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MIGRANT ACHIEVEMENT PENALTIES IN WESTERN EUROPE. WHAT ROLE FOR EDUCATIONAL SYSTEMS?

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Migrant achievement penalties in Western Europe.

What role for educational systems?

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Abstract: This paper presents a comparative examination of educational underachievement of second-generation immigrants in Western Europe near the end of compulsory schooling, based on the 2006-2009 waves of the PISA survey. We propose a measure for migrant educational penalty revealing the relative position of migrant children within the achievement distribution of natives with the same socio-economic background. We find that migrant specific disadvantage is severe in most Western European countries. We then analyze how this measure varies across countries and find it negatively related to the effect of socio-economic background on natives' achievement. Hence, migrant penalties and socio-economic penalties come forth as two distinct dimensions of educational inequalities. By means of recursive partitioning methods, we explore whether features of educational systems account for cross-country differences in migrant-specific penalties. We find that institutional dimensions theoretically related to educational careers of children of immigrants – entry age into (pre)school and degree of marginalization in low-performing schools –matter, in spite of the more or less comprehensive character of the secondary school systems.

1. Introduction

International assessments on students' competencies show that in most European countries migrant educational underachievement is a serious issue. In the last years, public debates have called attention to the need of identifying characteristics of schooling systems able to tackle migrant educational inequalities. Indeed, endowing children of migrants with equal chances to succeed in school compared to their native peers is seen as a major step toward their economic and social integration.

Research on ethnic educational inequality within the sociology of education has extensively explored its individual and family determinants (Heath and Brinbaum, 2007). Home resources, parental social class and qualifications explain the educational disadvantage of migrant children to a significant extent (Kristen and Granato, 2007; Van De Werfhorst and Van Tubergen, 2007). However, even after accounting for family background, a residual disadvantage persists (Rothon, 2007), sometimes labeled as ethnic "penalty" (Heath, Rothon, and Kilpi, 2008). Comparative works have shown that educational penalties associated with migrant status differ among European countries (Schnepf, 2007), even when same-origin migrants are contrasted (Crul, Schneider, and Lelie, 2012; Dustmann, Frattini, and Lanzara, 2012).

Less clear from previous research is the extent to which features of educational systems can be called in to explain such cross-country differences. A well established literature in the economics of education has identified some institutional features able to explain why countries differ in the way educational achievement is affected by socio-economic status (Hanushek and Wössmann, 2011). For instance, the degree of horizontal differentiation – and in particular age at first tracking – has been consistently found to increase educational inequalities driven by family background (Brunello and Checchi, 2007; Schütz, Ursprung, and Wössmann, 2008; Van de Werfhorst and Mijs, 2010). Just like socio-economically disadvantaged families, immigrant families are likely to suffer from a lack of culturally relevant resources crucial to make informed school choices, hence early tracking systems might be specifically detrimental to children of migrants. However, empirical evidence suggests that, given prior achievement, students with an immigrant background tend to make more ambitious educational choices with respect to their native peers (Kristen, Reimer, and Kogan, 2008; Cebolla Boado, 2011; Jackson, Jonsson, and Rudolphi, 2012). This positive "secondary effect" (Boudon, 1974) might have different origins, from unrealistic wishes of upward mobility to anticipation of discrimination on the labor market (Salikutluk, 2013). Therefore, the role of horizontal differentiation *per se* in explaining cross-country differences in migrant achievement penalties is not straightforward.

More generally, do conventional institutional accounts of socio-economic differentials in school achievement help in understanding why children of migrants suffer from more or less severe penalties in different receiving societies? Is migrant specific disadvantage just another facet of socio-economic disadvantage, or rather are they distinct dimensions of educational inequality?

In this paper, we present a comparative analysis of the relative educational disadvantage of second-generation immigrants in Western Europe based on PISA 2006 and 2009 surveys on mathematics literacy of 15-year-old students. We single out migrant specific disadvantage from overall migrant underachievement with a measure revealing the relative position of migrant children within the achievement distribution of natives with the same socio-economic background. We then explore how migrant penalties and socio-economic penalties vary across countries. Finally, we investigate whether features of schooling systems theoretically related to educational careers of second-generation immigrants matter in explaining cross-country differences in migrant penalties.

2. Analytical strategy

When looking for an institutional explanation of cross-country differences in migrant achievement, there are several caveats to bear in mind. The first one is the need to balance a sufficient degree of comparability across receiving societies with an adequate sample size. Indeed, even if analyses are based on a large number of individual observations, the relevant sample size to identify institutional effects is the number of countries. The second challenge is related to compositional effects: migrant students differ along a number of characteristics liable to affect educational achievement, such as socio-economic background, length of stay in the receiving society and origin country. These characteristics are not evenly distributed among immigrant populations, hence they may act as confounders when we try to isolate migrant specific disadvantage and compare it across countries. Finally, we should acknowledge the possibility that these institutional features may operate interactively rather than additively in shaping cross-country differences in migrant underachievement.

Other scholars (Fossati, 2011; Schneeweis, 2011; Cobb-Clark, Sinning, and Stillman, 2012; Dronkers, Heus and Levels, 2012) have recently addressed similar research questions. They estimate either country-level models for the achievement gap or individual-level regression models for test scores pooling countries together, with institutions as independent variables. These studies take a step forward in shedding light on how features of educational systems relate to migrant learning disadvantage. However, they incur in a number of problematic issues in their analytical strategies. The first limitation of these works is that, in order to increase the number of observations, they gather countries which differ greatly not only in their educational systems, but also in their societal structure. This lack of comparability hinders the explanatory potential of these studies. Moreover, the selected countries display very heterogeneous origin-country composition of the immigrant populations, resulting in different degrees of cultural and linguistic distance liable to affect educational achievement of children of migrants. Unfortunately, international surveys on cognitive abilities generally do not collect detailed data on the origin country. Failing to account for these compositional effects poses a second threat to the identification of institutional effects[1]. While these studies control for socio-economic background and migratory status (first- *vs*. second-generation immigrants), they do not always differentiate first-generation according to their age at arrival in the country. More generally, first-generation immigrants are less comparable than second-generation, because part of their educational career has developed in their origin country. Finally, in order to limit the number of parameters, restrictive assumptions are posited in the regression specifications. For example, Schneeweis (2011) and Fossati (2011) assume constant effects of institutions on the two migrant categories. Instead, Cobb-Clark, Sinning, and Stillman (2012) fix the social background effect across countries, an assumption that is hardly tenable in light of the evidence that the effect of social background varies considerably between early and late tracking countries (Hanushek and Woessmann, 2011). Most importantly, the effects of the features of educational systems are always assumed to be additive.

In this paper, we address the above mentioned challenges in the following way. First, to attain greater comparability of receiving societies, we limit our sample to Western European countries since their societal and institutional structures have been harmonized to a significant extent by the process of European integration. Moreover, they share a history of post-war labor immigration, as opposed to traditional settlement countries like the US or Australia. Even so, migrant populations across Western Europe are diverse. Hence, we substantiate our analyses by contrasting same-origin immigrants across receiving societies. We analyze educational achievement of second-generation immigrants in 17 countries of Western Europe and then, by narrowing our focus to those which provide information on the country of birth of students, we check the robustness of our findings by contrasting migrant penalties for children of Turkish immigrants only. Finally, we introduce a country-level indicator of linguistic distance between origin-countries and destination-countries official languages. In order to address the remaining composition effects, we control for socio-economic background and we focus on second-generation migrants, who have been entirely exposed to the schooling and preschooling system of the receiving country, just like their native peers. Finally, we adopt a two-step analytical strategy allowing for the greatest flexibility of parameters: first, we estimate migrant achievement penalties with individual-level regressions run separately for each country; second, we analyze the cross-country variability of migrant penalties. Our cross-country analyses are based on recursive binary partitioning methods. We do so – instead of estimating restrictive cross-country regression models – for two reasons: (i) to explore how different combinations of theoretically relevant institutions can explain cross country differences in migrant achievement penalties; (ii) to unambiguously adopt a descriptive perspective, that does not lead to generalize results outside the set of countries under investigation, since this set is interesting *per se* and cannot be thought as a sample drawn from a larger population of comparable units.

3. Migrant achievement penalties in Western Europe

3.1 Measure

Migrant underachievement is often operationalized with the average gap of migrants with respect to natives. We propose an alternative measure which reveals the average position of migrant children (*M*) into the distribution of their native peers (*N*), expressed in terms of standard deviations. We define the "raw *z*-score" as:

$$\bar{z}_M = \frac{1}{n}\sum_i z_{i,M} = \sum_i \frac{y_{i,M} - \bar{y}_N}{\hat{\sigma}_N} = \frac{\bar{y}_M - \bar{y}_N}{\hat{\sigma}_N}$$

The interpretation of $\bar{z}_M$ is straightforward. For instance, a *z*-score of –0.5 implies that if we place the average migrant into the distribution of natives, she would score 0.5 standard deviations below the average. Assuming normality, this positions her in the 31st percentile rank of the distribution of natives. The basic difference between the *z*-score metrics and the average gap is that the former also considers the existing variability in the receiving societies. Given the mean difference between migrant and native children in terms of PISA scores, lack of integration of migrants is more severe in a society with less heterogeneity among native children, as on average migrant children would perform not only substantially worse than the average native, but also worse than lower performing ones.

To isolate the migrant-specific disadvantage, we account for compositional effects due to socio-economic endowments *X* and use a modified version of the above *z*-score revealing the average position of second-generation migrants in the distribution of natives with the same socio-economic status. This index – emphasizing the relative rather than absolute distance between scores of natives and migrants – will be our measure of <u>migrant achievement penalty</u>. The "controlled *z*-score" is defined as:

$$\bar{z}_M^x = \frac{1}{n}\sum_i \frac{y_{i,M,x} - \bar{y}_{N|x}}{\hat{\sigma}_{N|x}} = \sum_x \bar{z}_{M|x}\, p_{M|x}$$

where *n* is the number of migrants, $\bar{z}_{M|x}$ is the *z*-score for given *x* and $p_{M|x}$ is the proportion of migrants with *X*=*x*. Instead of evaluating $\bar{z}_M^x$ completely non-parametrically, we refer to a simple model of performance *Y*:

$$Y_i = \alpha_N + \beta_N X_i + (\alpha_M - \alpha_N)D_i + (\beta_M - \beta_N)X_i D_i + \varepsilon_i \qquad (1)$$

where *D* is a dummy indexing migrant background, α_N and α_M the intercepts for migrants and natives respectively, β_N and β_M the corresponding effects of socio-economic status. In this case:

$$\bar{z}_M^x = \frac{\sum_x[(\hat{\alpha}_M+\hat{\beta}_M x)-(\hat{\alpha}_N+\hat{\beta}_N x)]p_{M|x}}{\hat{\sigma}_\varepsilon} = \frac{\sum_x(\hat{\alpha}_M-\hat{\alpha}_N)+(\hat{\beta}_M-\hat{\beta}_N)\bar{X}_M}{\hat{\sigma}_\varepsilon} \qquad (2)$$

Incidentally, the numerator of (2) coincides with the unexplained component of the Blinder-Oaxaca decomposition of the absolute differential:

$$\bar{y}_M - \bar{y}_N = (\hat{\alpha}_M - \hat{\alpha}_N) + (\hat{\beta}_M - \hat{\beta}_N)\bar{X}_M + \hat{\beta}_N(\bar{X}_M - \bar{X}_N)$$

The last term represents the portion of the gap ascribable to compositional effects. Instead, the first two terms remain unexplained. If *X* is expressed in terms of deviation from the mean, the difference between the intercepts is the migrant-native gap for the average *X,* while the second term accounts for different returns to socio-economic status between migrants and natives.[2]

3.2 Programme for International Student Assessment (PISA) dataset

Analyses are based on representative data from the *Programme for International Student Assessment* (PISA) collected in the years 2006 and 2009[3]. PISA assesses 15-year-old students' competences in three domains: reading, mathematics and science. Test scores are standardized on a common scale (OECD countries mean is 500 with a standard deviation of 100) allowing us comparing student achievement across countries. Moreover, individual, family and school background information is collected through questionnaires administered to students and school officials. PISA samples are derived from a two-stage stratified sampling procedure with schools selected in the first stage and individual students selected in the second one[4].

3.3 Variable construction and individual-level regressions

Our sample units are 15-year-old students over 17 Western European countries.[5] Since mathematics literacy is less influenced by lack of linguistic skills than reading and science, we use the former as the educational outcome of main interest. This choice has the advantage of limiting compositional effects due to the origin country. Nonetheless, to gain leverage, we replicate analyses on the two other literacy domains assessed by PISA. We define migrant categories according to information on place of birth provided by PISA: *g2* are second-generation migrants (native-born students with both foreign-born parents). Natives (students with at least one native-born parent) is the residual category, while first-generation migrants (foreign-born students with both foreign-born parents) are excluded from the sample. To operationalize the various dimensions of family background potentially affecting educational achievement, we used a synthetic measure provided by PISA: the index of economic, social and cultural status (*ESCS*). This is derived from three indices: highest occupational status of parents, highest parental education and home possessions – which in turn comprises items on the family wealth, cultural possessions and educational resources scales, as well as the number of books at home.

In order to compute the controlled *z*-score as a measure of migrant educational penalty, we run country-specific individual-level regressions on mathematics score over the dummy variables for migrant status, a dummy for female, the *ESCS* index and – where significant[6] – an interaction between *ESCS* and the dummy for migrant status.

Descriptive information on the sample sizes and summary statistics on the dependent variable and controls for natives and second-generation migrants can be found in Tables A1-3 in the Appendix.

3.4 Results and discussion

Results of the estimation of performance scores for each country are shown in Table 1. $(\alpha_M - \alpha_N)$ is the mean difference in the scores of migrants and natives at *ESCS*=0 (the OECD average), while β_N is the effect of one additional point in the *ESCS* scale for natives; where the interaction coefficient $(\beta_M - \beta_N)$ is non-significant, $(\alpha_M - \alpha_N)$ is the mean difference at all values of *ESCS*. Results of analyses on reading and science literacy are reported in Tables A4-5 in the Appendix and prove to be generally consistent with those on mathematics.

[Table 1 about here]

As expected, in all countries immigrants perform substantially worse than their native peers. Yet, differentials vary greatly across countries, from 10 PISA points in England and Wales to 56 in Belgium-Flanders. The socio-economic background also has large effects on educational achievement, for both native and migrant students. In countries where the interaction term is significant, it is generally negative, meaning that migrants benefit less than natives from a high endowment of socio-economic resources. However, when significant, interaction terms are rather small with respect to the coefficients associated to the migrant dummy, indicating that underachievement of second-generation immigrants is not so much driven by differential returns to socio-economic resources, but rather by the lack of other resources (e.g. linguistic, cultural, relational).

How do these results translate in terms of our measures of migrant disadvantage? As shown in Figure 1, raw *z*-scores provide a clear-cut picture of how severe is the issue of migrant underachievement in Western Europe: in most countries, second-generation migrants lie below the 30th percentile of the distribution of natives, despite being born in the receiving society and having been entirely exposed to its educational system. In Belgium-Flanders and Denmark the situation is critical, since the average second-generation migrant scores about 0.8 standard deviations less than the average native, lying around the 20th percentile of the distribution of natives.

[Figure 1 about here]

Sharp cross-country differences exist, not only among levels of general underachievement, but also in the extent to which they are explained by socio-economic resources differentials.

In the Netherlands, Luxembourg and France, underachievement is more than halved when accounting for such differences, while in Finland, Portugal, Italy and Spain more than three quarters remain unexplained. Our measure of migrant educational penalty – the controlled z – reveals that the average second-generation migrant child lies below the 35th percentile of the distribution of natives with the same socio-economic resources in Finland, Portugal, Belgium-Flanders, Denmark, Switzerland, Austria, Italy, Sweden and Germany. The least unequal countries for migrant achievement penalties are Greece, England-Wales, France, Luxembourg and Belgium-Wallonia.

Let us now consider how migrant achievement penalties are related to a traditional indicator of educational inequality: the effect of socio-economic status on natives' educational achievement[7].

[Figure 2 about here]

As shown by Figure 2-left, not only migrant-specific penalties do not coincide with socio-economic penalties, but they are negatively correlated in our sample of countries. This counterintuitive finding has relevant implications for cross-country analyses aimed at explaining migrant underachievement. Previous work implicitly assumed that the two effects go in the same direction, when including institutional variables related to socio-economic background in their explanatory models. However, the above mentioned findings should be interpreted as a call for a deeper reflection on the features of educational systems that may be specifically beneficial or detrimental to students of migrant origin.

Yet, cross-country variability of migrant penalties could be driven by compositional issues. This is why we contrast students with Turkish immigrant mothers across seven receiving societies, for which the information on birth country of parents is available and sample sizes are large enough. Figure 2-right shows that the ranking of most countries is left unchanged, with the exception of Belgium-Flanders. The inverse relation with socio-economic penalties holds true, and appears to be even stronger: therefore, even if compositional effects are in place, they are not responsible for the negative correlation.

To summarize, cross-country differences in migrant achievement penalties exist and cannot be reduced to compositional issues. Therefore, there is room for characteristics of educational systems in explaining such variability. Moreover, since migrant penalties and socio-economic penalties emerge as two distinct dimensions of educational inequalities, an in-depth reflection is needed in order to theoretically derive those dimensions of educational systems liable to specifically affect the underachievement of second-generation migrants.

4. What role for educational systems?

4.1 Theoretical background, mechanisms and variable construction

In this section, we reflect on the micro-foundations of educational inequalities for children of migrants, moving from five theoretically relevant dimensions of educational systems: (i) national standardization, (ii) horizontal stratification, (iii) school segregation, (iv) migrant participation rates in preschool and (v) start of compulsory education. We then argue that the underlying mechanisms through which these dimensions may affect migrant educational achievement can be traced back to two encompassing aspects: *marginalization in low-performing schools* and *entry age into the (pre)school system*. We operationalize the latter two with synthetic indicators. Since some dimensions of educational systems are likely to be particularly salient when migrants have to cope with a lack of language skills, we also introduce a country-level indicator of *linguistic distance*.

National standardization: According to Allmendinger (1989), it is the degree to which the quality of education meets the same standards nationwide. This dimension is relevant for educational inequalities because curricula differentiation and disparities in the allocation of human and financial resources may contribute to the creation of a low quality sector in the school system. However, it might prove explanatory of migrant achievement penalties only insofar immigrant students are disproportionately concentrated in this low-quality sector.

Horizontal stratification: Again according to Allmendinger (1989), we define it as the degree of differentiation within given educational levels. Tracking into differentiated curricula is considered to be detrimental to the egalitarian character of educational systems, since educational choices depend on strategic information and cultural capital (Müller and Karle, 1993). Moreover, empirical evidence consistently indicates that early tracking increases educational inequalities driven by socio-economic background (Hanushek and Wössmann, 2011). Even controlling for socio-economic status, immigrant families are likely to suffer from lack of information and cultural resources relevant to cope with destination-countries educational systems. Nevertheless, students with an immigrant background seem to make more ambitious educational choices given prior achievement (Kristen, Reimer, and Kogan, 2008; Cebolla Boado, 2011; Jackson, Jonsson, and Rudolphi, 2012). Hence, horizontal differentiation might be relevant for migrant penalties only as long as immigrant students are disproportionately concentrated in vocational tracks *and* these tracks are low-quality.

School segregation: It is defined as the uneven distribution of individual characteristics (e.g. socio-economic, immigration or ethnic background) across schools. Segregated schools might exacerbate educational inequalities, firstly because they will tend to have bad quality teaching, since teacher sorting often disadvantages already deprived schools (Kalogrides, Loeb, and Béteille, 2013). Indeed, highly qualified teachers have an incentive and means to leave troublesome schools and what is more, a higher turnover is associated with less effective teaching (Wyckoff and Boyd, 2005).

Secondly, students may negatively influence each other's performance, i.e., "peer effects" might be in place (Hoxby, 2000). When considering migrant school segregation, additional problems might arise, e.g. teachers' adaptation to children with different cultural and linguistic background may slow down the learning pace. However, previous literature on European countries has found little evidence of a substantial impact of migrant concentration on educational outcomes (Cebolla Boado, 2007; Cebolla Boado and Garrido Medina, 2011; Brunello and Rocco, 2011; Agirdag, Van Houtte, and Van Avermaet, 2012; Contini, 2013). Ultimately, the segregation of migrant children is an issue insofar it relegates them into marginal sectors of the schooling system, with low-quality teaching, low performance targets and low-quality peers, as the exposure to such environments is likely to limit aspirations and expectations about future life prospects and detriment the development of academic skills.

Hence, we argue that the mechanisms according to which national standardization, horizontal stratification and school segregation could affect migrant penalties are all triggered by the marginalization of second-generation migrants into low-performing schools. Moreover, the uneven concentration of migrant children in low-performing schools can only have three explanations. The first two relate to different forms of *segregation*: migrant-specific school segregation – due to residential segregation or to the explicit school choices made by the families – and social segregation, relevant if migrants are disadvantaged even in terms of socio-economic status. The third reason involves the existence of formal or informal ability-based entry barriers to the more prestigious schools or educational programs; this is related to *standardization* and *stratification*. If none of these mechanisms were operating, children would be randomly allocated to schools, and their chances to end up with well or bad performing peers would be the same for all of them.

Therefore we collapse these three dimensions into the single variable of *marginalization of second-generation migrants into low-performing schools*. We compute the latter as the relative risk for second-generation migrants (*vs*. natives) of attending the lowest-performing group of schools (situated in the 10th percentile of the achievement distribution according to PISA average scores on all literacy domains).

Migrant participation rates in preschool: Preschool attendance has been found to have a positive effect on cognitive development, especially for disadvantaged children (Currie, 2001; Carneiro and Heckman, 2003; Magnuson, Lahaie, and Waldfogel, 2006; Felfe and Hsin, 2012). Our expectation is that it is even more beneficial for children of immigrants because it provides formal and informal contexts to improve their linguistic skills in the official idiom of the destination country (Christensen and Stanat, 2007). Moreover, early socialization with native peers could reduce cultural distance and lack of information experienced by their families (Schofield, 2006). Empirical evidence, though limited to some studies conducted in the US and Germany, suggests that preschool attendance can boost educational opportunities for immigrants (Spiess, Büchel, and Wagner, 2003; Crosnoe, 2007; Biedinger, Becker, and Rohling, 2008).

Start of compulsory schooling: Mechanisms similar to those associated with preschool attendance might be triggered by an early start of compulsory schooling. Moreover, a formal educational context provides additional learning opportunities for children suffering from a lack of cultural resources at home, as it is often the case for children of migrants.

Again, in reason of the similar mechanisms underlying these dimensions, we operationalized migrant participation in preschool and start of compulsory schooling with a single variable, measuring the *average entry age into the (pre)school system for second-generation immigrants* born in 1993. The latter combines individual information on years of preschool attendance retrospectively assessed by PISA and the official starting age of compulsory primary schooling for our cohort of interest (Eurydice, 2000: 65–66).

Linguistic distance: A decisive factor for immigrant students school performance is given by their linguistic skills in the language of instruction (Esser, 2006) and these skills are likely to be affected by the distance between the instruction language and the mother tongue. We expect the above mentioned features of educational systems to be particularly beneficial to children of immigrants with a distant native tongue from the official language of the destination country. In particular, early entry in the educational system might be decisive for those children, since cognitive sciences have shown that the ability to learn a foreign language decreases sharply with age (Birdsong, 2006).

Therefore, we construct an indicator of *linguistic distance* between origin-countries and destination-country official languages, assessed according to the Encyclopedia of Languages (Lewis 2009). For details on the construction of this indicator, refer to Table A6 in the Appendix.

Table A7 reports the figures for each explanatory variable used for cross-country comparison.

4.2 Regression trees

In § 3 we have shown that Western European countries display different degrees of migrant achievement penalty (i.e. net of socio-economic resources) and that these cross-country differences cannot be reduced to compositional effects related to the origin country of immigrants. Therefore, characteristics of educational systems can be called in to explain such variability. We are aware that cross-country comparisons in most cases cannot identify causal effects, since other countries' outcomes cannot provide credible counterfactuals. Hence, we exploit the rich PISA database with an explorative purpose, to examine the relation between the system-level features – average age at entry in the (pre)school system, marginalization into low-performing schools and linguistic distance – which we consider theoretically relevant for migrant achievement penalties.

Preliminary simple regressions on country-level data have shown that all the estimated effects go in the expected directions, although only the coefficient of age of entry is relevant in size and statistically significant.

Against this evidence, we use regression trees, a multivariate data technique that recursively partitions data space into smaller regions, according to the one binary question which minimizes the sum *S* of squared deviations from the subgroup means in the response variable. Each parent node is further divided into child nodes, and the procedure is repeated until the largest decrease in *S* is below a given complexity threshold[8]. Regression trees are particularly useful to detect complex interaction patterns, for which we have no *a priori* assumptions. The approach is exploratory rather than confirmatory and it is entirely data driven. The following *caveat* holds. The set of countries we analyze is interesting *per se*, and cannot be conceived as a random sample drawn from a hypothetical population of units; for this reason, we are not too concerned at this stage with issues like over-fitting and generalizability of results.

4.3 Results

Figure 3 depicts results of the regression tree analysis. As a guidance to the interpretation of the tree, note that variables with the best predictive power are those generating splits at the higher level nodes and that show up again in subsequent divides, while those appearing for the first time in the lower level nodes are usually less important.

[Figure 3 about here]

In the first step, countries are split according to the average *entry age* in the (pre)school system. In the right branch we find late-entry countries (Finland, Denmark, Sweden, Portugal), all exhibiting severe migrant penalties (0.44 to 0.75). In the left branch, where age at entry is low to medium, the picture is more complex. This group is further divided according to *marginalization* of migrants. On the one hand, highly marginalizing systems

(Germany, Austria, Switzerland and Belgium-Flanders) all display severe migrant penalties (0.41-0.50). On the other hand, in Greece, where marginalization is very low, migrant penalties are close to zero (0.14). Moderately marginalizing systems display greater internal heterogeneity: indeed, Italy is set apart in reason of its rather delayed *entry age* and displays a severe penalty (0.45). The remaining countries (England and Wales, France, Luxembourg, Belgium-Wallonia, the Netherlands, Spain and Norway) all display fairly mild penalties (0.15-0.33). Nevertheless, they are further differentiated at lower-level splits, which are all consistent with our theoretical expectations. The case of England and Wales, with very early entry age and very low penalties (0.15), closes the tree as the lowest node.

These results are overall consistent with our theoretical predictions. Entry age in the (pre)school system stems as the most relevant variable in explaining cross-country differences in migrant penalties: it drives the first split and it emerges as a discriminating factor in further divides. As expected, earlier entry is associated to milder migrant penalties. Second order splits are driven by marginalization in low-performing schools, which is generally associated with more severe penalties. However, for a single observation (Finland), the split goes in the unexpected direction. Contrary to our anticipations, linguistic distance does not emerge as a variable of split. However, linguistic distance is relevant to differentiate countries according to migrant penalties in the other domains of literacy assessed by PISA, as appears from additional analyses performed on reading and science. Results of regression trees on these domains are reported in Figures A1-A2 in the Appendix and are generally consistent with our theoretical expectations.

5. Discussion and conclusions

In this paper, we have explored the issue of migrant educational disadvantage in Western Europe. By using the 2006-2009 waves of PISA survey on mathematics literacy of 15-year-old students, we have provided new descriptive evidence on where second-generation migrants are positioned within the achievement distribution of their native peers. We have shown that achievement penalties associated to migrant status are severe in most Western European countries, even after controlling for socio-economic resources. However, cross country variability exists in the extent to which migratory status affects the relative achievement of students. We have drawn attention on one finding in particular: the negative correlation between socio-economic and migrant penalties, a result that is substantiated with additional analyses on Turkish migrants in selected destination countries. Hence, migrant penalties and socio-economic penalties come forth as two distinct dimensions of educational inequalities.

The additional analyses on Turkish migrants have also shown that the observed cross-country differences in migrant educational penalties cannot be fully attributed to the diversity of origin countries, leaving scope for the role of institutional features in determining such penalties. We have reflected on the micro-foundations of migrant penalty in order to derive institutional dimensions that may matter in explaining its variability. By means of recursive partitioning methods, we have assessed how theoretically relevant features of educational systems combine with each other and with the dimension of linguistic distance in producing more or less severe migrant penalties.

Our exploratory analyses point at entry age into the (pre)school system as a major institutional factor behind cross-country differences in migrant achievement penalties. This finding was already hinted at by Schneeweis (2011) and can be understood in terms of a positive effect of early instruction on subsequent schooling performance, which is likely to be particularly beneficial to children of migrants, given their lack of cultural resources specific to the receiving society. Indeed, we find that systems characterized by late entry – Finland, Denmark and Sweden – exhibit severe migrant penalties, despite the extremely comprehensive character of their secondary school. It is worth mentioning that in

Scandinavian countries socio-economic resources affect educational outcomes to a relatively low extent. The absence of tracking into differentiated curricula and the high degree of national standardization of their educational systems may benefit native students with poor socio-economic background, but may not be sufficient to promote equal educational opportunities for second-generation immigrants, who could be harmed in the first place by late entry in (pre)school. This interpretation seems plausible, especially when we consider that in Scandinavian countries linguistic distance is generally high and early socialization with native peers is crucial to improve second-language skills. Moreover, Norway – similar in all other respects to other Scandinavian systems – displays a substantially lower entry age into the (pre)school system and milder achievement penalties for migrants. On the other side of the spectrum, in countries where second-generation immigrants access the educational system very early – England and Wales and the Netherlands – they are less likely to suffer from large achievement penalties.

Another relevant element in explaining cross-country differences is the degree to which second-generation immigrants are marginalized in low-performing sectors of the school system. This aspect encompasses several features of educational systems, such as horizontal differentiation into separate tracks, school segregation and lack of national standardization. Previous works have found inconsistent evidence in favor of the relevance of social or migrant segregation (Schneeweis, 2011) and age at tracking (Cobb-Clark, Sinning and Stillman, 2012; Dronkers, Heus and Levels, 2012) to explain cross-country differences in migrant underachievement. Our results suggest that – when dealing with migrant specific educational disadvantage – tracking into different curricula is not a discriminating factor *per se*. Indeed, among countries which track their students before age 15 (Austria, Flemish and Wallonian Belgium, Switzerland, Germany, Italy, Luxembourg and the Netherlands) those displaying particularly severe migrant penalties are very marginalizing, as opposed to those displaying milder penalties. Hence, we find evidence that horizontal differentiation matters, but only in so far it directly affects the educational opportunities of children of migrants, namely when it entails a disproportionate concentration of migrant students in low-quality tracks.

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List of tables

Table 1. Estimates of individual-level regressions of mathematics scores

country	$(\alpha_M - \alpha_N)$	β_N	$(\beta_M - \beta_N)$
Austria	-38.11** (5.44)	40.37** (2.13)	
Bel. Flanders	-56.43** (9.73)	44.63** (1.59)	-23.79** (6.07)
Bel. Walonia	-30.21** (6.61)	51.80** (2.28)	-21.00** (5.19)
Switzerland	-39.51** (3.12)	34.25** (1.36)	
Germany	-41.15** (4.84)	45.33** (1.80)	-15.35** (4.00)
Denmark	-40.26** (4.82)	32.52** (1.32)	-9.39* (3.90)
England+Wales	-10.86** (4.00)	40.8** (1.58)	
Spain	-25.80** (6.59)	28.45** (0.97)	
Finland	-54.27** (12.04)	28.58** (1.17)	
France	-33.31** (6.73)	52.17** (1.81)	-19.28** (4.14)
Greece	-10.43 (6.96)	33.88** (1.56)	
Italy	-35.77** (8.38)	23.24** (1.41)	
Luxembourg	-21.07** (2.66)	29.66** (1.01)	
Netherlands	-35.71** (6.00)	38.47** (1.64)	-16.94** (3.78)
Norway	-25.41** (7.08)	34.43** (1.53)	
Portugal	-40.02** (8.34)	31.57** (1.31)	10.10* (5.14)
Sweden	-34.32** (4.60)	37.56** (1.60)	

Source: PISA 2006-2009. Country-specific regressions of math scores estimated using replicate weights and plausible values. Model: refer to Equation (1) Controls: *female, ESCS, ESCS*G2*.
** Sig. at 1% level * Sig. at 5% level. Standard errors in parentheses.

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Figure 1. Overall underachievement and migrant achievement penalty

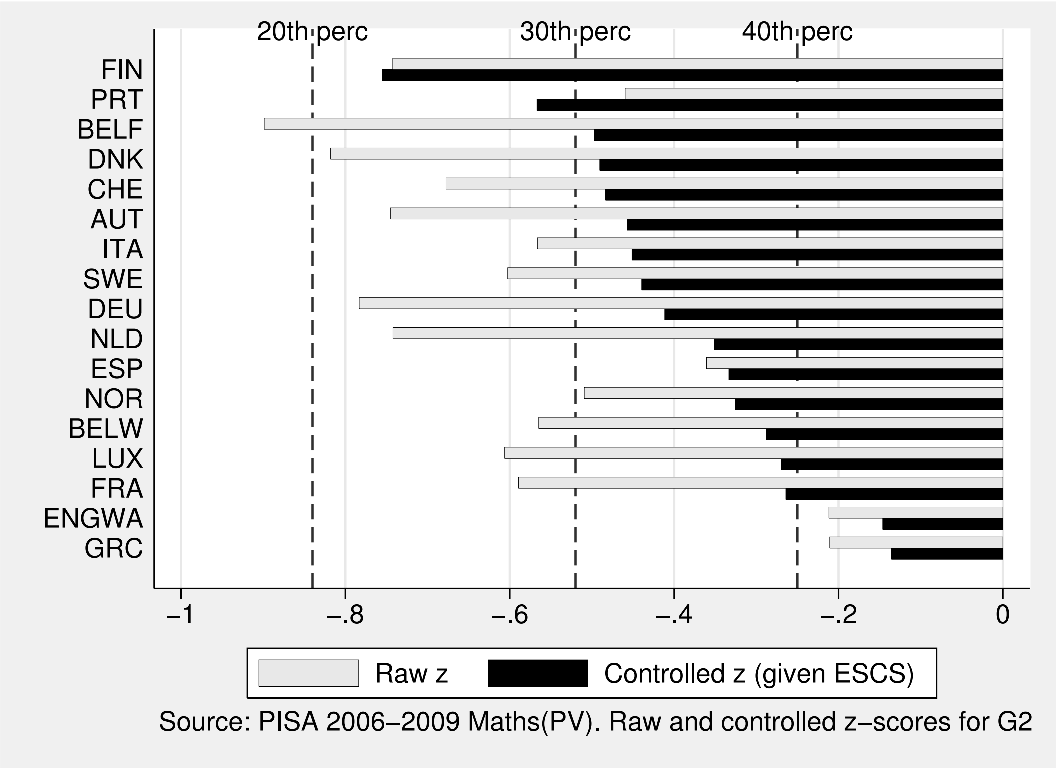


Figure 2. Migrant penalty vs. Socio-economic penalty in educational achievement

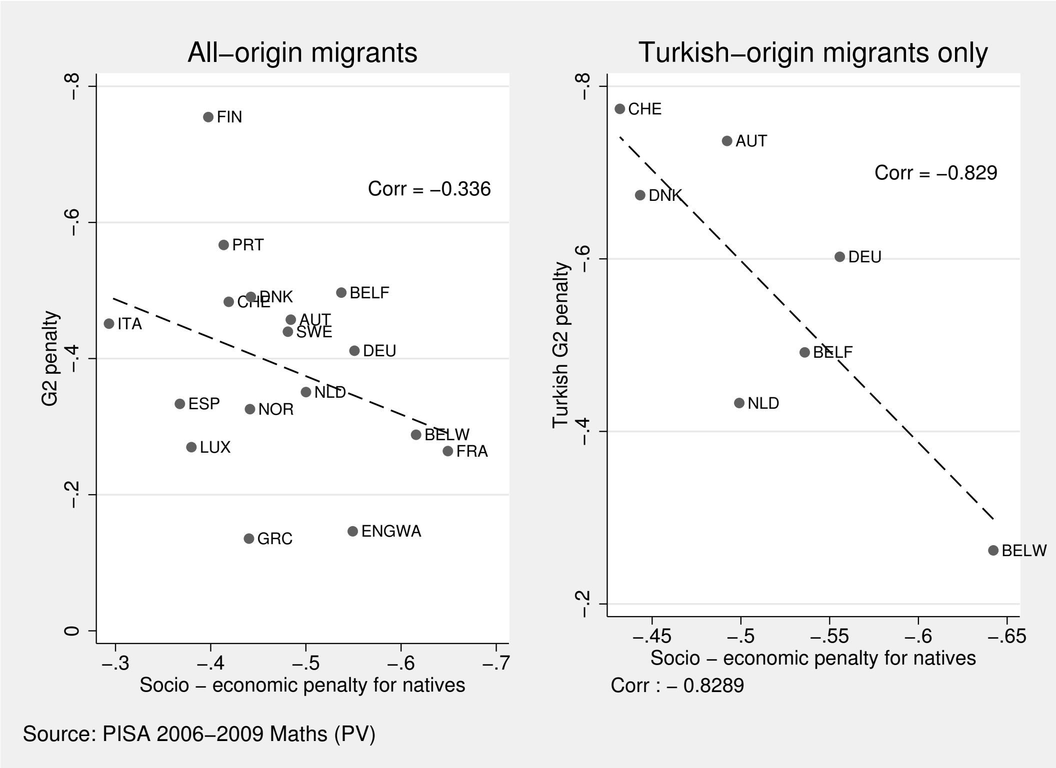
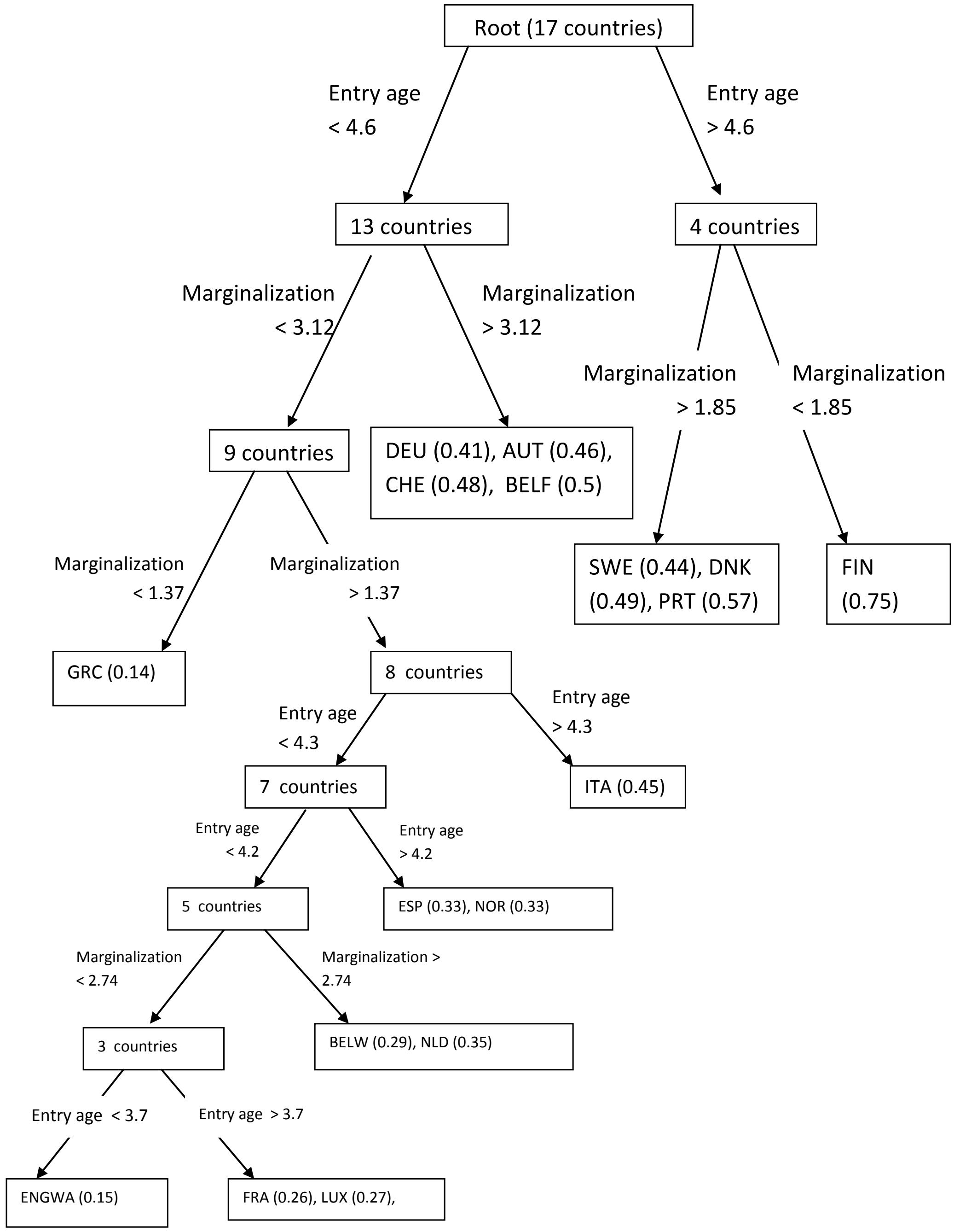


Figure 3. Regression tree of of G2 maths penalties on entry age, marginalization and linguistic distance



Analyses perfomed with package R "rpart". Method: "anova", Complexity parameter 0.01. To improve the readability of the graph, migrant achievement penalties are reported as absolute values.

Appendix

Table A1. Sample sizes used by country and migratory status

Country	Natives	G2 migrants (all origins)	Turkish G2 migrants
Austria	9838	869	330
Bel. Flanders	8859	380	104
Bel. Walonia	5277	683	123
Swizterland	18333	3066	368
Germany	7692	763	370
Denmark	8633	1109	375
England+Wales	13117	556	
Spain	41778	396	
Finland	10228	69	
France	7722	831	
Greece	9004	194	
Italy	18729	306	
Luxembourg	5658	1910	
Netherlands	8414	764	124
Norway	8606	307	
Portugal	10701	247	
Sweden	7900	609	

Source: PISA 2006-2009, not weighted. As motivated in the Data section, data from Italy exclude South.

Table A2. Summary statistics of maths score, by country and migratory status

	Natives		G2 migrants (all origins)		Turkish G2 migrants	
Country	Mean	SD	Mean	SD	Mean	SD
Austria	511.1	89.8	444.2	88.9	406.5	77.9
Bel. Flanders	547.7	92.0	465.1	88.9	451.7	85.8
Bel. Walonia	507.3	96.2	453.0	95.6	430.7	84.2
Swizterland	548.3	86.3	489.8	91.0	454.0	88.9
Germany	521.8	91.2	450.3	92.4	425.6	80.4
Denmark	514.6	78.6	450.3	79.9	423.9	73.3
England+Wales	497.4	82.1	480.0	82.5		
Spain	487.5	83.7	457.3	81.2		
Finland	546.3	75.4	490.3	79.9		
France	505.2	90.5	451.8	93.1		
Greece	467.4	83.8	449.7	86.5		
Italy	506.3	82.9	459.3	95.1		
Luxembourg	509.9	83.1	459.5	84.5		
Netherlands	536.3	83.6	474.3	77.7	462.9	69.9
Norway	498.3	81.8	456.7	90.6		
Portugal	480.1	86.0	440.6	97.4		
Sweden	506.5	83.6	456.2	83.2		

Source: PISA 2006-2009, weighted. As motivated in the Data section, data from Italy exclude South.

Table A3. Summary statistics of *ESCS*, by country and migratory status

	Natives		G2 migrants (all origins)		Turkish G2 migrants	
Country	Mean	SD	Mean	SD	Mean	SD
Austria	0.226	0.8	-0.477	0.8	-0.850	0.8
Bel. Flanders	0.256	0.9	-0.637	1.0	-0.978	0.9
Bel. Walonia	0.291	0.9	-0.285	1.0	-0.773	0.9
Swizterland	0.208	0.8	-0.340	0.9	-0.688	0.9
Germany	0.367	0.9	-0.476	1.0	-0.703	0.9
Denmark	0.370	0.8	-0.446	1.0	-0.885	0.9
England+Wales	0.221	0.8	0.056	0.9		
Spain	-0.278	1.1	-0.366	1.1		
Finland	0.322	0.8	0.246	0.9		
France	-0.032	0.8	-0.627	1.0		
Greece	-0.041	1.0	-0.258	0.9		
Italy	0.053	1.0	-0.500	1.1		
Luxembourg	0.489	0.9	-0.487	1.1		
Netherlands	0.361	0.8	-0.515	1.0	-0.656	0.9
Norway	0.482	0.7	0.036	0.9		
Portugal	-0.459	1.2	-0.321	1.3		
Sweden	0.334	0.8	-0.043	0.8		

Source: PISA 2006-2009, weighted. As motivated in the Data section, data from Italy exclude South.

Table A4. Estimates of individual-level regressions for reading score

Country	$(\alpha_M - \alpha_N)$	β_N	$(\beta_M - \beta_N)$
Austria	-37.13** (7.00)	43.81** (1.95)	
Bel. Flanders	-61.31** (8.63)	42.43** (1.76)	-15.61** (5.77)
Bel. Walonia	-25.71** (7.51)	51.84** (1.96)	-20.39** (5.91)
Swizterland	-26.06** (2.64)	34.28** (1.25)	
Germany	-40.08** (5.25)	44.14** (1.96)	-8.92** (3.92)
Denmark	-31.40** (5.14)	32.20** (1.29)	
England+Wales	0.74 (5.14)	43.83** (1.46)	
Spain	-6.75 (8.27)	27.18** (1.00)	
Finland	-47.66** (11.76)	27.65** (1.07)	
France	-25.27** (6.41)	51.66** (2.00)	-21.14** (4.79)
Greece	-10.89 (8.25)	35.13** (1.58)	
Italy	-36.84** (9.39)	27.78** (1.44)	
Luxembourg	-27.95** (3.00)	32.63** (1.09)	
Netherlands	-25.00** (6.44)	38.42** (1.54)	-12.13* (5.18)
Norway	-23.56** (7.06)	36.48** (1.80)	
Portugal	-32.25** (7.48)	31.77** (1.27)	
Sweden	-26.20** (4. 69)	36.39*** (1.73)	

Source: PISA 2006-2009. Country-specific regression of reading scores estimated using replicate weights and plausible values. Model: refer to Equation (1) Controls: *female, ESCS, ESCS*G2*.
** Sig. at 1% level * Sig. at 5% level. Standard errors in parentheses.

Table A5. Estimates of individual-level regressions for science score

Country	$(\alpha_M - \alpha_N)$	β_N	$(\beta_M - \beta_N)$
Austria	-53.67** (5.73)	42.24** (1.82)	
Bel. Flanders	-66.25** (7.90)	43.39** (1.54)	-19.92** (6.15)
Bel. Walonia	-29.58** (7.48)	51.44** (2.02)	-23.43** (5.57)
Swizterland	-45.42** (2.87)	35.58** (1.28)	
Germany	-57.03** (4.87)	44.25** (1.70)	-11.62** (3.45)
Denmark	-48.85** (5.28)	36.00** (1.40)	
England+Wales	-10.32* (4.73)	47.61** (1.64)	
Spain	-13.68 (7.13)	28.54** (0.97)	
Finland	-59.81** (13.47)	28.85** (1.16)	
France	-34.92** (6.79)	54.03** (1.74)	-21.21** (4.26)
Greece	-16.83** (6.05)	33.79** (1.55)	
Italy	-46.63** (8.68)	25.39** (1.29)	
Luxembourg	-33.78** (3.01)	32.15** (0.96)	
Netherlands	-42.77** (7.93)	42.02** (1.49)	-16.73** (4.45)
Norway	-41.90** (7.27)	35.17** (1.59)	
Portugal	-33.69** (7.65)	29.61** (1.13)	
Sweden	-41.22** (5.08)	36.98** (1.46)	

Source: PISA 2006-2009. Country-specific regression of science scores estimated using replicate weights and plausible values. Model: refer to Equation (1) Controls: *female, ESCS, ESCS*G2*.
** Sig. at 1% level * Sig. at 5% level. Standard errors in parentheses.

Table A6 Shares of immigrants according to linguistic distance

Country	*No distance*	*Mild distance*	*High distance*	*V. high distance*	**Zero to mild**	**High to very high**
Austria	2.0	0.0	46.2	51.9	2.0	98.0
Bel. Flanders	1.8	1.8	33.4	63.0	3.6	96.4
Bel. Walonia	4.5	58.3	8.6	28.5	62.8	37.2
Switzerland	6.0	0.2	62.8	31.0	6.2	93.8
Germany	2.5	2.7	41.6	53.2	5.2	94.8
Denmark	0.0	13.3	8.9	77.8	13.3	86.7
England+Wales	36.8	30.2	7.5	25.5	67.0	33.0
Spain	32.1	16.1	42.9	8.9	48.2	51.8
Finland	0.0	15.5	3.1	81.4	15.5	84.5
France	2.5	65.0	15.2	17.3	67.5	32.5
Greece	12.3	0.0	28.3	59.4	12.3	87.7
Italy	0.7	19.1	43.8	36.4	19.8	80.2
Luxembourg	2.9	8.5	77.5	11.1	11.3	88.7
Netherlands	22.2	1.2	14.9	61.7	23.5	76.5
Norway	2.2	5.5	0.0	92.3	7.7	92.3
Portugal	80.1	9.6	0.0	10.3	89.7	10.3
Sweden	0.0	16.0	39.4	44.6	16.0	84.0

Distance is assessed according to the encyclopaedia of languages Ethnologue (Lewis 2009) as follows: if the two languages coincide to a great extent (ex. U.S. and British English), the distance is set at zero; if they share the same linguistic sub-family (ex. Spanish and French as Romance languages), the distance is considered mild; if they only share the same family (ex. Polish and French as Indo-European languages), distance is high; if they belong to different families (ex. Turkish as Altaic and German as Indo-European), distance is very high. The distance is assessed for every single origin-group in each destination-country and then aggregated according to the share of each group. We assess the distance between the official language in the country of destination and the official language in the country of origin. However, when another language is widely spoken in the country of origin, we also assess the distance between the latter and the official language in the country of destination, and subsequently increase the distance by one factor. Ex. French as widely spoken in Algeria: linguistic distance for Algerians in France: mild.

For countries where information on the country of birth of the mother was available in the national questionnaires, PISA 2006-09 data were used to compute shares of second-generation immigrants with different degrees of linguistic distance (Austria, Belgium-Flanders, Belgium-Walonia, Switzerland, Germany, Denmark, England and Wales, Luxembourg, the Netherlands, Norway, Portugal, Sweden). As a second best, we used UN-DESA data on immigration flows in the period 1975-1993 to proxy origins of parents of second-generation immigrants born in 1994 (England and Wales, Sweden). Where no international information on country of origin was available, we relied on national statistics: Spain (Observatorio Permanente de la Inmigración – Ministerio del Interior: data on foreign residents aged 16-64 in 2003); France (INED: data on foreign residents aged 25-54 in 2009); Italy (ISTAT: data on foreign residents in 2003).

Since two clear-cut clusters of destination-countries emerge, we recode the indicator of linguistic distance as a dummy, with 0 indicating zero or mild linguistic distance, and 1 indicating high or very high linguistic distance.

Table A7 Explanatory variables at a country level

Country	(Pre)school entry age	Marginalization	Linguistic distance
Austria	4.246	5.542	1
Bel. Flanders	4.173	3.811	1
Bel. Walonia	4.186	3.094	0
Switzerland	4.263	3.137	1
Germany	4.431	3.445	1
Denmark	5.386	7.074	1
England+Wales	3.391	2.436	0
Spain	4.255	1.509	0
Finland	5.276	1.209	1
France	4.107	2.098	0
Greece	4.581	1.225	1
Italy	4.403	2.019	1
Luxembourg	4.184	1.908	1
Netherlands	3.287	3.051	1
Norway	4.212	2.198	1
Portugal	4.651	2.485	0
Sweden	5.536	3.057	1

Source: see text, § 4.

Figure A1. Regression tree of G2 science penalties on Entry age, Marginalization and Linguistic distance

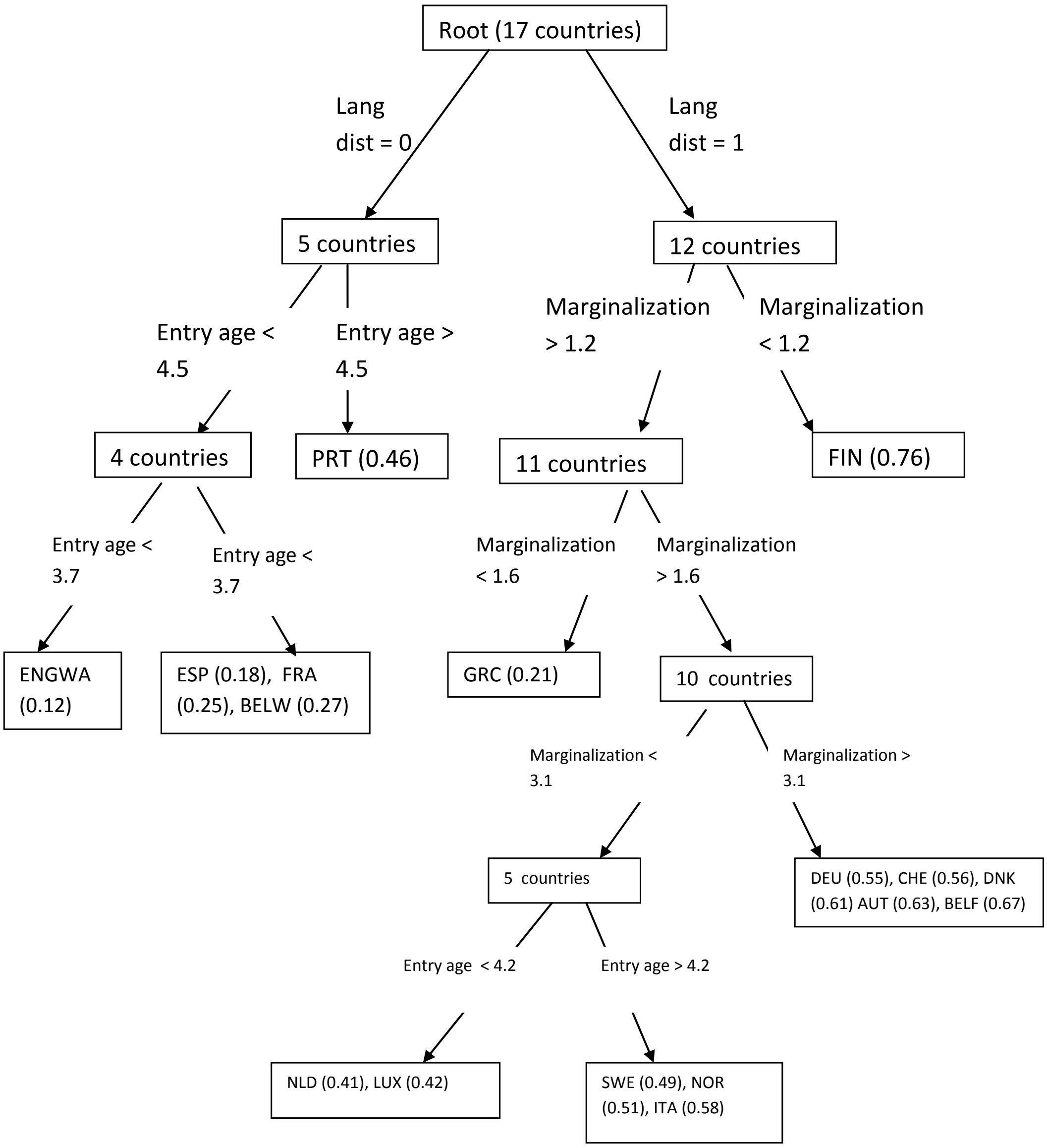
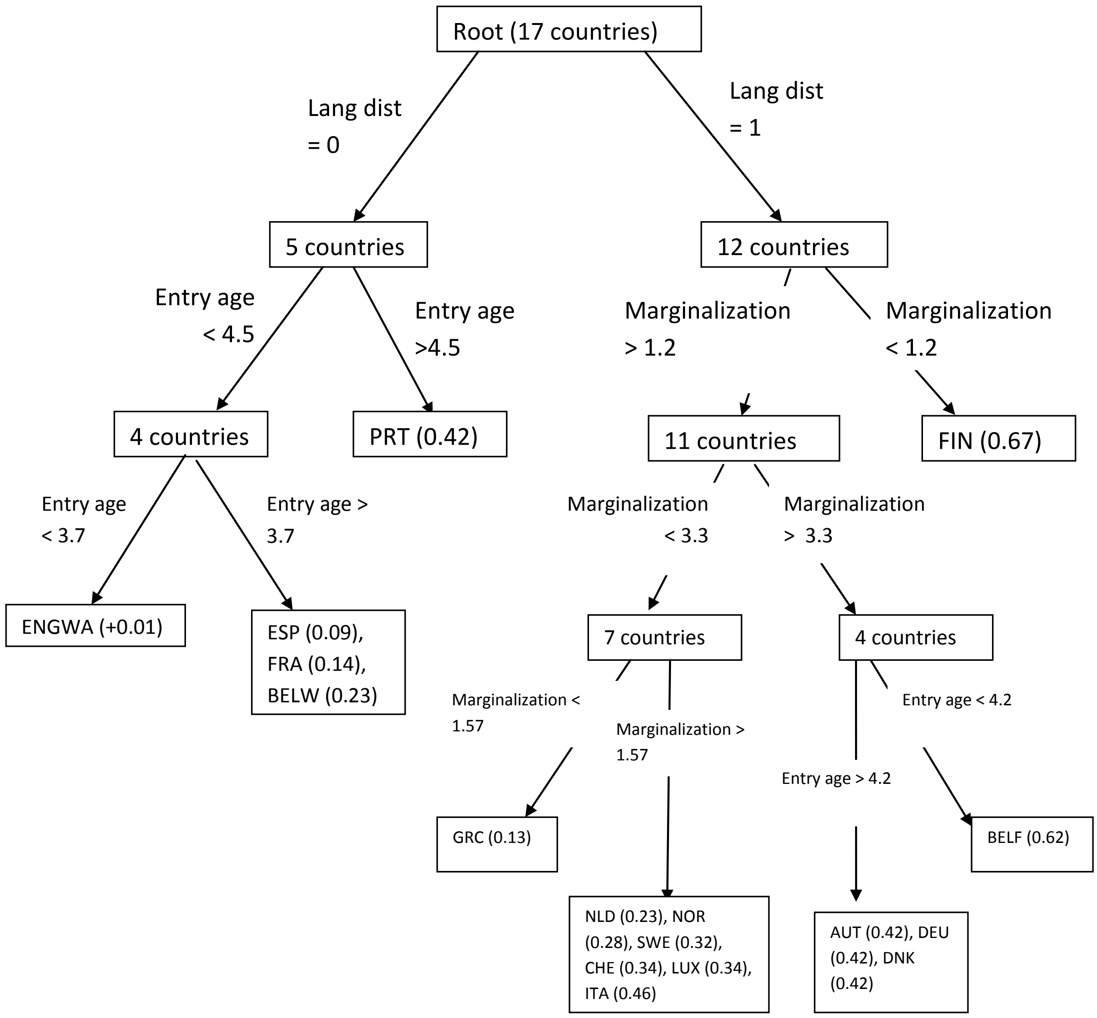


Figure A2. Regression tree of G2 reading penalties on Entry age, Marginalization and Linguistic distance



Endnotes

[1] Dronkers, Heus, and Levels (2012) explicitly address the compositional issue by including characteristics of the origin country. Since this information is available only for a limited number of destination countries, they are forced to analyze a reduced but heterogeneous sample. Schneeweis (2011) includes controls for emigration macro-regions. However, due to data restrictions, this is only possible for a small number of country-years, while the others are recoded as missing dummies.

[2] Schneeweis (2011: 1283) uses the unexplained component of the Blinder-Oaxaca decomposition as dependent variable in her analyses. Note that, differently from her, we do not put much emphasis on differential returns to interpret controlled *z*-scores, as our empirical results show that in all countries the largest part of the unexplained component is captured by the difference in the intercepts.

[3] We first performed separate analyses on the two waves 2006 and 2009. Since results proved consistent, in order to ensure greater sample sizes for immigrant students, we rerun the analyses on the pooled waves.

[4] In order to account for this complex sampling structure, we used the final sampling weights together with the 80 replicate sampling weights. To obtain unbiased estimates of the standard errors, we also used the five plausible values for students' proficiency, as recommended by PISA (OECD 2009: 129).

[5] Our initial country selection comprised Austria, Belgium (split into Belgium-Flanders and Belgium-Wallonia, given different educational systems), Switzerland, Germany, Denmark, Spain, Finland, France, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Sweden and the UK (again split according to the different educational systems into England and Wales, Scotland and Northern Ireland). Given the small sample sizes for second-generation migrants, we excluded Iceland, Ireland, Scotland and Northern Ireland. As for Italy, only Northern and Central are considered. We made this choice because of the well known territorial divide (students from the South perform much more poorly) and the limited presence of second-generation migrants in the South. An accurate measure of relative disadvantage must contrast second generation migrants with their native peers (therefore, natives in Northern and Central Italy). Data from Germany exclude students whose mother was born in former Soviet Union, since some indications (extremely high test scores, German as language spoken at home) make us suspicious of them being ethnic German return migrants.

[6] We include the interaction term provided it is significant at the 5% level. This does not occur for Denmark, England and Wales, Spain, Greece, Italy and Sweden.

[7] We divided the estimated coefficient of *ESCS* for natives by the root mean square error in order to obtain the same metric of our measure of migrant achievement penalty. This indicator of "socio-economic penalty" measures by how many standard deviations a native individual with $ESCS = x$-1 lags behind the achievement score of the native individual with $ESCS=x$.

[8] This is equivalent to inspecting the change in the overall R-squared (in the usual linear models definition).