# Educational Achievement of Indigenous Students in Chile: School Composition and Peer Effects

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This article focuses on observed achievement differentials between indigenous and non-indigenous students in Chile. Using national test score data, it confirms the findings from previous literature that ethnic gaps in educational achievement exist, though they are small and to a large extent explained by family socioeconomic status. The results indicate that school composition with respect to the socioeconomic background and indigenous status of students matters for academic achievement. Controlling for the student's socioeconomic background, the ethnic composition of the school attended is associated with student achievement. In schools where the ethnic composition is higher than the national average, the test score disadvantage of indigenous students is larger, especially for those students whose parents both identify as indigenous. The implications of the research underscore the complexities surrounding the creation of equal educational opportunities for indigenous populations in segregated contexts.

## Introduction

Accounting for ethnic differentials in test scores remains a somewhat enigmatic task, even 50 years after the Coleman Report (1966) was published. Over the decades, research by sociologists and economists has predominantly addressed this matter in regards to socioeconomic background, while school-level and sociocultural explanations have provided additional interpretive lenses (Kao and Thompson 2003; Harris 2010). Test score gaps across continents have shown that racial/ethnic background is strongly related to socioeconomic factors and to the preselection and sorting of pupils into school types and tracks (Nash 2003). While different school-choice policies can either ameliorate or exacerbate the segregation of students by ethnicity, the general consensus from international research is that high ethnic segregation[1] in schools has particularly negative effects on the educational achievement of ethnic minorities.

[1] Much international literature conflates the terms "segregation" (which can measure a number of unequal population distributions such as dissimilarity or isolation) and "composition," which we use to refer to the mix of indigenous and non-indigenous students in schools.

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However, evidence about the forces that explain these negative effects is mixed. One perspective attributes the negative effects of clustering ethnic minority students in schools solely to their shared (but individual) socioeconomic background of low family income and low parental years of education. The argument is that students from ethnic minorities who have higher socioeconomic background perform as well as the white majority (Marks 2005). A related perspective focuses on the school but incorporates cumulative socioeconomic factors to explain institutional disadvantage. Schools with established reputations for successful academic outcomes tend to cream off students from families with higher levels of parental income and education, admit students with higher previous test scores, and attract teachers with stronger credentials and more experience (Thrupp et al. 2002). Hence the homogenous composition of school environments may a priori consist of initial advantages or disadvantages, whereby the aggregate effects of individual characteristics, teacher quality and expectations, and school resources combine to reproduce particular education outputs (Szulkin and Jonsson 2007; Harris 2010; Wells 2010). Ethnically concentrated schools are likely found in residentially segregated areas, which have fewer resources and are less able to offer inclusive pedagogical practice to ethnic minorities.

Another explanation is that peer aspirations, motivations, and attitudes affect student performance, and these are negatively constructed in ethnically segregated schools and in low-performance-track classes. Peer effect research generally falls into one of two camps—either the contagion model or the institutional model. The contagion model emphasizes the epidemic effects within the school, that is, how a pupil's achievement is pulled up or down by peers. Schools that concentrate on SES (socioeconomic status) and ethnicity have students of similar backgrounds, who share similar beliefs about the benefits of education (or lack thereof), so there are few direct group effects on an individual student's behavior. However, the institutional model draws attention to the effects of material, resource, and political inequalities in school contexts (Harris 2010). From this perspective, restricted access to capital (economic, cultural, or social) and institutional discrimination translate into low academic performance and motivation of students and teachers (Van Laar and Sidanius 2001).

In this article we examine math and language test score differences between non-indigenous and indigenous students in Chile, and seek further evidence about the possible detrimental effects of high ethnic composition schools. The Chilean context has been particularly susceptible to high levels of socioeconomic segregation given that, until recently, "voucher" schools were able to select which students to admit (Elacqua 2009). In contrast, public schools accommodate proportionally more low-income and indigenous students. Our results confirm that while socioeconomic background plays a substantial part in explaining the test score gaps of indigenous students, the



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ethnic composition of schools, controlling for students' socioeconomic background, explains student performance.

*School Ethnic Composition and Educational Achievements*

Existing literature, mainly from Europe, has provided an important axis for comprehending student achievement that is related to the school attended (and discrete family- and individual-level factors like SES and parental years of education). The research finds relatively consistent findings with respect to the positive educational outcomes for ethnic minority students who participate in diverse schools, but more mixed findings of negative outcomes for ethnic minorities attending poorly mixed schools (Driessen 2001; Dronkers and Levels 2007; Szulkin and Jonsson 2007; van Ewijk and Sleegers 2010; van Houtte and Stevens 2010; Agirdag et al. 2012).

The US case has been even more expansive, linking ethnic school and classroom composition to enduring achievement gaps for blacks, Hispanic, and Native American racial categories. This owes much to the contextual particularities of the desegregation policies implemented after the *Brown versus Board of Education* decision in 1954. The reduction of the black-white test score gap following the desegregation period (1968–72) gave further credence to school-level explanations, particularly the detrimental effects of attending highly ethnic-minority concentrated schools. In later decades this reduction stalled (Mickelson et al. 2013), and some scholars have suggested this owed to the resegregation of minority and high-poverty schools (Orfield and Lee 2007). However, authors have been cautious to note the difficulties of disentangling this effect from other within-school variables such as teacher quality, differences in ability (including the deleterious effects on high-ability students), and SES and family background (Hanushek et al. 2009). Recent research has found more consistent results[2] regarding the small but significant negative effects of high ethnic-minority composition schools on the education outcomes of various ethnic minorities across areas of the US and across school grades, and also that these achievement gaps increase over the schooling years (Mickelson et al. 2013).

In Australia, Canada, and New Zealand, research has also analyzed the achievement gaps of indigenous or aboriginal populations (see Friesen and Krauth [2010] on Canada; Leigh and Gong [2009] on Australia; Harker and Tymms [2004] on New Zealand). These studies confirm the significant test score gaps between the indigenous and aboriginal students and other students. Friesen and Krauth's findings suggest that segregation and sorting of First Nation students from non-aboriginal students in Canada can explain

[2] Findings by Rivkin (2000) and Card and Rothstein (2007), among others, reach different conclusions, underlining the methodological complexities surrounding this matter.



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achievement gaps because the former are "disproportionately located in small, rural communities and in a handful of urban centers" (2010, 1287).

Comparisons between indigenous and non-indigenous test score gaps are also possible in Latin America, though there are important case-specific differences (demographic and political).[3] Studies have been carried out for Guatemala (McEwan and Trowbridge 2007); Bolivia (McEwan 2004); Peru (Sakellariou 2008); Peru, Mexico, and Guatemala (Hernandez-Zavala et al. 2006); and Ecuador (Garcia Aracil and Winkler 2004). According to McEwan and Trowbridge, in the case of elementary education (third and sixth grades), up to half of the gap in Guatemala can be explained by differences in the quality of schooling, as captured by school type, level of access to textbooks, and teacher quality.

*Literature on Chile*

The empirical literature on Chile that analyzes the differences in academic achievement between the indigenous population and the non-indigenous population is sparse. The major contributions to this literature have come from McEwan (2003, 2004, 2008) and, more recently, from Undurraga (2014).

McEwan's research (2004), which generated the first data in this field, finds an achievement gap of 0.3–0.5 SD between Mapuche students and other students. Despite limitations in the data used (indigenous origin was measured using only the mother's surname), the research acknowledges the importance of the school context and quality beyond an association with students' socioeconomic background. The author highlights the relevance of peer group characteristics to explain the differences in the achievement levels between public and private schools. In particular, peer effects partly account for the unobserved characteristics associated with the socioeconomic background of students and their families (McEwan 2003).

Undurraga's (2014) doctoral thesis examines the indigenous test score gap at both primary and secondary education levels over a 4-year period (2008–11). Employing data from the Education Quality Measurement System (SIMCE), he finds an average achievement gap in test scores that varies between 0.2 and 0.3 standard deviations, depending on the subject. Taking parental self-identification as the proxy for measuring indigenous origin, his results reveal that the indigenous gap is explained to a great extent by the student's socioeconomic background. Additionally, his findings show a negative association between ethnic composition and test scores in math and

[3] Indigenous populations in Chile are a smaller share of the population compared to other Latin American countries, and possess less cultural and linguistic diversity than Andean and Mesoamerican regions. For example, indigenous pupils in the Hernandez-Zavala et al. (2006) study of Peru, Mexico, and Guatemala are identified as those who grew up in a native-language-speaking household. In Chile this criterion would exclude most cases.



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science in primary education. The author suggests that this negative effect might be related to teachers' lower expectations in ethnically concentrated classrooms.

Two other articles analyze the educational achievement of the indigenous population in Chile. Cerda (2009) confirms that the Mapuche population has the lowest average years of schooling in the Araucania region. In particular, the students in rural schools in this region have the lowest SIMCE scores. Elacqua (2009) analyzes how school choice affects segregation. He notes that the segregation of indigenous students from non-indigenous students was lowest in public schools and in private subsidized schools, and highest in private schools.

This article contributes to the national and international literature in two ways. First, we offer further empirical evidence on a Latin American country—one of the world areas where there is a relative shortage of research on ethnic achievement differentials in comparison with developed countries. Comparisons between Chile and other developed countries are justified on the premise that Chile was included in the OECD in 2010, the second from Latin America after Mexico. However, Latin American countries with indigenous populations face different types of challenges regarding education equality and social justice. To date the Chilean case has not been specifically analyzed regarding ethnic concentration in schools as an explanation for achievement differentials. We argue that this issue is exceptionally relevant in this case study since, as in other settler societies with indigenous populations, certain geographical regions are ethnically segregated on account of colonial histories, as well as cultural ties to specific territories.

Another contribution, on a national scale, is that while McEwan notes the effect of unobserved characteristics operating on the indigenous test score gap, we provide specific evidence regarding how different thresholds of ethnic composition in schools affect education differentials. In addition, we analyze whether the potentially negative effect of a high ethnic school composition is related to school track (academic/vocational). Additionally, we control for previous achievement over time. This feature is novel within the Chilean context.

Following the theoretical framework, we propose that ethnically homogenous school environments prove detrimental to equitable education achievement for indigenous students in Chile. That is, high ethnic composition schools tend to cluster concentrations of students with lower family income and parental years of education into specific schools. Given that parental years of education are lower for indigenous versus non-indigenous populations in Chile (CASEN 2015), it is plausible that school contexts with greater proportions of indigenous pupils may be more susceptible to lower expectations on account of reproducing lower parental expectations about what education can provide for their families. Additionally, they might also



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be associated with the types of curriculum being studied, which are related to particular educational and occupational outcomes.

## Data, Variables, and Methodology

### *Data*

Our analysis is based primarily on data from the SIMCE. SIMCE is the Chilean national student testing system, which annually assesses knowledge of curricular content in different grades in areas such as language, mathematics, and social and natural sciences, among others. SIMCE is a census-based[4] assessment annually administered to students in public, private subsidized (voucher), and private schools.

Although SIMCE does not follow students over time, recent measures allow students who took the tests on more than one occasion to be identified. The grade schedule of the SIMCE test allows us to follow two groups[5] of students who were tested in two different grades.[6] The first group comprises those who were first tested in 2007 when they were finishing fourth grade, and then again in 2011 when they were completing eighth grade. The second group comprises students who were tested in 2013 when they were finishing tenth grade, and had a previous achievement measure in 2011 when they were completing eighth grade. Based on this strategy, we work with two analytical samples.[7] The first sample comprises information on 173,298 students enrolled in eighth grade in 2011, representing 67 percent of the student population who took the SIMCE tests in 2011 in eighth grade. Our second sample comprises information on 125,645 students enrolled in tenth grade in 2013, corresponding to 65 percent of the student population who took the SIMCE tests in 2013 at that level.

[4] The data collection process entails testing approximately 250,000 students annually. The assessment is representative of the national school population.

[5] The two groups do not comprise the same students. Only a third of the students tested in 2013 have complete information in the two previous tests.

[6] Both data sets are linked through the unique identification code for the student. We omit students whose unique identifier is missing or have duplicates in both data sets. We also exclude students who have missing test scores for one or both tests.

[7] We compare the excluded and included students in each of the cohorts used in our analysis in relation to their academic and socioeconomic characteristics (table C1). Evidence reveals that there are small socioeconomic differences between these two samples. Students who took only one test are slightly poorer than those who participated in both tests as measured by parental education and family income. The proportion of indigenous students is only slightly higher in the excluded sample than in the analytical sample. In relation to academic characteristics, we find larger differences between both subsamples. The excluded students have lower test scores in both cohorts than the analytical sample. In the cohort 2007–2011, students who were tested only in 2011 have significantly higher repetition rates than those who are included in the analysis. These results suggest that our analytical sample largely excludes poor performers. We do not find evidence that poor performers are correlated with the proportion of indigenous students. This exclusion may introduce a bias in our estimations, which we do not directly address in this article.



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The SIMCE data collection process also includes the administration of a set of comprehensive questionnaires to students, their parents, and teachers. We also use these data. Specifically, we employ information from the student and parent questionnaires to ascertain students' socioeconomic and academic background, along with their expectations. Additionally, we use the teacher questionnaire to learn about their expectations regarding students' occupational and educational futures. Finally, as a third source of information, we drew on administrative records from the Ministry of Education (MINEDUC) to generate information about the schools in our sample. These administrative data are merged with the SIMCE data set.

*Variables*

The analysis focuses on students' scores in SIMCE math and language tests. We analyze these test scores at two moments, at the eighth grade in 2011 and at tenth grade in 2013. The eighth grade corresponds to the last year of primary education, and tenth grade refers to the second year of secondary education. Students who are in tenth grade are two years away from making their decision about whether or not to pursue postsecondary studies. The response variable is standardized (mean $= 0$, $\sigma = 1$). Used as such in the regression analyses, it measures the achievement gap between indigenous and non-indigenous students as a fraction of the standard deviation.

A set of individual and school characteristics are included as explanatory variables. Ethnic origin, the main individual predictor, classifies students as belonging to an indigenous group if at least one[8] parent identified him/herself as indigenous. We recognize the complexities surrounding indigenous self-identification and categorization by others. This method is limited by the SIMCE questionnaires, which do not ask students to provide information about their own identification. We further control for individual sociodemographic characteristics such as gender and for socioeconomic background. Parental education and family income are used as proxies for family SES. In addition, we use an indicator of student educational expectations,[9] which refers to students'[10] expectations for after completing their secondary education. This measure is a categorical variable with three categories (finish high school, pursue technical studies in higher education, and pursue university education).

Following the literature, we also include two measures of past academic achievement as control variables (Clotfelter et al. 2006; Guarino et al. 2015). A previous score is considered to be a good proxy for latent ability and the

[8] We conduct sensitivity analyses using alternative definitions of indigenous self-identification.

[9] Expectations account for the assessment that students make regarding their academic futures, based on their socioeconomic background and their past and current academic performance.

[10] For eighth graders in 2011, we employ parents' expectations as a proxy measure for student expectations.



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unobserved history of inputs (Todd and Wolpin 2003). Specifically, we control by students' test scores in fourth grade (2007) for the analysis of test scores in eighth grade (2011). Likewise, we use students' test scores in eighth grade (2011) as a control for the analysis of test scores in tenth grade (2013). Additionally, we use an indicator for whether a student has ever repeated a grade as the second control for past academic achievement.

Regarding explanatory school-level variables, we use the ethnic composition of the classroom and the school, and the student's school track as the main school-classroom predictors. The ethnic composition variables in the school and classroom are measured as the proportion of indigenous students in both contexts. These school and classroom measures are proxies for peer group variables. School track is a dummy variable that indicates whether the student is enrolled in an academic or vocational (technical-professional) school.[11]

As school controls, we use an indicator variable for the type of school (public, private subsidized, or private) attended by the student, whether the school is located in an urban area, and a measure of the SES school composition, the school mean of parental education. This school composition variable is centered for ease of interpretation. Table 1 describes the dependent and independent variables used in this research.

Figures 1 and 2 present the descriptive statistics for the dependent variable, test scores, by ethnicity. We observe that there is a test score gap (unadjusted) between indigenous and non-indigenous students in math and language in different grades and years. As figure 1 shows, non-indigenous students obtain, on average, higher scores than indigenous students in both subjects. The achievement gap in eighth and tenth grades varies around 0.2 and 0.3 standard deviations in math, whereas the gap is around 0.2 in the language scores. Our results partially confirm Undurraga's findings (2014), but they are slightly lower than McEwan's (2003, 2004, 2008), particularly in language.

*Methodology*

We estimate a hierarchical linear model (HLM) to examine the association between variables at the school, classroom, and student levels, and student scores in math and language tests. This multilevel modeling allows us to decompose the variance in student test scores into within- and between-school components. We conducted a three-level random intercept model for predicting students' math and language test scores in SIMCE, where we treat students as nested in classrooms within schools.

[11] Students in tenth grade have not started the curriculum associated with a specific track, since formal tracking begins in eleventh grade; however, by the tenth grade they would have already taken a decision about their track.



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We start the analysis with a simple means-as-outcome model, then added an indigenous identification variable and, subsequently, individual- and school-level controls. Finally, we incorporate school- and classroom-level predictors, including ethnic composition and school track. Equation (1) presents the full specification:

$$Y_{ijK} = \beta_0 + \beta_1 X_{1ijk} + \beta_2 X_{2ijK} + \beta_3 X_{3ijK} + \beta_4 X_{4jk} + \beta_5 X_{5k} + \beta_6 X_{6ijk} + u_{0j} + v_{0k}, \quad (1)$$

where $Y_{ijk}$, the standardized test score in math or language of student $i$ in classroom $j$ in school k, is a function of an intercept ($\beta_0$); the student's indigenous origin ($X_{1ijk}$); the student's previous achievement in SIMCE ($X_{2ijk}$); a vector of student-level variables ($X_{3ijk}$); a vector of classroom-level variables ($X_{4jk}$); a vector of school-level variables ($X_{5k}$); an interaction term between the indigenous dummy variable and any school/class-level variable ($X_{6ijk}$); a random intercept for the classroom ($u_{0j}$); and a random intercept for the school ($v_{0k}$).

**Results**

In this section, we present how the variance in test scores in math and language in eighth and tenth grades is associated with the characteristics of the schools, classrooms, and students. In addition, we examine whether the relationship between student test scores and indigenous status varies when controlling for individual and school characteristics.

Tables 2 and 3 present the results for math tests in eighth (2011) and in tenth (2013) grades, respectively; tables 4 and 5 report the results for language tests in both years. In model 1 we assess whether there was enough variation in test scores across schools in both years. As has been found in other school-effect research (Teddlie and Reynolds 2000), most variation occurs within schools and between students. Likewise, the variance analyses showed some differences between both grades and subjects. While the proportion of the total variance in math scores between students (within schools) in eighth grade was 65 percent, the proportion of the variance among schools was 30 percent, and across classrooms was 4 percent. For tenth grade, the proportion of total variance in math scores among schools was 50 percent, whereas the within-school variance was around 46 percent, and across classrooms was 6 percent. However, the results reveal that the proportion of variance in language scores was in the same order of magnitude as the math scores in eighth grade, but slightly higher in tenth grade.

The intraclass correlation coefficient (ICC) for model 1 in table 3 reveals that around one-half of the observed variance in math scores in tenth grade is attributable to school or classroom characteristics, which is relatively consistent with previous studies on Chile (McEwan 2008; Undurraga 2014). The



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TABLE 1
Definition and Summary Statistics of Variables Used in the Analyses

| | Definition and Measure | Mean (SD) Eight Grade (2011) | Mean (SD) Tenth Grade (2013) |
|---|---|---|---|
| Dependent variables: | | | |
| Math | SIMCE math score | 263.3 (48.9) | 273.9 (64.2) |
| | Indigenous | 253.9 (46.1) | 257.7 (61.3) |
| | Non-indigenous | 265.9 (48.9) | 276.4 (64.1) |
| Language | SIMCE language score | 258.6 (49.5) | 259.6 (54.8) |
| | Indigenous | 253.4 (47.2) | 251.4 (52.4 |
| | Non-indigenous | 261.2 (49.3) | 260.8 (55.0) |
| Independent variables: | | | |
| Individual-level variables: | | | |
| Math 4th grade | SIMCE math score | 255.7 (53.1) | |
| | Indigenous | 245.6 (51.7) | |
| | Non-indigenous | 258.1 (52.9) | |
| Language 4th grade | SIMCE language score | 263.3 (50.9) | |
| | Indigenous | 255.9 (48.8) | |
| | Non-indigenous | 265.4 (50.9) | |
| Indigenous | Parents' self-reported ethnicity. Student has at least one parent who self-identifies as indigenous (dummy). | .13 | .13 |
| Gender | Female = 1, Male = 0 | .52 | .52 |
| Parental education | Maximum school attainment by parents. Student has at least one parent with higher education (dummy). | .29 | .38 |
| Grade repetition | Whether the student has repeated at least once (dummy). | .06 | .10 |

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| | | | | |
|---|---|---|---|---|
| Student expectations | Maximum level of education that students expect to attain (categorical variable with three categories). | Completion of SE | .15 | .06 |
| | | Study a technical program in HE | .15 | .19 |
| | | Study at the university | .56 | .60 |
| | | Missing | .14 | .14 |
| Income | Reported sum of all household income (monthly). Income scale is 100,000–2,200,000 Chilean pesos. | 450,000 | | 450,000 |
| School-level variables: | | | | |
| School SES composition | Proportion of parents with higher education | .00 | | .00 |
| School ethnic composition | Proportion of indigenous students in the school | .13 | | .13 |
| Class ethnic composition | Proportion of indigenous students in the classroom | .13 | | .08 |
| Type of school | Categories based on administrative dependency and whether received funding from the government | Publicly funded | .42 | .35 |
| | | Private subsidized | .50 | .57 |
| | | Private (nonsubsidized) | .08 | .08 |
| Rural | Whether the school is located in a rural area (dummy) | Rural | .09 | .03 |
| | | Urban | .91 | .97 |
| School track[a] | School is categorized as academic or vocational (dummy variable) | Academic | | .53 |
| | | Vocational | | .47 |

NOTE.—We used normalized scores for math and language test scores (dependent variables in the regression analyses). SES = socioeconomic status.

[a] The school track variable is only considered for the analyses of SIMCE scores in tenth grade.



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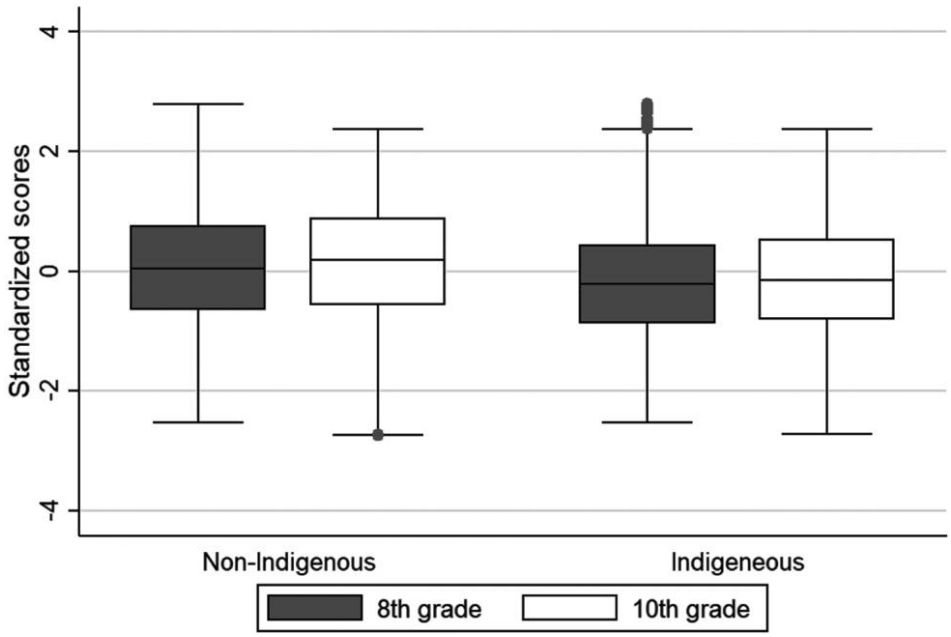


FIG. 1.—Box plots of SIMCE scores in math by ethnic origin

share of the variance in math test scores that is explained by school differences is greater in tenth grade than in eighth grade. For language, the ICC for model 1 in tables 4 and 5 reveals that 30–40 percent of the variance in test scores is explained by school characteristics. These findings suggest that student performance in math is explained to a larger extent by school differences rather than language scores.

In model 2, we test whether there is an indigenous gap in test scores. The results confirm that across schools there is a significant gap in math and language scores between indigenous and non-indigenous students. Being indigenous is associated with a lower math test score of 0.02–0.05 standard deviations and a lower language score of 0.02 standard deviation. These estimates are relatively similar to the findings by Undurraga (2014) for the eighth and tenth grades, but somewhat different from McEwan's (2004) results since we find that the gap is slightly larger in mathematics than in language. We conduct further analyses (not shown here)[12] that test whether the indigenous gap in language is explained by which language is spoken at home. The results largely confirm our main findings.

[12] Available upon request.



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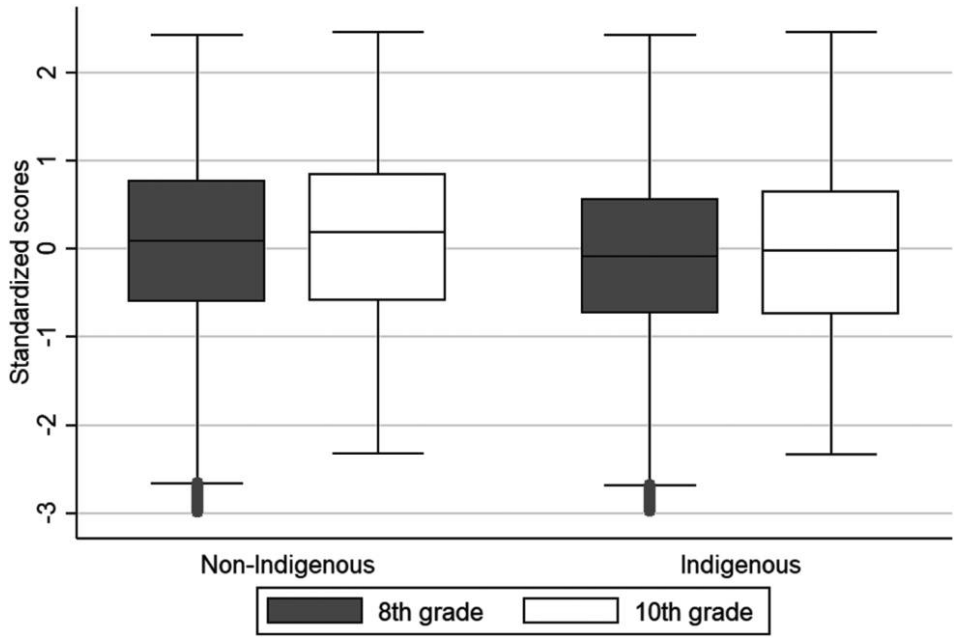


FIG. 2.—Box plots of SIMCE scores in language by ethnic origin

In models 3 and 4, we examine whether the relation between student test scores and indigenous status holds when controlling for individual and school characteristics. Before interpreting the results on the indigenous gap, we briefly analyze the coefficients of the student-level variables. Parental education is positively associated with test scores in both math and language. Family income is also positively associated with the scores in both subjects and grades, but the magnitudes of the estimates are rather small.

Previous achievement[13] is an important determinant of current SIMCE results. An increase of one standard deviation in the previous SIMCE test produces math and language achievement gains of approximately 0.6 standard deviation. We find that grade repetition has a negative association with test scores in both eighth and tenth grades. Current test scores are lower by 0.02 standard deviation when the student has previously repeated a grade.

Confirming previous research, the results of model 3 reveal that, to a great extent, the variance in math and language scores between and within schools is explained by students' socioeconomic background (McEwan 2003, 2004, 2008; Undurraga 2014). After the effects of student expectations,

[13] We conduct further analyses without including the previous SIMCE achievement. The results confirmed our main findings. They are available upon request.



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TABLE 2
THREE HIERARCHICAL LINEAR MODELS PREDICTING SIMCE MATH SCORES IN EIGHTH GRADE IN 2011

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
|---|---|---|---|---|---|---|---|---|
| Student variables: | | | | | | | | |
| Indigenous | | −.05*** | −.004 | −.003 | −.002 | −.002 | −.006 | −.002 |
| | | (.01) | (.01) | (.01) | (.01) | (.01) | (.005) | (.01) |
| SIMCE math score 4th grade | | | .64*** | .63*** | .63*** | .63*** | .63*** | .63*** |
| | | | (.00) | (.002) | (.002) | (.002) | (.002) | (.002) |
| Gender (female) | | | −.11*** | −.11*** | −.11*** | −.11*** | −.11*** | −.11*** |
| | | | (.003) | (.003) | (.003) | (.003) | (.003) | (.003) |
| Retention (repeated) | | | −.18*** | −.18*** | −.18*** | −.18*** | −.18*** | −.18*** |
| | | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| Parental education (HE) | | | .04*** | .34*** | .33*** | .33*** | .33*** | .33*** |
| | | | (.005) | (.02) | (.02) | (.02) | (.02) | (.02) |
| Income | | | .02*** | .01*** | .01*** | .01*** | .01*** | .01*** |
| | | | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) |
| Educational expectations (university ref.) | | | | | | | | |
| Completion of SE | | | −.16*** | −.16*** | −.16*** | −.16*** | −.16*** | −.16*** |
| | | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| Technical program in HE | | | −.13*** | −.13*** | −.13*** | −.13*** | −.13*** | −.13*** |
| | | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| School- and class-level variables: | | | | | | | | |
| Type of school (private ref.): | | | | | | | | |
| Public | | | | −.22*** | −.23*** | −.22*** | −.22*** | −.22*** |
| | | | | (.03) | (.03) | (.03) | (.03) | (.03) |
| Private subsidized | | | | −.17*** | −.17*** | −.17*** | −.17*** | −.17*** |
| | | | | (.03) | (.03) | (.03) | (.03) | (.03) |
| Rural | | | | .12*** | .12*** | .12*** | .12*** | .12*** |
| | | | | (.01) | (.01) | (.01) | (.01) | (.01) |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| School SES composition | | | | −.31*** | −.30*** | −.30*** | −.30*** | −.30*** |
| | | | | (.03) | (.03) | (.03) | (.03) | (.03) |
| School ethnic composition | | | | | −.03 | | −.04 | |
| | | | | | (.02) | | (.03) | |
| Class ethnic composition | | | | | | −.03 | | −.02 |
| | | | | | | (.02) | | (.03) |
| Indigenous × school ethnic composition | | | | | | | .02 | |
| | | | | | | | (.03) | |
| Indigenous × class ethnic composition | | | | | | | | .003 |
| | | | | | | | | (.03) |
| Random effects: | | | | | | | | |
| Individual variance (within schools) | .65 | .64 | .36 | .36 | .36 | .36 | .36 | .36 |
| | (.003) | (.003) | (.002) | (.002) | (.002) | (.002) | (.002) | (.001) |
| School variance | .28 | .28 | .06 | .05 | .05 | .05 | .05 | .05 |
| | (.002) | (.002) | (.04) | (.04) | (.003) | (.003) | (.003) | (.003) |
| Classroom variance | .04 | .03 | .02 | .02 | .02 | .02 | .02 | .02 |
| | (.002) | (.002) | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) |
| ICC school | .29 | .29 | .15 | .12 | .12 | .12 | .12 | .12 |
| ICC classroom/school | .33 | .33 | .18 | .16 | .16 | .16 | .16 | .16 |
| Intercept | −.05*** | −.02** | .11*** | .23*** | .23*** | .23*** | .23*** | .23*** |
| | (.01) | (.01) | (.01) | (.03) | (.03) | (.03) | (.03) | (.03) |
| *N* | 172.938 | 142.715 | 132.714 | 132.714 | 132.714 | 132.714 | 132.714 | 132.714 |
| Schools | 5,667 | 5,610 | 5,596 | 5,596 | 5,596 | 5,596 | 5,596 | 5,596 |
| Classes | 8,532 | 8,465 | 8,448 | 8,448 | 8,448 | 8,448 | 8,448 | 8,448 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.

* $P < .1$.

** $P < .05$.

*** $P < .001$.



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TABLE 3
THREE HIERARCHICAL LINEAR MODELS PREDICTING SIMCE MATH SCORES IN TENTH GRADE IN 2013

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Student-level variables: | | | | | | | | | | |
| Indigenous | | −.02*** | −.001 | .002 | .003 | .003 | .01 | .004 | .004 | .01 |
| | | (.00) | (.00) | (.05) | (.00) | (.00) | (.00) | (.01) | (.01) | (.01) |
| SIMCE math score 8th grade | | | .56*** | .55*** | .55*** | .55*** | .55*** | .55*** | .55*** | .55*** |
| | | | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| Gender (female) | | | −.08*** | −.08*** | −.08*** | −.08*** | −.08*** | −.08*** | −.08*** | −.08*** |
| | | | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| Retention (repeated) | | | −.17*** | −.17*** | −.17*** | −.17*** | −.17*** | −.17*** | −.17*** | −.17*** |
| | | | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| Parental education (HE) | | | .03*** | .80*** | .78*** | .80*** | .78*** | .80*** | .71*** | .71*** |
| | | | (.00) | (.03) | (.00) | (.00) | (.00) | (.00) | (.03) | (.03) |
| Income | | | .01*** | .003*** | .003*** | .003*** | .003*** | .003*** | .003*** | .003*** |
| | | | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| Educational expectations (university ref.) | | | | | | | | | | |
| Completion of SE | | | −.19*** | −.18*** | −.18*** | −.18*** | −.18*** | −.18*** | −.18*** | −.18*** |
| | | | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| Technical program in HE | | | −.14*** | −.13*** | −.13*** | −.13*** | −.13*** | −.13*** | −.13*** | −.13*** |
| | | | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| School- and class-level variables: | | | | | | | | | | |
| Type of school (private ref.): | | | | | | | | | | |
| Public | | | | −.05* | −.05* | −.05* | −.05** | −.05** | −.07** | −.07** |
| | | | | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) |
| Private subsidized | | | | .10*** | .10*** | .10*** | .10*** | .10** | .08** | .08** |
| | | | | (.02) | (.02) | (.02) | (.02) | (.02) | (.02) | (.02) |
| Rural | | | | −.04 | −.03 | −.03 | −.03 | −.03 | −.03 | −.03 |
| | | | | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) |
| School SES composition | | | | −.78*** | −.77*** | −.78*** | −.76*** | −.78*** | −.69*** | −.68*** |
| | | | | (.03) | (.04) | (.03) | (.03) | (.03) | (.03) | (.03) |
| School ethnic composition | | | | | −.10** | | −.09** | | −.08* | −.07 |
| | | | | | (.04) | | (.04) | | (.04) | (.04) |



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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Class ethnic composition | | | | | | −.03 | | −.03 | | |
| | | | | | | (.03) | | (.03) | | |
| Indigenous × school ethnic composition | | | | | | | −.02 | | | −.02 |
| | | | | | | | (.03) | | | (.03) |
| Indigenous × class ethnic composition | | | | | | | | −.02 | | |
| | | | | | | | | (.03) | | |
| School track (academic ref.) | | | | | | | | | | |
| Vocational | | | | | | | | | −.07*** | −.07*** |
| | | | | | | | | | (.01) | (.01) |
| Random effects: | | | | | | | | | | |
| Individual variance (within schools) | .46 | .46 | .26 | .26 | .26 | .26 | .26 | .26 | .26 | .26 |
| | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| School variance | .5 | .49 | .12 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| | (.01) | (.01) | (.04) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| Classroom variance | .06 | .06 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) | (.00) |
| ICC school | .49 | .49 | .30 | .18 | .18 | .18 | .18 | .18 | .18 | .18 |
| ICC classroom/school | .54 | .54 | .35 | .25 | .25 | .25 | .25 | .25 | .25 | .25 |
| Intercept | .05*** | .05*** | .11*** | −.16*** | −.14*** | −.15*** | −.14*** | −.16** | −.07* | −.07* |
| | (.01) | (.01) | (.001) | (.03) | (.001) | (.03) | (.03) | (.03) | (.04) | (.04) |
| *N* | 125.645 | 125.645 | 117.108 | 117.108 | 117.108 | 117.108 | 117.108 | 117.108 | 116.978 | 116.978 |
| Schools | 2,787 | 2,787 | 2,786 | 2,786 | 2,786 | 2,784 | 2,786 | 2,786 | 2,782 | 2,782 |
| Classes | 7,037 | 7,037 | 7,029 | 7,029 | 7,018 | 7,018 | 7,029 | 7,029 | 7,021 | 7,021 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.

* $P < .1$.

** $P < .05$.

*** $P < .001$.



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TABLE 4
THREE-LEVEL LINEAR HIERARCHICAL MODELS PREDICTING SIMCE LANGUAGE SCORES IN EIGHTH GRADE IN 2011

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
|---|---|---|---|---|---|---|---|---|
| Student variables: | | | | | | | | |
| Indigenous | | −.02** | .01 | .01 | .004 | .004 | .003 | −.001 |
| | | (.007) | (.01) | (.01) | (.01) | (.01) | (.006) | (.01) |
| SIMCE language score 4th grade | | | .61*** | .62*** | .61*** | .61*** | .61*** | .61*** |
| | | | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) |
| Gender (female) | | | .10*** | .10*** | .10*** | .10*** | .10*** | .10*** |
| | | | (.004) | (.004) | (.004) | (.004) | (.004) | (.004) |
| Retention (repeated) | | | −.20*** | −.20*** | −.20*** | −.20*** | −.20*** | −.20*** |
| | | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| Parental education (HE) | | | .05*** | .22*** | .22*** | .22*** | .22*** | .22*** |
| | | | (.005) | (.02) | (.02) | (.02) | (.02) | (.02) |
| Income | | | .01*** | .005*** | .005*** | .005*** | .005*** | .005*** |
| | | | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) |
| Educational expectations (university ref.) | | | | | | | | |
| Completion of SE | | | −.22*** | −.22*** | −.22*** | −.22*** | −.22*** | −.22*** |
| | | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| Technical program in HE | | | −.15*** | −.15*** | −.15*** | −.15*** | −.15*** | −.15*** |
| | | | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| School- and class-level variables: | | | | | | | | |
| Type of school (private ref.): | | | | | | | | |
| Public | | | | −.11*** | −.11*** | −.11*** | −.11*** | −.11*** |
| | | | | (.02) | (.02) | (.02) | (.02) | (.02) |
| Private subsidized | | | | −.06*** | −.06*** | −.06*** | −.06*** | −.06*** |
| | | | | (.02) | (.02) | (.02) | (.02) | (.02) |
| Rural | | | | .16*** | .15*** | .15*** | .15*** | .15*** |
| | | | | (.01) | (.01) | (.01) | (.01) | (.01) |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| School SES composition | | | | −.18*** | −.19*** | −.19*** | −.19*** | −.19*** |
| | | | | (.02) | (.02) | (.02) | (.02) | (.02) |
| School ethnic composition | | | | | .05 | | .04 | |
| | | | | | (.03) | | (.03) | |
| Class ethnic composition | | | | | | .05 | | .04 |
| | | | | | | (.03) | | (.03) |
| Indigenous × school ethnic composition | | | | | | | .02 | |
| Indigenous × class ethnic composition | | | | | | | (.03) | .01 |
| | | | | | | | | (.03) |
| Random effects: | | | | | | | | |
| Individual variance (within schools) | .70 | .70 | .41 | .40 | .40 | .40 | .40 | .40 |
| | (.002) | (.003) | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) |
| School variance | .21 | .20 | .05 | .04 | .04 | .04 | .04 | .04 |
| | (.005) | (.005) | (.002) | (.04) | (.003) | (.002) | (.002) | (.002) |
| Classroom variance | .05 | .05 | .03 | .03 | .03 | .03 | .03 | .03 |
| | (.002) | (.002) | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) |
| ICC school | .21 | .21 | .10 | .09 | .09 | .09 | .09 | .09 |
| ICC classroom/school | .27 | .27 | .16 | .15 | .15 | .15 | .15 | .15 |
| Intercept | −.001 | .03*** | −.12*** | −.09*** | −.10*** | −.09*** | −.10*** | −.10*** |
| | (.008) | (.008) | (.01) | (.03) | (.03) | (.03) | (.03) | (.03) |
| *N* | 172.938 | 142.715 | 132.714 | 132.714 | 132.714 | 132.714 | 132.714 | 132.714 |
| Schools | 5,667 | 5,610 | 5,596 | 5,596 | 5,596 | 5,596 | 5,596 | 5,596 |
| Classes | 8,532 | 8,465 | 8,448 | 8,448 | 8,448 | 8,448 | 8,448 | 8,448 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.

* $P < .1$.

** $P < .05$.

*** $P < .001$.



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TABLE 5
THREE-LEVEL LINEAR HIERARCHICAL MODELS PREDICTING SIMCE LANGUAGE SCORES IN TENTH GRADE IN 2013

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Student-level variables: | | | | | | | | | | |
| Indigenous | | −.005 | .005 | .01 | .01 | .01 | .02*** | .01 | .01 | .02** |
| | | (.007) | (.006) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) | (.01) |
| SIMCE language score 8th grade | | | .56*** | .56*** | .56*** | .56*** | .56*** | .56*** | .56*** | .56*** |
| | | | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) |
| Gender (female) | | | .07*** | .07*** | .07*** | .07*** | .07*** | .07*** | .07*** | .07*** |
| | | | (.004) | (.004) | (.004) | (.004) | (.004) | (.004) | (.004) | (.004) |
| Retention (repeated) | | | −.15*** | −.15*** | −.15*** | −.15*** | −.15*** | −.15*** | −.15*** | −.15*** |
| | | | (.006) | (.006) | (.01) | (.01) | (.006) | (.006) | (.006) | (.006) |
| Parental education (HE) | | | .05*** | .54*** | .55*** | .54*** | .55*** | .55*** | .39*** | .39*** |
| | | | (.005) | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) |
| Income | | | .01*** | .002* | .002* | .002* | .002* | .002* | .002* | .002* |
| | | | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) |
| Educational expectations (university ref.) | | | | | | | | | | |
| Completion of SE | | | −.19*** | −.18*** | −.18*** | −.18*** | −.18*** | −.18*** | −.17*** | −.17*** |
| | | | (.005) | (.005) | (.005) | (.005) | (.005) | (.005) | (.005) | (.005) |
| Technical program in HE | | | −.14*** | −.13*** | −.13*** | −.13*** | −.13*** | −.13*** | −.12*** | −.12*** |
| | | | (.005) | (.005) | (.005) | (.005) | (.005) | (.005) | (.005) | (.005) |
| School- and class-level variables: | | | | | | | | | | |
| Type of school (private ref.): | | | | | | | | | | |
| Public | | | | −.03 | −.03 | −.03 | −.03 | −.03 | −.06** | −.06** |
| | | | | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) |
| Private subsidized | | | | .08*** | .08*** | .08*** | .08*** | .08*** | .03 | .03 |
| | | | | (.02) | (.02) | (.02) | (.02) | (.02) | (.02) | (.02) |
| Rural | | | | .06** | .06** | .06** | .06** | .06** | .07*** | .07*** |
| | | | | (.03) | (.02) | (.03) | (.03) | (.03) | (.03) | (.03) |
| School SES composition | | | | −.51*** | −.51*** | −.51*** | −.51*** | −.51*** | −.35*** | −.36*** |
| | | | | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) | (.03) |



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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| School ethnic composition | | | | | .04 | | .04 | | .06 | .09* |
| | | | | | (.06) | | (.06) | | (.04) | (.05) |
| Class ethnic composition | | | | | | .02 | | .03 | | |
| | | | | | | (.03) | | (.04) | | |
| Indigenous × school ethnic composition | | | | | | | −.06* | | | −.06 |
| | | | | | | | (.04) | | | (.04) |
| Indigenous × class ethnic composition | | | | | | | | −.03 | | |
| | | | | | | | | (.04) | | |
| School track (academic ref.) | | | | | | | | | | |
| Vocational | | | | | | | | | −.10*** | −.10*** |
| | | | | | | | | | (.01) | (.01) |
| Random effects: | | | | | | | | | | |
| Individual variance (within schools) | .61 | .61 | .40 | .40 | .40 | .40 | .40 | .40 | .40 | .40 |
| | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) | (.001) | (.001) | (.001) |
| School variance | .30 | .30 | .07 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| | (.01) | (.01) | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) | (.002) |
| Classroom variance | .08 | .08 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| | (.002) | (.002) | (.001) | (.002) | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) |
| ICC school | .30 | .30 | .13 | .10 | .10 | .10 | .10 | .10 | .09 | .09 |
| ICC classroom/school | .38 | .38 | .21 | .18 | .18 | .18 | .18 | .18 | .18 | .18 |
| Intercept | .06*** | .06*** | −.11*** | −.28*** | −.29*** | −.29*** | −.29*** | −.29*** | −.19*** | −.20*** |
| | (.01) | (.01) | (.001) | (.03) | (.03) | (.03) | (.03) | (.03) | (.04) | (.04) |
| *N* | 125.645 | 125.645 | 117.108 | 117.108 | 117.092 | 117.092 | 117.092 | 117.092 | 116.978 | 116.978 |
| Schools | 2,787 | 2,787 | 2,786 | 2,786 | 2,784 | 2,784 | 2,784 | 2,784 | 2,782 | 2,782 |
| Classes | 7,037 | 7,037 | 7,029 | 7,029 | 7,018 | 7,018 | 7,018 | 7,018 | 7,021 | 7,021 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.

* $P < .1$.

** $P < .05$.

*** $P < .001$.



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socioeconomic and academic background are taken into account, the indigenous achievement gap disappears in both grades and subjects. Further analyses (not shown here) reveal that the indigenous gap in eighth grade for both subjects disappears once we control for SIMCE achievement in fourth grade. We find the same for the tenth-grade estimates.

In model 4, we find that a substantial part of the variance in test scores between schools, especially in mathematics, is explained by school characteristics, as indicated by the decrease in the school variance component. The school SES composition, in particular, is an important determinant of academic achievement in both grades. We examine whether the relationship between test scores and indigenous status varies when controlling for school characteristics. The results for eighth and tenth grades suggest that the achievement gap also stems from the relatively worse financial resources and condition of the schools that indigenous students attend as compared to the schools of their non-indigenous peers.

In models 5–10, we examine whether other school-level characteristics are associated with math and language scores. Models 5 and 6 examine whether the shares of indigenous students in the classroom and in the school are associated with math and language scores, controlling for individual and other school characteristics, including SES composition. Overall, we find that the school's ethnic composition is significantly associated with student achievement but not the classroom's ethnic composition. School ethnic composition is negatively associated with math scores but not with language scores. A higher proportion of indigenous students in a school significantly decreases student math scores in tenth grade ($-0.10$ standard deviation, $P < 0.01$) but not in eighth grade. These results are partly consistent with previous findings by McEwan (2003, 2008) and Undurraga (2014).[14]

We also test whether the effects of indigenous status on test scores vary by the school and classroom indigenous composition, now adding the interaction terms between indigenous status and school and classroom characteristics in models 7 and 8. Overall, we do not find significant results for these interaction terms in grades or subjects, except language in tenth grade ($-0.06$ standard deviation, $P < 0.1$).

The lack of statistical significance of the ethnic composition effects might be explained partly by the small number of indigenous students in the national population. The descriptive statistics reveal that around 15 percent of the school population who took the national tests attend schools without indigenous students. In 30 percent of schools, over 15 percent of students are indigenous, and only 1 percent of schools in which the student population is

[14] Using fixed effect models, McEwan (2003, 2008) finds that the class ethnic composition negatively affects math and Spanish scores. In contrast, Undurraga (2014), using a three-level hierarchical model, finds that the ethnic composition of the class significantly affects math and science scores, but not Spanish scores.



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over 60 percent indigenous. The relevance of looking at high ethnic composition schools becomes even clearer when considering that over half of indigenous students attend schools that have the highest concentration of ethnic pupils. Our results confirm previous research findings that indigenous students typically attend schools where their peers are likely to be also indigenous and whose parents have lower education and poorer economic resources (McEwan 2004).

In models 9 and 10 we test the relationship between math and language scores and the school track. We conduct the analyses only for tenth grade, since formal tracking takes place only in secondary education in Chile. As model 9 shows, there is a negative association between average test scores in math and language and the school track. Being enrolled in a vocational school, as compared with an academic track, is associated with lower achievement in both subjects. These results are in line with recent estimates by Farias and Carrasco (2012),[15] who find that vocational track students perform, on average, 0.28 standard deviation below similar students in the academic track in Chile. International research (Arum and Shavit 1995) has shown that the negative impact of attendance at vocational schools on educational achievement is related to a variety of factors, such as less demanding programs, lower teaching quality, negative peer effect, stigmatization, and lower expectations. Our findings show that a student's school track is a significant indicator of family SES background, but does not completely account for the association between SES and the student's achievement. Similarly, we find that the negative effect of higher ethnic school composition on test scores is partially explained by the student's school track; that is, schools with a higher ethnic composition are mostly technical-vocational schools.[16]

Finally, in model 10 we test whether being in the vocational track is associated with the effect of a school's ethnic composition on student achievement. The results do not support the hypothesis that a vocational track, controlling for other variables, explains the achievement gap between indigenous and non-indigenous students in high ethnic composition schools.

In sum, our various estimates suggest that the socioeconomic composition of schools and, to a lesser extent, their ethnic composition explain the achievement between indigenous and non-indigenous students. Regarding ethnic composition effects, our findings show significant variation between subjects and grades. This mixed evidence could be partly related to sampling variation or changes in the difficulty of SIMCE tests between years. We discuss this caveat further in the discussion and implications section.

[15] These authors analyze the impact of vocational education on university admission tests through propensity score matching.

[16] Descriptive evidence suggests that around two-thirds of schools that have a proportion of indigenous students above the national average are technical-vocational schools.



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*Sensitivity Analyses*

In order to test the robustness of our results, we undertake sensitivity analyses with alternative forms for capturing the strength of the ethnic variable. First, we conduct analyses considering only students whose parents both self-identified as indigenous. We carry out complementary analyses only with students whose mothers self-identified as indigenous, and also with students whose fathers declared to be indigenous, separately. The results of the analyses largely confirm our findings, but with some exceptions (see app. A). The indigenous/non-indigenous gap in test scores increases substantially when considering a more rigorous definition of ethnicity. The test score gap in math increases from 0.05 to 0.09 standard deviation in eighth grade and from 0.02 to 0.05 standard deviation in tenth grade when a student's parents both identify themselves as indigenous. The gap also increases, although only marginally, when the student's mother is indigenous.

Additionally, we carry out sensitivity analyses using different school ethnic composition thresholds, in line with the studies we have cited earlier. We begin with a sample of schools whose proportion of ethnic students is above the national mean (>13 percent). This sample represents 35 percent of the total number of schools tested nationally. We select another sample of schools with a proportion of indigenous students higher than 30 percent. This latter sample represents just 12 percent of the total number of schools in the population included in SIMCE. This sampling aims to focus on schools with an imbalance of indigenous/non-indigenous students, since composition effects are best observed from both ends of the spectrum (as opposed to well-mixed schools; Thrupp et al. 2002).

Overall, these sensitivity analyses (see app. B) are largely consistent with those presented in tables 2–5. They confirm that the indigenous gap does not hold in both eighth and tenth grades when controlling for school and individual characteristics. However, they do reveal that in schools with ethnic compositions above the national mean (>13 percent), the gap between indigenous and non-indigenous students increases in math scores in tenth grade. In schools with an ethnic composition higher than 30 percent, we also find significant interaction effects for ethnic school composition and being indigenous (−0.21 standard deviation, $P < 0.01$) and also between ethnic classroom composition and being indigenous (−0.10 standard deviation, $P < 0.01$). However, we did not find significant interaction effects for math in eighth grade or language for either grade. The analyses confirm the association between the school track, ethnic composition, and test scores but did not provide evidence that the school track explains the differential effect of higher ethnic composition schools on student performance.

Finally, using different school composition thresholds, we undertake further sensitivity analyses about whether ethnically concentrated schools are detrimental to students whose parents both identify as indigenous. Overall,



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these analyses confirm the negative impact of higher ethnic composition school contexts for this group of students.[17]

**Discussion and Implications**

Our results confirm that the indigenous gap in test scores is explained to a great extent by socioeconomic background, which supports McEwan's (2004, 2008) and Undurraga's (2014) findings in the Chilean context. Complementing their results, we also find support for the significance of previous educational achievement in current educational achievement (Clotfelter at al. 2006; Guarino et al. 2015).

In addition, our findings show that the school context matters for student test scores. The SES of students in the school, and to a lesser extent, the school's ethnic composition are strongly associated with observed achievement gaps between indigenous and non-indigenous students. These gaps can also be linked to the relatively fewer financial resources and poorer learning conditions in schools that indigenous students attend as compared to their non-indigenous peers. A higher concentration of indigenous students has a negative effect on student math scores (both indigenous and non-indigenous), but not on language scores. While we do not find significant evidence that the achievement gap between indigenous and non-indigenous students is related to the ethnic composition of schools nationally, we propose that these results attest to the fact that a high percentage of indigenous students are concentrated in some schools. Ethnically concentrated schools, those with an ethnic composition above the national average, contribute to explaining the gap in mathematics achievement in tenth grade between indigenous and non-indigenous students. In this regard, our findings are similar to Reardon's (2016) for the United States. We conclude that segregation is detrimental to achievement, particularly in schools where indigenous students are exposed mostly to peers who have low educational aspirations and motivations and come from poor families.

Our sensitivity analyses reveal that the indigenous test score gap in mathematics, and to a lesser extent in language, is larger for students who come from families where both parents self-identify as indigenous and marginally less so for those whose mothers identify as indigenous. Nine percent of students with both parents identifying themselves as indigenous have completed higher education, as compared with 15 percent for those with a mixed family origin and with 33 percent of non-indigenous students whose parents have higher education. Given the unusually high levels of exogamy among the Mapuche in Chile compared with other indigenous peoples in Latin America (Valenzuela and Unzueta 2015), disadvantages in

[17] Results are available upon request.



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terms of parental education or family SES are seldom analyzed for students with differing degrees of interracial marriage among parents. Consequently, an area for further research is to gauge more nuanced within-group differences among indigenous populations.

Our estimates of the indigenous-nonindigenous achievement gap in Chile are smaller than in Guatemala, Mexico, and Peru, especially in language. Certain authors suggest that language or reading tests are more closely affiliated with sociocultural and family attributes while mathematics learning depends more on school contexts (e.g., Marks 2005). Marks et al. (2006) add that reading is taught in early primary school and is well-established by the end of primary school. In contrast, mathematics is "cumulative" and is taught at different levels according to the student's ability to cope with the material (Marks et al. 2006). Our data show that only 1–3 percent of indigenous pupils speak an indigenous language at home as their first language. As a result, the proficiency required for standardized testing among indigenous populations is less of an issue in Chile than in other Latin American countries (McEwan and Trowbridge 2007). Further research is required to analyze other school characteristics such as teaching bias, learning opportunities, and teaching quality, which might explain the gap between indigenous and non-indigenous students in higher ethnic composition schools.

We also note that our results rely on the ability of the SIMCE test scores to measure student achievement accurately. Math tests may not necessarily reflect all aspects of the achievement gap between indigenous and non-indigenous students. Standardized tests are often designed to determine basic proficiency and may assign little value to advanced knowledge of a subject (Kane and Staiger 2002, 105; Jennings et al. 2015). There may also be other educational outcomes such as admission to university, high school dropout rates, and subject grades (or ranking) that may depict a different scenario regarding ethnic inequalities. Additionally, some evidence implies that the difficulty of SIMCE tests varies each year (Eyzaguirre and Fontaine 1999), thus limiting the comparability of test scores between years. To address this issue, we use a standardized measure of test scores, but annual differences may still account for some variation in the test score gap. As several researchers have pointed out, test scores are prone to volatility (Kane and Staiger 2002; Barrera-Osorio and Ganimian 2016).[18] Year-to-year changes in school average test scores are partially attributable to factors not related to school quality, such as sampling variation (changes in the number and composition of the student population) or one-time events (shocks, such as a more virulent flu strain or a longer spell of bad weather that increases student absences). The use of previous test scores ameliorates this problem somewhat but does not overcome it.

[18] These authors, in particular, analyze test score volatility in relation to school accountability.



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Overall, this article aims to contribute to the broader literature regarding highly segregated schools, especially by ethnicity, as a worldwide and negative phenomenon. These schools arise from a complex mix of sociopolitical factors, such as unequal residential and educational opportunities, sharply distinct socioeconomic classes, and school choice. This is the case in Chile despite the fact that Chile's indigenous population is not a large share of the national population, compared with other countries in Latin America. However, characteristics particular to Chile need more education research: the effects of isolation of rural schools, differences between indigenous populations, and mixed-race families. Further research is also needed to confirm our findings using longitudinal data, as well as earlier grades and other subjects.

Regarding implications for public policy, our research is somewhat too nascent to offer definitive recommendations. However, we offer a few propositions for the Chilean context. First, at present, the socioeconomic *and* ethnic inequalities of attending high indigenous composition schools lack visibility among key institutional actors, such as national and municipal departments of education. This cluster of issues warrants more policy attention.

Second, though reforms are underway to remove parental contributions in state-subsidized schools that are highly segregated by ethnicity, these measures alone will be insufficient to benefit indigenous populations who are relegated to schools with large concentrations of low SES peers. Areas densely populated by indigenous families, particularly in remote rural areas affiliated with ancestral territories, are particularly prone to clustering poor indigenous students in schools due to school choice policies. Although the international literature (particularly for the US) points to the need to desegregate schools (Orfield and Lee 2007), settler society contexts are somewhat more complex, given their ties to ancestral territories.

Third, we suggest a focus on within-school processes that may ameliorate the educational inequalities in these spaces. Some existing policies already work to this end. The implementation of an intercultural and bilingual education program in contexts with over 20 percent indigenous enrollment, for example, has been important for promoting the relevance of curricular content in multicultural contexts. School grants to indigenous students have improved access to education at primary, secondary, and tertiary levels (Webb 2015), but these initiatives pay little attention to school factors. The limited learning opportunities and low capacity to hire quality teachers in high ethnic composition schools show up as low student achievement. Indeed, there is need to provide these schools with teachers who are trained to work in multicultural classrooms so as to reduce bias or racist attitudes. Further research will enable more specifically targeted recommendations in this regard.



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## Appendix A
## Sensitivity Analyses with a More Stringent Definition of Ethnic Origin[19]

TABLE A1
THREE HIERARCHICAL LINEAR MODELS PREDICTING SIMCE MATH SCORES IN TENTH GRADE IN 2013, CONSIDERING ONLY STUDENTS WHOSE PARENTS BOTH SELF-IDENTIFIED AS INDIGENOUS

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fixed Effects | | | | | |
| Individual-level variables: | | | | | | | | | | |
| Indigenous | | −.0539*** | −.0147 | −.0109 | −.00848 | −.00864 | .0302 | .0292* | −.00814 | .0305 |
| | | (.0142) | (.0109) | (.0108) | (.0109) | (.0110) | (.0230) | (.0162) | (.0109) | (.0230) |
| SIMCE math score 8th grade | | | .558*** | .554*** | .554*** | .554*** | .554*** | .554*** | .554*** | .554*** |
| | | | (.00207) | (.00207) | (.00207) | (.00207) | (.00207) | (.00207) | (.00208) | (.00208) |
| Gender (female) | | | −.0829*** | −.0850*** | −.0850*** | −.0850*** | −.0850*** | −.0850*** | −.0852*** | −.0852*** |
| | | | (.00359) | (.00358) | (.00358) | (.00358) | (.00358) | (.00358) | (.00358) | (.00358) |
| Retention (repeated) | | | −.168*** | −.167*** | −.167*** | −.167*** | −.167*** | −.167*** | −.167*** | −.167*** |
| | | | (.00571) | (.00570) | (.00570) | (.00570) | (.00570) | (.00570) | (.00571) | (.00571) |
| Parental education (HE) | | | .0350*** | .801*** | .785*** | .795*** | .787*** | .796*** | .706*** | .708*** |
| | | | (.00453) | (.0300) | (.0311) | (.0303) | (.0311) | (.0303) | (.0347) | (.0347) |
| Income | | | .00871*** | .00273*** | .00273*** | .00272*** | .00273*** | .00272*** | .00272*** | .00272*** |
| | | | (.000776) | (.000801) | (.000801) | (.000801) | (.000801) | (.000801) | (.000802) | (.000802) |
| Educational expectations (university ref.) | | | | | | | | | | |
| Completion of SE | | | −.190*** | −.185*** | −.185*** | −.185*** | −.185*** | −.185*** | −.184*** | −.184*** |
| | | | (.00747) | (.00746) | (.00746) | (.00746) | (.00746) | (.00746) | (.00746) | (.00746) |
| Technical program in HE | | | −.144*** | −.139*** | −.139*** | −.139*** | −.139*** | −.139*** | −.138*** | −.138*** |
| | | | (.00469) | (.00468) | (.00468) | (.00468) | (.00468) | (.00468) | (.00469) | (.00469) |
| School- and class-level variables: | | | | | | | | | | |
| Type of school (private ref.) | | | | | | | | | | |
| Public | | | | −.0474 | −.0479 | −.0481 | −.0485 | −.0489 | −.0656** | −.0663** |
| | | | | (.0298) | (.0298) | (.0298) | (.0298) | (.0298) | (.0299) | (.0299) |
| Private subsidized | | | | .106*** | .105*** | .106*** | .105*** | .105*** | .0800*** | .0800*** |
| | | | | (.0244) | (.0244) | (.0244) | (.0244) | (.0244) | (.0248) | (.0248) |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Rural (ref. urban) | | | | −.0378 | −.0324 | −.0350 | −.0307 | −.0321 | −.0316 | −.0316 |
| | | | | (.0267) | (.0268) | (.0268) | (.0268) | (.0268) | (.0267) | (.0267) |
| School SES composition | | | | −.779*** | −.763*** | −.773*** | −.764*** | −.774*** | −.684*** | −.687*** |
| | | | | (.0301) | (.0311) | (.0304) | (.0311) | (.0304) | (.0348) | (.0348) |
| School ethnic composition | | | | | −.0827* | | −.0682 | | −.0613 | −.0468 |
| | | | | | (.0434) | | (.0441) | | (.0434) | (.0441) |
| Indigenous × school ethnic composition | | | | | | | −.111* | | | −.111* |
| | | | | | | | (.0581) | | | (.0581) |
| Class ethnic composition | | | | | | −.0424 | | | | |
| | | | | | | (.0320) | | | | |
| Indigenous × class school composition | | | | | | | | −.169*** | | |
| | | | | | | | | (.0532) | | |
| School track (academic ref.) Vocational | | | | | | | | | −.0750*** | −.0750*** |
| | | | | | | | | | (.0149) | (.0149) |
| **Random Effects** | | | | | | | | | | |
| Individual variance | .46 | .46 | .26 | .26 | .26 | .26 | .26 | .26 | .26 | .26 |
| School variance | .5 | .49 | .12 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| Classroom variance | .06 | .06 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| ICC school | .49 | .49 | .30 | .18 | .18 | .18 | .18 | .18 | .18 | .18 |
| ICC classroom/school | .54 | .54 | .35 | .25 | .25 | .25 | .25 | .25 | .24 | .24 |
| Intercept | .0504*** | .0673*** | .120*** | −.148*** | −.132*** | −.142*** | −.133*** | −.145*** | −.060* | −.062* |
| | (.0141) | (.0140) | (.0101) | (.0320) | (.0330) | (.0323) | (.0330) | (.0320) | (.0358) | (.0359) |
| Deviance | −137,039.6 | −119,983.6 | −82,804.5 | −82,080.8 | −82,079.0 | −82,079.9 | −82,077.2 | −82,074.9 | −81,986.2 | −81,984.4 |
| *N* | 125,645 | 109,823 | 104,290 | 104,290 | 104,290 | 104,290 | 104,290 | 104,290 | 104,168 | 104,168 |
| Schools | 2,787 | 2,785 | 2,783 | 2,783 | 2,783 | 2,783 | 2,783 | 2,783 | 2,779 | 2,779 |
| Classes | 7,037 | 7,025 | 7,013 | 7,013 | 7,013 | 7,013 | 7,013 | 7,013 | 7,005 | 7,005 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.
* $P < .1$.
** $P < .05$.
*** $P < .01$.

[19] We also conducted analyses using a mother and a father who identify themselves as indigenous. They are available upon request. Results using SIMCE 2011 data did not show significant differences in relation to the main findings.



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TABLE A2

THREE HIERARCHICAL LINEAR MODELS PREDICTING SIMCE LANGUAGE SCORES IN TENTH GRADE IN 2013, CONSIDERING ONLY STUDENTS WHOSE PARENTS BOTH SELF-IDENTIFIED AS INDIGENOUS

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fixed Effects | | | | | |
| Individual-level variables: | | | | | | | | | | |
| Indigenous | | −.0103 | −.00274 | .00274 | 8.08e-05 | .000765 | .0429 | .0430* | .0002 | .042 |
| | | (.0164) | (.0135) | (.0135) | (.0136) | (.0137) | (.0285) | (.0244) | (.0136) | (.0285) |
| SIMCE language score 8th grade | | | .566*** | .561*** | .561*** | .561*** | .561*** | .561*** | .560*** | .560*** |
| | | | (.00249) | (.00250) | (.00250) | (.00250) | (.00250) | (.00250) | (.00250) | (.00250) |
| Gender (female) | | | .0654*** | .0646*** | .0646*** | .0645*** | .0646*** | .0646*** | .0645*** | .0645*** |
| | | | (.00444) | (.00442) | (.00442) | (.00442) | (.00442) | (.00442) | (.00442) | (.00442) |
| Retention (repeated) | | | −.153*** | −.150*** | −.150*** | −.150*** | −.150*** | −.150*** | −.149*** | −.149*** |
| | | | (.00712) | (.00711) | (.00711) | (.00711) | (.00711) | (.00711) | (.00711) | (.00711) |
| Parental education (HE) | | | .0522*** | .526*** | .537*** | .530*** | .539*** | .539*** | .429*** | .431*** |
| | | | (.00564) | (.0304) | (.0315) | (.0308) | (.0315) | (.0315) | (.0324) | (.0324) |
| Income | | | .00882*** | .00178* | .00178* | .00179* | .00177* | .00178* | .0018* | .0018* |
| | | | (.00093) | (.00099) | (.00099) | (.00099) | (.00099) | (.00099) | (.00099) | (.00099) |
| Educational expectations (university ref.) | | | | | | | | | | |
| Completion of SE | | | −.190*** | −.181*** | −.181*** | −.181*** | −.181*** | −.181*** | −.179*** | −.179*** |
| | | | (.00931) | (.00930) | (.00930) | (.00931) | (.00930) | (.00930) | (.00934) | (.00934) |
| Technical program in HE | | | −.145*** | −.137*** | −.137*** | −.137*** | −.137*** | −.137*** | −.134*** | −.134*** |
| | | | (.00583) | (.00583) | (.00583) | (.00583) | (.00583) | (.00583) | (.00587) | (.00587) |
| School- and class-level variables: | | | | | | | | | | |
| Type of school (private ref.): | | | | | | | | | | |
| Public | | | | −.0300 | −.0297 | −.0295 | −.0304 | −.0304 | −.055* | −.056* |
| | | | | (.0301) | (.0301) | (.0301) | (.0301) | (.0301) | (.0297) | (.0297) |
| Private subsidized | | | | .0747*** | .0753*** | .0753*** | .0748*** | .0748*** | .0409 | .0404 |
| | | | | (.0247) | (.0247) | (.0247) | (.0247) | (.0247) | (.0246) | (.0246) |
| Rural (ref. urban) | | | | .0614** | .0576** | .0594** | .0595** | .0598** | .058** | .060** |
| | | | | (.0274) | (.0276) | (.0275) | (.0276) | (.0276) | (.0273) | (.0273) |



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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| School SES composition | | | | −.489*** | −.500*** | −.493*** | −.502*** | −.501*** | −.392*** | −.394*** |
| | | | | (.0305) | (.0316) | (.0309) | (.0316) | (.0316) | (.0355) | (.0355) |
| School ethnic composition | | | | | .0599 | | .0750 | .0679 | .0871 | .101 |
| | | | | | (.0439) | | (.0487) | (.0593) | (.0637) | (.0737) |
| Indigenous × school ethnic composition | | | | | | | −.122* | | | −.119* |
| | | | | | | | (.0716) | | | (.0716) |
| Class ethnic composition | | | | | | .0303 | | .0122 | | |
| | | | | | | (.0371) | | (.0511) | | |
| Indigenous × class school composition | | | | | | | | −.139** | | |
| | | | | | | | | (.0658) | | |
| School track (academic ref.) Vocational | | | | | | | | | −.0968*** | −.0967*** |
| | | | | | | | | | (.0148) | (.0148) |
| Random Effects | | | | | | | | | | |
| Individual variance | .61 | .61 | .40 | .40 | .40 | .40 | .40 | .40 | .40 | .40 |
| School variance | .30 | .29 | .06 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| Class variance | .08 | .08 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| ICC school | .30 | .30 | .13 | .10 | .10 | .10 | .10 | .10 | .09 | .09 |
| ICC classroom/school | .38 | .38 | .21 | .18 | .18 | .18 | .18 | .18 | .18 | .18 |
| Intercept | .0629*** | .0779*** | −.108*** | −.268*** | −.280*** | −.272*** | −.281*** | −.281*** | −.183*** | −.185*** |
| | (.0116) | (.0116) | (.0106) | (.0328) | (.0338) | (.0331) | (.0338) | (.0338) | (.0341) | (.0341) |
| Deviance | −154,338.8 | −135,483.9 | −105,156.9 | −104,851.1 | −104,850.1 | −104,850.7 | −104,848.7 | −104,847.9 | −104,722.2 | −104,720.8 |
| *N* | 125,645 | 109,823 | 104,290 | 104,290 | 104,290 | 104,290 | 104,290 | 104,290 | 104,168 | 104,168 |
| Schools | 2,787 | 2,785 | 2,783 | 2,783 | 2,783 | 2,783 | 2,783 | 2,783 | 2,779 | 2,779 |
| Classes | 7,037 | 7,025 | 7,013 | 7,013 | 7,013 | 7,013 | 7,013 | 7,013 | 7,005 | 7,005 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.

* $P < .1$.

** $P < .05$.

*** $P < .01$.



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## Appendix B
## Sensitivity Analyses with Different Thresholds of School Ethnic Composition[20]

TABLE B1
THREE HIERARCHICAL LINEAR MODELS PREDICTING SIMCE MATH SCORES IN TENTH GRADE IN 2013 IN SCHOOLS WITH AN ETHNIC COMPOSITION ABOVE THE NATIONAL AVERAGE (OVER 13%)

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fixed Effects | | | | | |
| Student-level variables: | | | | | | | | | | |
| Indigenous | | −.0207* | −.000839 | −.00132 | −.000513 | .0883** | −.00119 | .0335 | .00695 | .0394** |
| | | (.0118) | (.00945) | (.00945) | (.00947) | (.0416) | (.00954) | (.0210) | (.00668) | (.0172) |
| SIMCE math score 8th grade | | | .535*** | .534*** | .534*** | .534*** | .534*** | .534*** | .551*** | .551*** |
| | | | (.00577) | (.00577) | (.00577) | (.00577) | (.00577) | (.00577) | (.00374) | (.00374) |
| Gender (female) | | | −.0841*** | −.0846*** | −.0846*** | −.0847*** | −.0846*** | −.0843*** | −.0886*** | −.0886*** |
| | | | (.0100) | (.0100) | (.0100) | (.01000) | (.0100) | (.0100) | (.00639) | (.00639) |
| Retention (repeated) | | | −.162*** | −.161*** | −.161*** | −.161*** | −.161*** | −.161*** | −.162*** | −.162*** |
| | | | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.00927) | (.00927) |
| Parental education (HE) | | | .0484*** | .986*** | .954*** | .961*** | 1.016*** | 1.014*** | .738*** | .739*** |
| | | | (.0158) | (.136) | (.139) | (.139) | (.138) | (.137) | (.0805) | (.0805) |
| Income | | | .00371 | .00226 | .00222 | .00216 | .00218 | .00214 | .00398** | .00398** |
| | | | (.00284) | (.00285) | (.00285) | (.00285) | (.00285) | (.00285) | (.00166) | (.00166) |
| Educational expectations (university ref.) | | | | | | | | | | −.181*** |
| Completion of SE | | | −.170*** | −.166*** | −.166*** | −.166*** | −.166*** | −.166*** | −.181*** | (.0116) |
| | | | (.0168) | (.0168) | (.0168) | (.0168) | (.0168) | (.0168) | (.0116) | −.120*** |
| Technical program in HE | | | −.117*** | −.114*** | −.114*** | −.114*** | −.114*** | −.114*** | −.121*** | (.00779) |
| | | | (.0118) | (.0118) | (.0118) | (.0118) | (.0118) | (.0118) | (.00779) | |
| School- and class-level variables: | | | | | | | | | | |
| Type of school (private ref.) | | | | | | | | | | |
| Public | | | | .915* | .903* | .907* | .944* | .944* | −.0271 | −.0288 |
| | | | | (.494) | (.493) | (.493) | (.494) | (.494) | (.108) | (.108) |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Private subsidized | | | | 1.042** | 1.029** | 1.034** | 1.067** | 1.067** | .0882 | .0872 |
| | | | | (.492) | (.492) | (.492) | (.492) | (.492) | (.105) | (.105) |
| Rural | | | | .0517 | .0632 | .0633 | .0534 | .0554 | .0449 | .0455 |
| | | | | (.0484) | (.0493) | (.0493) | (.0486) | (.0485) | (.0418) | (.0418) |
| School SES composition | | | | −.945*** | −.913*** | −.919*** | −.975*** | −.971*** | −.708*** | −.709*** |
| | | | | (.136) | (.139) | (.139) | (.138) | (.138) | (.0806) | (.0806) |
| School ethnic composition | | | | | −.0263 | | .0276 | | −.00657 | .0471 |
| | | | | | (.0757) | | (.0801) | | (.0754) | (.0798) |
| Indigenous × school ethnic composition | | | | | | −.101** | | | | −.100** |
| | | | | | | (.0489) | | | | (.0489) |
| Class ethnic composition | | | | | | | −.00324 | .0223 | | |
| | | | | | | | (.0389) | (.0435) | | |
| Indigenous × class school composition | | | | | | | | −.0525 | | |
| | | | | | | | | (.0399) | | |
| School track (academic ref.) Vocational | | | | | | | | | −.0847*** | −.0846*** |
| | | | | | | | | | (.0261) | (.0261) |
| Random Effects | | | | | | | | | | |
| Individual variance | .47 | .47 | .27 | .27 | .27 | .27 | .27 | .27 | .27 | .27 |
| School variance | .29 | .29 | .10 | .07 | .07 | .07 | .07 | .07 | .07 | .07 |
| Classroom variance | .07 | .07 | .02 | .02 | .02 | .02 | .02 | .02 | .02 | .02 |
| ICC school | .35 | .35 | .25 | .19 | .19 | .19 | .19 | .19 | .19 | .19 |
| ICC classroom/school | .43 | .43 | .31 | .26 | .26 | .26 | .26 | .26 | .26 | .26 |
| Intercept | −.307*** | −.301*** | −.0297* | −.238** | −.228** | −.242** | −.242** | −.245** | −.135 | −.149 |
| | (.0209) | (.0210) | (.0176) | (.112) | (.115) | (.112) | (.115) | (.112) | (.118) | (.118) |
| Deviance | −39232.2 | −39229.2 | −26638.5 | −26533.5 | −26533.5 | −26525.7 | −26531.4 | −26524.8 | −26528.3 | −26526.2 |
| *N* | 35,653 | 35,653 | 32,911 | 32,911 | 32,911 | 32,911 | 32,900 | 32,900 | 32,911 | 32,911 |
| Schools | 798 | 798 | 798 | 798 | 798 | 798 | 797 | 797 | 798 | 798 |
| Classes | 2,154 | 2,154 | 2,152 | 2,152 | 2,152 | 2,152 | 2,146 | 2,146 | 2,152 | 2,152 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.
* $P < .1$.
** $P < .05$.
*** $P < .01$.

[20] We also conducted sensitivity analyses using SIMCE 2011. Available upon request.



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TABLE B2

THREE HIERARCHICAL LINEAR MODELS PREDICTING SIMCE MATH SCORES IN TENTH GRADE IN 2013 IN SCHOOLS WITH MORE THAN 30% ETHNIC COMPOSITION

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fixed Effects | | | | | |
| Student-level variables: | | | | | | | | | | |
| Indigenous | | −.0207* | −.000839 | −.00132 | −.000513 | −.00119 | .0883** | .0335 | −.000525 | .0883** |
| | | (.0118) | (.00945) | (.00945) | (.00947) | (.00954) | (.0416) | (.0210) | (.00947) | (.0416) |
| SIMCE math score 8th grade | | | .535*** | .534*** | .534*** | .534*** | .534*** | .534*** | .534*** | .534*** |
| | | | (.00577) | (.00577) | (.00577) | (.00577) | (.00577) | (.00577) | (.00577) | (.00577) |
| Gender (female) | | | −.0841*** | −.0846*** | −.0846*** | −.0846*** | −.0847*** | −.0843*** | −.0846*** | −.0847*** |
| | | | (.0100) | (.0100) | (.0100) | (.0100) | (.01000) | (.0100) | (.0100) | (.01000) |
| Retention (repeated) | | | −.162*** | −.161*** | −.161*** | −.161*** | −.161*** | −.161*** | −.161*** | −.161*** |
| | | | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) |
| Parental education (HE) | | | .0484*** | .986*** | .954*** | 1.016*** | .961*** | 1.014*** | .908*** | .914*** |
| | | | (.0158) | (.136) | (.139) | (.138) | (.139) | (.137) | (.156) | (.156) |
| Income | | | .00371 | .00226 | .00222 | .00218 | .00216 | .00214 | .00220 | .00214 |
| | | | (.00284) | (.00285) | (.00285) | (.00285) | (.00285) | (.00285) | (.00285) | (.00285) |
| Educational expectations (university ref.) | | | | | | | | | | |
| Completion of SE | | | −.170*** | −.166*** | −.166*** | −.166*** | −.166*** | −.166*** | −.166*** | −.166*** |
| | | | (.0168) | (.0168) | (.0168) | (.0168) | (.0168) | (.0168) | (.0168) | (.0168) |
| Technical program in HE | | | −.117*** | −.114*** | −.114*** | −.114*** | −.114*** | −.114*** | −.114*** | −.114*** |
| | | | (.0118) | (.0118) | (.0118) | (.0118) | (.0118) | (.0118) | (.0118) | (.0118) |
| School- and class-level variables: | | | | | | | | | | |
| Type of school (private ref.): | | | | | | | | | | |
| Public | | | | .915* | .903* | .944* | .907* | .944* | .881* | .884* |
| | | | | (.494) | (.493) | (.494) | (.493) | (.494) | (.494) | (.494) |
| Public subsidized | | | | 1.042** | 1.029** | 1.067** | 1.034** | 1.067** | 1.006** | 1.010** |
| | | | | (.492) | (.492) | (.492) | (.492) | (.492) | (.493) | (.493) |
| Rural | | | | .0517 | .0632 | .0534 | .0633 | .0554 | .0650 | .0652 |
| | | | | (.0484) | (.0493) | (.0486) | (.0493) | (.0485) | (.0493) | (.0493) |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| School SES composition | | | | −.945*** | −.913*** | −.975*** | −.919*** | −.971*** | −.867*** | −.872*** |
| | | | | (.136) | (.139) | (.138) | (.139) | (.138) | (.156) | (.156) |
| School ethnic composition | | | | | −.147 | | −.00126 | | −.143 | .00317 |
| | | | | | (.125) | | (.142) | | (.125) | (.142) |
| Indigenous × school ethnic composition | | | | | | | −.206** | | | −.206** |
| | | | | | | | (.0939) | | | (.0939) |
| Class ethnic composition | | | | | | −.00225 | | .0554 | | |
| | | | | | | (.0502) | | (.0591) | | |
| Indigenous × class ethnic composition | | | | | | | | −.105* | | |
| | | | | | | | | (.0569) | | |
| School track (academic ref.) Vocational | | | | | | | | | −.0270 | −.0273 |
| | | | | | | | | | (.0418) | (.0418) |
| Random Effects | | | | | | | | | | |
| Individual variance | .47 | .47 | .27 | .27 | .27 | .27 | .27 | .27 | .27 | .27 |
| School variance | .19 | .18 | .09 | .06 | .06 | .06 | .06 | .06 | .06 | .06 |
| Classroom variance | .08 | .08 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 |
| ICC school | .25 | .25 | .22 | .18 | .18 | .18 | .18 | .18 | .18 | .18 |
| ICC classroom/school | .36 | .36 | .29 | .25 | .25 | .25 | .25 | .25 | .25 | .25 |
| Intercept | −.440*** | −.430*** | −.0865*** | −1.170** | −1.090** | −1.199** | −1.154** | −1.215** | −1.045** | −1.109** |
| | (.0275) | (.0280) | (.0268) | (.497) | (.501) | (.498) | (.502) | (.498) | (.506) | (.507) |
| Deviance | −16,505.7 | −16,504.2 | −11,314.6 | −11,280.6 | −11,279.9 | −11,275.3 | −11,277.5 | −11,273.6 | −11,279.7 | −11,277.3 |
| *N* | 15.050 | 15.407 | 13.825 | 13.825 | 13.825 | 13.819 | 13.825 | 13.819 | 13.825 | 13.825 |
| Schools | 328 | 328 | 328 | 328 | 328 | 327 | 328 | 327 | 328 | 328 |
| Classes | 915 | 915 | 914 | 914 | 914 | 911 | 914 | 911 | 914 | 914 |

NOTE.—Standard errors in parentheses; HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.

* $P < .1$.

** $P < .05$.

*** $P < .01$.



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TABLE B3

THREE HIERARCHICAL LINEAR MODELS PREDICTING SIMCE LANGUAGE SCORES IN TENTH GRADE IN 2013 IN SCHOOLS WITH AN ETHNIC COMPOSITION ABOVE THE NATIONAL AVERAGE (OVER 13%)

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fixed Effects | | | | | |
| Student-level variables: | | | | | | | | | | |
| Indigenous | | .00336 | .00451 | .00468 | .00372 | .00428 | .0308 | .00917 | .00372 | .0305 |
| | | (.00945) | (.00805) | (.00804) | (.00809) | (.00813) | (.0207) | (.0139) | (.00809) | (.0207) |
| SIMCE math score 8th grade | | | .552*** | .549*** | .549*** | .549*** | .549*** | .549*** | .549*** | .549*** |
| | | | (.00437) | (.00437) | (.00437) | (.00437) | (.00437) | (.00437) | (.00437) | (.00437) |
| Gender (female) | | | .0699*** | .0698*** | .0698*** | .0697*** | .0698*** | .0698*** | .0696*** | .0696*** |
| | | | (.00766) | (.00765) | (.00765) | (.00765) | (.00765) | (.00765) | (.00765) | (.00765) |
| Retention (repeated) | | | −.128*** | −.126*** | −.126*** | −.126*** | −.126*** | −.126*** | −.126*** | −.126*** |
| | | | (.0112) | (.0112) | (.0112) | (.0112) | (.0112) | (.0112) | (.0112) | (.0112) |
| Parental education (HE) | | | .0423*** | .661*** | .677*** | .669*** | .678*** | .669*** | .519*** | .520*** |
| | | | (.0109) | (.0696) | (.0709) | (.0701) | (.0709) | (.0701) | (.0803) | (.0803) |
| Income | | | .00449** | .00160 | .00164 | .00160 | .00163 | .00160 | .00161 | .00161 |
| | | | (.00199) | (.00201) | (.00201) | (.00201) | (.00201) | (.00201) | (.00201) | (.00201) |
| Educational expectations (university ref.) | | | | | | | | | | |
| Completion of SE | | | −.156*** | −.150*** | −.151*** | −.151*** | −.150*** | −.151*** | −.149*** | −.149*** |
| | | | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) |
| Technical program in HE | | | −.126*** | −.121*** | −.122*** | −.121*** | −.121*** | −.121*** | −.120*** | −.120*** |
| | | | (.00941) | (.00942) | (.00942) | (.00942) | (.00942) | (.00942) | (.00942) | (.00942) |
| School- and class-level variables: | | | | | | | | | | |
| Type of school (private ref.): | | | | | | | | | | |
| Public | | | | .00551 | .00613 | .0106 | .00460 | .0105 | −.0350 | −.0365 |
| | | | | (.110) | (.110) | (.110) | (.110) | (.110) | (.109) | (.109) |
| Private subsidized | | | | .113 | .115 | .117 | .114 | .117 | .0714 | .0705 |
| | | | | (.107) | (.107) | (.107) | (.107) | (.107) | (.107) | (.107) |
| Rural | | | | .0892** | .0772* | .0870** | .0777* | .0874** | .0775* | .0781* |
| | | | | (.0410) | (.0423) | (.0415) | (.0423) | (.0415) | (.0419) | (.0419) |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| School SES composition | | | | −.629*** | −.645*** | −.637*** | −.646*** | −.637*** | −.487*** | −.488*** |
| | | | | (.0697) | (.0711) | (.0702) | (.0710) | (.0702) | (.0805) | (.0804) |
| School ethnic composition | | | | | .0853 | | .129 | | .107 | .150 |
| | | | | | (.0750) | | (.0810) | | (.0744) | (.0954) |
| Indigenous × school ethnic composition | | | | | | | −.0836 | | | −.0830 |
| | | | | | | | (.0588) | | | (.0588) |
| Class ethnic composition | | | | | | .0171 | | .0275 | | |
| | | | | | | (.0456) | | (.0515) | | |
| Indigenous × class school composition | | | | | | | | −.0208 | | |
| | | | | | | | | (.0482) | | |
| School track (academic ref.) Vocational | | | | | | | | | −.104*** | −.104*** |
| | | | | | | | | | (.0255) | (.0255) |
| Random Effects | | | | | | | | | | |
| Individual variance | .6 | .6 | .39 | .39 | .39 | .39 | .39 | .39 | .39 | .39 |
| School variance | .21 | .21 | .07 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| Classroom variance | .10 | .10 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| ICC school | .23 | .23 | .13 | .10 | .10 | .10 | .10 | .10 | .10 | .10 |
| ICC classroom/school | .34 | .34 | .22 | .20 | .20 | .20 | .20 | .20 | .20 | .20 |
| Intercept | −.178*** | −.179*** | −.184*** | −.354*** | −.384*** | −.363*** | −.394*** | −.364*** | −.262** | −.273** |
| | (.0188) | (.0190) | (.0188) | (.114) | (.116) | (.114) | (.117) | (.114) | (.119) | (.119) |
| Deviance | −43,273.0 | −43,272.9 | −32,770.2 | −32,701.5 | −32,700.8 | 32,692.2 | −32,699.8 | −32,692.1 | −32,692.7 | −32,691.7 |
| *N* | 35,653 | 35,653 | 32,911 | 32,911 | 32,911 | 32,900 | 32,911 | 32,900 | 32,911 | 32,911 |
| Schools | 798 | 798 | 798 | 798 | 798 | 797 | 798 | 797 | 798 | 798 |
| Classes | 2.154 | 2.154 | 2.152 | 2.152 | 2.152 | 2.146 | 2.152 | 2.146 | 2.152 | 2.152 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.

* $P < .1$.

** $P < .05$.

*** $P < .01$.



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TABLE B4

THREE HIERARCHICAL LINEAR MODELS PREDICTING SIMCE LANGUAGE SCORES IN TENTH GRADE IN 2013 IN SCHOOLS WITH AN ETHNIC COMPOSITION ABOVE 30%

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fixed Effects | | | | | |
| Student-level variables: | | | | | | | | | | |
| Indigenous | | −.00575 | −.00279 | −.00316 | −.00390 | −.00336 | .0157 | .00379 | −.00390 | .0158 |
| | | (.0131) | (.0112) | (.0112) | (.0112) | (.0113) | (.0490) | (.0248) | (.0112) | (.0490) |
| SIMCE math score 8th grade | | | .548*** | .546*** | .546*** | .546*** | .546*** | .546*** | .546*** | .546*** |
| | | | (.00667) | (.00668) | (.00668) | (.00668) | (.00668) | (.00668) | (.00668) | (.00668) |
| Gender (female) | | | .0695*** | .0693*** | .0693*** | .0691*** | .0693*** | .0691*** | .0693*** | .0692*** |
| | | | (.0117) | (.0117) | (.0117) | (.0117) | (.0117) | (.0117) | (.0117) | (.0117) |
| Retention (repeated) | | | −.146*** | −.144*** | −.145*** | −.145*** | −.145*** | −.145*** | −.145*** | −.145*** |
| | | | (.0165) | (.0165) | (.0165) | (.0165) | (.0165) | (.0165) | (.0165) | (.0165) |
| Parental education (HE) | | | .0542*** | .719*** | .739*** | .744*** | .741*** | .744*** | .715*** | .717*** |
| | | | (.0187) | (.133) | (.136) | (.135) | (.136) | (.135) | (.154) | (.154) |
| Income | | | .00514 | .00365 | .00369 | .00361 | .00368 | .00361 | .00368 | .00366 |
| | | | (.00335) | (.00336) | (.00336) | (.00337) | (.00336) | (.00337) | (.00336) | (.00336) |
| Educational expectations (university ref.) | | | | | | | | | | |
| Completion of SE | | | −.141*** | −.136*** | −.136*** | −.136*** | −.136*** | −.136*** | −.136*** | −.136*** |
| | | | (.0199) | (.0199) | (.0199) | (.0199) | (.0199) | (.0199) | (.0199) | (.0199) |
| Technical program in HE | | | −.111*** | −.107*** | −.107*** | −.107*** | −.107*** | −.107*** | −.107*** | −.107*** |
| | | | (.0139) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) | (.0140) |
| School- and class-level variables: | | | | | | | | | | |
| Type of school (private ref.): | | | | | | | | | | |
| Public | | | | 1.478*** | 1.486*** | 1.501*** | 1.487*** | 1.502*** | 1.474*** | 1.475*** |
| | | | | (.542) | (.542) | (.542) | (.542) | (.542) | (.543) | (.543) |
| Private subsidized | | | | 1.593*** | 1.602*** | 1.615*** | 1.603*** | 1.615*** | 1.589*** | 1.590*** |
| | | | | (.541) | (.541) | (.541) | (.541) | (.541) | (.542) | (.542) |
| Rural | | | | .0874* | .0805* | .0881* | .0805* | .0885* | .0813* | .0814* |
| | | | | (.0472) | (.0480) | (.0474) | (.0480) | (.0474) | (.0481) | (.0481) |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| School SES composition | | | | −.672*** | −.693*** | −.698*** | −.694*** | −.697*** | −.669*** | −.670*** |
| | | | | (.133) | (.136) | (.135) | (.136) | (.135) | (.154) | (.154) |
| School ethnic composition | | | | | .0923 | | .124 | | .0942 | .126 |
| | | | | | (.123) | | (.145) | | (.123) | (.146) |
| Indigenous × school ethnic composition | | | | | | | −.0455 | | | −.0457 |
| | | | | | | | (.111) | | | (.111) |
| Class ethnic composition | | | | | | .00754 | | .0197 | | |
| | | | | | | (.0574) | | (.0687) | | |
| Indigenous × class school composition | | | | | | | | −.0217 | | |
| | | | | | | | | (.0673) | | |
| School track (academic ref.) | | | | | | | | | | |
| Vocational | | | | | | | | | −.0136 | −.0137 |
| | | | | | | | | | (.0405) | (.0405) |
| Random Effects | | | | | | | | | | |
| Individual variance | .58 | .58 | .38 | .38 | .38 | .38 | .38 | .38 | .38 | .38 |
| School variance | .13 | .13 | .06 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| Classroom variance | .11 | .11 | .04 | .04 | .04 | .04 | .04 | .04 | .04 | .04 |
| ICC school | .16 | .16 | .12 | .10 | .10 | .10 | .10 | .10 | .10 | .10 |
| ICC classroom/school | .29 | .29 | .20 | .18 | .18 | .18 | .18 | .18 | .18 | .18 |
| Intercept | −.257*** | −.254*** | −.215*** | −1.829*** | −1.880*** | −1.856*** | −1.895*** | −1.860*** | −1.857*** | −1.871*** |
| | (.0251) | (.0258) | (.0284) | (.545) | (.549) | (.546) | (.550) | (.546) | (.554) | (.555) |
| Deviance | −18,077.4 | −18,077.3 | −13,598.9 | −13,574.2 | −13,573.9 | −13,568.9 | −13,573.9 | −13,568.8 | −13,573.9 | −13,573.8 |
| *N* | 15,050 | 15,050 | 13,825 | 13,825 | 13,825 | 13,819 | 13,825 | 13,819 | 13,825 | 13,825 |
| Schools | 328 | 328 | 328 | 328 | 328 | 327 | 328 | 327 | 328 | 328 |
| Classes | 915 | 914 | 914 | 914 | 914 | 914 | 914 | 911 | 914 | 914 |

NOTE.—Standard errors in parentheses. HE = higher education; SE = secondary education; SES = socioeconomic status; ICC = intraclass correlation coefficient.

* $P < .1$.

** $P < .05$.

*** $P < .01$.



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## Appendix C
## Comparison between Excluded and Included Students in Both Cohorts

TABLE C1
SUMMARY STATISTICS OF ACADEMIC AND SOCIOECONOMIC VARIABLES USED IN THE EXCLUDED AND INCLUDED SUBSAMPLES

| | Definition and Measure | Mean (SD) Analytical Sample 2007–11 | | Mean (SD) Students Who Were Tested Only in 2011 | Mean (SD) Analytical Sample 2011–13 | Mean (SD) Students Who Were Tested Only in 2013[a] |
|---|---|---|---|---|---|---|
| Dependent variables: | | | | | | |
| Math | SIMCE math score | 263.3 (48.9) | | 241.2 (45.2) | 273.9 (64.2) | 246.5 (64.4) |
| | Indigenous | 253.9 (46.1) | | 233.7 (42.8) | 257.7 (61.3) | |
| | Non-indigenous | 265.9 (48.9) | | 244.0 (45.4) | 276.4 (64.1) | |
| Language | SIMCE language score | 258.6 (49.5) | | 236.2 (48.7) | 259.6 (54.8) | 240.6 (55.8) |
| | Indigenous | 253.4 (47.2) | | 233.4 (45.9) | 251.4 (52.4 | |
| | Non-indigenous | 261.2 (49.3) | | 239.0 (48.6) | 260.8 (55.0) | |
| Independent variables: | | | | | | |
| Indigenous | Parents' self-reported ethnicity. Student has at least one parent that identified as indigenous (dummy). | .13 | | .16 | .13 | |
| Gender | Female = 1, Male = 0 | .52 | | .5 | .51 | .47 |
| Parental education | Maximum school attainment by parents. Student has at least one parent with higher education (dummy). | .29 | | .21 | .33 | .30 |
| Grade repetition | Whether the student has repeated at least once (dummy). | .06 | | .5 | .10 | |
| Student expectations | Maximum level of education that students expect to attain (categorical variable with three categories). | Completion of SE | .15 | .27 | .06 | .10 |
| | | Study a technical program in HE | .15 | .18 | .19 | .25 |
| | | Study at the university | .56 | .38 | .60 | .50 |
| | | Missing | .14 | .18 | .14 | .15 |
| Income | Reported sum of all household income (monthly). Income scale goes from 100,000–2,200,000 Chilean pesos | 450,000 | | 350,000 | 450,000 | 350,000 |

NOTE.—Mean tests for SIMCE test scores are all significant at $P < .001$. SE = secondary education; HE = higher education.

[a] The SIMCE 2013 questionnaire did not include information about indigenous status and grade repetition. Thus, we do not have information on these variables for tenth graders who were tested only in 2013.

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**References**

Agirdag, Orhan, Mieke Van Houtte, and Piet Van Avermaet. 2012. "Why Does the Ethnic and Socioeconomic Composition of Schools Influence Math Achievement? The Role of Sense of Futility and Futility Culture." *European Sociological Review* 28 (3): 366–78.

Arum, Richard, and Yossi Shavit. 1995. "Secondary Vocational Education and the Transition from School to Work." *Sociology of Education* 68 (3): 187–204.

Barrera-Osorio, Felipe, and Alejandro Ganimian. 2016. "The Barking Dog That Bites: Test Score Volatility and School Rankings in Punjab, Pakistan." *International Journal of Educational Development* 49 (July): 31–54.

Card, David, and Jesse Rothstein. 2007. "Racial Segregation and the Black White Test Score Gap." *Journal of Public Economics* 91 (December): 2158–84.

CASEN. 2015. *Encuesta de Caracterizacion Socioeconomica*. Santiago of Chile: Ministerio de Desarrollo Social. http://observatorio.ministeriodesarrollosocial.gob.cl/casen-multidimensional/casen/basedatos.php.

Cerda, Rodrigo. 2009. "Situación Socioeconómica Reciente de los Mapuches en la Región de la Araucanía." *Estudios Públicos*, no. 113, 1–81.

Clotfelter, Charles, Helen Ladd, and Jacob Vigdor. 2006. "Teacher-Student Matching and the Assessment of Teacher Effectiveness." *Journal of Human Resources* 41 (4): 778–820.

Driessen, Geert. 2001. "Ethnicity, Forms of Capital, and Educational Achievement." *International Review of Education* 47 (6): 513–37.

Dronkers, Jaap, and Mark Levels. 2007. "Do School Segregation and School Resources Explain the Region-of-Origin Differences in the Mathematics Achievement of Immigrant Students?" *Educational Research and Evaluation* 13 (5): 435–62.

Elacqua, Gregory. 2009. "The Impact of School Choice and Public Policy on Segregation: Evidence from Chile." Centro de Políticas Comparadas de Educación Working Paper no. 10, Santiago de Chile.

Eyzaguirre, Barbara, and Loreto Fontaine. 1999. "¿Que Mide Realmente el SIMCE?" *Estudios Públicos* 75:107–61.

Farias, Mauricio, and Rafael Carrasco. 2012. "Diferencias en Resultados Académicos entre Educación Técnico-Profesional y Humanista-Científica en Chile." *Revista Calidad en la Educación* 36:87–121.

Friesen, Jan, and Brian Krauth. 2010. "Sorting, Peers, and Achievement of Aboriginal Students in British Columbia." *Canadian Journal of Economics* 43 (4): 1273–301.

Garcia Aracil, Adela, and Donald Winkler. 2004. "Educación y Etnicidad en Ecuador." In *Etnicidad, Raza, Género y Educación en América Latina*, ed. Donald Winkler and Santiago Cueto. Washington, DC: PREAL.

Guarino, Casandra, Mark Reckase, Brian Stacy, and Jeffrey Wooldridge. 2015. "A Comparison of Student Growth Percentile and Value-Added Models of Teacher Performance." *Statistics and Public Policy* 2 (1): 66–76

Hanushek, Eric, John Kain, and Steven Rivkin. 2009. "New Evidence about *Brown v. Board of Education*: The Complex Effects of School Racial Composition on Achievement." *Journal of Labor Economics* 27 (3): 349–75.



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Harker, Richard, and Peter Tymms. 2004. "The Effects of Student Composition on School Outcomes." *School Effectiveness and School Improvement: An International Journal of Research, Policy and Practice* 15 (2): 177–99.

Harris, Douglas. 2010. "How Do School Peers Influence Student Educational Outcomes? Theory and Evidence from Economics and Other Social Sciences." *Teachers College Record* 112 (4): 1163–97.

Hernandez-Zavala, Martha, Harry Anthony Patrinos, Chris Sakellariou, and Joseph Shapiro. 2006. "Quality of Schooling and Quality of Schools for Indigenous Students in Guatemala, Mexico and Peru." World Bank Policy Research Working Paper no. 3982, World Bank, Washington, DC.

Jennings, Jennifer, David Deming, Christopher Jencks, Maya Lopuch, and Beth Schueler. 2015. "Do Differences in School Quality Matter More than We Thought? New Evidence on Educational Opportunity in the Twenty-First Century." *Sociology of Education* 88 (1): 56–82.

Kane, Thomas, and Douglas Staiger. 2002. "The Promise and Pitfalls of Using Imprecise School Accountability Measures." *Journal of Economic Perspectives* 16 (4): 91–114.

Kao, Grace, and Jennifer Thompson. 2003. "Racial and Ethnic Stratification in Educational Achievement and Attainment." *Annual Review of Sociology* 29:417–42.

Leigh, Andrew, and Xiaodong Gong. 2009. "Estimating Cognitive Gaps between Indigenous and Non-indigenous Australians." *Education Economics* 17 (2): 239–61.

Marks, Gary. 2005. "Cross-National Differences and Accounting for Social Class Inequalities in Education." *International Sociology* 20 (4): 483–505.

Marks, Gary, John Creswell, and John Ainley. 2006. "Explaining Socioeconomic Inequalities in Student Achievement: The Role of Home and School Factors." *Educational Research and Evaluation* 12 (2): 105–28.

McEwan, Patrick. 2003. "Peer Effects on Student Achievement: Evidence from Chile." *Economics of Education Review* 22:131–41.

McEwan, Patrick. 2004. "The Indigenous Test Score Gap in Bolivia and Chile." *Economic Development and Cultural Change* 53 (1): 157–90.

McEwan, Patrick. 2008. "Can Schools Reduce the Indigenous Test Score Gap? Evidence from Chile." *Journal of Development Studies* 44 (10): 1506–30.

McEwan, Patrick, and Marisol Trowbridge. 2007. "The Achievement of Indigenous Students in Guatemalan Primary Schools." *International Journal of Educational Development* 27:61–76.

Mickelson, Roslyn, Martha Bottia, and Richard Lambert. 2013. "Effects of School Racial Composition on K–12 Mathematics Outcomes: A Metaregression Analysis." *Review of Educational Research* 83 (1): 121–58.

Nash, Roy. 2003. "Is the School Composition Effect Real? A Discussion with Evidence from the UK PISA Data." *School Effectiveness and School Improvement* 14 (4): 441–57.

Orfield, Gary, and Chungmei Lee. 2007. *Historic Reversals, Accelerating Resegregation, and the Need for New Integration Strategies*. Los Angeles: Civil Rights Project, University of California.

Reardon, Sean. 2016. "School Segregation and Racial Academic Achievement Gaps." *Russell Sage Foundation Journal of the Social Sciences* 2 (5): 34–57.

Rivkin, Steven. 2000. "School Desegregation, Academic Attainment, and Earnings." *Journal of Human Resources* 35 (Spring): 333–46.



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Sakellariou, Chris. 2008. "Peer Effects and the Indigenous/Non-Indigenous Early Test-Score Gap in Peru." *Education Economics* 16 (4): 371–90.

Szulkin, Ryszard, and Jan Jonsson. 2007. "Ethnic Segregation and Educational Outcomes in Swedish Comprehensive Schools." Linnaeus Center for Integration Studies Working Paper no. 2007-2, Stockholm University, Stockholm.

Teddlie, Charles, and David Reynolds. 2000. *The International Handbook of School Effectiveness Research*. London: Falmer.

Thrupp, Martin, Hugh Lauder, and Tony Robinson. 2002. "School Composition and Peer Effects." *International Journal of Educational Research* 37 (5): 483–504.

Todd, Petra E., and Kenneth I. Wolpin. 2003. "On the Specification and Estimation of the Production Function for Cognitive Achievement." *Economic Journal* 113 (485): 3–33.

Undurraga, Eduardo. 2014. "Unraveling Development: Three Essays on Structural Determinants of Human Capabilities." PhD diss., Brandeis University.

Valenzuela, Eduardo, and Belén Unzueta. 2015. "Parental Transmission of Ethnic Identification in Mixed Couples in Latin America: The Mapuche Case." *Ethnic and Racial Studies* 38 (12): 2090–2107.

Van Ewijk, Reyn, and Peter Sleegers. 2010. "The Effect of Peer Socioeconomic Status on Student Achievement: A Meta-Analysis." *Educational Research Review* 5 (2): 134–50.

Van Houtte, Mieke, and Peter Stevens. 2010. "School Ethnic Composition and Aspirations of Immigrant Students in Belgium." *British Educational Research Journal* 36 (2): 209–37.

Van Laar, Colette, and Jim Sidanius. 2001. "Social Status and the Academic Achievement Gap: A Social Dominance Perspective." *Social Psychology of Education* 4:235–58.

Webb, A. 2015. "Indigenous Schooling Grants in Chile: The Impacts of an Integrationist Affirmative Action Policy among Mapuche Pupils." *Race Ethnicity and Education* 18 (3): 419–41.

Wells, Ryan. 2010. "Children of Immigrants and Educational Expectations: The Roles of School Composition." *Teachers College Record* 112 (6): 1679–704.



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