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Is there an immigrant-gender gap in education? An empirical investigation based on PISA data from Italy.

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Abstract. Gender and origin background are widely accepted in the economics of education literature as factors that highly correlate with educational outcomes. However, little attention has been devoted so far to the interaction of these two dimensions. We use Italian data from PISA 2015 to investigate potential immigrant-gender gaps in education. We find that, as expected, girls outperform boys in reading and are outperformed by them in math and science. In addition, immigrant students' scores are persistently below those of natives. However, interestingly, we find that being immigrant and female does not imply a double disadvantage in math and science. On the contrary, immigrant girls slightly compensate for the immigrant gap in all disciplines. Moreover, the wider gap we find is that of immigrant boys in reading: it ranges from to 0.66 to 2 school years with respect to native boys. Language spoken at home is one of the main cofactors affecting immigrant boy's scores. Targeted policies should therefore be implemented.

Keywords: immigrant-gender gap, education, OECD-PISA
JEL classification: I24, F22, J16.

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1. Introduction

The existence of persistent gender and immigrant gaps in education achievements across countries and time clearly emerges from several waves of the Program for International Student Assessment (PISA) and other surveys on students' performances. PISA data (OECD, 2016a) show that – save for a few countries – fifteen-year-old girls tend to outperform boys in reading and to be outperformed by them in mathematics and science. In addition, in all fields native students tend to do better than immigrants do. Less known and explored are the interactions between these two dimensions and the possible existence of a double disadvantage of being both a girl and a foreign-born. On the one hand, due to the immigrant and female status, some students could be experiencing higher difficulties than their native peers. On the other hand, this outcome should not be taken for granted. The empirical evidence shows that gender and immigrant gaps are affected by factors that vary widely across countries, to the extent that in a few countries girls outperform boys in mathematics and science (OECD, 2016a; Guiso *et al.* 2008), and immigrants do better than natives in a few others (Murat, Frederic 2012; OECD, 2016a).

This paper focuses on the i and gender gaps in education in Italy, with a specific interest in interacting disadvantages (or advantages) across these two dimensions. To test the existence of an immigrant-gender gap, we use data from the 2015 PISA survey and estimate an educational production function to understand the effect that various inputs have on students' achievement.

The importance of education in the human capital formation and in the access to the labour market is well documented in the literature (Heckman and Mosso, 2014) and education is considered in the capability approach a fundamental factor in enabling other capabilities to develop (Addabbo, Di Tommaso, Maccagnan, 2016; Terzi, 2007). Hence, to the extent that a positive and robust correlation exists between wages in the labour market and the educational level of workers and, in particular, their mathematics-related skills (Machin and Puhani, 2003) a disadvantage (or advantage) in education, particularly in certain fields, can affect labour market outcomes.

Few empirical studies have focused on the possibly interactive nature of gender and migratory background, and mostly so with respect to labour market outcomes (see, among others, Zaiceva, 2010). Despite many studies in the economics of education literature confirm the importance of both gender and origin, these two aspects have mostly been studied separately from each other. Gaps in the different areas of educational achievements at the disadvantage of immigrant students have been detected across OECD countries[1]. Moreover, these gaps significantly shrink after controlling for the family's human capital and other key background factors (OECD, 2016a). Cross-countries analyses

[1] In some countries with increasing shares of immigrants in the population, the reverse holds. This is partly because inclusive social and educational policies can contribute to narrow the performance gaps in education.

(OECD (2015a, 2016a), Azzolini, Schnell, & Palmer (2012), Murat and Frederic (2015)), detect inequalities in the achievement of education with regard to either immigrant status or gender. Girls' gap in mathematics tests scores has been found to be sensible to gender equalities and gender social norms across countries (Guiso *et al.*, 2008, Nollenberger *et al.*, 2016). Rodríguez-Planas and Nollenberger (2018) extend the analysis to other education fields.

For the Italian case, a number of empirical studies show that *family background factors* play a key role on the determinants of educational achievements (Bratti, Checchi and Filippin, 2007; Giambona, Porcu, 2015). Further, Italy is generally characterized by a high degree of *regional heterogeneity* in children's educational achievements, with higher achievements in education for children in the Northern regions of the country matched with regional disparities in the quality of the school system (Agasisti & Vittadini, 2012; Quintano, Castellano and Longobardi, 2012; INVALSI, 2017). In addition, the *different type of school attended* plays a key role in opening inequalities in children's educational achievements, with students enrolled in general education performing better than those enrolled in vocational schools (INVALSI, 2017). The school attended affects results, both because the school system is characterized in Italy by early tracking, at the age of 14, between general (which include lyceums) and vocational schools and because of a potential segregation effect across schools of the same type. The presence of girls in schools with a classical curriculum is relatively higher than that of boys. In turn, immigrant students tend to be relatively more present in vocational than in general schools. The school choice is influenced by the socioeconomic conditions of the children's household (Bratti, Checchi and Filippin, 2007), however, also after controlling for family background variables, immigrant students show a greater propensity to attend vocational schools (Barban and White, 2011).

Consistently with such literature, together with our variables of interest, concerning gender, origin, and the interaction between the two, we include several inputs in the educational production function, among which students' characteristics, the socioeconomic status of their families, the language spoken at home, the schools attended, regions of residence as well as age of arrival for immigrant students.

Our main results on immigrant and gender gaps are as expected. Female students perform better than males in reading and worst in math and science. Immigrants perform persistently below natives. More interesting are results on the immigrant-gender gap. Perhaps unexpectedly, being an immigrant girl partly compensates for the disadvantage of being immigrant in reading, and being female and immigrant in math and science. More precisely, the immigrant-gender gap is lower than it would result by the sum of two separate disadvantages. Other results show that immigrant gaps are strongly affected by the schools attended by students and the age of their arrival in Italy. Family

economic and social conditions influence especially immigrant and female scores, both directly and through the school attended. When immigrant gaps are tested separately for boys and girls, some significant differences between the two emerge.

The remainder of the paper is as follow: Section 2 reviews the survey data used and present some descriptive statistics; section 3 presents the empirical strategy adopted, results are in section 4 and section 5 concludes.

2. Data and descriptive statistics

2.1. Data

To test our hypothesis, we use the 2015 wave of PISA assessment, focusing on the sample of Italian schools and using information from both the Student Questionnaires and the individual test scores. The full sample includes 11,583 students enrolled in over 450 schools, representative of the Italian population of 15 years old students. The Italian PISA dataset (so as for most of the other participating countries) is the result of a two-stage stratified design, where, first, individual schools are sampled, and secondly, students are sampled within sampled schools. All throughout the paper we make use of the final student weights, which allow us to scale the sample up to the size of the Italian population and take into account the oversampling of specific Italian regions (Lombardy and Campania) and provinces (Trento and Bolzano). The number of students in the nationally defined target population that our analytical sample represents is 480,600, with a coverage over 95% of the desired national population.

Several variables present a number of observations inferior to the full sample, as a small percentage of students did not provide all the necessary information asked by the Background Questionnaire. Because of our specific interest in assessment gaps by gender and foreign origin of the student, we restricted the sample to those students that can be classified according to our immigrant variables. Moreover, we excluded from the analysis individuals with missing information on the set of other relevant regressors, such as ESCS and grade repetition. Hence, our final sample consists of 11,205 observations, where about 3% percent of the initial full sample was dropped.[2] The weighted means and standard deviations of the scores and the variables used in the analysis are in Table A1 in the Appendix. The Table shows that girls compose about 51% of the sample employed in our study, while the proportion of immigrants is about 8% (and immigrant girls are about half of the immigrant population).

[2] Our tests show that dropping observations with missing information causes a slight upward bias in test scores. However, such a small percentage of dropped observations should not significantly affect results, even if the selection on missing variables may not have happened at random.

Given that each participating student in PISA survey answers a limited amount of questions taken from the total test item pool, OECD provides ten test scores (known as plausible values), which can be interpreted as multiple imputed values of students' performance based on students' answers to the test and their background questionnaires. The difficulty of each item represents a weight, used to compute the weighted averages of correct responses. This approach allows having a measure of an individual's proficiency for each student in each subject area, regardless of the questions actually answered. We employ the recommended OECD strategy for estimation of coefficients and their variance, making use of all ten plausible value all throughout the main analysis.

2.2. Descriptive statistics

PISA data on Italy provides an interesting base for analysing potential immigrant-gender gaps in education, firstly for its representativeness of the Italian student population, and secondly because marked and significant gender and immigrant imbalances in Italy have been registered over different cross-section of the survey. According to PISA 2015, Italian girls on average do better than boys in reading-related skills by 16 points and worse than boys in science and math by about 17 and 20 points respectively. The latter is one of the largest gender gaps across PISA-participating countries.

Regarding inequalities by immigrant status, the interest of Italy resides on the rapid growth of its immigrant population, which has determined a doubling of the share of immigrant students on the total students' population (OECD, 2016b). This crucially enhances the role of the educational system in easing the integration process (Barban and White, 2011). Immigrants in Italy tend to perform persistently below natives in all fields, but – differently than the gender gap – this disadvantage has narrowed along the last decade. (OECD, 2016b).

[Table 1 here]

The descriptive statistics by gender and immigrant status show the immigrants' disadvantage in the achievements in all subjects, with a larger gap for boys in reading (Table 1). (Mean values in test scores of the whole students' population, in Table A1 in the Appendix, confirm the higher average achievements by girls in reading and of boys in mathematics and science). The occurrence of repeated grade is higher for immigrants, with immigrant boys registering the highest share (38%), followed by immigrant girls (23.8%), native boys (17%) and native girls (10%). Turning to the language spoken at home, a language different from Italian language is spoken more frequently in immigrant children's households, with percentages of about 62% for immigrant boys and 55% of immigrant girls, 15% by native boys and 10% by native girls. Table 1 also shows a higher presence of immigrant boys and

girls in Lombardy than in Campania, which is in line with the overall higher presence of immigrants in the Northern and central part of the country.

3. Empirical strategy

We seek to test the determinants gender and immigrant gaps in PISA test scores for the three main subject areas –mathematics, reading and science – by using the following base specification:

$$T_{ij} = \alpha + \beta_1 Female_{ij} + \beta_2 Immig_{ij} + \beta_3 (Female * Immig)_{ij} + \gamma X_{ij} + \delta S_j + \varepsilon_{ij} \qquad (1)$$

where T_{ij} is the test score of student i within school j, standardized for each subject with mean zero and variance equal to one. At the individual level, besides gender, immigration status and the interaction between the two, we include information about age, grade repetition, an index of socio-economic status of the students' family and a set of dummies concerning the (immigrant's) age of arrival into the country. A dummy takes value 1 if the main language spoken at home is not Italian and zero otherwise. OLS specifications include geographical variables concerning some regions and provinces (those for which data are available in PISA 2015), and a dummy for the school type attended, which, following PISA 2015, can only be vocational or general. In FE specifications, we include S_j, a full set of school dummies. ε_{ij} is the individual error term, estimated with a Huber-White adjustment to take the clustering of students within schools into account.

The coefficients of interest, β_1, β_2 and β_3, concern the gender, immigration and immigration-gender variables. Ideally, we would like to observe the country of origin of immigrant students, but this information is not available from PISA concerning Italian data. Hence, our variable is a dummy taking value one for students who were either born abroad or with both parents of foreign origin, and zero otherwise. In this classification, native students have at least one parent of Italian origin. We estimate equation (1) separately for each PISA subject. In each, we use students' sampling weights, replicate weights and the ten plausible values of students' scores present in 2015 data. The fixed effect specification is our preferred one, as it allows taking into account the great heterogeneity of the Italian situation across regions and school types. Relatively to the OLS specification, it shows whether school effects influence coefficients on gender, origin, socio-economic background and other cofactors. This could suggest school segregation working through each of these dimensions.

In a second part of the analysis we test the specification of equation (1) on two separate female and male subsamples (without including the interacted variable *Female*Immigrant*). In order to measure how immigrant students perform relatively peers of the same gender and to analyse the

incidence of cofactors within each group, we test immigrant gaps within each subsample, immigrant girls relatively to native girls and immigrant boys relatively to native boys.

Subsequently, we use the Oaxaca-Blinder decomposition (Oaxaca, 1973; Blinder,1973) to disentangle the part of the gender gap in Reading, Mathematics and Science that can be explained by differences in the observed variables *X* (students' characteristics and other household's and school related variables) $\beta_M(\overline{X_M} - \overline{X_F})$ from the 'unexplained part' $(\alpha_M - \alpha_M)+(\beta_M-\beta_F)\,\overline{X_F}$ related to differences in the return of each variable included in the model or to unobserved variables affecting reading, mathematics and science achievements.

$$\Delta\bar{T} = (\alpha_M - \alpha_M)+(\beta_M-\beta_F)\,\overline{X_F}+ \beta_M(\overline{X_M} - \overline{X_F}) \qquad (2)$$

4. Results

4.1. Base specification

OLS regression coefficients are in columns 1 and 8 of Tables 2, 3 and 4, while school FE regression coefficients are in columns 2-7 and 9. Results evidence some main patterns. First, as expected, coefficients on our first variable of interest, *Female*, are positive and significant in reading and negative and significant in math and science. Second, coefficients on the *Immigrant* variable are always negative, in all specifications of the three subjects. Third, the coefficient on the interacted variable, *Female*Immigrant*, is always positive, although significance is below 10%. Hence, the immigrant-gender gap is narrower than the sum of the two single gaps: being an immigrant girl slightly compensates for the immigrant status in reading, and for being female or immigrant in math and science.

[Table 2 about here]

[Table 3 about here]

[Table 4 about here]

Another result common to the three fields is that the immigrant gaps shrink significantly when school effects are initially included into the regressions. This emerges from comparing columns 1 and 2 in the three Tables, and concerns especially math and science. It suggests the existence of school segregation across native and immigrant status. Coefficients associated to the immigrant status shrink again when other cofactors are included. In particular, they are significantly affected by the age of the immigrant student at arrival in Italy, where we observe a particularly negative effect for students

who arrived in the country after the school starting age, i.e. 6 years. The age effect is especially strong in reading-related skills and lower and less significant in math and science.

Other cofactors contributing to explain the immigrant gap are *Language at home* and *Grade repetition*. This is not surprising when we consider that the proportion of immigrant students talking a language at home that is not Italian and repeating a grade is substantially higher than that of native students (Table A1). Both factors significantly correlate with poor performances at school in the three subjects. They affect scores directly, as indicated by the strong, negative and significant coefficients on *Language at home* and on *Grade repetition* in columns 5 and 7 of the three Tables, and indirectly through the immigrant status, as indicated by the changes in the coefficients on *Immigrant* from columns 2 to columns 5 and 7.

Other findings emerge by comparing the full model with and without school fixed effects (columns 8 and 9). Column 8 (OLS) includes region fixed effects (Trento, Bolzano, Lombardy and Campania) and the attendance of general as distinguished from vocational schools. The school performance of students in Lombardy, Bolzano and Trento located in the Northern part of the country are strongly and significantly above average in all fields, while that of students in Campania, in the South of Italy, is significantly negative. Moreover, attending a general school rather than a vocational one increases reading and science scores by about 0.6 standard deviations, and the score in mathematics by 0.46 (significance at 1% in the three cases). Following Woessmann (2016), across PISA-OECD countries, a school year corresponds to about 0.33 standard deviations. Hence, attending a general rather than a vocational school implies an advantage in mathematics corresponding to more than a school year.

Perhaps unexpectedly, in all fields, the coefficient on the *Immigrant* variable is more negative and significant in column 9 (FE) than in column 8 (OLS). As before, in column 2, the immigrant gap was expected to shrink with the introduction of FE in the fully specified model. However, at least partially, the more negative coefficient in column 9 can be explained by the geographic distribution of immigrant students across the country. The immigrant student population is proportionally higher in the productive provinces and regions of the North-Centre of Italy, where school performance is higher than average. Lombardy, Trento, and Bolzano are three high performing region and provinces but other regions such as Emilia-Romagna, Veneto, Piedmont and Tuscany (from which no separate data are available) also register above average scores, together with a substantial presence of immigrant students. Hence, once school fixed effects ‘absorb’ this provincial and regional distribution, immigrant students of high performing regions score below natives within schools (column 9), but across schools they have a good performance relatively to students in the Southern regions; in the country as a whole, this is captured by the smaller and less significant OLS coefficient (column 8).

When the full model with FE is considered, a main difference between the three subjects is that immigrant students are especially disadvantaged in reading, but immigrant gaps are significant also in science and mathematics. Specifically, the immigrant gap in reading is wide and significant at the 5% level (column 9, Table 2); in science, it is narrower, but still significant, at the 10% level (column 9, Table 4); in mathematics it is still negative, but not significant (column 9, Table 3). This suggests that factors such as immigrant background and culture influence learning in disciplines related to 'reading' – and in a lesser degree to science – even beyond the language spoken at home, while learning math can be relatively more 'culture-free'. Similar results are in Murat (2012).

Another interesting result is that the introduction of school effects changes significantly girls' scores relatively to boys' in the three subjects, but especially in math. Coefficients on *Female* shrink from column 8 to column 9 in all three subjects. The differences between the two coefficients are statistically significant at the 5% level in math, at the 1% level in science, and at the 15% in reading. These differences can be explained by the relatively higher presence of girls in schools with more hours of teaching in humanities and less in math and science. Moreover, once schools and all cofactors are considered, the girls' disadvantages in mathematics and science more than compensate their advantage in reading.

Two cofactors significantly affecting immigrant scores are *Language at home* and *Repeated grade*. Regarding both, immigrant students face less favourable conditions than natives do. Coefficients on both variables are strongly negative and significant at the 1% level in the three subjects (columns 5 Tables 2, 3 and 4). In particular, repeating a school year leads to lower scores by about 0.45 standard deviations in reading, 0.53 in mathematics and 0.42 in science. Another factor strongly affecting results is the economic and social status at home, *ESCS*. The three variables affect scores directly and, indirectly, through school segregation. This evidently emerges with the change in the coefficients on three variables, moving from the OLS specification (columns 8) to the FE tests (columns 9) for all three subjects.

4.2. Female and male immigrant gaps

This Section tests the immigrant gap in reading, math and science on the two separate subsamples of female and male students. In Tables 5, we use the complete OLS and FE models (corresponding to columns 8 and 9). Coefficients on the *Immigrant* variable report the difference in scores between native and immigrant students of the same gender.

[Table 5 about here]

The first general and interesting result is that immigrant girls do not experience a significant disadvantage with respect to native girls in any of the three subjects, both across (OLS) and within schools (FE), since the coefficients on *Immigrant* are not significant in the even columns of Table 5. On the other hand, immigrant boys register negative gaps with respect to native boys in the three subjects, which are wider and more significant when school effects are included into the regressions (odd columns). As above, bigger gap within schools can be related to the geographic distribution of immigrant students, more concentrated in areas with above average levels of education. Specifically, once school effects are considered, immigrant boys score below native boys by about 22 standard deviations in reading, by 16 in mathematics and by 24 in science (columns 7, 9 and 11 of Table 5). Among factors acting in the direction of mitigating school gaps, are specific social, educational and integration policies implemented by Central and Northern regions of Italy.

A comparison of immigrant gaps in the female and male populations shows that the difference across the two groups is significant for math and science. The two coefficients on the *Immigrant* variable statistically differ at the 15% level for mathematics and at the 10% level for science. Hence, the school performance of immigrant girls in math and science is not very different to that of native girls, contrary to that of immigrant boys, who exhibit a considerable disadvantage relative to native boys. In reading, where in the overall population boys are outperformed by girls, immigrant boys experience a further disadvantage, as their scores are significantly below those of native boys (column 4, Table 5). On the other hand, the immigrant girls' performance in reading is not significantly below that of native girls.

The incidence of cofactors affecting girls and boys performances partially differs. Among these, the language spoken at home has a significantly stronger impact on the proficiency levels of boys. Moreover, the difference in coefficients on *Language at home* across the female and male samples is statistically significant in reading and math at the 10% level in the OLS regressions of (columns 1 and 2), and in science at the 1% level (columns 9 and 10).

In all subjects and specifications, the economic and social condition of the student's family, *ESCS*, significantly affects results. However, it has a stronger impact on girls' performances. Differences in coefficients on *ESCS* between boys and girls (between columns 1 and 2; 5 and 6; 9 and 10; Table 5) are significant at the 5% level in the three subjects. They shrink for both girls and boys once schools attended are included into the regressions. This selection effect of schools, based on economic and social conditions at home, supports previous results (Agasisti & Vittadini, 2012; Bratti, Checchi and Filippin, 2007). We have estimated a Probit analysis that consistently shows a positive impact of a higher socioeconomic status on the probability of attending the general track (results available upon request). Once all cofactors have been considered, being girl increases the probability of attending a

general – rather than vocational – school by 26 percentage points. The immigrant status does not significantly affect the probability of attending a general school, but talking at home a language different than Italian reduces by 12% the probability of attending general schools.

4.3. Explaining the gender gap in test scores: Oaxaca-Blinder Decomposition.

In this section we use the Oaxaca-Blinder (OB) decomposition of the differentials in reading, math, and science between the two subpopulations of boys and girls and, subsequently, of natives and immigrants. This implies decomposing the gap between the two groups into that part due to differences in the mean values of the independent variables within the groups, on the one hand, and group differences in the effects of the independents variables, on the other hand (O'Donnell *et al.* 2008; Jann, 2008).

The decomposition by gender is based on the FE models of Tables 5 (columns 3-4; 7-8; 11-12) and is presented in Table 6. The predicted means in test scores in the different disciplines confirm the findings of a girls' disadvantage in mathematics and in science and a boys' disadvantage in reading: the gender net gap in education – controlling for all cofactors – is negative for boys in reading (-0.17) and positive in mathematics (0.25) and science (0.21).

[Table 6 about here]

OB allows to decompose the gender gap in one part related to differences in the magnitude of the observed characteristics affecting test scores for girls and boys (explained part) and another part related to the difference in the effects of the factors and to unobserved variables (unexplained part). Results show that the largest part of the gender gap can be attributed to differences in the coefficients of the observed variables and to unobserved factors (0.26 in mathematics, 0.23 in sciences and -0.15 in reading). The part attributable to differences in the measured means of the observed characteristics for girls and boys in the three fields shows a better performance for girls. Overall, the Oaxaca-Blinder decomposition evidences that the largest part of the gender gap in the educational achievements can be attributed to the differences by gender in the effects of the factors included in the model but we cannot exclude that it can also be related to unobservable factors not included in our specification.

Table A2 in the Appendix uses the complete FE specification to replicate the above regressions on the two subsamples of natives and immigrants. Results confirm previous findings: both immigrant boys and girls have lower predicted average mean test scores in math, science and reading but immigrant girls do not perform significantly worse than immigrant boys in math and science. Moreover, interestingly, not only immigrant girls perform above immigrant boys in reading, but also

their advantage is wider than that of native girls relatively to native boys. Gaps in reading are, respectively, 0.28 for immigrant girls and 0.17 for native girls.

[Table 7 about here]

The OB (Table 7) decomposition of the net test scores gap by gender between natives and immigrants confirms for each group a higher unexplained part of the differential related to the effects of the factors rather than to the magnitudes of the characteristics included in the model.

5. Conclusions

Several waves of PISA and other surveys have shown that cross-country and through time girls tend to perform below boys in mathematics and science and above them in reading. At the same time, immigrants tend to have lower scores than natives. These stylized facts suggest that immigrant girls may experience a double disadvantage in education (at least in the fields of mathematics and science) or, more generally, that gender and migratory background could interact in affecting test scores.

Testing PISA 2015 data from Italy we found that, differently from expected, being female and immigrant, is not necessarily associated with lower test scores. On the contrary, immigrant girls slightly compensate for their immigrant status in reading, and for their immigrant and gender status in mathematics and science. Immigrant boys, on the other hand, appear to perform worse as compared to their native peers in math and science, a disadvantage that we do not observe for immigrant female as compared to native girls. Moreover, across all specifications, immigrant boys struggle the most in reading. Without controlling for the school attended and other cofactors, they perform below average in a measure corresponding to about two school years. Once all cofactors are considered and within schools, the immigrant boys' negative gap in reading corresponds to about two thirds of a school year. Considering the important role played by reading as a base to develop other skills and for the whole cognition and thinking process (Kern *et al*., 2008), this result is an interesting starting point to think about targeted integration policies.

We also find significant heterogeneous effects across the gender dimension, with several factors affecting the performances of girls and boys differently. A language different from Italian being spoken at home has a stronger (negative) impact on boys, while the family's economic and social conditions especially influence the school performance of girls. For both immigrant groups, the age of arrival into the country plays a crucial role. Arriving after the age of compulsory schooling has a

negative impact on scores: this affects performance especially in reading-related fields. Immigrants attend vocational school relatively more than native students, and immigrant boys do so more than immigrant girls do. This partly explains the difference in scores between natives and immigrant girls being narrower than expected. However, also within schools the immigrant girls' gap is smaller than what would result from a double disadvantage.

Therefore, policy measures should especially address the economic and social conditions of the immigrants' families and the language talked at home. The social integration and language education of parents would strongly improve the performance of immigrant students.

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Table 1. Descriptive statistics by gender and by immigrant status

	Male		Female	
Variable	Native (N=5,128)	Immigrant (N=428)	Native (N=5,186)	Immigrant (N=463)
Test score: read	483.16	427.276	497.846	454.196
	(3.559)	(7.617)	(3.697)	(6.755)
Test score: math	505.859	463.094	483.293	455.712
	(3.608)	(8.261)	(3.513)	(6.674)
Test score: science	494.266	456.025	475.512	449.225
	(3.224)	(6.462)	(3.646)	(6.165)
ESCS	0.30	-0.395	-0.087	-0.576
	(0.024)	(0.062)	(0.028)	(0.056)
Grade repeated	0.169	0.380	0.103	0.238
	(0.008)	(0.035)	(0.008)	(0.024)
Age	15.8	15.80	15.81	15.85
	(0.006)	(0.023)	(0.007)	(0.020)
Language at home	0.154	0.621	0.099	0.554
	(0.010)	(0.032)	(0.007)	(0.038)
School type: General	0.397	0.275	0.627	0.462
	(0.017)	(0.039)	(0.018)	(0.036)
Bolzano	0.010	0.012	0.011	0.009
	(0.000)	(0.001)	(0.000)	(0.001)
Trento	0.010	0.013	0.010	0.013
	(0.000)	(0.002)	(0.000)	(0.001)
Lombardy	0.153	0.247	0.152	0.208
	(0.010)	(0.032)	(0.011)	(0.036)
Campania	0.119	0.017	0.111	0.027
	(0.008)	(0.006)	(0.007)	(0.007)

Source: PISA 2015. The full sample of interest is employed. Immigrant students are both "II generation", born in Italy from two parents born abroad and "I generation", born outside the country of assessment. The mean of the test scores has been computed using all 10 plausible values. All results are weighted.

Table 2: Read Scores: OLS and FE

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	0.169***	0.071**	0.072**	0.095***	0.049	0.070**	0.064**	-0.009	0.065*
	(0.050)	(0.035)	(0.034)	(0.035)	(0.034)	(0.035)	(0.034)	(0.047)	(0. 034)
Immigrant	-0.597***	-0.479***	-0.335***	-0.444***	-0.422***	-0.481***	-0.410***	-0.081	-0.188**
	(0.075)	(0.068)	(0.084)	(0.070)	(0.068)	(0.069)	(0.071)	(0.097)	(0.085)
Imm*Female	0.129	0.118	0.115	0.125	0.092	0.14	0.116	0.105	0.089
	(0.102)	(0.094)	(0.090)	(0.093)	(0.094)	(0.094)	(0.094)	(0.1110)	(0.087)
Years 0-3			-0.165					-0.210	0.168
			(0.150)					(0.169)	(0.156)
Years 4-6			-0.020					0.021	0.016
			(0.133)					(0.146)	(0.128)
Years 7-9			-0.294*					-0.527**	-0.333*
			(0.176)					(0.239)	(0.184)
Years 10-12			-0.429***					-0.508***	-0.450***
			(0.156)					(0.162)	(0.151)
Years 13-15			-0.658***					-0.914***	-0.717***
			(0.197)					(0.198)	(0.207)
ESCS				0.099***				0.179***	0.086***
				(0.016)				(0.020)	(0.016)
Repeated grade					-0.447***			-0.597***	-0.446***
					(0.049)			(0.054)	(0.049)
Age						0.096**		0.074	0.103**
						(0.041)		(0.050)	(0.041)
Language at home							-0.148***	-0.174***	-0.113***
							(0.043)	(0.052)	(0.041)
School type: General								0.581***	
								(0.049)	
Bolzano								0.383***	
								(0.943)	
Trento								0.349***	
								(0.039)	
Lombardy								0.289***	
								(0.047)	
Campania								-0.293***	
								(0.063)	
Constant	-0.034	0. 717	0.731	0.717	0.739	-0.805	0.723	-1.309	-0.879
	(0.036)	(2.312)	(2.152)	(2.276)	(1.969)	(2.514)	(2.27)	(0.800)	(1.962)
FIXED EFFECT	NO	YES	YES	YES	YES	YES	YES	NO	YES
Observations	11,205	11,205	11,205	11,205	11,205	11,205	11,205	11,205	11,205

*** p<0.01, ** p<0.05, * p<0.1 Source: PISA 2015. All plausible values employed. All results are weighted and replication weights are taken into account. Errors are robust and clustered at the school level.

Table 3: Math Scores: OLS and FE

VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	-0.241***	-0.224***	-0.224***	-0.207***	-0.250***	-0.225***	-0.229***	-0.387***	-0.239***
	(0.046)	(0.032)	(0.031)	(0.032)	(0.031)	(0.032)	(0.031)	(0.043)	(0.030)
Immigrant	-0.457***	-0.319***	-0.262***	-0.290***	-0.249***	-0.319***	-0.267***	-0.047	-0.118
	(0.082)	(0.071)	(0.089)	(0.071)	(0.066)	(0.071)	(0.072)	(0.104)	(0.086)
Imm*Female	0.162	0.122	0.125	0.125	0.090	0.116	0.119	0.126	0.093
	(0.108)	(0.095)	(0.091)	(0.094)	(0.092)	(0.094)	(0.094)	(0.102)	(0.086)
Years 0-3			-0.050					-0.105	0.062***
			(0.165)					(0.204)	(0.018)
Years 4-6			0.120					0.208	-0.072
			(0.166)					(0.181)	(0.175)
Years 7-9			-0.075					-0.391*	-0.128
			(0.151)					(0.204)	(0.152)
Years 10-12			-0.445***					-0.505***	-0.491***
			(0.167)					(0.165)	(0.156)
Years 13-15			-0.188					-0.440**	-0.271
			(0.181)					(0.207)	(0.198)
ESCS				0.076***				0.166***	0.062***
				(0.019)				(0.022)	(0.018)
Repeated grade					-0.526***			-0.706***	-0.525***
					(0.048)			(0.050)	(0.048)
Age						0.108**		0.100*	0.116***
						(0.043)		(0.052)	(0.042)
Language at home							-0.107***	-0.143***	-0.084**
							(0.036)	(0.042)	(0.034)
School type: General								0.460***	
								(0.054)	
Bolzano								0.456***	
								(0.079)	
Trento								0.321***	
								(0.040)	
Lombardy								0.240***	
								(0.064)	
Campania								-0.355***	
								(0.058)	
Constant	0.172***	0.425	0.424	0.408	0.433	-1.299	0.412	-1.461*	-1.375
	(0.037)	(1.959)	(1.949)	(2.069)	(1.631)	(2.836)	(2.070)	(0.829)	(2.435)
School FIXED EFFECT	NO	YES	YES	YES	YES	YES	YES	NO	YES
Observations	11,205	11,205	11,205	11,205	11,205	11,205	11,205	11,205	11,205

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Source: PISA 2015. All plausible values employed. All results are weighted and replication weights are taken into account. Errors are Robust and clustered at the school level.

Table 4: Science Scores: OLS and FE

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	-0.205***	-0.208***	-0.207***	-0.192***	-0.229***	-0.209***	-0.212***	-0.359***	-0.220***
	(0.052)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0. 049)	(0.028)
Straniero	-0.418***	-0.296***	-0.255***	-0.273***	-0.241***	-0.296***	-0.243***	0.041	-0.130*
	(0.068)	(0.067)	(0.077)	(0.067)	(0.065)	(0.067)	(0.067)	(0. 093)	(0.077)
Imm*Female	0.131	0.096	0.087	0.101	0.069	0.089	0.092	0.097	0.061
	(0.106)	(0.088)	(0.082)	(0.088)	(0.087)	(0.088)	(0.087)	(0.094)	(0.079)
Years 0-3			-0.003					-0.078	-0.013
			(0.159)					(0.197)	(0.180)
Years 4-6			0.224					-0.272*	0.246
			(0.143)					(0.152)	(0.137)
Years 7-9			-0.146					-0.426**	-0.183
			(0.122)					(0.179)	(0.126)
Years 10-12			-0.282*					-0.304**	-0.311**
			(0.145)					(0.147)	(0.145)
Years 13-15			-0.478**					-0.711***	-0.535**
			(0.208)					(0.205)	(0.221)
ESCS				0.066***				0.162***	0.055***
				(0.014)				(0.019)	(0.014)
Repeated grade					-0.417***			-0.602***	-0.418***
					(0.042)			(0.048)	(0.042)
Age						0.118***		0.092*	0.121***
						(0.043)		(0.053)	(0.042)
Language at home							-0.111***	-0.154***	-0.090***
							(0.032)	(0.042)	(0.032)
School type: General								0.518***	
								(0.048)	
Bolzano								0.558***	
								(0.044)	
Trento								0.381***	
								(0.037)	
Lombardy								0.297***	
								(0.051)	
Campania								-0.297***	
								(0.057)	
Constant	0.150***	0.939	0.938	0.939	0.9451***	-0.938	0.930	-1.397*	-0.946
	(0.035)	(2.589)	(2.611)	(2.570)	(2.399)	(2.922)	(2.711)	(0.828)	(2.463)
School FIXED EFFECT	NO	YES	YES	YES	YES	YES	YES	NO	YES
Observations	11,205	11,205	11,205	11,205	11,205	11,205	11,205	11,205	11,205

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Source: PISA 2015. All plausible values employed. All results are weighted and replication weights are taken into account. Errors are robust and clustered at the school level.

Table 5: Reading scores by gender. OLS and FE estimates

	Read						Math						Science					
Variable	Male	Female	Diff	Male	Female	Diff	Male	Female	Diff	Male	Female	Diff	Male	Female	Diff	Male	Female	Diff
	(1)	(2)		(3)	(4)		(5)	(6)		(7)	(8)		(9)	(10)		(11)	(12)	
Immigrant	-0.100	-0.018		-0.225**	-0.105		-0.001	0.025		-0.164*	0.018	+	-0.105	0.051		-0.241**	-0.050	*
	(0.121)	(0.071)		(0.106)	(0.066)		(0.125)	(0.087)		(0.088)	(0.056)		(0.116)	(0.079)		(0.100)	(0.057)	
Repeated grade	-0.583***	-0.635***		-0.410***	-0.479***		-0.656***	-0.737***		-0.458***	-0.583***	+	-0.570***	-0.628***		-0.364***	-0.452***	
	(0.063)	(0.048)		(0.056)	(0.060)		(0.050)	(0.054)		(0.064)	(0.070)		(0.064)	(0.050)		(0.068)	(0.067)	
Language at home	-0.213***	-0.087	*	-0.102**	-0.101**		-0.184***	-0.068	*	-0.079***	-0.051		-0.246***	-0.072	***	-0.113***	-0.075**	
	(0.057)	(0.059)		(0.051)	(0.050)		(0.040)	(0.056)		(0.029)	(0.043)		(0.044)	(0.055)		(0.036)	(0.037)	
Years 0-3	-0.126	-0.244		-0.016	-0.230		-0.191	-0.032		-0.017	-0.081		0.075	-0.118		0.132	-0.021	
	(0.242)	(0.191)		(0.237)	(0.170)		(0.296)	(0.169)		(0.304)	(0.143)		(0.334)	(0.156)		(0.293)	(0.178)	
Years 4-6	-0.119	-0.069		-0.060	-0.040		0.219	0.095		0.268**	0.067		0.449**	0.205		0.443***	0.180	
	(0.208)	(0.121)		(0.157)	(0.143)		(0.195)	(0.171)		(0.127)	(0.144)		(0.223)	(0.178)		(0.148)	(0.191)	
Years 7-9	-0.388	-0.584**		-0.286	-0.296*		-0.445	-0.230		-0.112	0.033		-0.258	-0.521***		-0.059	-0.255**	
	(0.274)	(0.234)		(0.182)	(0.174)		(0.268)	(0.215)		(0.171)	(0.218)		(0.230)	(0.175)		(0.147)	(0.101)	
Years 10-12	-0.502***	-0.492***		-0.387***	-0.366***		-0.631***	-0.642***		-0.470**	-0.713***		-0.339**	-0.278*		-0.274**	-0.286**	
	(0.174)	(0.157)		(0.143)	(0.122)		(0.214)	(0.164)		(0.178)	(0.163)		(0.159)	(0.165)		(0.119)	(0.140)	
Years 13-15	-1.004***	-0.761***		-0.762***	-0.426*		-0.687**	-0.198		-0.438**	-0.168		-0.932**	-0.627***		-0.739**	-0.448**	
	(0.350)	(0.171)		(0.268)	(0.233)		(0.303)	(0.251)		(0.213)	(0.186)		(0.381)	(0.176)		(0.338)	(0.186)	
ESCS	0.155***	0.223***	**	0.083***	0.123***	+	0.122***	0.190***	**	0.037*	0.073***		0.134***	0.199***	**	0.051***	0.075***	
	(0.020)	(0.027)		(0.021)	(0.015)		(0.021)	(0.026)		(0.019)	(0.020)		(0.019)	(0.028)		(0.017)	(0.020)	
Age	0.118*	0.016		0.163***	0.065		0.142**	0.054		0.159***	0.118**		0.101	0.061		0.140***	0.104**	
	(0.062)	(0.060)		(0.050)	(0.045)		(0.066)	(0.059)		(0.044)	(0.053)		(0.068)	(0.067)		(0.040)	(0.045)	
School type: General	0.590***	0.542***					0.505***	0.424***					0.504***	0.490***				
	(0.058)	(0.072)					(0.059)	(0.071)					(0.060)	(0.081)				
Bolzano	0.484***	0.306***	**				0.449***	0.331***					0.607***	0.498***				
	(0.055)	(0.057)					(0.046)	(0.053)					(0.053)	(0.057)				
Trento	0.390***	0.285***					0.315***	0.296***					0.415***	0.338***				

	(0.053)	(0.044)			(0.048)	(0.046)			(0.052)	(0.051)				
Lombardy	0.299***	0.281***			0.273***	0.220***			0.281***	0.278***				
	(0.062)	(0.065)			(0.068)	(0.082)			(0.064)	(0.072)				
Campania	-0.255***	-0.284***			-0.352***	-0.377***			-0.369***	-0.377***				
	(0.064)	(0.069)			(0.057)	(0.068)			(0.066)	(0.070)				
Constant	-2.019**	-0.364	-3.935***	-0.716	-2.150**	-1.082	-3.022***	-1.652*	-1.512	-1.248	-2.433***	-0.844		
	(0.998)	(0.948)	(0.798)	(0.771)	(1.042)	(0.936)	(0.692)	(0.976)	(1.078)	(1.058)	(0.625)	(0.724)		
School FE	NO	NO	YES	YES	NO	NO	YES	YES	NO	No	YES	YES		
Observations	5,556	5,649	5,556	5,649	5,556	5,649	5,556	5,649	5,556	5,649	5,556	5,649		

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1, +p<0.15. Source: PISA 2015. Diff. provides the statistical significance of the difference between the coefficients in the model by gender. First plausible value employed. All results are weighted and replication weights are taken into account. Errors are robust and clustered at the school level.

Table 6: Oaxaca-Blinder decomposition by gender.

	Math		Science		Reading	
VARIABLES	Diff	Decomp.	Diff	Decomp.	Diff	Decomp.
Male	0.134***		0.122***		-0.0662*	
	(0.0330)		(0.0332)		(0.0363)	
Female	-0.0917***		-0.0843**		0.105***	
	(0.0336)		(0.0379)		(0.0350)	
Difference	0.225***		0.206***		-0.171***	
	(0.0411)		(0.0466)		(0.0442)	
Explained		-0.0330**		-0.0274*		-0.0221
		(0.0146)		(0.0142)		(0.0160)
Unexplained		0.258***		0.233***		-0.149***
		(0.0372)		(0.0436)		(0.0397)
Observations	11,205	11,205	11,205	11,205	11,205	11,205

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Source: PISA 2015. First plausible value employed. All results are weighted and replication weights are taken into account. Errors are robust and clustered at the school level.

Table 7: Oaxaca-Blinder decomposition by immigrant status.

	Natives						Immigrants					
	Math		Science		Reading		Math		Science		Reading	
VARIABLES	Diff	Decomp.	Diff	Decomp	Diff	Decomp	Diff	Decomp	Diff	Decomp	Diff	Decomp
Male	0.167***		0.155***		-0.0205		-0.284***		-0.298***		-0.638***	
	(0.0335)		(0.0339)		(0.0367)		(0.0724)		(0.0648)		(0.0723)	
Female	-0.0641*		-0.0595		0.148***		-0.390***		-0.352***		-0.359***	
	(0.0345)		(0.0395)		(0.0358)		(0.0666)		(0.0556)		(0.0515)	
Difference	0.231***		0.215***		-0.169***		0.106		0.0544		-0.279***	
	(0.0424)		(0.0492)		(0.0454)		(0.0883)		(0.0882)		(0.0830)	
Explained		-0.0350**		-0.0266*		-0.0243		-0.0679		-0.0976**		-0.0754
		(0.0142)		(0.0142)		(0.0153)		(0.0475)		(0.0459)		(0.0509)
Unexplained		0.266***		0.241***		-0.144***		0.174**		0.152**		-0.204**
		(0.0380)		(0.0456)		(0.0404)		(0.0778)		(0.0745)		(0.0780)
Observations	10,314	10,314	10,314	10,314	10,314	10,314	891	891	891	891	891	891

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1 Source: PISA 2015. First plausible value employed. All results are weighted and replication Weights are taken into account. Errors are robust and clustered at the school level.

Appendix

Table A1: Descriptive statistics

Variable	Obs	Mean	SD	Min	Max
Test score: read	11,205	486.704	2.667	145.12	775.586
Test score: math	11,205	491.6585	2.893	140.802	822.637
Test score: science	11,205	482.2236	2.505	120.419	803.295
Female	11,205	0.508	0.015	0	1
Immigrant	11,205	0.079	0.005	0	1
Female*Imm	11,205	0.04	0.003	0	1
ESCS	11,205	-0.066	0.018	-4.4318	4.0683
Grade repeated	11,205	0.149	0.006	0	1
Age	11,205	15.807	.005	15.25	16.33
Language at home	11,205	0.163	0.163	0	1
Years 0-3	11,205	0.011	0.002	0	1
Years 4-6	11,205	0.013	0.002	0	1
Years 7-9	11,205	0.009	.002	0	1
Years 10-12	11,205	0.010	0.001	0	1
Years 13-15	11,205	0.005	0.000	0	1
School type: General	11,205	0.502	0.012	0	1
Bolzano	11,205	0.010	0.000	0	1
Trento	11,205	0.010	0.000	0	1
Lombardy	11,205	0.158	0.006	0	1
Campania	11,205	0.108	0.004	0	1

Source: Pisa 2015. The full sample of interest is employed. The mean of the test scores has been computed using all 10 plausible values. All results are weighted.

Table A2: Test scores by immigrant status and gender, FE estimates

	Native						Immigrants					
	Reading		Math		Science		Reading		Math		Science	
VARIABLES	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Repeated grade	-0.669***	-0.728***	-0.729***	-0.862***	-0.632***	-0.727***	-0.391**	-0.705***	-0.480***	-0.488***	-0.450**	-0.579***
	(0.0682)	(0.0632)	(0.0494)	(0.0645)	(0.0669)	(0.0651)	(0.149)	(0.126)	(0.142)	(0.114)	(0.173)	(0.121)
Language at home	-0.287***	-0.168**	-0.271***	-0.125*	-0.326***	-0.127*	-0.265*	-0.0315	-0.109	-0.0239	-0.188	-0.0270
	(0.0600)	(0.0706)	(0.0404)	(0.0657)	(0.0442)	(0.0645)	(0.157)	(0.107)	(0.148)	(0.106)	(0.167)	(0.0983)
ESCS	0.285***	0.329***	0.235***	0.276***	0.254***	0.299***	0.0780	0.211***	0.0718	0.178**	0.0148	0.175**
	(0.0236)	(0.0266)	(0.0223)	(0.0250)	(0.0226)	(0.0256)	(0.0861)	(0.0648)	(0.0780)	(0.0712)	(0.0731)	(0.0807)
Age	0.158**	0.0792	0.191***	0.0799	0.141**	0.0912	0.218	-0.360**	0.0447	0.0542	0.115	0.0415
	(0.0628)	(0.0684)	(0.0645)	(0.0670)	(0.0681)	(0.0722)	(0.269)	(0.152)	(0.313)	(0.176)	(0.264)	(0.178)
Years 0-3							-0.114	-0.233	-0.204	0.0243	0.0243	-0.0755
							(0.233)	(0.211)	(0.258)	(0.170)	(0.315)	(0.177)
Years 4-6							-0.189	-0.141	0.145	0.0240	0.349	0.115
							(0.215)	(0.116)	(0.181)	(0.182)	(0.231)	(0.172)
Years 7-9							-0.199	-0.650***	-0.336	-0.325*	-0.137	-0.603***
							(0.278)	(0.224)	(0.254)	(0.193)	(0.236)	(0.184)
Years 10-12							-0.519***	-0.559***	-0.672***	-0.661***	-0.402**	-0.329**
							(0.183)	(0.154)	(0.222)	(0.163)	(0.181)	(0.152)
Years 13-15							-0.941***	-0.698***	-0.723***	-0.131	-0.935**	-0.557***
							(0.317)	(0.184)	(0.263)	(0.261)	(0.366)	(0.185)
Constant	-2.369**	-0.984	-2.694**	-1.203	-1.929*	-1.388	-3.543	5.888**	-0.535	-0.903	-1.752	-0.640
	(1.000)	(1.075)	(1.021)	(1.052)	(1.076)	(1.134)	(4.197)	(2.410)	(4.860)	(2.773)	(4.141)	(2.785)
School FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	5,128	5,186	5,128	5,186	5,128	5,186	428	463	428	463	428	463

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1, +p<0.15. Source: PISA 2015. First plausible value employed. All results are weighted and replication weights are taken into account. Errors are robust and clustered at the school level.