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Lost in Translation: Reading Performance and Math Performance of Second-Generation Children in Italy

Mariagrazia Cavallo and Giuseppe Russo

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University of Naples Federico II | University of Salerno | Bocconi University, Milan

CSEF - Centre for Studies in Economics and Finance
Department of Economics – University of Naples
80126 Naples - Italy
Tel. and fax +39 081 675372 – e-mail. csef@unina.it
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Reading Performance and Math Performance of Second-Generation Children in Italy

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Abstract
This paper studies the effect of language proficiency on Math achievement for ten-year-old second-generation children in Italy. Through an IV given by the interaction between age and linguistic distance, we find that a higher score in Italian *reduces* the score in Math. This outcome is led by children with insufficient command of Italian (namely, those whose reading score is below 95% of the natives' average) and suggests that these students can improve their Italian only at the cost of reducing their performance in other subjects. This delay in language acquisition may undermine equality of opportunities from childhood.

JEL Classification: I21, I24, Z13

Keywords: Second generations, language, math performance, linguistic distance, instrumental variable

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[*] University of Bristol and Università di Salerno

[**] Università di Salerno, CSEF and GLO. Corresponding address: Università di Salerno, Dipartimento di Scienze Economiche, via Giovanni Paolo II 132, 84084 Fisciano (Italy). Email: grusso@unisa.it

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1 Introduction

Language acquisition is essential for the integration of immigrants. The adaptation to the receiving society is a delicate process that involves several dimensions such as language, culture, social interactions, and economic outcomes (Zimmermann, Zimmermann, and Constant (2007); Constant and Zimmermann (2008); Constant, Gataullina, and Zimmermann (2009); Gorinas (2014)). Lack of integration in one dimension does not necessarily preclude integration along other dimensions; however, proficiency in the destination country language is a prerequisite for integration in *all* dimensions.[1] Analogously, language acquisition is not only an outcome of the educational process but also a prerequisite in the acquisition of further skills (Dustmann and Glitz (2011); Akresh and Akresh (2011); Isphording, Piopiunik, and Rodriguez-Planas (2016)).

The objective of this paper is to identify *the causal effect of language acquisition on Math achievement* for second-generation children at the age of 10.

Identifying this effect is essential to understand the formation of immigrant children's human capital at the very beginning of their integration process. Actually, it is well-known that early educational gaps are likely to persist and may determine major difficulties in adulthood (Almond, Currie, and Duque (2018)). For instance, Carneiro, Heckman, and Masterov (2005) point out that gaps in ability across ethnic groups arisen even at a very early age may become permanent and hinder labor market opportunities. Similarly, Neal and Johnson (1996) find that test score differences between black and white children can explain future wage gaps.

Our work is strictly related to Isphording, Piopiunik, and Rodriguez-

[1] An extensive literature has found a positive effect of language proficiency on labor market outcomes (Dustmann and Fabbri (2003); Bleakley and Chin (2004); Chiswick and Miller (2010)).

Planas (2016) and Fenoll (2018). Both of these contributions measure the causal effect of immigrants' language skills on Math results. While Isphording, Piopiunik, and Rodriguez-Planas (2016) find that language proficiency positively affects Math performance, Fenoll (2018) finds no evidence of such an effect.[2] Our results differ from both of these articles, and suggest that children can improve their Italian only at the cost of reducing their performance in Math. This is a worrying outcome since it points out that, at the end of the Primary School, second generations in Italy have not yet achieved linguistic integration, and they could easily be caught in a poverty trap (see Bleakley and Chin (2004)).

Our analysis adds to the literature in many respects. First, unlike Isphording, Piopiunik, and Rodriguez-Planas (2016) and Fenoll (2018), we focus on second generations.[3] Thus, all children in our sample are born in Italy. Second, and most importantly, we know the language *actually* spoken at home. While Isphording, Piopiunik, and Rodriguez-Planas (2016) and Fenoll (2018) try to infer this language from information on the country of origin, associating a country to a single language is not possible in many cases, in particular with many North-African countries that are a major source of emigration to Italy. Third, by focusing on Italy, we can study the peculiar situation of a country where immigration is a relatively recent phenomenon,[4] and where the educational gap between natives and immigrants looks serious (Azzolini, Schnell, and Palmer (2012); MIUR (2019)).

[2] Isphording, Piopiunik, and Rodriguez-Planas (2016) study a mix of destination-origin countries, and Fenoll (2018) studies immigrants into the US.

[3] Isphording, Piopiunik, and Rodriguez-Planas (2016) consider first-generation students aged 15; Fenoll (2018) puts together both first and second-generation children aged 6-12.

[4] Actually, even though in the last 20 years Italy has become an important destination country, only few papers concern second generations in Italy (Algan et al. (2012); Azzolini, Schnell, and Palmer (2012)).

Notice also that we study children aged 10-11. This ensures that they are within -or at least still close to- the critical period for language acquisition so that being "older" does not hinder the acquisition of Italian[5] (Lenneberg (1967); Snow and Hoefnagel-Höhle (1978); Newport (2002); Van Den Berg et al. (2014)).
Estimating to what extent language proficiency (*i.e.* test scores in Italian) determines Math achievement (*i.e.* test scores in Math) is subject to well-known econometric issues. Both Math and language scores can be affected by omitted variables such as ability and motivation. In the case of immigrants, other unobservable mechanisms -like family self-selection along dimensions that are relevant for school performance- may be at work, making causal estimation even harder. Then, by the simple fact that second generations usually suffer from a socioeconomic disadvantage, it might be difficult to disentangle the effects on educational performance due to language barriers from the effects due to the immigrant status (Schnepf (2007); Dustmann et al. (2012); Ochinata and Van Ours (2012); Kunz (2016)). The educational performance originates from the endogenous interaction of many factors, such as the family, school, educational policy, as well as parents' and children's desire to succeed (Albornoz, Cabrales, and Hauk (2018); Albornoz, Berlinski, and Cabrales (2018)). In some cases, immigrant children can even *outperform* the natives. This phenomenon is known in the literature as the *immigrant paradox*[6] (Chiswick and DebBurman (2004); Wilson, Burgess, and Briggs (2011); Coll and Marks (2012); Pong and Lan-

[5] In other words, since children at 10 are still within the critical period for language acquisition, age does not produce any obstacle to the learning process, and only captures the benefit of a longer exposition to the destination country. It is still controversial what should be the critical age for language acquisition; however, there is enough consensus on the period just before puberty, around the age of 12 (Bleakley and Chin (2010); Van Den Berg et al. (2014)).

[6] This is the case of immigrant children in Canada and Australia and, in particular, of Asian children in the US and Indian children in the UK.

dale (2012); Burgess (2014); Burgess and Heller-Sahlgren (2018)). As a consequence, no general conclusions are possible, and the literature is still in the making.

In order to overcome the econometric difficulties we have outlined, many authors rely on instrumental variables. For instance, in an influential paper, Bleakley and Chin (2004) measure the causal effect of immigrants' language skills on earnings through an IV given by the interaction between age at arrival and a dummy for non-English speaking countries. Fenoll (2018) and Isphording, Piopiunik, and Rodriguez-Planas (2016) measure the causal effect of immigrants' language skills on Math results. The former uses the same IV as Bleakley and Chin (2004), and the latter modify Bleakley and Chin by using the interaction between a continuous measure of linguistic distance and age at arrival as their IV.

We use the interaction between the linguistic distance from Italian and age as our instrumental variable for proficiency in Italian, which is closely related to Bleakley and Chin (2004) and Isphording, Piopiunik, and Rodriguez-Planas (2016). The age captures the length of exposure to the language and linguistic distance the difficulty of adaptation with respect to the language spoken at home. The interaction of these two variables gives the difference in the exposure to the destination language across the different linguistic distances. While the linguistic distance can be endogenous because of destination country choice, and age can be endogenous because of family planning, the exposure to the destination language across the different linguistic distances is in all likelihood uncorrelated with unobservable Math determinants like ability or motivation.

Our results show a *negative* effect of proficiency in Italian on the performance in Math. Thus, it seems like children have to trade knowledge of Italian against knowledge of Math.

In order to shed light on this puzzle, we conjecture that there may exist a threshold beyond which further progress in Italian is irrelevant for understanding Math class. In order to test for this effect, we consider a threshold equal to the score for attaining Proficiency Level 3, which the Italian National Institute for the Evaluation of the Education System (henceforth INVALSI) considers as a ”sufficient” command of Italian [7] and split our sample between students below and above this threshold. The estimates on the subsamples clarify that the negative effect is led by children below the threshold. For the other children, our instrument is weak: once a sufficient command of Italian is achieved, further exposure to the language does not increase the score. Our conclusion is that immigrants with poor linguistic performance are still struggling to catch-up with language at the age of 10, and they are able to do so only at the cost of reducing their performance in other subjects. This outcome looks particularly worrying since ten years should be enough to acquire proficiency. In the absence of appropriate education policies, the future integration of these children already looks at risk at the age of 10.[8]

In general, our findings suggest that destination countries should promote linguistic integration in the very first years of education. Moreover, investing in the linguistic integration of first generations should be a priority since its benefits spillover to the second generations.

[7] This refers to the widely adopted scale that evaluates proficiency on a range from Level 1 (lowest) to 5 (highest). Level 3 is defined by scores in the range of (95%; 110%] of the natives’ average. According to the National Educational Criteria (*Indicazioni Nazionali e Linee Guida* stated in the *D.M. n. 254 del 16/11/2012*) and the INVALSI framework, (INVALSI (2018)) this level defines a sufficient command of Italian.

[8] These children account for 65.70% of the second generations in the school year 2014-15, 51.23% in the school year 2015-16, 66.13% in the school year 2016-17, and 54.27% in the school year 2017-18.

The rest of the paper is organized as follows. Section 2 reviews some related literature. Section 3 describes our data. Section 4 introduces the empirical strategy. Section 5 discusses the results, and Section 6 concludes.

2 Related Literature

This analysis bridges two groups of literature. The first studies the relationship between the acquisition of language proficiency and the development of further skills (Barwell (2005a); Barwell (2005b); Dustmann and Glitz (2011); Akresh and Akresh (2011); Isphording, Piopiunik, and Rodriguez-Planas (2016)). The second concerns the economics of language and migration (Chiswick and Miller (2007), Chiswick and Miller (2015)).Our contribution is also broadly related to the research about skill formation and early childhood interventions (Heckman (2006), Heckman and Cunha (2007), Heckman and Masterov (2007), Almond and Currie (2011) Fryer and Levitt (2013), Almond, Currie, and Duque (2018)).

Chiswick and Miller (2001) and Chiswick and Miller (2015) argue that language is perhaps the most important form of human capital for the immigrants. Therefore, its acquisition and degree of proficiency are, to some extent, the result of an investment decision. According to Chiswick and Miller, the economics of language proficiency is governed by factors that include the exposure to the destination country language, the efficiency of the investment, and the economic incentives. The latter include, for instance, higher wages, lower probability of unemployment, and increased participation in the social, cultural and political environment of the receiving society.

Language proficiency is essential not only on its own but also as a factor that helps the acquisition of other skills[9](Chiswick and Miller (2003); Berman, Lang, and Siniver (2003)). We try to identify similar mechanisms; however, unlike Chiswick and Miller, who focus on first-generation adults in the labor market, we focus on second-generation children who are exposed to the destination country since their birth and are young enough to conserve a high psycho-biological elasticity in acquiring languages.

As we argued in the previous section, this also differentiates our analysis with respect to Bleakley and Chin (2004), Isphording, Piopiunik, and Rodriguez-Planas (2016), and Fenoll (2018). The first consider first-generation adults aged 25-38; the second consider first-generation students aged 15; the third considers a mix of first and second-generation children aged 6-12.

Focusing on 10-year-old children allows us to examine an age where possible policy interventions are likely to be most effective. This is even more important since the lack of language proficiency inherited by the second generations can have permanent effects unless the school does not neutralize it.[10] Thus, analyzing the outcomes of fifth-grade students is important not only because their age is critical for human capital formation but also because it provides a broad assessment of the Italian primary school in integrating the second generations.

3 Data

We use data on the performance in Italian and Math on the standardized test administered by INVALSI. The whole population of stu-

[9] In the case of the first generation , it is also crucial to transfer initial human capital in the destination country (Chiswick and Miller (2009); Dustmann and Glitz (2011)).

[10] Many authors show that early childhood can be decisive for the long-term performance of individuals (Almond, Currie, and Duque (2018)). This occurs because disadvantages accumulate over time due to mechanisms like the dynamic complementarity and the self-productivity outlined by Cunha and Heckman (2007).

dents in the 2nd (7-year-old) and 5th (10-year-old) grade of the Primary School is evaluated every year.[11] We focus on second-generation children in the 5th grade, which is the last Primary School grade.[12] The INVALSI tests are standardized, anonymous, and marked outside the schools; thus, the measure of performance is as objective as possible. Moreover, since some authors have detected cheating behavior (Quintano, Castellano, and Longobardi (2009); Bertoni, Brunello, and Rocco (2013); Angrist, Battistin, and Vuri (2017)), scores are corrected for this possibility.[13]

The "Student's Questionnaire," which is administered to 5th-grade students, includes detailed information on family characteristics and home environment.[14] This material is summarized in a synthetic index of economic, social, and cultural status (ESCS index[15]). Additional useful information comes from questions about the student herself, her family, and her attitude towards the classes and the test. In particular, pupils are asked whether they speak Italian or other languages at home.[16] We consider a repeated cross-section of students for the school years 2014-15, 2015-16, 2016-17, and 2017-18. We start with 2014 because the question that identifies the linguistic origin of pupils was introduced then. The subsample of second gener-

[11] Evaluations began in 2005-06. However, mandatory participation of the schools to the test started in 2009-2010.

[12] We define "second generations" as children born in Italy with both non-Italian parents. Equivalently, we define "natives" as children born in Italy with both Italian parents.

[13] Cheating is a broad concept that denotes any attempt to alter the results both by students and teachers (Jacob and Levitt (2003)).

[14] For instance, the availability of a computer, an internet connection, a quiet room, a desk, encyclopediae, and the number of books.

[15] This indicator considers parents' occupation, education, as well as educational resources available at home. See Campodifiori et al. (2010).

[16] Namely, Albanian, Arabic, Chinese, Croatian, French, Greek, Hindi, English, Ladin, Portuguese, Romanian, Slovenian, Spanish, German, or a language not included in the previous list.

ations includes 99,952 pupils.[17] The linguistic distance from Italian is a continuous variable computed through the Automated Similarity Judgment Program (ASJP) database, which is commonly used in linguistic analyses.[18]

A major advantage of our analysis is that the linguistic distance refers to the language *actually* spoken. Though most authors (like Isphording, Piopiunik, and Rodriguez-Planas (2016) and Bleakley and Chin (2004)) try to infer this language from information on the country of origin, associating a country to a single language is not always possible since different languages may be spoken. This is the case of many North-African countries that are a major source of emigration to Italy.[19]

The main variables are summarized in Table 1. The dependent variable of our regressions is the score in Math. The mathematical section of the test is made of various subsections that include numerical questions, geometry, mappings, data, and forecasting. The test of Italian focuses on text comprehension and on the grammatical and lexical structure of the sentence. This test of language proficiency is much

[17] This number excludes second-generation children who speak languages not included in the list. In order to avoid errors in data, it also excludes all children who are at least two years younger or older than 10. In Italy, it is not possible to start school before 5, and all children must finish primary school by the age of 12. Classes with INVALSI observers have also been excluded because external observers may affect the chilren's behavior.

[18] See Wichmann, Holman, and Brown (eds.), 2018. The ASJP Database (version 18). This measure of linguistic distance is built by comparing the inner structure of 40 words in all the world's languages and gives a continuous measure that ranges from a minimum distance of 58.77 (Romanian-Italian) to a maximum distance of 101.14 (Chinese-Italian). It compares the phonetic similarity between pairs of words in two languages that have the same meaning. This should capture the existence of common ancestries that can affect the ease of learning Italian (Isphording and Otten (2013)).

[19] For instance, immigrants from Morocco can speak Arabic, French, or Spanish; immigrants from Egypt speak Arabic, French or English; immigrants from Tunisia speak Arabic or French, and immigrants from India speak Hindi or English. Immigrant stocks from these countries are sizable in Italy: on December 31, 2018, we observe 422,980 immigrants from Morocco, 126,733 from Egypt, 95,071 from Tunisia, and 157,965 from India. Source: ISTAT (2018)

Table 1. Descriptive Statistics

Variable	**Natives**	**Second Generations**	**Diff.**
Female	0.4948	0.4965	-0.0016
	(0.0005)	(0.0017)	(0.0018)
Age in Months	129.3924	130.2242	-0.8318***
	(0.0083)	(0.0308)	(0.0319)
Math Score	57.2472	50.097	7.1501***
	(0.0554)	(0.2048)	(0.2123)
Italian Score	62.809	54.232	8.5775***
	(0.0498)	(0.1840)	(0.1919)
ESCS student	0.135	-0.490	0.6257***
	(0.0035)	(0.0130)	(0.0134)
Mother's Higher Education	0.200	0.116	0.0843***
	(0.0011)	(0.0040)	(0.0041)
Father's Higher Education	0.154	0.095	0.0592***
	(0.0010)	(0.0036)	(0.0037)
Mother Unemployed	0.314	0.518	-0.2042***
	(0.0016)	(0.0058)	(0.0060)
Mother Blu-collar worker	0.106	0.221	-0.1150***
	(0.0006)	(0.0024)	(0.0024)
Mother Self-employed	0.084	0.057	0.0269***
	(0.0004)	(0.0015)	(0.0016)
Mother White-collar worker	0.374	0.056	0.3172***
	(0.0015)	(0.0056)	(0.0059)
Father Unemployed	0.042	0.090	-0.0479***
	(0.0005)	(0.0017)	(0.0017)
Father Blu-collar worker	0.235	0.499	-0.2642***
	(0.0011)	(0.0041)	(0.0042)
Father Self-employed	0.226	0.174	0.0519***
	(0.0008)	(0.0030)	(0.0031)
Father White-collar worker	0.359	0.069	0.2900***
	(0.0014)	(0.0051)	(0.0053)
Obs	1,304,886	99,952	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Standard Errors in parenthesis clustered at the school-cohort level.

more reliable than self-reported assessments.
In the data, the natives perform better than second generations, both in Math and in Italian. However, second generations also face worse socioeconomic conditions, so this result is expected. Their parents are generally less educated, more unemployed, or employed in low-wage jobs.

4 Empirical Strategy

In this work, we try to assess the importance of linguistic skills for the acquisition of Math skills. Before proceeding, it is necessary to clarify why linguistic skills should be important for understanding Math. After all, it is generally acknowledged that Math is a symbolic language of its own. However, it is also widely accepted that it depends to a large extent on oral language and cannot be viewed as a non-verbal subject (Cuevas (1984); Lager (2006); Vukovic and Lesaux (2013); Naziev (2018); Wilkinson (2019)).
In other words, language skills are the vehicles through which students learn and apply math and are used in testing Math skills.[20] The ability to participate in classroom interactions, ask questions, and express doubts is crucial in order to benefit from the Math classes. All these reasons clarify why language proficiency is a prerequisite to learn Math.[21]
As a first approach to evaluate the relationship between the performance in Math and the performance in Italian, one may use a standard regression:

$$ScoreMath_{ijt} = \beta_0 + \beta_1 ScoreItalian_{ijt} + \beta_2 Dist_{ijt} + \beta_3 Age_{ijt} + \mathbf{X}\lambda + \vartheta_j + \vartheta_t + \epsilon_{ijt}, \tag{1}$$

[20] Notice that special Math textbooks exist for children who do not speak the mother tongue. For Italy, see Arici and Maniotti (2010).
[21] See section 2 for the economics of language literature.

where *ScoreMath* is the score in Math of student i in class j, *Score-Italian* is the score in Italian, *Dist* is the linguistic distance between the language spoken at home and Italian, *Age* is the student's age in months, $\mathbf{X}$ is a vector of socioeconomic controls, ϑ_j are class fixed effects, and ϑ_t are wave fixed effects. However, this specification suffers from an omitted variable bias because students' motivation and ability are not observable but are crucial for their educational results. To identify the causal effect of linguistic proficiency in Math, the model requires an IV for the score in Italian. Usually, the literature about the effects of language proficiency adopts instruments given by the interaction between the immigrants' age at arrival and the linguistic distance or a dummy for non-English speaking countries (see Bleakley and Chin (2004); Isphording, Piopiunik, and Rodriguez-Planas (2016); and Fenoll (2018)). Since, unlike these authors, we focus on second generations, it is not possible to use these authors' instruments for our purposes. Our individuals are born in Italy; thus we cannot use variation in age at arrival.

However, differences in age are still a good proxy of exposure to Italian. Actually, as suggested by the vast literature on age effects, being born only a few months before her peers gives a child considerable advantages because "older" children have had more time for learning and benefit from their higher psycho-biological maturity (Black, Devereux, and Salvanes (2011); Crawford, Dearden, and Greaves (2014); Dee and Sievertsen (2018); Duckworth and Peña (2018)). In our case, an "older" age gives the children more time to learn Italian.[22] As a consequence, we use the interaction between age and linguistic distance from Italian as our instrumental variable.

[22] In principle, since the ability in the acquisition of language is inversely related to age, there could be a confounding effect that goes in the opposite direction. This critique does not apply to our case because our sample is made of children within the critical period for language acquisition. This ensures a precise direction of the effect of age on language performance.

Notice that we do not use either linguistic distance or age as an instrument because both could be endogenous.
In the case of age, there are many potential causes of endogeneity. First, parents may plan the birth of their children (Buckles and Hungerman (2013)). Second, parents may choose to anticipate or postpone school entrance (West, Meek, and Hurst (2000); Aliprantis (2012); Lenard and Peña (2018)). This is particularly relevant for Italy, where parents, in many cases, can decide to anticipate the enrollment of their children in Primary School.[23] Finally, age could also capture grade retention even though retention is very rare in the Italian Primary School. As a consequence, age does not fit as an instrumental variable. Similarly, linguistic distance may be endogenous because different linguistic origins may induce a different selection in the migration decision. This kind of selection can depend on unobservable characteristics that could be transmitted to the children. If these characteristics affect scores, they could induce endogeneity as well.
On the other hand, the interaction of age and linguistic distance captures the exposition to Italian *across different languages* and can be used as our instrument. In other words, given the heterogeneity in birthdays and origin countries, we can isolate the effect on the score in Italian given by differences in the exposure across different linguistic distances.
Problems of endogeneity could arise, for instance, if exposure to Italian were determined by the *natives*, who could discriminate against second-generations in social interactions. If the natives discriminate against the second generations, the mechanism of the exposition

[23] Anticipation is very common in Italy, where, though enrollment is compulsory for all children who are 6 in September, parents can enroll younger children provided that they turn 6 by April 30 of the following year. Since exercising or not this option is a choice, this creates an important source of endogeneity.

could fail. However, discrimination is *not* based on *language*. Rather, it applies to ethnicity, gender, race, and so on. Discrimination on the *sole* basis of language is very unlikely. Yet, this could still be a concern if language were perfectly correlated with ethnicity. This is not the case for our sample, where an individual speaking French could be either African or European; an individual speaking English could be European, African, Indian, and so on. As a consequence, in the absence of perfect correlation between languages and ethnicity, this concern does not apply.

Family self-segregation could be another source of endogeneity: parents could decide to reduce the exposure to the Italian culture in order to preserve their traditional norms and customs. However, the choice of separation from the receiving society may happen at *any* level of linguistic distance. To the extent that there is no perfect correlation between the level of linguistic distance and family self-segregation, this concern does not apply either. Thus, we conclude that the interaction between age and linguistic distance is likely to be exogenous.

As a supplement to our analysis, we also use an alternative instrument inspired by Bleakley and Chin (2004). This instrument is given by the interaction between age and a dummy coded 1 if the child does *not* speak Italian at home. This interaction captures the exposition to Italian as if all languages had the same distance from Italian. As a consequence, it is a much rougher instrument with respect to the one we have chosen. Nonetheless, we think it is a useful check.

In what follows, we estimate a two-stage least squares model, where the first stage is given by

$$ScoreItalian_{ijt} = \alpha_0 + \alpha_1 Age_{ijt} * Dist_{ijt} + \alpha_2 Dist_{ijt} + \alpha_3 Age_{ijt} + \mathbf{X}\lambda + \vartheta_j + \vartheta_t + \eta_{ijt}, \tag{2}$$

and the second stage is given by

$$ScoreMath_{ijt} = \gamma_0+\gamma_1 Score\hat{I}talian_{ijt}+\gamma_2 Dist_{ijt}+\gamma_3 Age_{ijt}+\mathbf{X}\lambda+\vartheta_j+\vartheta_t+\xi_{ijt}. \tag{3}$$

The results of our regressions are reported in the following Section.

5 Results

In Table 2, we report the OLS estimation of Equation 1 on the whole sample of second-generation students. OLS regressions find a sizable positive relationship between the score in Italian and the score in Math. Actually, increasing the score in Italian by one point, the score in Math increases by 0.6 points. However, this relationship can hardly capture a causal effect.

In Tables 3 and 4, we report the 2SLS estimation of equations 2 and 3. Specification (1) uses our main instrument, and specification (2) the instrument *à la* Bleakey and Chin. In the next sections, we present the first and the second stage, respectively .

5.1 First stage

Our main instrument -the exposure to the destination country's language across the different linguistic origins- is the interaction between age (measured in months) and the linguistic distance from Italian, which are both continuous variables. As a consequence, the coefficient on their interaction measures how the effect of the exposure to Italian on the score in Italian changes as the linguistic distance changes.[24] A higher linguistic distance makes exposure less effective; thus the negative sign we find is expected.[25]

[24] This coefficient can also be interpreted as how the effect of the linguistic distance on the score in Italian changes when the exposure to Italian changes.

[25] Similarly, the effect of linguistic distance decreases as the exposure to Italian increases.

The coefficient of age is positive and significant at the 1% level. Notice that since in the first-stage regression we have the interaction age*distance, this coefficient does *not* represent the main effect of age but gives the absolute age effect *when the linguistic distance is zero*.[26] This only holds for second-generation children who speak Italian at home. For non-Italian speakers, the effect of age is given by $\alpha_1 + \alpha_3 * (Distance)$. For instance, in the case of the Chinese, who are the most linguistically distant, it is -0.125 score points. In other words, *the effect* of age (namely, exposure) decreases as the linguistic distance increases.

The coefficient of the linguistic distance is also positive and significant at the 1% level. Again, since we have the interaction age*distance, by itself, it only gives the effect of the linguistic distance *when age is zero*. When we consider this effect conditioned on a more plausible age, it becomes negative as expected. For instance, at the age of 123 months (10.25 years), it is -0.051. At the age of 132 months (11 years), it is -0.078 score points. Thus, *the effect* of the linguistic distance decreases as the exposure increases.

Finally, the F-statistic of the instrument is above the Stock and Yogo threshold; thus it is considered relevant.

We obtain analogous results with the instrument *à la* Bleakey and Chin.

5.2 Second stage

Turning to the second stage, we note that the coefficient of the instrumented score in Italian is negative and significant at the 1% level. Increasing the score in Italian by one point *decreases* by 0.55 points the score in Math. At first sight, this result looks unexpected since it seems to contradict the idea that language proficiency is a pre-

[26] See Jaccard and Turrisi (2003) for a useful review.

requisite for understanding Math classes taught in Italian. However, at a closer look, the negative coefficient simply suggests that the children still have to sacrifice their performances in other subjects if they want to improve their proficiency in Italian.

We should also remark on the large difference between the OLS and IV estimates. In other words, the OLS estimator looks heavily biased. This is not surprising since the naïve relationship between the score in Italian and the score in Mathematics is driven by omitted variables such as ability and motivation. These omitted variables should generate an *upward* bias in the OLS coefficient, which we actually find. Previous literature, such as Isphording, Piopiunik, and Rodriguez-Planas (2016), and Fenoll (2018), also identifies an upward bias, though less considerable. In our case, the ability bias seems to be higher in absolute value than the negative value of the instrumented coefficient, which is the reason why the OLS coefficient is positive. This outcome is in line with the literature and confirms the crucial importance of unobserved cognitive and non-cognitive abilities for educational and economic performances (Heckman, Stixrud, and Urzua (2006); Borghans et al. (2016); Hitt, Trivitt, and Cheng (2016); Peña and Duckworth (2018); Zamarro, Hitt, and Mendez (2019)).

We try to shed further light on the trade-off we have uncovered. Our idea is that the causal relationship between proficiency in Italian and scores in Math may be nonlinear. In other words, the proficiency necessary to understand a Math class is well below the proficiency necessary to understand Dante's Divine Comedy. Once the threshold for understanding a Math class is attained, further progress in Italian could be irrelevant for the Math performance. Therefore, we expect that the negative effect of the performance in Italian on the performance in Math could be particularly relevant for children who under-perform in Italian. In order to test this idea, we first have to identify a proper threshold. Since the INVALSI approves Proficiency Level 3 as a ”sufficient” knowledge of Italian, we compute the threshold accordingly,[27] and then we split our sample between children below the threshold and children on or above the threshold.

5.3 Second Generations under Proficiency Level 3

In table 5, we report the first-stage estimation for second-generation children whose performance in Italian is under Proficiency Level 3. Again, we may note that the effect of exposure to Italian decreases as the linguistic distance increases, and the effect of the linguistic distance decreases as the exposure increases.

The F-statistic of the instrument is above the Stock and Yogo threshold; thus, it is considered relevant. In table 6, we report the second-stage estimation. The effect of the Italian score on the Math score is negative and statistically significant at the 1% level. Increasing the score in Italian by one unit, decreases the score in Math by 1.37 or 1.46 points, depending on the specification. This suggests that the negative effect we uncover is driven by the subsample of children under Proficiency Level 3.

The same estimation strategy for second-generation children who perform beyond the sufficiency threshold does not work as well. In tables 7 and 8, we report two-stage least squares estimations for this subsample. Both instruments are weak, suggesting that exposure to Italian *per se* does not explain the performance in Italian beyond sufficiency. As a consequence, we cannot use our instruments to estimate the causal effect of the Italian score on the Math score for students on or above Proficiency Level 3.

[27] Proficiency Level 3 is defined as a score belonging to a range that goes from 95% to 110% of the natives' average score. Thus, we take the lower bound, namely 95%, as our threshold.

6 Conclusions

In this study, we estimated the effect of language acquisition on the performance in Math of second-generation children at the end of Italian primary school. This age deserves special attention because a vast literature suggests that 1) early educational gaps may have lifetime effects and, in any case, are hard to recover in later years; 2) language proficiency is required to acquire other forms of human capital; 3) language proficiency is crucial for the social and economic integration of the second generations.

The existing literature is still in the making, and the results are somewhat contrasting. While Isphording, Piopiunik, and Rodriguez-Planas (2016) find a positive effect of linguistic performances on Math outcomes, Fenoll (2018) finds no evidence of such an effect.

Using Italian data on second-generation children, we found that a higher test score in Italian *reduces* the score in Math.

This result reveals that second generations are still struggling to learn Italian at the age of 10, and they can do so only at the cost of reducing their performance in other subjects. Actually, the effect is driven by children with insufficient knowledge of Italian who account for 59% of our sample. Thus, it seems that the large majority of the second generation is already being left behind. These children cannot benefit from the complementarity between language proficiency and other forms of human capital as other children do. They look doomed to poor future educational performances and, therefore, to poor labor market outcomes. This penalization evokes scaring long-term scenarios.

Overall, our findings have profound policy implications. First, they suggest that primary education should consider linguistic integration as a priority, and avoid leaving behind children with poor linguistic backgrounds.[28] Second, they stress that investing in the linguistic integration of the first generation can generate positive spillovers on the second generation. Overall, we confirm that efforts to linguistically integrate immigrants should be of the greatest importance because these efforts yield high social returns not only in the short run (by improving the economic possibilities of newcomers) but also in the very long run (by intergenerational spillovers). Unlike policies that take place later in life, achieving linguistic integration in the Primary School is simpler and has permanent effects.

[28] The awareness of this issue is increasing in Italy: since 2012, the Ministry of Education has introduced the possibility of adopting customized study plans *(piani di studio personalizzati)* for children with limited proficiency in Italian. These plans may be adopted by the schools after a linguistic assessment of the child. They replace the most linguistically demanding subjects with easier ones, or simply reduce the educational objectives the student has to meet to pass her grade. There also exist some Math textbooks for children with limited command of Italian. However, these measures are not yet a systematic approach to the linguistic integration of the minorities.

References

Akresh, Richard and Ilana R. Akresh (2011). "Using Achievement Tests to Measure Language Assimilation and Language Bias among the Children of Immigrants". *Journal of Human Resources* 46.3, pp. 647–667.

Albornoz, Facundo, Samuel Berlinski, and Antonio Cabrales (2018). "Motivation, resources, and the organization of the school system". *Journal of the European Economic Association* 16.1, pp. 199–231.

Albornoz, Facundo, Antonio Cabrales, and Esther Hauk (2018). "Immigration and the school system". *Economic Theory* 65.4, pp. 855–890.

Algan, Yann et al. (2012). "Cultural integration of immigrants in Europe". *Oxford. Oxford University Press*, pp. 1–360.

Aliprantis, Dionissi (2012). "Redshirting, Compulsory Schooling Laws, and Educational Attainment". *Journal of Educational and Behavioral Statistics* 37.2, pp. 316–338.

Almond, Douglas and Janet Currie (2011). "Human capital development before age five". *Handbook of Labor Economics* 4.B, pp. 1315–1486.

Almond, Douglas, Janet Currie, and Valentina Duque (2018). "Childhood Circumstances and Adult Outcomes: Act II". *Journal of Economic Literature* 56.4, pp. 1360–1446.

Angrist, Joshua D., Erich Battistin, and Daniela Vuri (2017). "In a Small Moment: Class Size and Moral Hazard in the Italian Mezzogiorno". *American Economic Journal: Applied Economics* 9.4, pp. 216–49.

Arici, Maria and Paola Maniotti (2010). "Studiare matematica e scienze in italiano L2. Unità di apprendimento per alunni stranieri della scuola primaria". *Erickson.*

Azzolini, Davide, Philipp Schnell, and John RB Palmer (2012). "Educational Achievement Gaps between Immigrant and Native Students in Two "New Immigration Countries": Italy and Spain in comparison". *The Annals of the American Academy of Political and Social Science* 643.1, pp. 46–77.

Barwell, Richard (2005a). "Working on arithmetic word problems when English is an additional language". *British Educational Research Journal* 31.3, pp. 329–348.

— (2005b). "Language in the Mathematics Classroom". *Language and Education* 19.2, pp. 96–101.

Berman, Eli, Kevin Lang, and Erez Siniver (2003). "Language-skill complementarity: returns to immigrant language acquisition". *Labour Economics* 10.3, pp. 265–290.

Bertoni, Marco, Giorgio Brunello, and Lorenzo Rocco (2013). "When the cat is near, the mice won't play: The effect of external examiners in Italian schools". *Journal of Public Economics* 104.C, pp. 65–77.

Black, Sandra, Paul Devereux, and Kjell G. Salvanes (2011). "Too Young to Leave the Nest? The Effects of School Starting Age". *The Review of Economics and Statistics* 93.2, pp. 455–467.

Bleakley, Hoyt and Aimee Chin (2004). "Language Skills and Earnings: Evidence from Childhood Immigrants". *The Review of Economics and Statistics* 86.2, pp. 481–496.

— (2010). "Age at Arrival, English Proficiency, and Social Assimilation Among U.S. Immigrants". *American Economic Journal: Applied Economics* 2.1, pp. 165–192.

Borghans, Lex et al. (2016). "What grades and achievement tests measure". *Proceedings of the National Academy of Sciences* 113.47, pp. 13354–13359.

Buckles, Kasey S. and Daniel M. Hungerman (2013). "Season of Birth and Later Outcomes: Old Questions, New Answers". *Review of Economics and Statistics* 95.3, pp. 711–724.

Burgess, Simon (2014). "Understanding the success of London's schools". *CMPO WP* 14.333.

Burgess, Simon and Gabriel Heller-Sahlgren (2018). "Motivated to Succeed? Attitudes to Education Among Native and Immigrant Pupils in England". *IZA Discussion Paper* 11678.

Campodifiori, Emiliano et al. (2010). "Un indicatore di status socio-economico-culturale degli allievi della quinta primaria in Italia". *INVALSI WP* 02.

Carneiro, Pedro, James J. Heckman, and Dimitriy Masterov (2005). "Labor Market Discrimination and Racial Differences in Premarket Factors". *Journal of Law and Economics* 48.1, pp. 1–39.

Chiswick, Barry R. and Noyna DebBurman (2004). "Educational attainment: Analysis by immigrant generation." *Economics of Education Review* 23.4, pp. 361–379.

Chiswick, Barry R. and Paul W. Miller (2001). "A model of destination-language acquisition: Application to male immigrants in Canada". *Demography* 38.3, pp. 391–409.

— (2003). "The complementarity of language and other human capital: immigrant earnings in Canada". *Economics of Education Review* 22.5, pp. 469–480.

— (2007). "The Economics of Language. International Analysis." *Routledge Studies in the Modern World Economy*, pp. 1–595.

— (2009). "The international transferability of immigrants' human capital". *Economics of Education Review* 28.2, pp. 162–169.

— (2010). "Occupational language requirements and the value of English in the US labor market". *Journal of Population Economics* 23.1, pp. 353–372.

— (2015). “International Migration and the Economics of Language”. *Handbook of the Economics of International Migration* 1.5, pp. 211–269.

Coll, Cynthia García and Amy Kerivan Marks (2012). “The Immigrant Paradox in Children and Adolescents: Is Becoming American a Developmental Risk?” *American Psychological Association.*

Constant, Amelie, Liliya Gataullina, and Klaus Zimmermann (2009). “Ethnosizing Immigrants”. *Journal of Economic Behavior & Organization* 69.3, pp. 274–287.

Constant, Amelie F. and Klaus F. Zimmermann (2008). “Measuring Ethnic Identity and Its Impact on Economic Behavior”. *Journal of the European Economic Association* 6.2-3, pp. 424–433.

Crawford, Claire, Lorraine Dearden, and Ellen Greaves (2014). “The drivers of month-of-birth differences in children’s cognitive and non-cognitive skills”. *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 177.4, pp. 829–860.

Cuevas, Gilberto J (1984). “Mathematics Learning in English as a Second Language”. *Journal for Research in Mathematics Education* 15.2, pp. 134–144.

Cunha, Flavio and James J. Heckman (2007). “The Technology of Skill Formation”. *American Economic Review* 97.2, pp. 31–47.

Dee, Thomas S. and Hans H. Sievertsen (2018). “The gift of time? School starting age and mental health”. *Health Economics* 27.5, pp. 781–802.

Duckworth, Angela L and Pablo A Peña (2018). “The effects of relative and absolute age in the measurement of grit from 9th to 12th grade”. *Economics of Education Review* 66, pp. 183 –190.

Dustmann, Christian and Francesca Fabbri (2003). “Language proficiency and labour market performance of immigrants in the UK”. *The Economic Journal* 113.July, pp. 695–717.

Dustmann, Christian and Albrecht Glitz (2011). “Migration and Education”. *Handbook of the Economics of Education, Edited by Hanushek E. A., Machin S., Woessmann L.* 4.4, pp. 327–439.

Dustmann, Christian et al. (2012). “Educational achievement of second-generation immigrants: an international comparison”. *Economic Policy* 27.69, pp. 145–185.

Fenoll, Ainhoa Aparicio (2018). “English proficiency and mathematics test scores of immigrant children in the US”. *Economics of Education Review* 64, pp. 102–113.

Fryer, Roland G. Jr and Steven D. Levitt (2013). “Testing for Racial Differences in the Mental Ability of Young Children”. *American Economic Review* 103.2, pp. 981–1005.

Gorinas, Cédric (2014). “Ethnic identity, majority norms, and the native–immigrant employment gap”. *Journal of Population Economics* 27.1, pp. 225–250.

Heckman, James J. (2006). “Skill formation and the economics of investing in disadvantaged children”. *Science* 312.5782, pp. 1900–1902.

Heckman, James J. and Flavio Cunha (2007). “The technology of skill formation”. *American Economic Review* 97.2, pp. 31–47.

Heckman, James J. and Dimitriy V. Masterov (2007). “The productivity argument for investing in young children”. *Applied Economic Perspectives and Policy* 29.3, pp. 446–493.

Heckman, James J, Jora Stixrud, and Sergio Urzua (2006). “The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior”. *Journal of Labor Economics* 24.3, pp. 411–482.

Hitt, Collin, Julie Trivitt, and Albert Cheng (2016). “When you say nothing at all: The predictive power of student effort on surveys”. *Economics of Education Review* 52, pp. 105 –119.

INVALSI (2018). "Quadro di Riferimento delle Prove INVALSI di Italiano del 30.08.2018". *INVALSI documentation*.

Isphording, Ingo and Sebastian Otten (2013). "The Costs of Babylon—Linguistic Distance in Applied Economics". *Review of International Economics* 21.2, pp. 354–369.

Isphording, Ingo E., Marc Piopiunik, and Nuria Rodriguez-Planas (2016). "Speaking in Numbers: The Effect of Reading Performance on Math Performance among Immigrants". *Economics Letters* 139, pp. 52–56.

ISTAT (2018). "Bilancio Demografico Nazionale". *Statistiche. Report* July 3rd, 2019.

Jaccard, James and Robert Turrisi (2003). "Interaction Effects in Multiple Regression, ($2^{nd}ed$)". *Sage University Papers Series on Quantitative Applications in the Social Sciences* Second Edition.07-072.

Jacob, Brian A and Steven D. Levitt (2003). "Rotten apples: an investigation of the prevalence and predictors of teacher cheating". *Quarterly Journal of Economics* 118.3, pp. 843–877.

Kunz, Johannes S. (2016). "Analyzing Educational Achievement Differences between Second-Generation Immigrants: Comparing Germany and German-Speaking Switzerland". *German Economic Review* 17.1, pp. 61–91.

Lager, Carl A (2006). "Types of Mathematics-Language Reading Interactions that Unnecessarily Hinder Algebra Learning and Assessment". *Reading Psychology* 27.2-3, pp. 165–204.

Lenard, Matthew A. and Pablo A. Peña (2018). "Maturity and minorities: the impact of redshirting on achievement gaps". *Education Economics* 26.6, pp. 593–609.

Lenneberg, Eric H. (1967). "Biological foundations of language". *New York: Wiley*.

MIUR (2019). “Gli alunni con cittadinanza non italiana A.S. 2017/2018”. *MIUR - Ufficio Statistica e studi.*

Naziev, Aslanbek (2018). “The Role of Language in Teaching and Learning Mathematics”. *BRAIN – Broad Research in Artificial Intelligence and Neuroscience* 9.1, pp. 114–124.

Neal, Derek Pedro and William Johnson (1996). “The Role of Pre-Market Factors in Black-White Wage Differences”. *Journal of Political Economy* 104.5, pp. 869–895.

Newport, Elissa L. (2002). “Critical Periods in Language Development”. *The Encyclopedia of Cognitive Science, In Lynn Nadel (ed.)* Pp. 737–740.

Ochinata, Asako and Jan C. Van Ours (2012). “Young immigrant children and their educational attainment”. *Economics Letters* 116.3, pp. 288–290.

Peña, Pablo A. and Angela Duckworth (2018). “The effects of relative and absolute age in the measurement of grit from 9th to 12th grade”. *Economics of Education Review* 66, pp. 183–190.

Pong, Suet-ling and Nancy S. Landale (2012). “Academic achievement of legal immigrants’ children: the roles of parents’ pre- and postmigration characteristics in origin-group differences.” *Child Development* 83.5, pp. 1543–1559.

Quintano, Claudio, Rosalia Castellano, and Sergio Longobardi (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”. *Statistica & Applicazioni. Milano : Vita e Pensiero* VII.2, pp. 149–171.

Schnepf, Sylke (2007). “Immigrants’ educational disadvantage: an examination across ten countries and three surveys”. *Journal of Population Economics* 20.3, pp. 527–545.

Snow, Catherine E. and Marian Hoefnagel-Höhle (1978). "The Critical Period for Language Acquisition: Evidence from Second Language Learning". *Child Development* 49.4, pp. 1114–1128.

Van Den Berg, Gerard J. et al. (2014). "Critical periods during childhood and adolescence". *Journal of the European Economic Association* 12.6, pp. 1521–1557.

Vukovic, Rose K and Nonie K Lesaux (2013). "The relationship between linguistic skills and arithmetic knowledge". *Learning and Individual Differences* 23, pp. 87–91.

West, Jerry, Anne Meek, and David Hurst (2000). "Children Who Enter Kindergarten Late or Repeat Kindergarten: Their Characteristics and Later School Performance". *Education Statistics Quarterly* 2, pp. 21–24.

Wilkinson, Louise C (2019). "Learning language and mathematics:A perspective from Linguistics and Education". *Linguistics and Education* 49, pp. 86–95.

Wilson, Deborah, Simon Burgess, and Adam Briggs (2011). "The dynamics of school attainment of England's ethnic minorities". *Journal of Population Economics* 24.2, pp. 681–700.

Zamarro, Gema, Collin Hitt, and Ildefonso Mendez (2019). "When Students Don't Care: Reexamining International Differences in Achievement and Student Effort". *Journal of Human Capital* 13.4, pp. 519–552.

Zimmermann, Laura, Klaus F. Zimmermann, and Amelie F. Constant (2007). "Measuring Ethnic Identity and Its Impact on Economic Behavior". *International Migration Review* 41.3, pp. 769–781.

Table 2. OLS regression

Math Score	**OLS (1)**	**OLS (2)**	**OLS (3)**
Score Italian	0.644***	0.628***	0.627***
	(0.00273)	(0.00544)	(0.00544)
Age in months	0.205***	0.211***	0.212***
	(0.0118)	(0.0204)	(0.0204)
Distance	0.0108***	0.0103***	
	(0.00111)	(0.00200)	
Non Italian			0.646***
			(0.174)
Obs	99,917	99,917	99,917
Controls	YES	YES	YES
Class-by-cohort FE	NO	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Robust Standard Errors in parenthesis (OLS (1))
Clustered Standard Errors at the school-cohort level (OLS (2) and OLS (3))
Controls: student's gender, socioeconomic background (ESCS index)
Math score, total and first section of the Italian test score are corrected for cheating.

Table 3. Two-stage least square regression. First Stage

Score Italian	**(1)**	**(2)**
Age in months	0.178***	0.152***
	(0.02659)	(0.02718)
Distance	0.318***	
	(0.05009)	
Non Italian		24.250***
		(4.62195)
Age in months* Distance	-0.003***	
	(0.00039)	
Age in months* Non Italian		-0.214***
		(0.03556)
Kleibergen-Paap rk Wald F statistic	53.355	36.19
Obs	77,457	77,457
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

Table 4. Two-stage least square regression. Second Stage

Math Score	**(1)**	**(2)**
Score Italian	-0.552***	-0.555**
	(0.192)	(0.235)
Age in months	0.241***	0.238***
	(0.0255)	(0.0256)
Distance	-0.0467***	
	(0.00945)	
Non Italian		-3.622***
		(0.863)
Obs	77,457	77,457
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

Table 5. Two-stage least square regression. First Stage (Score Italian < Level 3)

Score Italian	**(1)**	**(2)**
Age in months	0.008	-0.018
	(0.02741)	(0.02819)
Distance	0.233***	
	(0.04937)	
Non Italian		17.090***
		(4.64034)
Age in months*Distance	-0.002***	
	(0.00038)	
Age in months*Non Italian		-.148***
		(0.03568)
Kleibergen-Paap rk Wald F statistic	27.94	17.14
Obs	38,759	38,759
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

Table 6. Two-stage least square regression. Second Stage (Score Italian < Level 3)

Math Score	**(1)**	**(2)**
Score Italian	-1.369***	-1.457***
	(0.423)	(0.561)
Age in months	0.0170	0.00359
	(0.0598)	(0.0744)
Distance	-0.0374***	
	(0.0124)	
Non Italian		-3.200**
		(1.253)
Obs	38,759	38,759
Controls	YES	YES
Class-by-cohort FE	YES	YES

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

Table 7. Two-stage least square regression. First Stage (Score Italian $\geq$ Level 3)

Score Italian	**(1)**	**(2)**
Age in months	0.143***	0.140***
	(0.02496)	(0.02560)
Distance	0.106**	
	(0.04911)	
Non Italian		8.662*
		(4.46891)
Age in months*Distance	-0.0009**	
	(0.00038)	
Age in months*Non Italian		-0.073**
		(0.03428)
Kleibergen-Paap rk Wald F statistic	5.78	4.55
Obs	22,185	22,185
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

Table 8. Two-stage least square regression. Second Stage (Score Italian $\geq$ Level 3)

Math Score	**(1)**	**(2)**
Score Italian	-1.179	-1.063
	(1.058)	(1.149)
Age in months	0.323***	0.311**
	(0.114)	(0.123)
Distance	-0.0185	
	(0.0130)	
Non Italian		-1.385
		(1.055)
Obs	22,185	22,185
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)