Intergenerational Educational Mobility within Chile[*]

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Abstract

I estimate intergenerational mobility (IGM) in education at a disaggregated geographic level for the cohort born in the nineties using full-count census microdata of Chile. I document wide variation across more than three hundred communes in several measures of IGM. Relative mobility measured as one minus the regression coefficient of children's years of schooling on parents' years of schooling ranges between 0.54 and 0.97 while absolute mobility estimated as the intercept of the same regression ranges between 7.16 and 11.73. Relative mobility is positively correlated to the number of doctors, and negatively correlated to the ratio of students per teacher, and to labor earnings inequality, especially in the upper half of the income distribution. Using a LASSO, I find that the share of students in public schools and municipal budget are the strongest predictors of IGM. In addition, I also document within country variability in how parental education affects other child's outcomes such as attending tertiary education and being mother as a teenager in the case of females.

JEL-Codes: D63, I24, J62.

Keywords: *Socioeconomic mobility, Geography, Chile, Education.*

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I Introduction

A recent literature estimates intergenerational mobility (IGM) in education within countries (see for example Alesina, Hohmann, Michalopoulos, & Papaioannou, 2020; Asher, Novosad, & Rafkin, 2018; Van der Weide, Ferreira de Souza, & Barbosa, 2020). This is an extension of the literature on intergenerational income mobility within countries initiated by Chetty, Hendren, Kline, and Saez (2014), and the intergenerational mobility in education at the country-level (see Torche, 2019, for a survey focused on developing countries).

In this paper, I contribute to this literature in three ways. First I estimate intergenerational mobility in education in Chile at the commune level using census data for the cohort born in the nineties. I focus on one minus the intergenerational persistence coefficient as a measure of relative mobility but I also compute other measures that provide information about different aspects of educational IGM. I provide all estimates in an online data appendix for future research. Second, I show how other child's outcomes such as teenage pregnancy and tertiary education attendance that are related to parental education at the country-level also display wide variation within-country. Finally, I explore how the estimates of educational IGM are correlated with a rich set of variables related to income, geography, education, municipal budget, and other characteristics of the communes. Furthermore, I investigate by means of a lasso (least absolute shrinkage and selection operator) which correlates have the most predictive power over IGM at the level of commune.

IGM literature for Chile. Previous studies have used different household and opinion surveys (see for example, Celhay & Gallegos, 2015; Celhay, Sanhueza, & Zubizarreta, 2010; Hertz et al., 2007; Narayan et al., 2018; Neidhöfer, Serrano, & Gasparini, 2018; Nuñez & Miranda, 2010; Sapelli, 2016; Torche, 2005; van der Weide, Lakner, Gerszon Mahler, Narayan, & Ramasubbaiah, 2021) to document IGM in income, education, and other socioeconomic measures. However, they all have in common that the samples are not representative at the commune level, so they focus on country level estimates. Two exceptions are Celhay

and Gallegos (2015) that also explores mobility at the regional level[1], and Gutierrez (2020) that uses administrative records to estimate income mobility at regional-level and across municipalities in the Metropolitan Region.

Institutional background. Chile is an interesting case study to analyze IGM at the sub-national level. One the one hand, the country is one of the richest economies in the Latin American region and has shown important progress in poverty reduction and income per capita growth over the last twenty years. On the other hand, income inequality is relatively high for OECD standards and previous research has documented high school-level stratification by socioeconomic status, which has fueled some educational reforms in the last decade. Moreover, the country is marked by the free-market reforms inherited from the military dictatorship (1973-1990). This include an universal voucher system and decentralization of the administration of public schools, which are managed by municipalities.[2]

In terms of IGM at the country level, the best evidence available at global scale (Narayan et al., 2018; van der Weide et al., 2021) shows some interesting findings for Chile. Among the 148 countries for which there are estimates of educational mobility for the cohort born in the 1980s, the country ranks around the middle when a summary statistic of relative IGM is used. For example. when measured with the slope of a regression between years of schooling of children and parents or their correlation coefficient, although more mobile according to the latter. Similarly, absolute mobility measured as the share of children with higher education than their parents ranks the country as highly mobile. However, when a measure that aims to capture directional mobility from the bottom to the top is considered (i.e., "rags to riches"), then the country appears among the least mobiles (see Figure A1 in the Appendix).[3]

[1]Region is the coarser administrative unit in which the country is divided.
[2]A recent reform started a process of centralization in 2018.
[3]Ranked 138 among the 148 available estimates.

II Data and Methods

Data sources. I use full-count census 2017 microdata obtained from the National Institute of Statistics to compute a set of measures of IGM. In addition, I use the Unemployment Insurance System administrative data set to create income-related correlates, data from the Center for Crime Studies and Analysis (CEAD in Spanish), the Chilean Education Quality Agency, and the National System of Municipal Information to gather a set of budgetary, health, geographic, and education-related correlates. A description of the set of covariates is available in Table A1 of the Appendix.

Geography. Chile is divided into 16 regions, 56 provinces and 346 communes. The data set contains information about where the interview was conducted and the place of birth in terms of these three administrative divisions.

Education. The census data contains a variable reporting years of schooling, regardless of the track or kind of study. When I study how the educational attainment of children relates to the attainment of parents or old relatives living in the same household, I take the highest attainment among the individuals in the older generation.[4]

Measurement. I consider seven different measures that relate to different aspects of educational IGM. The first two are derived from a simple OLS regression that relates educational attainment of children to attainment of parents. Hence, these measures come from the following specification by commune c:

$$y_{ic}^{y} = \alpha_c + \beta_c y_{ic}^{o} + \epsilon_{ic} \tag{1}$$

where y_{ic}^{y} is educational attainment of individual i (using a sample of individuals with ages between 21-25), y_{ic}^{o} is the attainment of his/her parents or older relatives cohabiting in the same household, and the parameters of interest α_c and β_c are respectively a measure of absolute and relative mobility for commune of birth c (see Narayan et al., 2018; Torche, 2019,

[4]The results are qualitatively similar if I use the average rounded to the nearest integer instead of the maximum.

for a discussion about the concepts of absolute and relative mobility in education). Given that the expected years of schooling of an individual in equation 1 depends on the average years of schooling of parents in his/her commune (in addition to the parameters α_c and β_c), I also compute average years of schooling of parents by commune as the third measure. Given the typical educational path in Chile where students start first grade at the age of 6, the average student would be able to attain at most 15 years of schooling by the age of 21. To accommodate for this, the regression is run using years of schooling censored at 15 for both children and parents. The fourth measure relates to the concept of absolute mobility measured as the share of children attaining more years of schooling than their parents (including ties at 15). The last three measures address directional mobility. First, upward IGM measure as the probability of children reaching 15 years of schooling (it corresponds to approximately the highest 30% among children) if their parents completed less than 10 (it corresponds to approximately the bottom 26%). Second, intergenerational low education which is the probability of attaining less than 12 years (approximately bottom 15%) when their parents attained less than 10 (approximately bottom 26%). Finally, intergenerational high education, which is the probability of children attaining at least 15 years of schooling when their parents attained more than 13 (approximately top 24%). The indicators are summarized in Table 1.

Table 1: Indicators of Educational Intergenerational Mobility

Indicator		Description
Absolute mobility	α	OLS estimate of intercept in Eq. 1
Relative mobility	β	OLS estimate of slope in Eq. 1
Average education	$\bar{Y}$	Average years of schooling of parents
Above parent	$\bar{y}^{\geq}$	Share with higher schooling than parents
Rags to riches	$P_{1,5}$	Conditional probability of top education
Intergenerational low	$P_{1,1}$	Conditional probability of bottom education
Intergenerational high	$P_{5,5}$	Conditional probability of top education

Correlates of relative mobility. I correlate the measure of relative mobility β with a rich set of local area characteristics with the aim of documenting a set of stylized facts.

I do it by running regressions of relative mobility (i.e., β) at commune-level against each covariate:

$$\beta_c = \gamma_0 + \gamma_1 Z_c [+\gamma_2 W_c] + \epsilon_c \tag{2}$$

where Z_c is the covarite, W_c is average education of individuals born in the commune that are older than 24 but younger than 66. For each correlate, I estimate γ_1 with and without controlling by W_c to get a sense of how IGM is related to a given covariate above and beyond "initial conditions" of the commune in terms of educational attainment.

Predictors of relative mobility. I estimate a LASSO (least absolute shrinkage and selection operator) over the full set of covariates to select the set with the strongest predictive power on relative IGM (i.e., β) at the level of commune. I compute the "optimal" degree of regularization using 10-fold cross-validation and plot the coefficients path allowing the regularization parameter to range from 0 (OLS) to infinity (where all the coefficients are set to zero).

Sample. The full count sample consists of 17,574,003 individuals. I drop those that are considered domestic service, living in collective housing, persons in transit, and individuals considered homeless, which reduces the sample to 16,673,838. The target sample to estimate mobility uses only individuals born in Chile with ages between 21 and 25, which further reduces the sample to 1,155,207. This target sample is composed by 568,231 men and 586,976 women.

Linking individuals across generations. The data set enumerate individuals into households and contains a variable that describes the relationship of each individual with the head of the household. I use this variable to link individuals with their parents or older relatives according to table 2. In addition, those living only with individuals not identified in the table are matched with other relatives, provided that these relatives are at least 15 years but less than 40 years older than them. In the end, I am able to match approximately 73% of the target sample using specific relationships to the head and an extra 6% using other relatives, reaching a final sample of 833,107 individuals.

The use of co-residents may generate bias in the estimates of intergenerational mobility as individuals who reside with their parents may systematically differ from those not residing with them. However, Narayan et al. (2018) use household survey data that contain retrospective information for a large number of countries to show that the bias is small when using individuals of age 21-25.

Table 2: Relationship to household head and identification of different generations

Relationship to the head	**Generation**	**Relationship to the head**	**Generation**
Grandparent	-2	Sibling	0
Parent	-1	Sibling-in-law	0
Parent-in-law	-1	Child	1
Head	0	Child-in-law	1
Spouse	0	Spouse/partner of child	1
Legal live-in partner	0	Grandchild	2
Partner	0	Others	Missing

Categories left missing are: Other relative, non-relative, domestic employee, person in collective housing, visitor, and homeless person.

III Estimates of intergenerational mobility

In this section I document the level of IGM in Chile derived from my estimates. First, I go over country-level estimates for the seven indicators of IGM described in the previous section, I explore whether there is some evidence of heterogeneity by gender, urban status and indigenous population in absolute and relative mobility, and then I go over the estimates of mobility using other outcomes. Second, I document within country mobility at the region-level using the same seven indicators, describe and map the estimates at commune-level, analyze the correlation patterns between these indicators, and finally explore within country variation in the effect of parental education on alternatives outcomes.

III.1 Country-level estimates

I first estimate intergenerational mobility in education at the country level[5] and then I explore some potential heterogeneity across sub-populations such as male versus female, urban versus rural, and indigenous versus non-indigenous people in some of the indicators. Then I estimate the relationship between parental educational attainment and other child's outcomes.

IGM in education. Table 3 summarizes the level of educational IGM using the previously described seven indicators estimated at the country-level with a sample that includes only children with ages between 21 and 25. The most recent estimates of IGM (at least for few of these indicators) at the country-level available in the literature for Chile are for the cohort born in the 1980s. Compared to them, I find a slightly higher relative mobility (or lower intergenerational persistence) as measured by β, which suggest that the upward trend in mobility seen with these indicators may have persisted for the cohort born in the 1990s.[6] In addition, although not directly comparable, the indicators of directional mobility show a consistent picture with respect to Narayan et al. (2018) results in terms of high-persistence at the top of the educational distribution and relatively low chances of reaching the top conditional on having parents at the bottom.

Table 3: IGM at country-level

Absolute mobility	α	9.576	Relative mobility	β	0.286
Average education	$\bar{Y}$	11.128	Above parents	$\bar{y}^{\geq}$	0.666
Rags to riches	$P_{1,5}$	0.156	Intergenerational low	$P_{1,1}$	0.273
Intergenerational high	$P_{5,5}$	0.568			

The table reports estimates of IGM (as described in Table 1) using a sample of individuals with age between 21 and 25 linked to parents or older relatives as explained in section II.

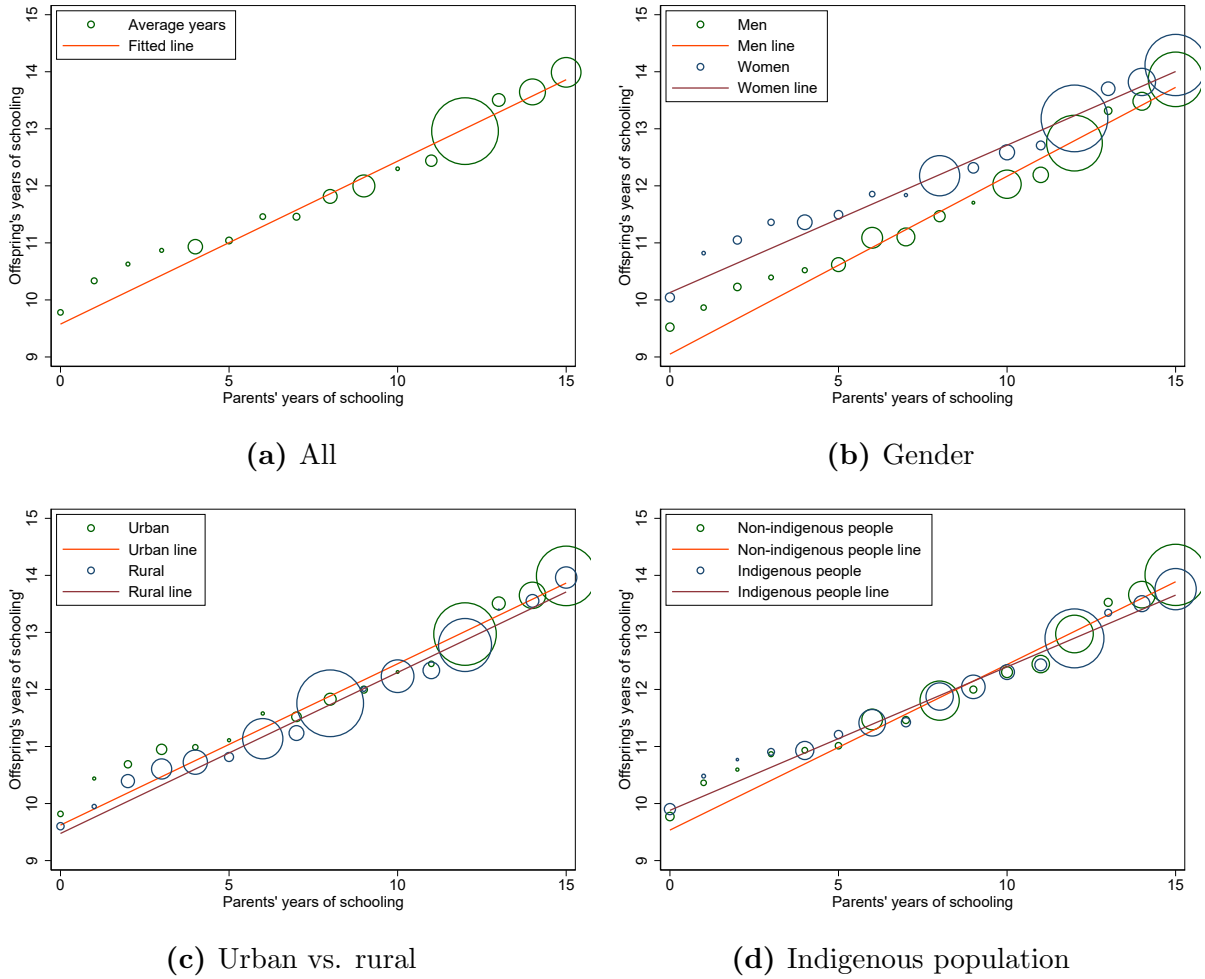
Figure 1a displays the average attainment conditional on parental education attainment,

[5]Figure A2 in the Appendix displays the distribution of years of schooling for children and parents.

[6]Figure A3 in the Appendix shows the evolution over time of these indicators in the literature versus my estimates.

the relationship appears linear with a deviation only in the lowest level of parental education.[7] When this regression is estimated using sub-populations, I find higher absolute mobility for women compared to men but lower relative mobility (see Figure 1b). In contrast, I do not find significant differences between rural and urban population (see Figure 1c), and between indigenous versus non-indigenous populations (see Figure 1d).

Figure 1: Country-level educational IGM



(a) All **(b)** Gender

(c) Urban vs. rural **(d)** Indigenous population

The graphs display average years of schooling of children for each level of schooling of the generation above (highest years of schooling among parents and older relatives living in the same household). The sample includes only individuals with age between 21 and 25. The size of the bubble varies according to the number of individuals.

[7] Figure A4 in the Appendix displays the transition matrix between children and parental years of schooling, each of them aggregated into three groups (i.e., bottom, middle and top) that are close to quintiles according to the distribution of years of schooling.

Other child's outcomes. I estimate the relationship between parental education and two additional child's outcomes: the likelihood of attending tertiary education and the likelihood of having a child while teenager in the case of women.[8] These outcomes can be measured at earlier ages than education reducing the magnitude of any potencial coresidence bias.

First, I estimate the probability of attending at least one year of tertiary education using a sample of individuals with ages between 19 and 21. Figure 2a shows this likelihood for each parental educational attainment, finding a positive slope approximately equal to 0.046 with a somewhat prominent discontinuity at 12 years of schooling and a somewhat nonlinear relationship for low values of parents' years of schooling. This contrasts with the virtually linear relationship between parental income rank and college attendance documented for the US in Chetty et al. (2014). Despite these differences and other differences in terms of measurement and concepts I find similar gaps. The gap in the likelihood of attending tertiary education for individuals with low-educated vs. highly-educated parents is around 60 percentage points while Chetty et al. (2014) documented a gap of 67.5 percentage points in the US for individuals with lowest-income vs. highest-income parents.

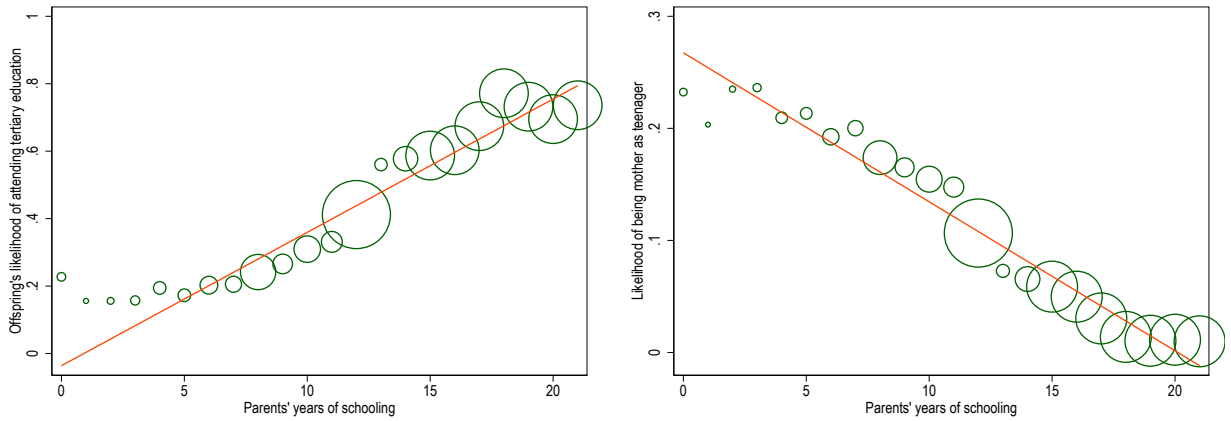
Second, I estimate the probability of becoming mother as teenager defined as having a child for females with ages between 15 and 19. Figure 2b shows this likelihood for each parental educational attainment, finding a negative relationship close to linear with a slope of -0.017. The gap between highly-educated and low-educated parents is around 20-25 percentage points (Chetty et al. (2014) documents a gap of 29.8 percentage points for highest-lowest parents' incomes).

III.2 Intergenerational mobility within Chile

Region-level estimates. Before presenting the most disaggregated estimates, Table 4 summarizes the seven measures of IGM estimated for the 16 regions of Chile. Non-negligible differences can be found across regions in most of these dimensions. For example, the chances

[8] I use the same econometric specification as in Equation 1 with a different dependent variable.

Figure 2: Other child's outcomes



(a) Tertiary education attendance **(b)** Teenage birth (females only)

The first plot displays the likelihood of completing at least one year of tertiary education for each level of education of the generation above (highest years of schooling among parents and older relatives living in the same household). The second plot displays the likelihood of having a child as teenager for each level of education of the generation above. The samples include individuals with age between 19 and 21 (left) and 15 and 19 (right). The size of the bubble varies according to the number of individuals.

of reaching the top quintile of the educational distribution for children with parents at the bottom quintile (i.e., $P_{1,5}$) is approximately 80% higher in the northern Arica y Parinacota region relative to Aysén region. Similarly, in terms of absolute mobility (i.e., α) the there are regions with more than one year of difference, and relative mobility (i.e., β) is 17% higher in Arica y Parinacota than in Metropolitana de Santiago or Los Rios.

Commune-level estimates. I document wide variation within country at the level of commune. Absolute mobility, excluding places with less than 50 individuals[9], ranges between 7.16 in Quemchi, a commune located in Chiloé island in the south of the country, and 11.73 in San Pedro de Atacama, a commune located in the north. Similarly, relative mobility ranges between 0.54 and 0.97, being the same previous two communes the ones showing the minimum and maximum values. Non-negligible variation is seen in all the indicators studied. Figure A6 in the Appendix shows the distribution of the commune-level estimates for the

[9]Figure A5 in the Appendix displays the CDF of the sample size by commune.

Table 4: Region-level estimates of IGM Statistics

Region	α	β	$\bar{Y}$	$\bar{y}^{\geq}$	$P_{1,5}$	$P_{1,1}$	$P_{5,5}$
Tarapacá	9.66	0.74	11.53	0.60	0.15	0.28	0.48
Antofagasta	9.25	0.71	11.61	0.57	0.14	0.30	0.48
Atacama	9.54	0.73	10.98	0.62	0.12	0.31	0.45
Coquimbo	9.44	0.72	10.53	0.65	0.13	0.26	0.50
Valparaíso	9.61	0.72	11.23	0.65	0.16	0.26	0.54
Libertador General Bernardo O'Higgins	10.06	0.76	9.95	0.71	0.15	0.26	0.48
Maule	9.75	0.73	9.84	0.73	0.16	0.26	0.52
Biobío	10.12	0.74	10.65	0.74	0.19	0.24	0.59
Araucanía	9.58	0.71	9.89	0.75	0.13	0.27	0.57
Los Lagos	9.35	0.71	9.77	0.71	0.12	0.31	0.48
Aysén del General Carlos Ibáñez del Campo	9.38	0.76	9.58	0.65	0.11	0.35	0.39
Magallanes y de la Antártica Chilena	10.36	0.77	11.33	0.66	0.17	0.22	0.49
Metropolitana de Santiago	9.38	0.70	11.33	0.64	0.15	0.27	0.57
Los Ríos	9.46	0.70	10.20	0.72	0.12	0.27	0.55
Arica y Parinacota	10.76	0.82	11.48	0.61	0.20	0.20	0.46
Ñuble	10.02	0.74	9.87	0.76	0.19	0.24	0.57

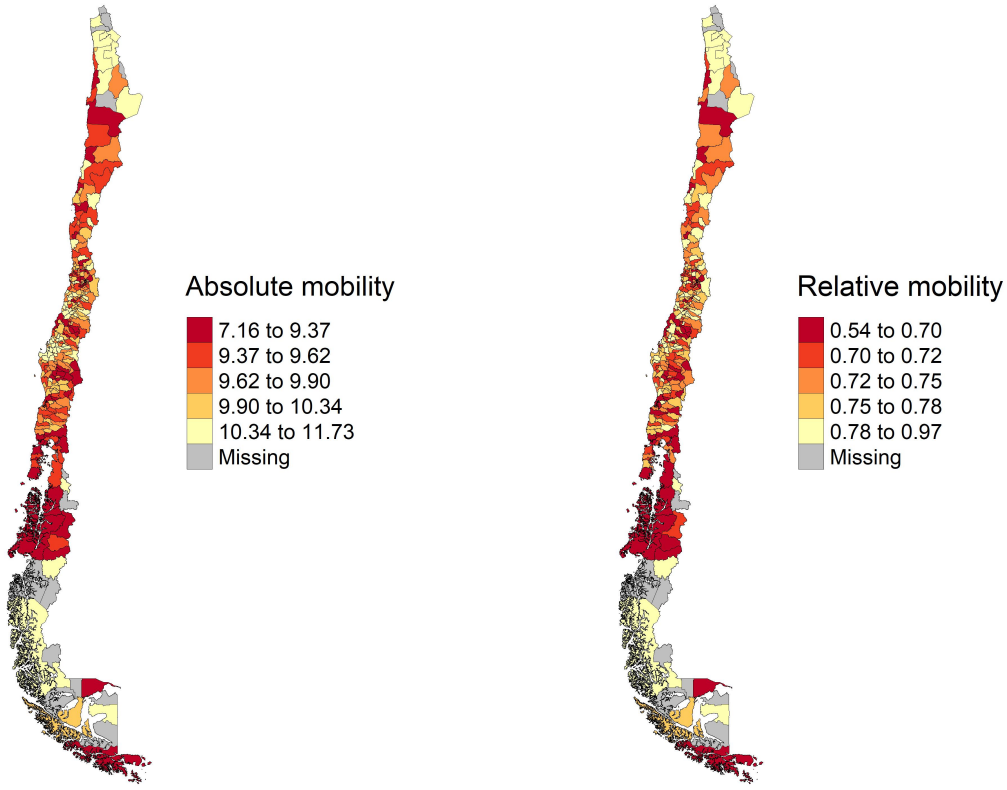
The table reports region-level estimates of absolute mobility, relative mobility, average parents' education, share of children with higher education than parents, rags to riches, intergenerational low, and intergenerational high, respectively. A description of the measures can be found in Table 1.

seven measures.

Figure 3 maps absolute and relative mobility across the country. There are some regions with clusters of communes showing relatively similar levels of IGM, such as the northern regions and more heterogeneity in the center of the country. Figure A7 in the Appendix plots absolute and relative mobility dividing the map of the country into three parts, a northern region less the metropolitan region, the metropolitan region, and a southern region. These three regions have communes with relatively low and high levels of intergenerational educational mobility. However, in this map the variety IGM levels in the metropolitan region (where the highest share of the population lives) can be appreciated with more detail.

Correlations among different measures of IGM. Table 5 presents the Pearson correlation coefficients between the seven mobility statistics computed at the level of commune. I find the strongest positive correlation to be between absolute and relative mobility (0.912). These two measures are at the same time positively correlated to above parents and rags to

Figure 3: Intergenerational educational mobility within Chile



(a) Absolute IGM by commune (min: 7.16, median: 9.75, and max: 11.73)

(b) Relative IGM by commune (min: 0.54, median: 0.73, and max: 0.97)

Notes: The map plots absolute and relative IGM measures as the intercept and one minus the slope of a regression (by commune) between child's years of schooling (using only age between 21 and 25) against parents' years of schooling. Educational attainment is censored at 15. Communes with less than 50 individuals are left as missing (Figure A5 in the Appendix displays the CDF of the sample size by commune).

riches, especially absolute mobility. Intergenerational low is negatively correlated to all the other six indicators.

Other outcomes within Chile. I estimate the relationship between parental education and the two alternative outcomes described in the previous section: the likelihood of attending at least one year of tertiary education, and the likelihood of being mother as a teenager for females. Table 6 reports these estimates at the regional-level.

There is significant variation across regions in the effect of one extra year of parental

Table 5: Correlation among IGM statistics

	α	β	$\bar{Y}$	$\bar{y}^{\geq}$	$P_{1,5}$	$P_{1,1}$	$P_{5,5}$
Absolute mobility (α)	1						
Relative mobility (β)	0.912***	1					
Average education ($\bar{Y}$)	-0.0129	-0.140*	1				
Above parents ($\bar{y}^{\geq}$)	0.283***	0.149**	-0.712***	1			
Rags to riches ($P_{1,5}$)	0.505***	0.248***	0.310***	0.123*	1		
Intergenerational low ($P_{1,1}$)	-0.791***	-0.588***	-0.162**	-0.205***	-0.525***	1	
Intergenerational high ($P_{5,5}$)	0.0790	-0.128*	0.176**	0.248***	0.299***	-0.174**	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

schooling on the chances of attending tertiary education. Araucania shows the strongest effect (0.044) which suggest that moving from parents with no education to the highest level in our data increases the chances of attending tertiary education by 92 percentage points (21×0.044). A caveat to note is that this calculation may overestimate the effect in light of the non-linearity observed at the national level in Figure 2a for lower levels of parental education. If I assume that the effect is null in the first 5 years of education, then the chances increase by approximately 70 percentage points. On the other extreme, Aysén region shows the smallest average effect (0.019).

Similarly, the effect of an extra year of parents' schooling on teenage birth rates varies significantly across regions. The effect of one year goes from a fall in the likelihood of a teenage birth equal to 0.8 percentage points in Ñuble to 1.6 percentage in Antofagasta or Coquimbo. This last effect implies a gap between uneducated and highly educated parents of approximately 33.6 percentage points, which again may be an overestimation due to non-linearities.

IV Correlates of IGM within Chile

In this section, I study whether the measures of intergenerational mobility in education at the commune level are correlated with a rich set of variables related to income, education, budget, geography, and other characteristics at the commune-level. The definition of the

Table 6: Parental education effect on other outcomes

Region	Tertiary education	Teenage birth
Tarapacá	0.038	-0.013
Antofagasta	0.038	-0.016
Atacama	0.042	-0.012
Coquimbo	0.040	-0.016
Valparaíso	0.042	-0.014
Libertador General Bernardo O'Higgins	0.028	-0.010
Maule	0.034	-0.012
Biobío	0.039	-0.013
Araucanía	0.044	-0.013
Los Lagos	0.035	-0.014
Aysén del General Carlos Ibáñez del Campo	0.019	-0.015
Magallanes y de la Antártica Chilena	0.033	-0.009
Metropolitana de Santiago	0.043	-0.015
Los Ríos	0.039	-0.013
Arica y Parinacota	0.026	-0.012
Ñuble	0.037	-0.008

The table reports of effect of an extra year of parents' schooling on the likelihood of completing at least one year of tertiary education and likelihood of having a child as teenager for females (computed using an OLS regression). The samples include individuals with age between 19 and 21 (left) and 15 and 19 (right).

variables and data sources are listed in the Appendix (see Table A1). An important caveat is that this analysis should not be interpreted as causal. The sole purpose is to document stylized facts that can latter be used to model theoretically or estimate empirically the mechanisms behind local differences in IGM.

Figure 4a reports the coefficients and their respective 95% confidence intervals with or without conditioning on average education of the old generation. I find that relative mobility is positively correlated in a statistically significant way at the 5% to the number of doctors.[10] In contrast, relative mobility is negatively correlated in a statistically significant way at the 5% to the Gini index, 90th quantile, 95th quantile, ratio 90-10 quantiles, ratio 90-50 quantiles, and the log of students per teacher.

[10]Budget availability and total expenditure are also positively correlated but only marginally insignificant at the 5%.

These results imply that in Chile higher intergenerational mobility (in education) is more strongly associated with lower levels of income inequality in the upper half of the income distribution. This contrasts with the findings of Corak (2019) showing that in Canada mobility (in income) is more associated to inequality in the lowest half of the income distribution. Moreover, these results are in line with the country-level evidence reported in Narayan et al. (2018) showing that income inequality is positively associated to relative mobility in education, and suggest that such a relationship may also holds within countries (see Figure A8b).

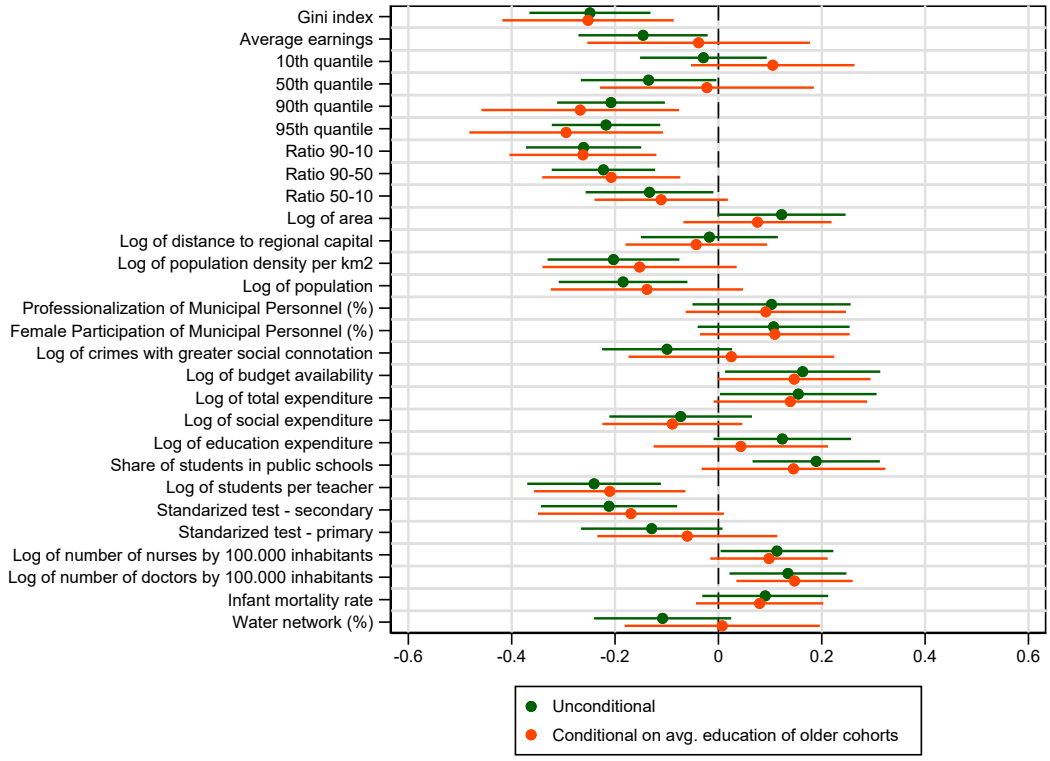
In addition, I estimate a LASSO (least absolute shrinkage and selection operator) to select via regularization the correlates that most strongly predict relative mobility. An important caveat of this exercise is that there may be different levels of measurement error in the variables, so the chosen variables can be not only the result of predictive power but also that they are just better measured.

Figure 4b plots the entire coefficients paths derived from the LASSO allowing the penalization parameter *lambda* to range from 0 (OLS) to infinity (where all the coefficients go to zero), highlighting only those correlates that remain non-zero after the optimal λ is used (vertical red line in the graph). I find that the set of strongest predictors is composed by the ratio 90-10 of earnings, area, density, municipal quality, personnel's female share, budget, students in public schools, students per teacher, primary test scores, nurses, doctors, and water network. The two strongest predictors are the share of students enrolled in public schools and budget.

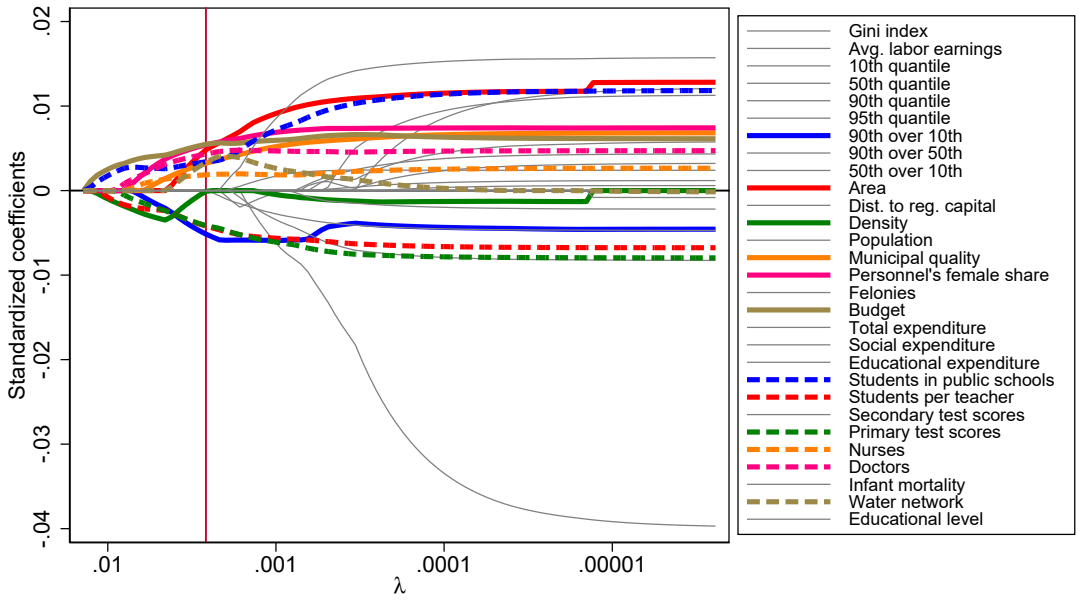
V Final remarks

In this paper, I make three main contributions to the literature on within-country intergenerational socioeconomic mobility. First, I provide estimates of intergenerational mobility in education at the regional and municipal level in Chile. I document wide variation across these administrative units in several measures of intergenerational mobility. Second, I doc-

Figure 4: Correlates of the IGM at the Commune-level



(a) Uni-variate correlations



(b) Coefficient paths from LASSO estimates

ument within country variability in how parental education affects other child's outcomes such as attending tertiary education and being mother as a teenager in the case of women. The gaps between children from low- and highly-educated parents that I document are close to those previously documented for highest- lowest-income parents in the US. Finally, I show that IGM in education within Chile is correlated with labor earnings inequality, especially in the upper half of the income distribution, number of doctors in the commune, and students per teacher ratio. Moreover, I also show using LASSO that the two strongest predictors of IGM are the share of students in public schools and the municipal budget.

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Appendices

The appendix provides additional tables and figures, and other relevant information.

Table A1 lists the set of correlates that I use together with a short description and data sources.

Figure A1 plots different measures of intergenerational mobility in education at country-level highlighting where Chile falls relative to Latin America and the Caribbean and the world.

Figure A2 displays an histogram with the distributions of educational attainment of parents and children.

Figure A3 displays the evolution of mobility across birth cohorts in recent literature versus my estimate.

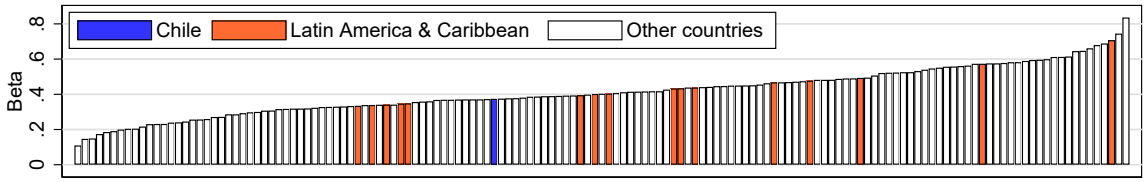
Figure A4 displays the transition probabilities between educational attainment of parents and children (classified into three categories).

Figure A5 shows the cumulative distribution of the sample size by commune.

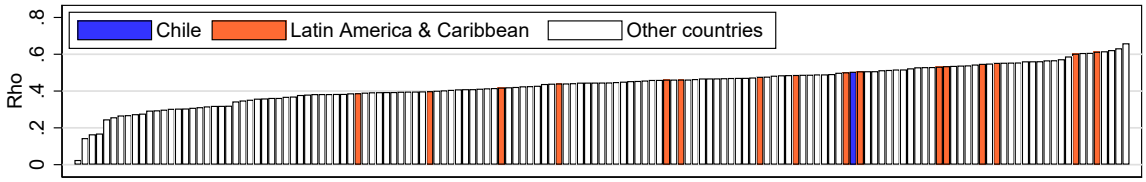
Figure A6 displays the distribution of all the measures at commune-level.

Figure A7 maps the level of educational intergenerational mobility at the commune level separating the country into north, metropolitan region, and south.

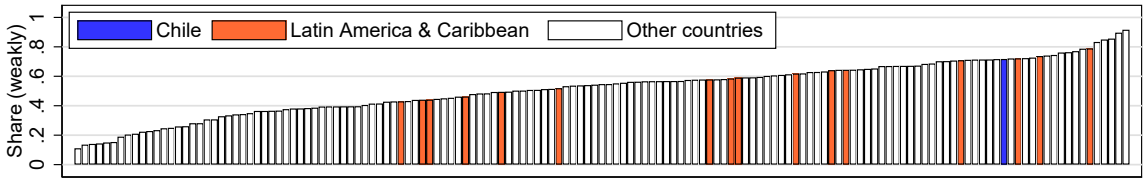
Figure A1: Chile relative to the world in terms of educational IGM



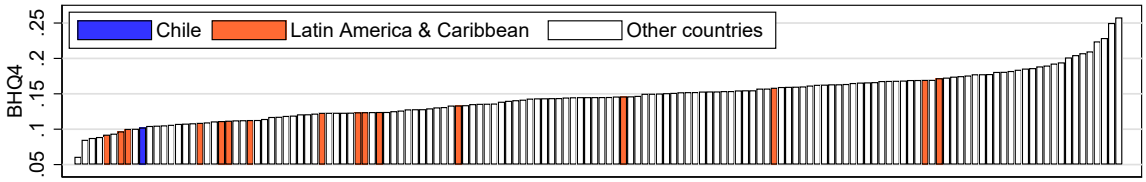
(a) Relative IGM - Intergenerational persistence (beta)



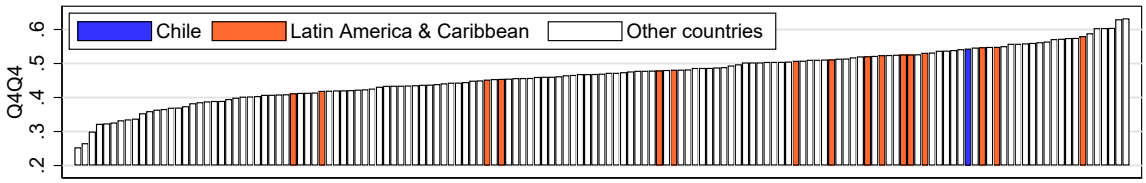
(b) Relative IGM - Correlation coefficient (rho)



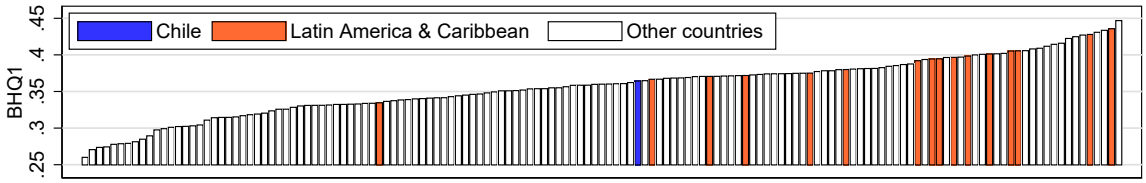
(c) Absolute IGM - Share of students with higher education than parents (share)



(d) Directional IGM - Probability child from bottom half ends up in Q4 (BHQ4)



(e) Directional IGM - Probability child from Q4 ends up in Q4 (Q4Q4)



(f) Directional IGM - Probability child from bottom half ends up in Q1 (BHQ1)

Notes: Elaboration by the author with data from Narayan et al. (2018).

Table A1: Covariates

Label	Source	Description
Gini Index	UID	Gini Index
Average earnings	UID	Average earnings in the formal sector
10th quantile	UID	10th percentile of earnings in the formal sector
50th quantile	UID	50th percentile of earnings in the formal sector
90th quantile	UID	90th percentile of earnings in the formal sector
95th quantile	UID	95th percentile of earnings in the formal sector
Ratio 90-10	UID	Ratio 90th to 10th percentile of earnings in the formal sector
Ratio 90-50	UID	Ratio 90th to 50th percentile of earnings in the formal sector
Ratio 50-10	UID	Ratio 50th to 10th percentile of earnings in the formal sector
Area	SINIM	Log of the total surface of commune
Distance to regional capital	SINIM	Log of the distance between the commune and the regional capital
Population density per km2	SINIM	Log of population density per km2 by commune
Population	SINIM	Log of commune's estimated population in June 2012
Municipal professionalization	SINIM	Share of college educated workers in the municipality
Female Share in Municipality	SINIM	Share of female workers over the total workers in personnel of the municipality
Crimes	CEAD	Log of the number of crimes with greater social connotation
Budget availability	SINIM	Log of commune's budget availability per capita
Total expenditure	SINIM	Log of commune's total expenditure per capita
Social expenditure	SINIM	Log of the commune's total expenditure in the social programs area per capita
Education expenditure	SINIM	Log of the commune'e total expenditure education programs
Students in public schools	ACE	Number of students enrolled in public schools over total enrollment
Students per teacher	SINIM	Log of students per teacher ratio in the municipal education system
Standarized test - secondary	ACE	Average score between math and language in SIMCE taken in high school
Standarized test - primary	ACE	Average score between math and language in SIMCE taken in 4th grade
Nurses by 100K inhabitants	SINIM	Log of number of nurses by 100.000 inhabitants within the commune
Doctors by 100K inhabitants	SINIM	Log of number of doctors by 100.000 inhabitants within the commune
Infant mortality rate	SINIM	Number of children under 1 year of age who die for every 1.000 live births
Water network	SINIM	Percentage of homes connected to drinking water network in the commune
Parental education	Census	Average education of individual older than 24 but younger than 66

Notes:
Unemployment insurance database (UID) can be accessed at:
https://www.spensiones.cl/apps/bdp/index.php.
National system of municipal information (SINIM) can be accessed at:
http://datos.sinim.gov.cl/datos_municipales.php.
Center for crime studies and analysis (CEAD) can be accessed at:
http://cead.spd.gov.cl/estadisticas-delictuales/.
Research unit, education quality agency data (ACE) can be accessed at:
https://informacionestadistica.agenciaeducacion.cl/#/bases.
Census 2017 data can be requested from the National Institute of Statistics at:
https://www.ine.cl.

Figure A2: Histogram of education

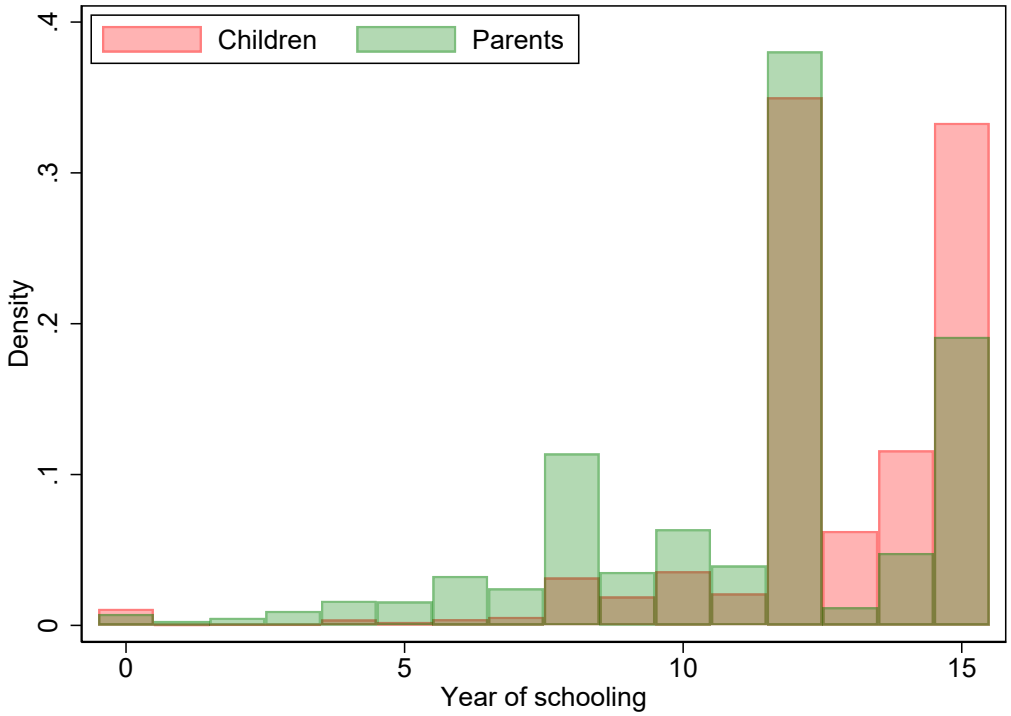
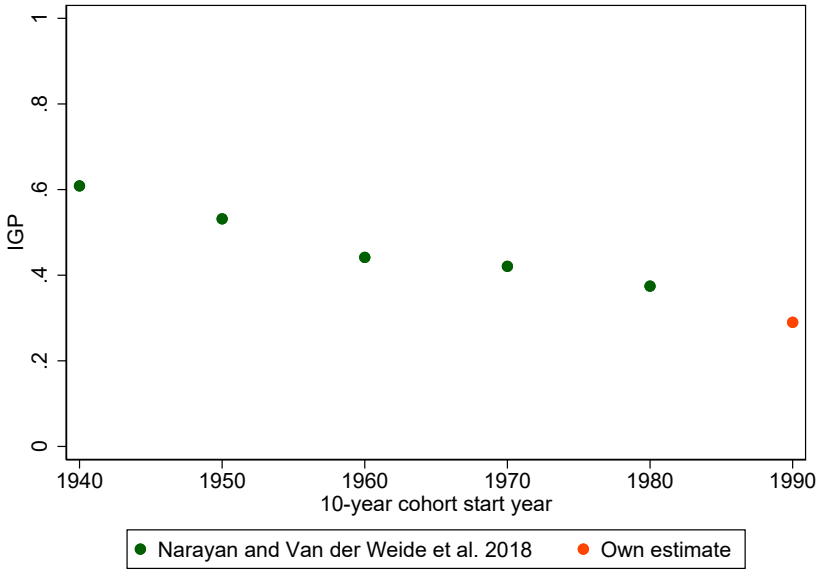
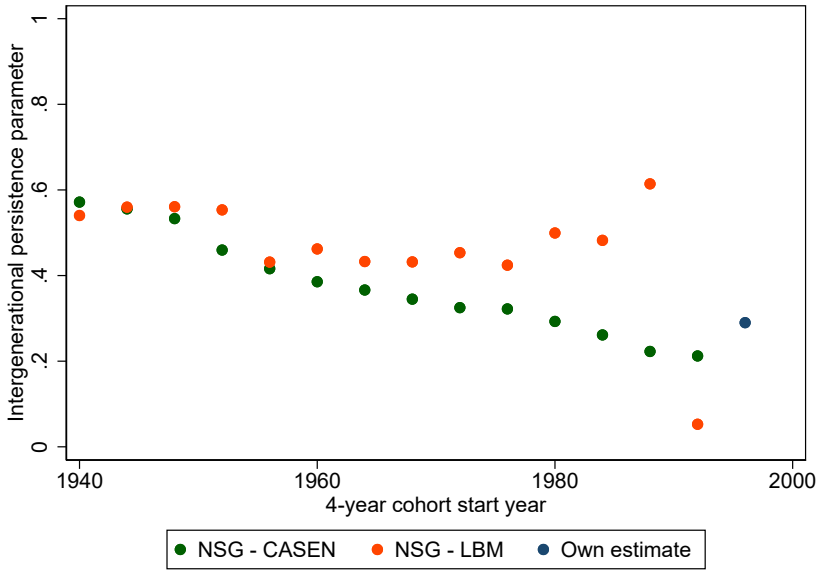


Figure A3: Own estimates versus recent estimates at the country level



(a) Elaboration by the author with data from Narayan et al. (2018) and own estimate.



(b) Elaboration by the author with data from Neidhöfer et al. (2018) and own estimate.

Figure A4: Transition probabilities at the country-level

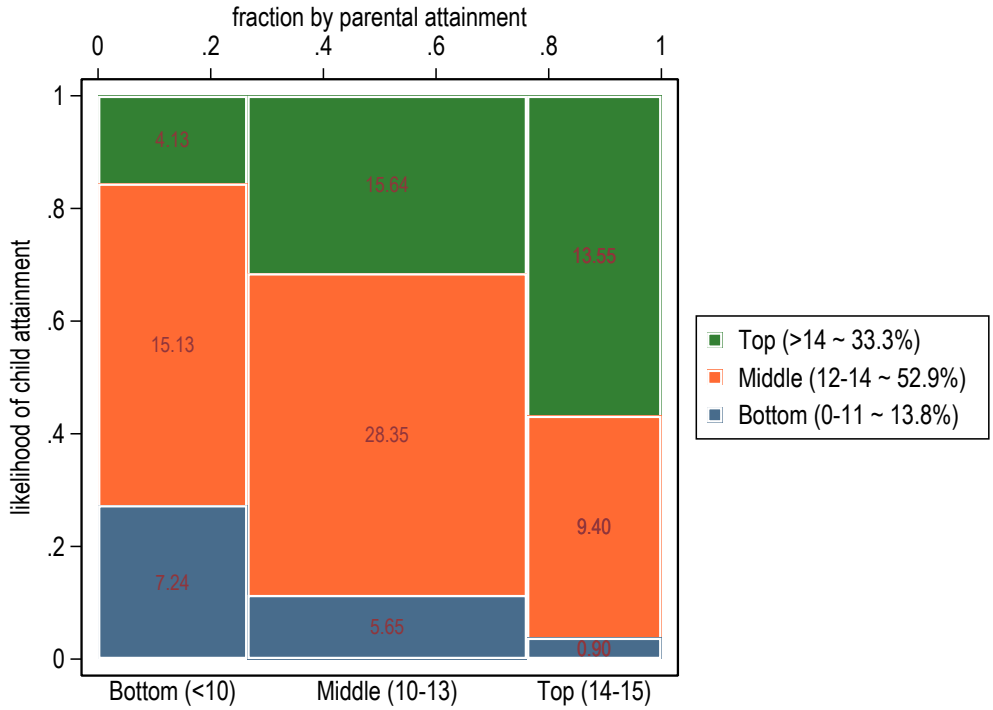


Figure A5: Cumulative distribution of the sample size at the commune level

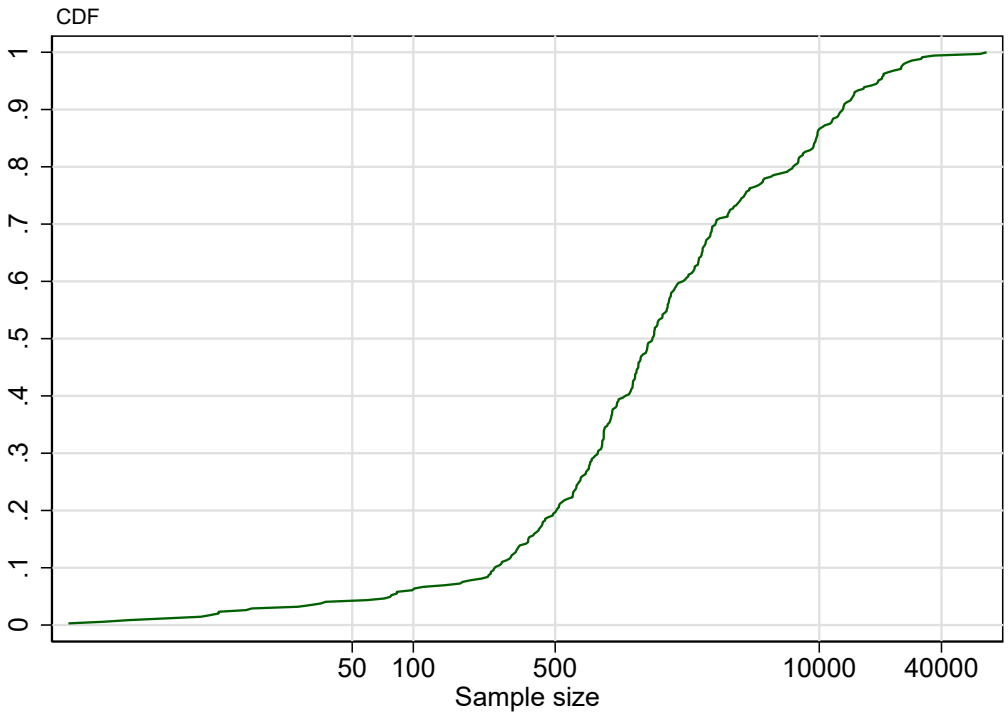
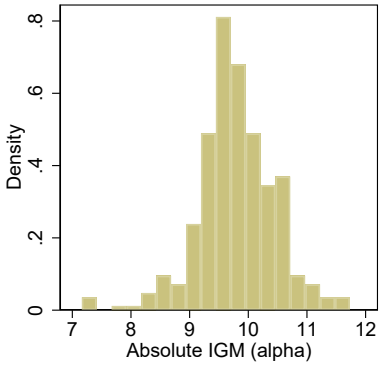
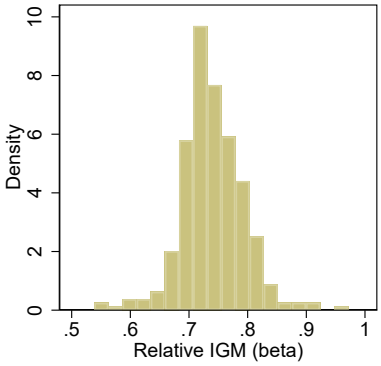


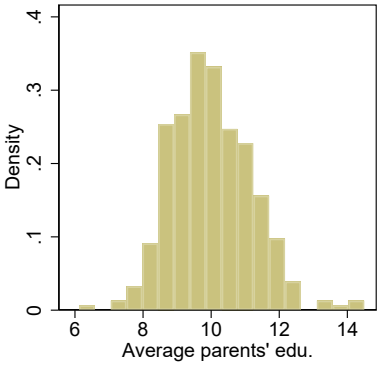
Figure A6: Distribution of commune-level estimates



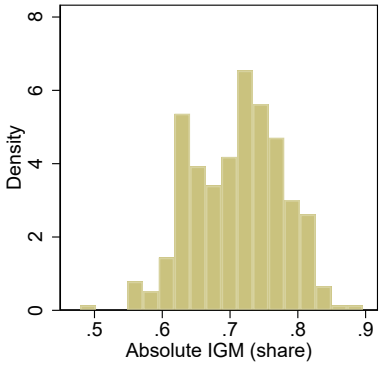
(a) Absolute IGM (α)



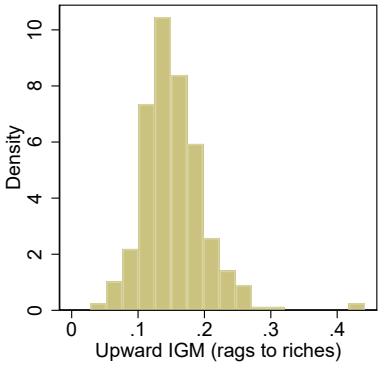
(b) Relative IGM (β)



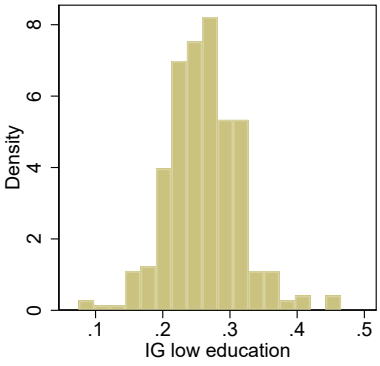
(c) Avg. education of parents



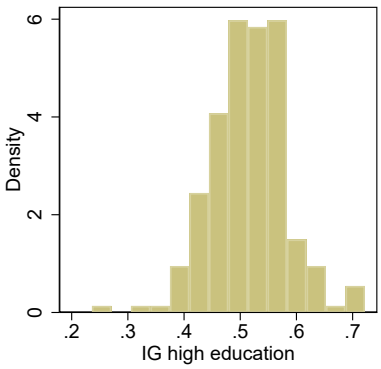
(d) Absolute IGM (share)



(e) Upward IGM

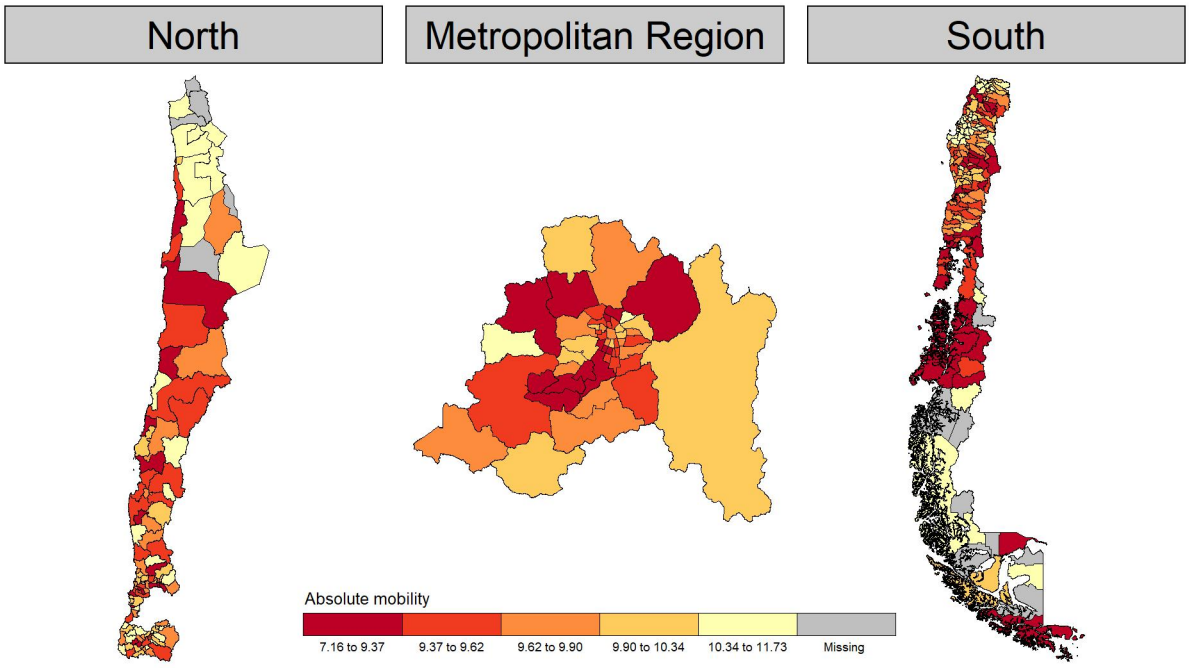


(f) IG low education

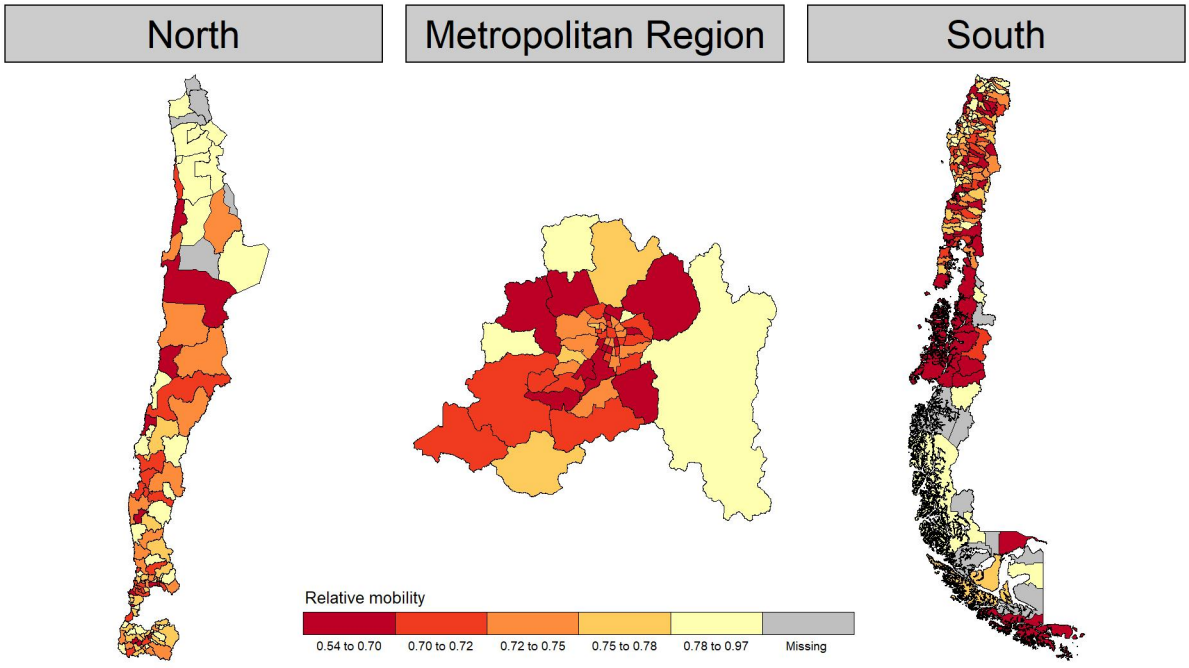


(g) IG high education

Figure A7: Intergenerational educational mobility within Chile



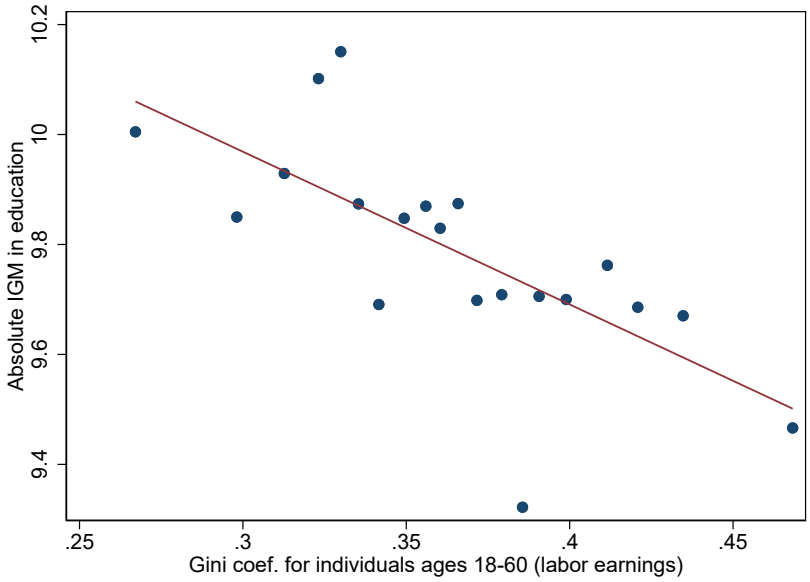
(a) Absolute mobility by commune - Chile, 2017 (min: 7.16, median: 9.74, and max: 11.73)



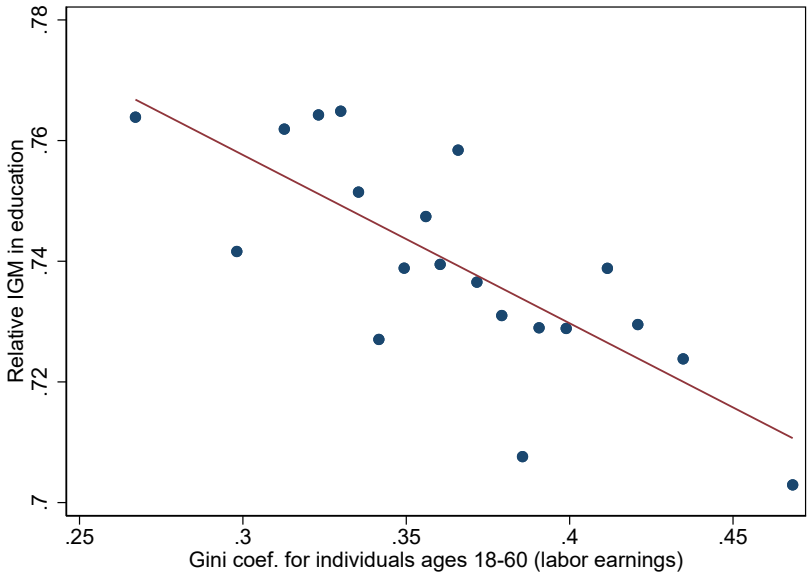
(b) Relative mobility by commune - Chile, 2017 (min: 0.54, median: 0.73, and max: 0.97)

Notes: The map plots absolute and relative IGM measures as the intercept and one minus the slope of a regression (by commune) between child's years of schooling (using age between 21 and 25) against parents' years of schooling. Educational attainment is censored at 15. Communes with less than 50 observations are left as missing.

Figure A8: Intergenerational mobility in education vs. income inequality



(a) Absolute IGM versus Gini Coef.



(b) Relative IGM versus Gini Coef.

Notes: The figures show a binscatter plot between absolute and relative IGM (measured as the intercept and one minus the slope of a regression (by commune) between child's years of schooling (using age between 21 and 25) against parents' years of schooling). Educational attainment is censored at 15. Communes with less than 50 observations are not included.