (3) and (6) refer to students with a low-educated mother (i.e. educational level lower than or equal to a lower secondary school diploma). All specifications include province, cohort and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, studies regularity and father’s educational level. Municipality-level control variables include taxable income and population size. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In the bottom panel of Table 7, we report the estimates of the impact of early childcare attendance on math test scores for children with a high- (low-) educated mother. Focusing on immigrant students (columns (4)-(6)), we find no effect on math test scores, regardless of the mother’s educational level. Interestingly, the fact that the results we observe for language are not mirrored for math test scores suggests that for immigrant children, early childcare is likely to serve as a device for facilitating the learning of the host country’s language. We investigate this hypothesis at length in subsection 6.4.

We now turn our attention to native students. Our results show that the average negative effect of childcare attendance on math test scores discussed above is due entirely to the larger negative impact on students from a highly educated background, while no effect is found for children with

low-educated mothers (see columns (2) and (3)). This finding is consistent with evidence from previous studies that early childcare is more likely to adversely affect advantaged children from relatively affluent families able to provide a more stimulating context or to have access to high-quality substitutes of formal childcare. In particular, in the Italian context, [Fort et al. \(2020\)](#) find similar results, adopting a quasi-experimental approach that exploits discontinuities in the admission thresholds in a regression discontinuity design and thus showing that early childcare has a negative effect on cognitive outcomes of children from wealthier backgrounds.

We have thus far neglected heterogeneity by gender, which we investigate now by running separate regressions for males and females for both natives and immigrants. The impact of early childcare could differ by gender because of developmental differences of boys and girls in early childhood due to both biological and social processes. In fact, the psychological literature suggests that, at the same age, girls tend to outperform boys in terms of language, social development and behavior (see [Magnuson et al. \(2016\)](#) for a review). This advantage may allow girls to reap greater benefits in learning cognitive and behavioral skills from formal early childcare, but at the same time, girls may also reap greater benefits from other childcare settings, such as stimulating parental care (see [Del Boca et al. \(2019\)](#) for an extensive discussion on the heterogeneous impact of childcare by gender). Our results reported in Table 8 point to weak heterogeneity by gender. The impact of early childcare is not statistically significantly different between males and females in our native sample, while we find a slightly larger effect for immigrant females compared to males, possibly due to their greater sensitivity to early interaction (see [Fenson et al. \(1994\)](#), [Bornstein et al. \(2004\)](#)).

Table 8: Heterogeneous effects by gender, language and math.

LANGUAGE				
	Natives		Immigrants	
	(1) Male	(2) Female	(3) Male	(4) Female
Panel A: Second Stage				
Early childcare	-0.159 (0.130)	-0.170 (0.116)	0.376 (0.360)	0.665** (0.313)
Panel B: First stage				
Early childcare supply	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
First stage F-stat	220.13***	265.55***	33.04***	46.86***
Observations	209,791	204,591	17,472	17,415
MATH				
Panel A: Second Stage				
Early childcare	-0.440*** (0.138)	-0.556*** (0.124)	-0.017 (0.381)	0.200 (0.299)
Panel B: First stage				
Early childcare supply	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
First stage F-stat	212.63***	264.00***	29.37***	44.81***
Observations	202,652	198,177	16,865	16,831

Notes: the table shows IV estimates in which the dependent variables are the INVALSI standardized language and math test scores. Columns (1)-(2) refer to native students, while columns (3)-(4) refer to immigrant students. Columns (1) and (3) refer to males, while columns (2) and (4) refer females. All specifications include province, cohort and province dummies interacted with a time trend. Individual-level control variables include month of birth, preschool attendance, studies regularity and parents' educational level. Municipality-level control variables include taxable income and population size. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Overall, our findings highlight how the effect of early childcare attendance is not uniform across subgroups of the population. The positive impact is concentrated among immigrant children and, in particular, on their test scores in language. This effect is mostly driven by females and by students coming from a disadvantaged background. For this group of students, early childcare attendance is successful at narrowing the educational gap.

Crucially, our results emphasize that the impact of early childcare depends on the predetermined characteristics of children enrolled in the service, that is, whether they are native or immigrant and whether they come from a disadvantaged background. The existence of countervailing effects on different parts of the population of students is in line with the existing literature. On the one hand, a number of studies investigating the impact on disadvantaged children find that early intervention has a positive impact on students' cognitive outcomes, with the effect estimates being more pronounced for girls (Drange and Telle (2015), Felfe et al. (2014), Havnes and Mogstad (2011) Anderson (2008), among others). In particular, in our case, the positive effect of early childcare service attendance on immigrant students' language test scores is likely to mirror the positive impact of early exposure to the host country's language. On the other hand, the findings of several studies analyzing untargeted early interventions or the expansion of early childcare access report negative or no impact on native students, particularly if they come from an advantaged background (Baker et al. (2008), Herbst (2017), Drange et al. (2016)).

Relative to the recent literature on Italy, our results are again in line with those of [Fort et al. \(2020\)](#) by showing detrimental effects on native children’s cognitive skills, with the effect being stronger for females. This result can be interpreted considering the alternative modes of care that native children particularly when coming from an advantaged background might gain access to. According to [ISTAT \(2014\)](#), when the mother is working, the most frequent mode of care among native children are grandparents, 54.4% of native parents leave children in their care. The latter might imply that native children when not attending formal childcare are more likely to be exposed to an adult-to-children ratio of 1. One-to-one interactions with adults are crucial inputs for cognitive development in the first three years of life of a child, especially when adults are highly educated and have a larger vocabulary, which on average tends to happen more frequently for natives. On the contrary, only 17.7% of immigrant children are looked after by grandparents, often not residing in the same country. Working immigrant mothers are more likely to enroll their children in formal care (56%) or rely on their extended family network (8.4%), often only speaking a non-Italian language, which may entail that immigrant children are on average less likely to be exposed to one-to-one interactions and to host country language.¹³

Clearly, the quality of childcare service attended by each child may have an important role in affecting his cognitive development. Unfortunately, the INVALSI questionnaire does not provide any information on the quality or characteristics of the childcare service attended. We can, nevertheless, somehow investigate the role played by the characteristics of childcare services available to each child by dividing our sample according to the share of public/private services provided at the municipal level, computed using data from ISTAT. Specifically, using the number of municipal authorized early childcare spots over the period 2013-2018¹⁴ we first calculate the share of public spots over the total number of spots available, and then we define a municipality to have a high (low) share of public spots whenever the share of public spots is above (below) the median. The idea is that public childcare is characterized by high-quality standards, while private care is less regulated and therefore more heterogeneous in quality. For example, educators in public settings must hold at least a bachelor’s degree in education sciences specific for working in early childcare, while there are no top-level regulations regarding staff qualification in private settings. Our results are reported in Table 9 and indicate that the negative impact of childcare attendance on natives is restricted to municipalities with a relatively low share of public supply, while the positive impact on migrants’ language test score is limited to municipalities with a larger share of public provision.

¹³The source of these figures is the "Survey on births and mothers", conducted in 2012 by the Italian National Statistical Institute (ISTAT) and sampling mothers of children born in the period July 2009 - June 2010. The survey collects information on the weekly number of hours of different types of care provided to children.

¹⁴ISTAT data available from 2013 are the only data providing the information on whether the early childcare service is publicly or privately managed.

Table 9: Heterogeneous effects by public vs private share of early childcare supply, language and math.

LANGUAGE				
	Natives		Immigrants	
	(1) Low Pub. Supply	(2) High Pub Supply	(3) Low Pub Supply	(4) High Pub Supply
Panel A: Second Stage				
Early childcare	-0.575** (0.263)	0.009 (0.079)	0.148 (0.697)	0.776*** (0.280)
Panel B: First stage				
Early childcare supply	0.001*** (0.000)	0.003*** (0.000)	0.001*** (0.000)	0.003*** (0.000)
First stage F-stat	56.42***	578.97***	8.73***	60.68***
Observations	184,926	174,129	16,320	15,662
MATH				
Panel A: Second Stage				
Early childcare	-1.368*** (0.336)	-0.069 (0.082)	-0.807 (0.816)	0.392 (0.277)
Panel B: First stage				
Early childcare supply	0.001*** (0.000)	0.003*** (0.000)	0.001*** (0.000)	0.003*** (0.000)
First stage F-stat	50.51***	573.65***	7.09***	56.80***
Observations	178,880	168,370	15,738	15,139

Notes: the table shows IV estimates in which the dependent variables are the INVALSI standardized language and math test scores. Columns (1)-(2) refer to native students, while columns (3)-(4) refer to immigrant students. Columns (1) and (3) refer to municipalities with a relatively low share of public early childcare spots (i.e. share of public early childcare spots lower than the median), while columns (2) and (4) refer to municipalities with a relatively high share of public early childcare spots (i.e. share of public early childcare spots higher than the median). All specifications include province, cohort and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, studies regularity and parents' educational level. Municipality-level control variables include taxable income and population size. See Table A4 in Section 8 for variable definitions and sources. Robust standard errors are given in parentheses; ***p<0.01, **<0.05, *p<0.1.

6.3 The effect of early childcare attendance on oral grades assigned by teachers

We now focus on the impact of early childcare on oral grades assigned by teachers in language and math at the end of the first term of the same school year in which the INVALSI tests take place. We repeat the same analysis performed for INVALSI test scores but consider oral grades assigned by teachers as dependent variables. We regard oral grades to be particularly interesting because they capture something different than just cognitive skills; they are nonblind scores and are likely to be affected by teachers' evaluations regarding students' behaviors and thus should grasp a mixture of cognitive and noncognitive skills such as students' motivation, resilience and effort.

In the following tables, we investigate the impact of early childcare attendance on language and math oral grades. In Table 10, we report results by subject (columns (1)-(2), language; columns (3)-(4), math) and immigrant status (columns (1)-(3) native children, and columns (2)-(4) immigrant children). Our results show that, on average, early childcare has a positive and significant impact on the language and math oral grades of immigrant children. The positive

impacts of early childcare attendance do not vary by gender and mother’s educational level, neither for language nor for math oral grades assigned by teachers.¹⁵ Interestingly, no effect is detected on native children’s oral grades both on average and by child’s gender and mother’s education.

For immigrant students, evidence on oral grades strongly suggests that greater fluency in the host country’s language is the channel driving the observed positive effects. In fact, the results are consistent with those in the previous section analyzing the impact of early childcare on INVALSI standardized test scores. However, differing from before, our coefficients turn highly significant for math oral grades as well. The latter is likely not related to children’s higher ability in math but to their oral exposure competences, which strongly depend on their language fluency and comprehension.

Table 10: Effects of early childcare attendance on oral marks assigned by teachers.

	LANGUAGE ORAL MARKS		MATH ORAL MARKS	
	Natives	Immigrants	Natives	Immigrants
	(1)	(2)	(3)	(4)
Panel A: Second Stage				
Early childcare	-0.000 (0.082)	0.878*** (0.249)	-0.012 (0.083)	0.651** (0.251)
Panel B: First Stage				
Early childcare supply	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
First stage F-stat	471.73***	73.84***	479.43***	74.44***
Observations	397,920	33,369	397,228	33,349

Notes: entries in the Table are the estimated coefficients of early childcare attendance on standardized language (columns (1)-(2)) and math (columns (3)-(4)) oral grades assigned by teachers. Columns (1)-(3) report estimates for native students, while columns (2)-(4) report estimates for immigrant students. All specifications include province, cohort and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, studies regularity and parents’ educational levels. Municipality-level control variables include taxable income and population size. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; ***p<0.01, **<0.05, *p<0.1.

6.4 The role of language proximity

To date, we have found that childcare attendance improves the test scores of children with immigrant backgrounds. This result may be explained by how childcare provides second-generation immigrants with early exposure to their host country’s language, which is often different from the language spoken at home. To understand whether this is indeed the channel at work, we investigate whether the linguistic distance of the immigrant children’s mother tongue to the Italian language plays a role in shaping the effect of childcare. If our hypothesis that early childcare improves immigrants’ school achievement by improving their language and communication skills is correct, we should expect that children whose parents speak a language significantly different from Italian will benefit the most from early childcare attendance, as the context will grant them greater exposure to the new language.

To compute linguistic distance from Italian, we employ the continuous linguistic distance measure developed by the Max Planck Institute for Evolutionary Anthropology. This measure evaluates the phonetic dissimilarities between words in two languages, called the Levenshtein linguistic

¹⁵For the sake of brevity, we do not report tables on heterogeneity by gender and mother’s educational level.

distance. The intuition behind the construction of this measure is to compare pairs of words on the basis of their pronunciation. In particular, a key set of 40 words, the so-called *Swadesh word list* (Swadesh (1952)) that contain terms of everyday life common to most of the world’s languages is transcribed using a phonetic alphabet, the Automatic Similarity Judgement Program. Then, for each word, the number of sounds that have to be changed (to express one language’s word in another language) is calculated (Isphording and Otten (2013)).¹⁶

The Levenshtein linguistic distance has been previously exploited to investigate the impact of linguistic dissimilarity on immigrant destination country language acquisition (Isphording and Otten (2013), Isphording and Otten (2014)), migration determinants (Adsera and Pytlikova (2015)) and the heterogeneous impact of immigrant peers on native students’ achievements in the classroom (Frattini and Meschi (2019)). However, to the best of our knowledge, no other studies on early childhood development have focused on this relevant dimension.

INVALSI data contain unique information about the language children mostly speak at home. We merge this information to the Levenshtein linguistic distance measure.¹⁷ More specifically, we restrict the sample to second-generation immigrant students, and we match individual information about the language most spoken at home with the Levenshtein measure. In our sample, the index ranges between 0 and 100 and has 14 unique values.

Using the same specification as in section 6, we run separate regressions for second-generation immigrant students whose language is more or less distant from Italian based on the Levenshtein linguistic distance being above (below) the median in our sample.

The results are reported in Table 11. Columns (1)-(2) ((3)-(4)) show the results for children speaking a language with a low (high) level of dissimilarity with respect to Italian for INVALSI language and math standardized test scores. The estimates confirm our expectations and reveal that the positive effect of childcare on language test scores holds only for children speaking a language highly distant from Italian, whereas no effect is detected on math test scores and on children speaking a language relatively close to Italian. When we repeat the analysis by gender, we see that the latter result is mainly driven by the effect on females (see Table A2). Although not statistically significant (presumably because of a very low sample size), the results by linguistic distance and mother’s educational level (not reported here for the sake of brevity) are consistent with the one in the main analysis pointing to a positive effect of early childcare attendance on children from less favorable backgrounds and speaking a language distant from Italian.

These findings reveal that the mechanism through which the effect might operate consists of a reduction in the cost of language acquisition due to students’ early exposure to the destination country’s language. Immigrant females reap the largest benefit from early childcare service attendance. This latter piece of evidence adds to our previous results, showing that among females, those speaking a language strongly dissimilar from Italian benefit the most from early childcare service attendance. Consistent with our argument, no effect is detected for either male or female students who speak a language closer to Italian.

¹⁶For further details on the measure construction, see Bakker et al. (2009).

¹⁷INVALSI data do not provide immigrant children’s country of origin.

Table 11: Effects of early childcare attendance on children’s test scores by child’s linguistic distance.

	LOW LINGUISTIC DISTANCE		HIGH LINGUISTIC DISTANCE	
	Language	Math	Language	Math
Panel A: Second Stage	(1)	(2)	(3)	(4)
Early childcare	0.037 (0.310)	-0.029 (0.314)	0.830* (0.487)	0.105 (0.450)
Panel B: First Stage				
Early childcare public supply	0.003*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
First stage F-stat	40.60***	40.60***	21.22***	21.22***
Observations	13,609	13,609	11,830	11,830

Notes: the table shows IV estimates in which the dependent variables are the INVALSI language and math test scores. Columns (1)-(2) refer to immigrant students speaking a language with a low level of linguistic distance from Italian (LLD). Columns (3)-(4) refer to immigrant students speaking a language with a high level of linguistic distance from Italian (HLD). All specifications include province, cohort and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, studies regularity and parents’ educational levels. Municipality-level control variables include taxable income, population size and the incumbent mayor’s political orientation. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; ***p<0.01, **<0.05, *p<0.1.

7 Robustness checks

This section presents a set of robustness checks of our main findings. In table 12, we augment our main specification (see section 5) with a number of additional variables. First, we include a set of control variables at the class and school levels (see columns (2) and (8)). As discussed above, our specification allows for a qualified number of controls that allow us to identify the causal effect of early childcare attendance on standardized test scores. However, one might consider including a more extensive set of controls, taking into account school and class compositional differences to investigate whether their inclusion has a substantial impact on the estimated coefficient. In particular, we control for school and class size and their square and the share of female, immigrant and retained students per class.

Second, in subsection 5.3, we argue that municipalities in the same province with a number of residents greater than 10,000 are likely to be characterized by a high level of internal homogeneity. However, provincial capitals might differ economically, culturally and socially with respect to the other municipalities in the same province. A provincial capital is usually the largest municipality in the province, with a prominent economic and cultural role. In our framework, provincial capitals may provide better resources to parents and children, together with a more vibrant environment, which would potentially benefit children’s test outcomes. To address this potential threat to identification, we control in our specification also for a dummy equal to 1 if the municipality is a provincial capital and 0 otherwise (see columns (3) and (9)). Third, we include a control for the municipalities’ mayors’ political faction to account for local anti-immigrant sentiments and policies that may affect immigrants’ access to childcare facilities as well as their performance at school (see columns (4) and (10)). Fourth, in section 5.3, we provide a number of tests to show that the availability of early childcare spots is substantially unrelated to immigrant location choices and to the variation in other predetermined socioeconomic municipal characteristics. However, one might still worry that taxable income in our estimating equation does not fully capture some relevant dimensions, such as the municipality’s job opportunities. To address this concern, we include in our controls the unemployment rate at the municipal level

(see columns (5) and (11)).

Estimates are reported in Table 12 for language test scores (top panel) and for math test scores (bottom panel). For ease of comparison, in columns (1) and (7), we report baseline estimates from Table 6 for native and immigrant students, respectively. Columns (2) and (8) control for school and class characteristics, columns (3) and (9) control for the municipality being the provincial capital, columns (4) and (10) control for mayor’s political faction and columns (5) and (11) control for municipal unemployment rate and columns (6) and (12) include all previous controls in the same specification. Reassuringly, augmenting our specification with additional controls, the results are remarkably similar to those in Table 6.

Later, in Table 13, we investigate whether our main findings concerning language test score outcomes for immigrant children by mother’s educational level are sensitive to the usage of alternative proxies of students’ socioeconomic backgrounds. Specifically, we investigate whether using the father’s educational level or the tertiles of the ESCS index has an impact on the estimated coefficients. Again, the results are almost identical in terms of both significance and magnitude.

Finally, in Table A3 of the Appendix, we control the robustness of our results using language and math test scores not corrected by cheating as dependent variables. Again, our results are mostly unaffected by this alternative definition of our main dependent variables.

In sum, robustness checks yield results that are similar to those in the main analysis, thereby confirming the overall pattern of our findings.

Table 12: Robustness check: including additional controls, language and math.

LANGUAGE												
	Natives						Immigrants					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Second Stage												
Early childcare	-0.165* (0.087)	-0.152* (0.083)	-0.108 (0.100)	-0.242** (0.101)	-0.165* (0.087)	-0.217** (0.094)	0.577** (0.239)	0.535** (0.239)	0.940** (0.410)	0.521** (0.248)	0.581** (0.242)	0.467* (0.247)
Panel B: First Stage												
Early childcare supply	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
First stage F-stat	483.38***	529.23***	362.62***	361.58***	485.24***	416.89***	78.65***	78.04***	30.20***	72.64***	77.35***	72.16***
Observations	414,382	414,382	414,382	359,381	414,382	359,381	34,887	34,887	34,887	32,122	34,887	32,122
MATH												
Panel A: Second Stage												
Early childcare	-0.505*** (0.093)	-0.497*** (0.089)	-0.432*** (0.106)	-0.537*** (0.107)	-0.505*** (0.093)	-0.521*** (0.100)	0.140 (0.239)	0.026 (0.239)	0.070 (0.390)	0.148 (0.250)	0.124 (0.241)	0.005 (0.250)
Panel B: First Stage												
Early childcare supply	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
First stage F-stat	473.85***	517.96***	354.52***	358.49***	474.98***	412.32***	73.00***	72.50***	27.37***	67.11***	71.60***	66.45***
Observations	400,829	400,829	400,829	348,345	400,829	348,345	33,696	33,696	33,696	31,017	33,696	31,017
Baseline	✓						✓					
Class and school controls		✓						✓				
Provincial capital			✓						✓			
Mayor's political orientation				✓						✓		
Unemployment rate					✓						✓	
All controls						✓						✓

Notes: entries in the table are the estimated coefficients of early childcare attendance on INVALSI standardized language and math test scores. Columns (1)-(6) report estimates for native students, and columns (7)-(12) report estimates for immigrant students. All specifications include province, cohort and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, regularity of studies and parents' educational levels. Municipality-level control variables include taxable income, resident population and the incumbent mayor's political orientation. Class and school controls include school and class size and their square and the share of female, immigrant and retained students per class. See Table A4 in Section 8 for variable definitions and sources. Robust standard errors are given in parentheses; ***p<0.01, **p<0.05, *p<0.1.

Table 13: Robustness check: using alternative proxies for socio-economic background, language and math.

	Natives					Immigrants				
	(1) High Edu	(2) Low Edu	(3) I ter	(4) II ter	(5) III ter	(6) High Edu	(7) Low Edu	(8) I ter	(9) II ter	(10) III ter
Panel A: Language										
Early childcare	-0.111 (0.107)	-0.104 (0.143)	0.039 (0.126)	-0.307** (0.139)	-0.383* (0.220)	0.148 (0.284)	1.090** (0.427)	0.726* (0.392)	0.193 (0.398)	0.536 (0.414)
Observations	288,304	126,078	135,408	132,263	133,337	21,168	13,719	11,360	11,442	11,139
Panel B: Math										
Early childcare	-0.475*** (0.114)	-0.421*** (0.151)	-0.302** (0.130)	-0.606*** (0.150)	-0.737*** (0.246)	0.267 (0.292)	-0.121 (0.392)	-0.182 (0.388)	0.176 (0.395)	0.391 (0.420)
Observations	280,162	120,667	132,533	131,179	132,911	20,524	13,172	11,113	11,353	11,084

Notes: the table shows IV estimates in which the dependent variable is the INVALSI standardized language test score in Panel A and math test score in Panel B. Columns (1)-(5) refer to native students, while columns (6)-(10) refer to immigrant students. Columns (1) and (6) refer to students with a high-educated father (i.e. education level higher than a lower secondary school diploma), while columns (2) and (7) refer to students with a low-educated father (i.e. educational level lower than or equal to a lower secondary school diploma). Columns (3)-(5) ((8)-(10)) refer to the first, second and third tertile of the ESCS index native (immigrant) distribution. All specifications include province, cohort and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, studies regularity and mother's (parents') educational level. Municipality-level control variables include taxable income and population size. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; ***p<0.01, **<0.05, *p<0.1.

8 Conclusions

The successful integration of immigrant children into the educational system is one of the most important challenges for the majority of European countries. Children who are migrants or who have immigrant parents face significant educational barriers, which may lead to substantial educational disadvantages relative to native students. Performance gaps at school then translate into persistent differences between immigrant students and their native peers in terms of literacy levels, drop-out rates and, eventually, labor market outcomes, thus perpetuating inequalities and slowing the integration of migrants into the host country.

In this paper, we analyzed the impact of early childcare attendance on second-generation immigrant children's cognitive outcomes. In particular, we investigated whether childcare provided at a very young age is an effective policy to close or at least reduce the existing performance gap between immigrant and native children. To carry out our analysis, we drew on novel Italian administrative data and made use of a neat IV identification strategy to address children's nonrandom sorting into early childcare.

Our results point to a positive and significant impact of early childcare attendance on immigrant children's cognitive outcomes, with the effect driven by students with low-educated mothers. Furthermore, we find that the impact of childcare is stronger for immigrant children whose mother tongue is further from Italian, which strongly suggests that greater fluency in the host country language might well be the mechanism through which the effect operates. Thus, access to early childcare may be a relevant policy tool for improving the language proficiency of immigrant children, thus fostering their integration and assimilation into the host country.

On the other hand, our estimates report a negative and significant effect on native students with regard to both language and math test scores. The detrimental effects are mostly concentrated

among students coming from more advantaged backgrounds. These findings might be interpreted in light of the relatively better alternative modes of care that native students might gain access to and call policymakers' attention to the educational content and organization of early childcare services.

Our findings provide empirical support for the renewed interest of social scientists and policymakers in early childcare and preprimary school program attendance as an effective tool for facilitating immigrant children's integration and for closing the gap in their educational performance.¹⁸ Unfortunately, despite the encouraging empirical evidence and the rich policy debate, the access of children with immigrant backgrounds to early childcare facilities (and other preprimary school programs) is still very limited in OECD countries (including Italy, the country of origin for the data used in this study).¹⁹ Institutional and economic factors play a crucial role in determining the limited access of immigrant children to these precious social services. In Italy, for instance, municipal authorities are responsible for administering early childcare programs and defining the rules to allocate the limited available slots across families. In some cases, this institutional situation has translated into inefficient and discretionary allocation rules, such as those restricting access to early childcare programs to families who satisfy time requirements with their legal residence in the municipality.²⁰ Our results strongly question the desirability and appropriateness of such legal requirements, as they are very likely to reduce the social benefit of early childcare programs and limit the effective integration of immigrant children into the education system of the host country.

¹⁸See, for instance, the recent [OECD \(2018\)](#).

¹⁹For Europe, see [CoE \(2017\)](#). According to [OECD \(2015\)](#), first-generation immigrant students are almost half as likely as nonimmigrant students to attend preprimary education; there are, however, significant exceptions such as Belgium, Austria, Slovenia, Canada and Norway, where immigrant students are more likely than nonimmigrants to have attended preprimary school education.

²⁰For instance, in 2018, Veneto introduced the requirement of 15 years of legal residence in the municipality to obtain access to early childcare programs. However, this requirement was declared unconstitutional a few months after its introduction.

References

- Adsera, A. and Pytlikova, M. (2015). The role of language in shaping international migration. *The Economic Journal*, 125(586):F49–F81.
- Ahad, A. and Benton, M. (2018). Mainstreaming 2.0. Technical report, Brussels: Migration Policy Institute Europe.
- Alesina, A., Carlana, M., La Ferrara, E., and Pinotti, P. (2018). Revealing stereotypes: Evidence from immigrants in schools. Working Paper 25333, National Bureau of Economic Research.
- Anderson, M. L. (2008). Multiple inference and gender differences in the effects of early intervention: A reevaluation of the abecedarian, perry preschool, and early training projects. *Journal of the American Statistical Association*, 103(484):1481–1495.
- Angrist, J. D. and Pischke, J.-S. (2008). *Mostly Harmless Econometrics*. Princeton University Press.
- Antonelli, M. A. and Grembi, V. (2011). *Target centrali e finanza locale: Il caso degli asili nido in Italia*. Carocci editore.
- Antonelli, M. A. and Grembi, V. (2014). Central targets and local agendas: Missing lisbon 2010. Public finance research papers 6, Available at SSRN 2161985.
- Baker, M., Gruber, J., and Milligan, K. (2008). Universal child care, maternal labor supply, and family well-being. *Journal of Political Economy*, 116(4):709–745.
- Baker, M., Gruber, J., and Milligan, K. (2019). The long-run impacts of a universal child care program. *American Economic Journal: Economic Policy*, 11(3):1–26.
- Bakker, D., Müller, A., Velupillai, V., Wichmann, S., Brown, C. H., Brown, P., Egorov, D., Mailhammer, R., Grant, A., and Holman, E. W. (2009). Adding typology to lexicostatistics: A combined approach to language classification. *Linguistic Typology*, 13(1):169–181.
- Berlinski, S., Galiani, S., and Gertler, P. (2009). The effect of pre-primary education on primary school performance. *Journal of public Economics*, 93(1-2):219–234.
- Blau, D. and Currie, J. (2006). Pre-school, day care, and after-school care: who’s minding the kids? 2:1163–1278.
- Bornstein, M. H., Hahn, C.-S., and Haynes, O. M. (2004). Specific and general language performance across early childhood: Stability and gender considerations. *First language*, 24(3):267–304.
- Bracco, E., De Paola, M., Green, C. P., and Scoppa, V. (2018). The effect of far right parties on the location choice of immigrants: Evidence from lega nord mayors. *Journal of Public Economics*, 166(C):12–26.
- Brilli, Y., Del Boca, D., and Pronzato, C. D. (2016). Does child care availability play a role in maternal employment and children’s development? evidence from italy. *Review of Economics of the Household*, 14(1):27–51.
- Brunello, G. and Rocco, L. (2019). Grandparents in the blues. The effect of childcare on grandparents’ depression. *Review of Economics of the Household*, 17(2):587–613.
- Carta, F. and Rizzica, L. (2018). Early kindergarten, maternal labor supply and children’s outcomes: Evidence from italy. *Journal of Public Economics*, 158(C):79–102.

- Cascio, E. and Schanzenbach, D. W. (2013). The Impacts of Expanding Access to High-Quality Preschool Education. *Brookings Papers on Economic Activity*, 44(2):127–192.
- Cittadinanzattiva (2011). Dossier sugli asili nido comunali 2011. Technical report, Osservatorio prezzi e tariffe di Cittadinanzattiva.
- CoE (2017). Fighting school segregation in europe through inclusive education: a position paper. Technical report, Concil of Europe Commissioner for Human Rights.
- Cornelissen, T., Dustmann, C., Raute, A., and Schönberg, U. (2018). Who benefits from universal child care? estimating marginal returns to early child care attendance. *Journal of Political Economy*, 126(6):2356–2409.
- Cunha, F. and Heckman, J. (2007). The technology of skill formation. *American Economic Review*, 97(2):31–47.
- Damm, A. P. (2009). Determinants of recent immigrants’ location choices: Quasi-experimental evidence. *Journal of Population Economics*, 22(1):145–174.
- Del Boca, D., Martino, E. M., Meroni, E. C., and Piazzalunga, D. (2019). Early Education and Gender Differences. *Economia Italiana*, 3:11–36.
- Del Boca, D., Pasqua, S., and Suardi, S. (2016a). Child care, maternal employment, and children’s school outcomes. an analysis of italian data. *European Journal of Population*, 32(2):211–229.
- Del Boca, D., Pronzato, C., and Sorrenti, G. (2016b). When Rationing Plays a Role: Selection Criteria in the Italian Early Childcare System. *CESifo Economic Studies*, 62(4):752–775.
- Del Boca, D. and Vuri, D. (2007). The mismatch between employment and child care in italy: the impact of rationing. *Journal of Population Economics*, 20(4):805–832.
- Drange, N. and Havnes, T. (2019). Early childcare and cognitive development: Evidence from an assignment lottery. *Journal of Labor Economics*, 37(2):581–620.
- Drange, N., Havnes, T., and Sandsør, A. M. (2016). Kindergarten for all: Long-run effects of a universal intervention. *Economics of Education Review*, 53(C):164–181.
- Drange, N. and Telle, K. (2015). Promoting integration of immigrants: Effects of free child care on child enrollment and parental employment. *Labour Economics*, 34(C):26–38.
- Dustmann, C., Frattini, T., and Lanzara, G. (2012). Educational achievement of second-generation immigrants: an international comparison. *Economic Policy*, 27(69):143–185.
- Felfe, C. and Huber, M. (2017). Does preschool boost the development of minority children?: the case of roma children. *Journal of the Royal Statistical Society (Series A)*, 180(2):475–502.
- Felfe, C. and Lalive, R. (2018). Does early child care affect children’s development? *Journal of Public Economics*, 159(C):33–53.
- Felfe, C., Nollenberger, N., and Rodríguez-Planas, N. (2014). Can’t buy mommy’s love? universal childcare and children’s long-term cognitive development. *Journal of population economics*, 28(2):393–422.
- Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D. J., Pethick, S. J., Tomasello, M., Mervis, C. B., and Stiles, J. (1994). Variability in early communicative development. *Monographs of the society for research in child development*, 59:1–173.

- Fort, M., Ichino, A., and Zanella, G. (2020). Cognitive and non-cognitive costs of daycare 0–2 for children in advantaged families. *Journal of Political Economy*, 128(1):158–205.
- Frattini, T. and Meschi, E. (2019). The effect of immigrant peers in vocational schools. *European Economic Review*, 113(C):1–22.
- Frattini, T. and Vigezzi, N. (2018). 2nd migration observatory report: Immigrant integration in europe and in italy. Technical report, Centro Studi Luca D’Agliano and Collegio Carlo Alberto.
- Giulietti, C. (2014). The welfare magnet hypothesis and the welfare take-up of migrants. *IZA World of Labor*, pages 1–37.
- Havnes, T. and Mogstad, M. (2011). No child left behind: Subsidized child care and children’s long-run outcomes. *American Economic Journal: Economic Policy*, 3(2):97–129.
- Havnes, T. and Mogstad, M. (2015). Is universal child care leveling the playing field? *Journal of Public Economics*, 127(C):100–114.
- Heckman, J. and Masterov, D. V. (2007). The productivity argument for investing in young children. *Applied Economic Perspectives and Policy*, 29(3):446–493.
- Heckman, J. J. and Mosso, S. (2014). The Economics of Human Development and Social Mobility. *Annual Review of Economics*, 6(1):689–733.
- Herbst, C. M. (2013). The impact of non-parental child care on child development: Evidence from the summer participation “dip”. *Journal of Public Economics*, 105(C):86–105.
- Herbst, C. M. (2017). Universal child care, maternal employment, and children’s long-run outcomes: Evidence from the us lanham act of 1940. *Journal of Labor Economics*, 35(2):519–564.
- Isphording, I. E. and Otten, S. (2013). The costs of babylon—linguistic distance in applied economics. *Review of International Economics*, 21(2):354–369.
- Isphording, I. E. and Otten, S. (2014). Linguistic barriers in the destination language acquisition of immigrants. *Journal of economic Behavior & organization*, 105(C):30–50.
- ISTAT (2014). Avere figli in italia negli anni 2000. approfondimenti dalle indagini campionarie sulle nascite e sulle madri. Technical report.
- Magnuson, K., Kelchen, R., Duncan, G., Schindler, H., Shager, H., and Yoshikawa, H. (2016). Do the effects of early childhood programs on academic and adult outcomes vary by gender? a meta-analysis. *Early Childhood Research Quarterly*, 36:521–536.
- OECD (2012). Untapped skills. realizing the potential of immigrant students. Technical report.
- OECD (2015). Help immigrant students to succeed at school and beyond. Technical report.
- OECD (2018). Working together for local integration of migrants and refugees. Technical report.
- Quintano, C., Castellano, R., and Longobardi, S. (2009). *A fuzzy clustering approach to improve the accuracy of italian student data: An experimental procedure to correct the impact of outliers on assessment test scores*. Vita e pensiero.
- Swadesh, M. (1952). Lexico-statistic dating of prehistoric ethnic contacts: With special reference to north american indians and eskimos. *Proceedings of the American Philosophical Society*, 96(4):452–463.

Todd, P. E. and Wolpin, K. I. (2003). On the specification and estimation of the production function for cognitive achievement. *The Economic Journal*, 113(485):F3–F33.

Declaration of interest

None.

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Appendices

Table A1: Full list of controls: effect of early childcare on test scores, language and math.

	LANGUAGE		MATH	
	Natives	Immigrants	Natives	Immigrants
	(1)	(2)	(3)	(4)
Early childcare	-0.165*	0.577**	-0.505***	0.140
	(0.087)	(0.239)**	(0.093)***	(0.239)
Preschool	0.121***	0.105*	0.195***	0.149**
	(0.020)	(0.060)	(0.022)	(0.059)
Female	0.107***	0.129***	-0.182***	-0.175***
	(0.003)	(0.011)	(0.003)	(0.011)
Regular students	0.301***	0.326***	0.265***	0.073***
	(0.010)	(0.025)	(0.011)	(0.025)
Second quarter	-0.031***	-0.033**	-0.039***	-0.031**
	(0.004)	(0.014)	(0.004)	(0.013)
Third quarter	-0.143***	-0.126***	-0.145***	-0.129***
	(0.004)	(0.015)	(0.005)	(0.014)
Father high school	0.232***	0.139***	0.217***	0.093***
	(0.005)	(0.016)	(0.005)	(0.016)
Father college degree	0.401***	0.199***	0.378***	0.138***
	(0.007)	(0.024)	(0.008)	(0.024)
Mother high school	0.297***	0.194***	0.296***	0.142***
	(0.008)	(0.018)	(0.009)	(0.018)
Mother college degree	0.515***	0.342***	0.520***	0.306***
	(0.016)	(0.026)	(0.017)	(0.026)
2006	0.313***	-0.036	0.436***	0.217
	(0.037)	(0.374)	(0.039)	(0.360)
2007	0.602***	-0.049	0.918***	0.465
	(0.073)	(0.747)	(0.078)	(0.719)
Population	-0.000***	-0.000	-0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Income	0.000***	-0.000	0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	414,382	34,887	400,829	33,696

Notes: entries in the table are the estimated coefficients of early childcare attendance on standardized language (columns (1)-(2)) and math (columns (3)-(4)) INVALSI standardized test scores. Columns (1)-(3) report estimates for native students, while columns (3)-(4) report estimates for immigrant students. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; ***p<0.01, **<0.05, *p<0.1.

Table A2: Effects of early childcare attendance on children's test scores by child's linguistic distance and gender.

	LOW LINGUISTIC DISTANCE		HIGH LINGUISTIC DISTANCE	
	Male	Female	Male	Female
LANGUAGE				
Panel A: Second Stage	(1)	(2)	(3)	(4)
Early childcare	0.137 (0.505)	-0.112 (0.374)	0.320 (0.736)	1.134* (0.670)
Panel B: First Stage				
Early childcare public supply	0.002*** (0.001)	0.003*** (0.001)	0.002*** (0.001)	0.002*** (0.001)
First stage F-stat	15.20***	27.64***	8.08**	12.37***
MATH				
Panel A: Second Stage				
Early childcare	0.347 (0.528)	-0.353 (0.376)	-0.542 (0.759)	0.615 (0.605)
Panel B: First Stage				
Early childcare public supply	0.002*** (0.001)	0.003*** (0.001)	0.002*** (0.001)	0.002*** (0.001)
First stage F-stat	15.20***	27.64***	8.08***	12.37***
Observations	6,731	6,878	5,924	5,906

Notes: the table shows IV estimates in which the dependent variables are the INVALSI language and math test scores. Columns (1)-(2) refer to immigrant students speaking a language with a low level of linguistic distance from Italian (LLD). Columns (3)-(4) refer to immigrant students speaking a language with a high level of linguistic distance from Italian (HLD). Columns (1) and (3) refer to male immigrant students while columns (2) and (4) refer to female students. All specifications include province, cohort and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, studies regularity and parents' educational levels. Municipality-level control variables include taxable income, population size and the incumbent mayor's political orientation. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A3: Effects of early childcare attendance on children's test scores at grade 5, no cheating correction.

	LANGUAGE		MATH	
	Natives	Immigrants	Natives	Immigrants
Panel A: Second Stage	(1)	(2)	(3)	(4)
Early childcare	-0.350*** (0.088)	0.587** (0.238)	-0.664*** (0.094)	0.181 (0.234)
Panel B: First Stage				
Early childcare supply	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
First stage F-stat	483.38***	78.65***	473.85***	73.00***
Observations	414,382	34,887	400,829	33,696

Notes: entries in the Table are the estimated coefficients of early childcare attendance on INVALSI standardized language (columns (1)-(2)) and math (columns (3)-(4)) test scores. Columns (1)-(3) report estimates for native students, and columns (2)-(4) for immigrant students. All specifications include province-fixed effects, cohort-fixed effects and province dummies interacted with a time trend. Individual-level control variables include gender, month of birth, preschool attendance, studies regularity and parents' educational levels. Municipality-level control variables include taxable income and population size. See Table A4 in Section 8 for variables definition and sources. Robust standard errors are given in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A4: Definition of variables and sources.

Variable	Description	Source
Outcome variables		
Language test score	Percentage of correct answers in Language test	INVALSI
Math test score	Percentage of correct answers in Math test	INVALSI
Language oral grade	Oral grade got past school year	INVALSI
Math oral grade	Oral grade got past school year	INVALSI
Childcare variable		
Childcare coverage	Public childcare slots over population 0-2 by municipality	Antonelli and Grembi (2011)
High share of public spots	dummy =1 if share of public spots greater than the median	
Endogenous variables		
Childcare attendance	dummy=1 if the child attended early childcare	ISTAT
Individual level control variables		
Female	dummy=1 if female	INVALSI
Immigrant I generation	dummy=1 if child is Immigrant II generation	INVALSI
Immigrant II generation	dummy=1 if child is Immigrant I generation	INVALSI
Age	child year of birth	INVALSI
I quarter month of birth	dummy=1 if the child is born in first quarter	INVALSI
II quarter month of birth	dummy=1 if the child is born in second quarter	INVALSI
III quarter month of birth	dummy=1 if the child is born in third quarter	INVALSI
Low level of paternal/maternal education	dummy=1 if mother/father has an educational level lower than or equal to lower secondary school diploma	INVALSI
Medium level of paternal/maternal educ.	dummy=1 if mother/father has an educational level higher than lower secondary school diploma or equal to high school diploma	INVALSI
High level of paternal/maternal educ.	dummy=1 if mother/father has an educ. level higher than high school	INVALSI
Mother's working status	dummy=1 if the mother works	INVALSI
Father's working status	dummy=1 if the father works	INVALSI
Language mostly spoken at home	dummy=1 if the child mostly speaks a language different from Italian at home	INVALSI
Preschool attendance	dummy=1 if the child attended preschool	INVALSI
High ESCS	dummy=1 if the student's ESCS index is greater than or equal to the upper tertile of the native (immigrant) ESCS distribution	INVALSI
Class- and school-level control variables		
Share of female	Share of female per class	INVALSI
Share of late students	Share of retained students per class	INVALSI
Share of migrants	Share of immigrants per class	INVALSI
Average class size	Average number of students per class	INVALSI
Average class size squared		INVALSI
School size	Total number of students per school	INVALSI
School size squared		INVALSI
Municipality level control variables		
Taxable income	Resident population in 2001	Ministry of Economy and Finance
Resident population	dummy=1 if the incumbent mayor is endorsed by left parties	INVALSI
Incumbent mayor's political faction		Ministry of the Interior
Unemployment rate	Unemployed residents as a percentage of the labor force 15-64 in 2001	(for elaborated data Bracco et al. (2018))
		Census