DRAFT

Intergenerational Mobility After Expanding Educational Opportunities: A Quasi Experiment

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Intergenerational income mobility may be affected by a plethora of factors; however, much recent literature has focused on the environmental impact of the local neighborhood. Given the focus on the U.S., that literature is unable to distinguish the effect of neighborhoods from that of the schools, since US students are usually tied to their neighborhood schools. Distinguishing between the impact of neighborhoods and of schools is crucial for policy debates on school choice and housing policy. I rely on a quasi-experiment in Chile to measure the impact of education outside of the neighborhood of origin. In Chile, a country with a voucher school system where parents can choose schools in any neighborhood, a new subway line in Santiago provided access to educational opportunities for low-income students by reducing their transport time to schools outside of their neighborhood (Asahi, 2014). Using an enormous, novel, student-level data set and a DID approach, this paper shows that the expansion of educational opportunities promoted intergenerational income mobility, with students' future income increasing by 1.8 percental points above that of their parents.

* I would like to thank the support of Erik Wibbels, Marcos Rangel, Kenzo Asahi, Seth Morgan, Fernanda Meneses, Harlan Down-Stepper, Emily Rains and the DevLab, GRW seminars at Duke, The Chilean Ministry of Labor and the Chilean Ministry of Education.

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I. Introduction

How important are educational interventions compared to neighborhood environments for social and economic mobility? Intergenerational mobility could be affected by factors beyond the neighborhood of residence such as educational opportunities. In the US students are often required to attend neighborhood schools, therefore in that case is not easy to disentangle the effect of education from that of neighborhoods on intergenerational mobility. As such, much of the recent research fails to disaggregate more general effects of neighborhood environments from the effects of educational opportunities (Ananat, Gassman-Pines, and Gibson-Davis, 2011; Chetty and Hendren, 2018a; Chetty, Hedren, Kline, and Saez, 2014). Nonetheless, there is no doubt that education is an important factor impacting intergenerational mobility, as more years of education has shown to cause increased intergenerational mobility (Maurin and McNally, 2008; Oreopoulos, Page, and Stevens, 2006; Pekkarinen, Uusitalo, and Kerr, 2009), and it is certainly arguable that students who attend better schools have additional positive social-mobility outcomes. Therefore, it is important to determine if students can increase their intergenerational mobility by attending "better" schools which may be located beyond their neighborhood of residence.[1]

The effect of school quality versus neighborhoods on intergenerational mobility is important since it generates different policy solutions to promote social mobility. While some authors propose the creation of housing subsidies or vouchers, educational experts have long promoted school vouchers. If the objective is to generate intergenerational mobility, instead of moving the family to a different neighborhood, an option that can be extremely disruptive and expensive, students could be simply allowed to attend a school in a different neighborhood. The school choice literature in the US and Chile has found that there is an endogenous problem with school choice, as parents tend to choose schools considering quality, distance, and other characteristics such as religious orientation and discipline practices (Blagg et al. 2018; Blagg, Rosenboom, and Chingos 2018; Chumacero, Gómez, and Paredes 2011; Valenzuela, Bellei, and Ríos 2014). A quasi-experiment could help determine the relative importance of neighborhood environment versus education on intergenerational mobility.

1 In this phrase, "better" schools is a broad expression than includes both traditional measures of educational quality and also better role models, peers, teachers, expectations, educational environments, and other factors that are valued by the students' families or may have an impact on future outcomes.

Chile has a voucher school system, where parents can choose schools from any neighborhood and no school is allowed to choose their students by location. This allows students to attend schools far from home (Canals et al., 2015). A new subway line in the capital city of Santiago generated an external shock in 2005, allowing for increased educational opportunities for students by reducing their transport time to schools outside of their neighborhoods, promoting school switches to school beyond their neighborhood (Asahi, 2014). The new subway line is used as a quasi-experiment to evaluate the impact of reduced transport cost and the subsequent increase in educational opportunities. A difference-in-difference (DID) in conjunction with the new subway line is used to evaluate the impact of increased educational opportunities. The DID methodology measures the Intent to Treat Effect (ITT) of the subway on students' intergenerational income mobility. Students in the areas affected by the subway[2] are compared to control students who were later affected by another subway expansion. This allows us to detangle the advantages a new subway has on the neighborhood — such as easier access to jobs — from those specifically related to secondary education. A novel dataset of educational trajectories, family data, and wages is used to estimate intergenerational income mobility using a rank-rank specification (see Chetty et al., 2014) as the outcome variable. This dataset was created by merging educational datasets from the Ministry of Education and Labor, analyzing one national cohort of 8th graders in 2004. These 250,000 thousand students are followed for over thirteen years with detailed data on educational, residential, and labor market trajectories.

Both methodologies find that affected individuals who were in middle schools that finished in eighth grade — forcing them to switch schools and families to reevaluate their educational decisions — and could take advantage of the new subway line, have a higher intergenerational economic mobility of 1.8 percental points above their parents' income ranking. The exploration of several channels of impact suggests that graduation from tertiary education and choosing different areas of study could explain the increased income mobility, even when these students reduce their scores in standardized tests. This paper contributes to the intergenerational mobility literature the developing world and adds to the school choice discussion as it finds a positive effect for allowing low-income students to choose schools beyond their neighborhood, and provides evidence for a school system based entirely on school choice.

2 The areas of influence of the new subway stations have been studied in the literature and the origin-destination (OD) surveys (Asahi 2014; Metro 2017).

This paper is organized as follows, Section 2 reviews the theoretical and empirical literature on social mobility, school choice, and the characteristics of the quasi-experiment. Section 3 describes the data sets used while Section 4 describes the methodology. Section 5 shows the results, and Section 6 discusses the results and concludes.

II. Neighborhoods, Education and Social Mobility

While the work on social mobility analyzes intergenerational effects, particularly the effect of neighborhoods, the school choice literature describes the factors that influence parents to choose among different educational institutions. The motivations of parents' school choice selections are important, as they reflect — in part — parental concern for the long-term outcomes for their children. This section briefly reviews the theoretical and empirical research on social mobility and school choice relevant for this research.

The dilemma of neighborhood environments versus education is important as it suggests different public policies to promote social mobility. While some authors propose the creation of housing subsidies or vouchers, others policy experts propose school vouchers; instead of moving the family to a different neighborhood, it may be an option simply to have students attend schools in those neighborhoods instead. The school choice solution would allow the families to maintain their social networks within their communities while allowing the student to have better educational opportunities. Moreover, the school voucher solution is less expensive than the housing voucher subsidy. This situation thus demands further research in this arena before large scale policy programs are implemented.

Low social mobility is important as it affects the capacity of individuals to live up to their full potential. Moreover, low social mobility is inefficient as it reduces the capacity of the economy to obtain maximum productivity from individuals. The idea of the "American dream" — rooted in the idea that a citizen can prosper regardless of the economic conditions in which they are born — is a reason why some citizens may accept inequalities in democratic countries (Corak, 2013). However, recent estimates of social mobility in the developed world have shown that it is lower than previously estimated (Chetty and Hendren, 2018b; Corak, 2013; Landersø and Heckman, 2017). The literature of social mobility has investigated causes that affect social mobility including

education, enviromental, neighborhoods, and parental education, among others (Chetty and Hendren, 2018b; Chetty et al. ,2014; Torche, 2015).

In their seminal work, Becker and Tomes developed a theory of intergenerational mobility that has served as the base for the analysis of social mobility and the cornerstone of further theoretical and empirical improvements in the literature (Solon, 2004). In their model, parents influence the outcomes of their children through several channels: genetics and human capital investment as well as social reputation and connections (Becker & Tomes, 1979). Parents invest in their children and then these investments interact with the market and generate revenues. The recent availability of large administrative datasets from tax records and surveys has benefited this empirical literature, allowing for detailed estimations of Intergenerational Elasticity (IGE) (Palomino et al., 2018). In example, for the United States, initial estimations of social mobility were close to 0.2 (Becker & Tomes, 1986), while more recent estimates using detail data are between 0.3 and 0.5 (Chetty et al., 2014; Connolly, Corak, and Haeck 2017; Mazumder 2005).

Moreover, the empirical literature has shown that social mobility is affected by aspects such as ethnicity, early childhood education, neighborhood, family characteristics, college education, and social class (Chetty and Hendren, 2018a; Heckman, 2006; Streib, 2011; Torche, 2011; 2015; Zimmerman, 2019). There is a long history in the literature regarding the analysis of the effect of education on wages and social mobility. One of the problems in this analysis is that education is endogenous to family characteristics as parents affect their offspring's educational attainment (Björklund and Jäntti, 2009). Parents choose the schools of their children or the neighborhood where to live according to their income level, education and other factors.

Several approaches have been used to assess the causal effects of education on social mobility. In particular, policy expansions of education and quasi-experiments have been useful tools to distangle and identify the effect of family background and education (Black, Devereux, and Salvanes, 2005; Carneiro, Meghir, and Parey, 2007; Chevalier, 2004; Machin, 2007; Magnuson, 2007; Maurin and McNally, 2008; Oreopoulos, Page, and Stevens, 2006; Pekkarinen, Uusitalo, and Kerr, 2009). Most of this research has posited the importance of education, supporting the role of educational public policies to promote social mobility (Björklund and Jäntti, 2009).

Previous literature has shown the relatively high importance of the family over other background factors like neighborhood of residence (Björklund and Jäntti, 2009). However, recent research has revitalized the idea that neighborhoods are important in promoting social mobility

(Ananat, Gassman-Pines, and Gibson-Davis, 2011; Chetty et al., 2014). New evidence, using randomized residential voucher programs in the US, have shown the importance of neighborhoods on wages and social mobility (Bergman et al., 2019; Chetty, Hendren, and Katz 2016). However, this new research done in the US is linked not only to geographical environments but also to educational opportunities, bundling several factors into their "neighborhood" impact. In the US geographically-set school districts determine the schools that students can attend. Therefore, this literature combines two factors: the social environment in neighborhoods with the educational opportunities and quality. Consequently, there is a limit to how much it's possible to learn from empirical experiences in the US[3].

Luckily for the literature, other countries have educational systems that do not bound educational opportunities to the neighbourhood of residence. Therefore, there is an opportunity for international evidence to contribute to the current literature and to test the importance of the neighbourhood versus education on social mobility. However, there are challenges to measure the impact of education on intergenerational mobility as school choice is endogenous to family characteristics, and thus direct estimations of educational quality on mobility will be biased (Hoxby, 2000). To solve the endogeneity issue, the economics of education literature has relied successfully on lotteries, randomization and external shocks to evaluate the impact of educational interventions (Abdulkadiroglu, 2013; Hoxby, 2000). Therefore, a quasi-experiment in an educational system with school choice can help to analyse the impact of the expansion of educational opportunities on intergenerational mobility.

III. Schooling in Chile

There are multiple mechanisms worldwide by which students are assigned to schools, ranging from models that regulate school zones to systems of complete free choice. The latter are known as school choice systems. School choice schemes rely on the assumption that maximizing the rational and informed choices of the families could promote optimal competition in the educational market (Friedman, 1955)[4] and increase social welfare.

3 In the US there are charter schools and magnet schools, however to the best of my knowledge there are no papers analyzing their effect on intergenerational mobility.

4 Although there are many variations of school choice systems, they all share the ideas of competition, freedom of choice, and decentralization (Chubb and Moe, 1990).

The promoters of these systems argue that they increase efficiency, competition, quality, and opportunities for students (Sapelli and Vial, 2002; Brighouse, 2000; Hoxby, 2000; Cohen-Zada, 2009). The detractors argue that school choice systems increase inequality and segregation (Valenzuela, Bellei, and de los Ríos, 2014; Elacqua, 2012; Ladd and Fiske, 2003; McEwan and Carnoy, 2000). Additionally market failures could prevent school choice systems from achieving optimum competition conditions (Mizala and Romaguera, 2000; Carnoy 1998). Thus, there is no consensus regarding the effect of school choice systems on educational outcomes, especially given that most results are contradictory, small, or insignificant (Mizala and Romaguera, 2000; Ramos, 2002; Bustos, Contreras, and Sepulveda, 2007).

There are few countries in the world with as extensive of a school choice system as Chile (OECD, 2017; McEwan et al., 2008) which includes over 90% of students. Furthermore, the school system in Chile has two characteristics that are useful for this study: high stratification and segregation in the school choice environment. In Organization for Economic Cooperation and Development (OECD) countries, a high proportion of educational education is explained by the families' socioeconomic status (OECD, 2018). This stratification tends to lead to higher quality schools being located in higher income neighbourhoods, therefore resulting in limited educational opportunities for low-income students (Elacqua, 2012).

The school choice literature in Chile has shown that it is also affected by this stratification, finding that parents tend to choose schools considering distance as well as quality, safety, and other characteristics like religious orientation and discipline (Chumacero, Gómez, and Paredes, 2011; Urzua et al., 2010; Valenzuela, Bellei, and de los Ríos, 2014).[5] The educational system in Chile does not put any geographical limits on school choice, parents can choose schools far from home. However lower income parents tend to live in lower income neighbourhoods and preferences for distance can limit them to local lower-quality schools. Thus, policies that reduce transportation costs could promote school switches, allowing low income students to attend higher "quality" schools. Therefore, it is possible to decouple the neighborhood from the school effect on social mobility.

5 Besides such characteristics like quality or cost of education, there could be other factors invisible to the researchers that influence parents choosing schools far from their places of residence. These unobservable characteristics could be important for students' futures. One example is that parents may want to isolate their child from what they consider bad company or other problems in their neighborhood schools.

Schools benefit from accepting students, as students bring vouchers or governmental subsidies;[6]. Chile has a mixture of public, privately owned and publicly funded (private voucher) and private paid schools. In the country, 93% of schools are financed under a voucher program with only 7% of schools being completely private. Public schools in Chile are organized according to educational cycles: separating students from kindergarten to 8th grade and from 9th to 12th grade. Comparatively private voucher schools tend to have to run from kindergarten to 12th grade. In the system it's possible to see a re-shuffling of students after eighth grade, as there is an important proportion of students moving to different schools (Canals et al., 2015).

In this school environment, we use a new subway line as a quasi-experiment. This subway line promoted a safe, inexpensive, and fast way for students to attend schools in different neighborhoods. Other authors have used this subway shock (Agostini and Palmucci, 2008), including to investigate to investigate the change in schooling opportunities (Asahi, 2014).

III. Empirical Setting

A. New Subway Line

This subsection reviews a quasi-experiment, the inauguration of the new subway in Santiago and the impact from how it made it easier for students to switch to schools outside of their neighborhoods. The scenario of a spatially segregated city, with stratified educational opportunities (Elacqua, 2012) was affected by key event. During the mid-2000s an important expansion in the subway system was inaugurated, in the context of great inequality in Santiago and a lack of transport services for the lower income groups (Asahi, 2014). This expansion in the subway system increased the proximity of millions of households to the subway network, affecting mainly low and middle income groups (Asahi, 2014). The inauguration in 2005 of subway lines 4 and 4A, in Santiago (See Figure 1A) connected some of the most populated municipalities in the city to the subway network, increasing their educational opportunities, Table 1.

6 Although no school in the country selects students according to their neighborhood of residence, private paid schools and private vouchers schools do, in practice, select students considering such variables as academic performance, religious affiliation and socioeconomic status

Private paid schools represent 7% of schools in country and students pay tuition, private voucher schools represent over 50% of schools in the country and are funded mainly using the governmental voucher. These schools are also able to charge tuition, reducing the real "choice" that families have for schools that would accept their children that they can afford, whereas public schools accept all students that apply.

The Santiago subway has some notable characteristics, specifically it is clean, fast, safe, and inexpensive for students. The impact of the subway networks has been analyzed by several authors. In terms of real estate, it has been documented that housing prices increased at a distance of 1000 meters from subway stations (Agostini and Palmucci, 2008). Similarly, the effect of school switches from the new subway line has also been found to have a maximum impact around 1000 meters from the subway stations (Asahi, 2014). Figure 1.B shows the example of a middle school in Puente Alto in 2004, in a low-income area, the new subway line. Figure 1 C shows that the same students when in 12th grade were attending schools all around Santiago, probably using the subway as their transit. As students graduated from this middle school, they could take advantage of the new subway line to attend schools in different parts of the city.

The surveys of origin-destination trajectories of the Santiago Subway Metro S.A, have discovered that that 80% of travelers walk 300 meters or less to and from the subway stations and that 98% of travelers walk 600 meters or less to and from the subway stations (Appendix I).

TABLE 1—POPULATION AFFECTED BY NEW SUBWAY LINE 4 AND 4A

	Populati
Puente Alto	491,22
Peñalolen	216,04
La Florida	364,60
Macul	111,91
Nuñoa	162,48
San Ramon	94,906
La Granja	132,
Providencia	117,02
Total	1,690,

Source: Chilean Census 2002.

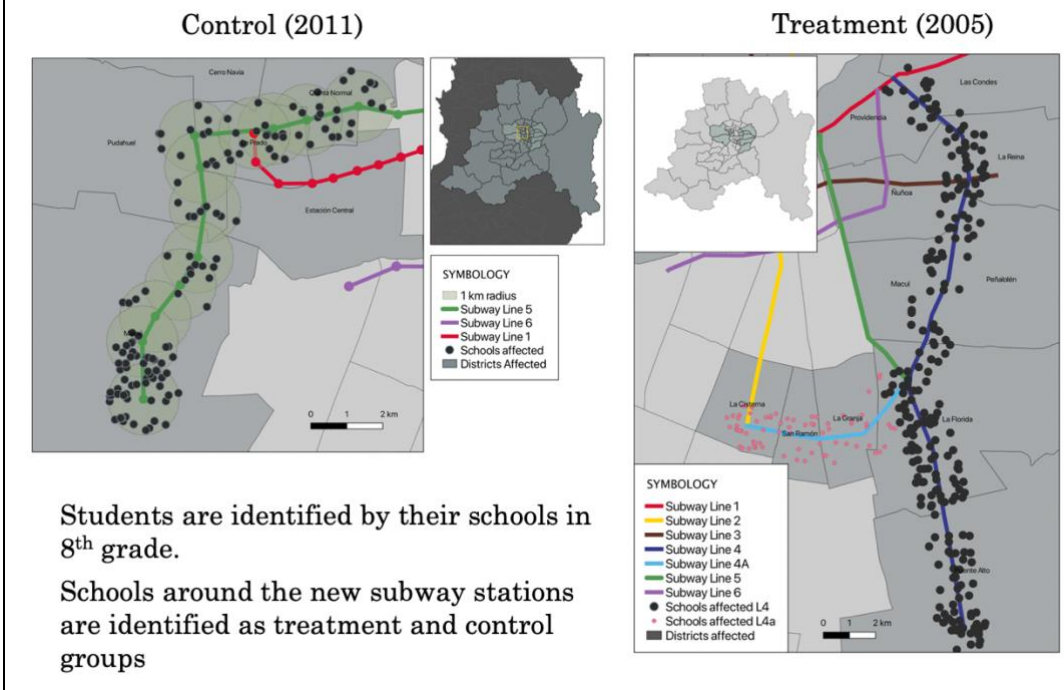
Beside lines 4 and 4a, another subway expansion occurred in Santiago in 2011. This later subway expansion occurred in a different part of Santiago, but also connected individuals with similar income levels to the subway network. Students affected by the 2011 subway expansion are the control group since the expansion happened after they had left high school. Therefore, the

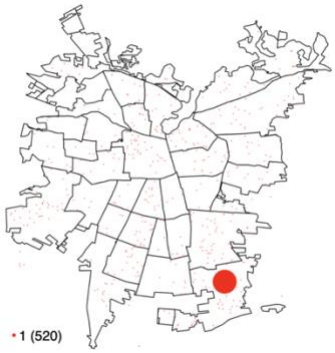
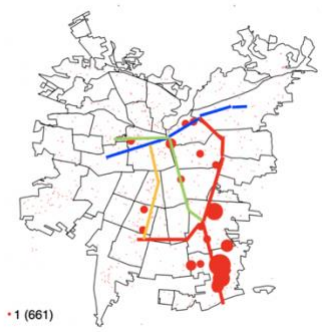
expansion did not promote school switches, but it did have an impact on many other relevant economic factors as labor markets, land value, college access, etc. This allows us to detangle secondary school affects from many other potentially confounding factors.

To identify treated and control students or first best solution would be to use their geocoded address, however, it's no possible to have it for all individuals in the sample (See Appendix II). A second-best solution is to use their middle schools. I define treated students as students enrolled in 8th grade in the middle schools around the catchment areas of the new subway lines 4 and 4A. The control group are the students in 8th grade in middle schools around the catchment areas of the line 5 expansion. This method to define the treatment and control group assumes that if students were able to walk to their middle school, they would also be able to walk to the new subway stations and use the subway. The selected middle schools are shown in Figure 1A.

FIGURE 1. SUBWAY LINES AND STUDENTS

A. New Subway lines



B. Example Middle School in 8th grade	C. Destination of Students in 12th grade
	

B. Data Sets

To analyze social mobility and wages, a panel data set is created following students from 14 to 27 years old. These data sets come from the Ministry of Education and the Ministry of Labor which were merged by the Ministry of Labor and all individual identifiers erased. The initial data set documents the results of a national mandatory test administered to students in the 8th grade and 10th grade– the SIMCE. There is also information regarding college entrance and graduation, as well the wages of those in the formal sector.

The SIMCE (the System of Quality Measurement in Education, abbreviated to SIMCE by its Spanish name) test is a government-provided, national, mandatory test taken by8th and 10th graders in Chile. The SIMCE includes parent and teacher questionnaires that provide self-reported information for parents' socio-demographic factors such as parental education, family income level, and type of school attended, among other factors. The family income and parental education in these questionnaires are used in this paper to estimate the family baseline and controls.

The Ministry of Labor provided information detailing the wages of the students between 2015 and 2018 for those employed in the private sector. This data come from the unemployment

insurance systems, where worker have an account that follows them through job changes. The majority of workers are enrolled. However, it does not include workers in the informal sector.[7]

The outcome variables of this paper constitute the rank-rank intergenerational mobility of students in which parents and students are both ranked using the full national student cohorts, estimated following Chetty et al. 2014. Parental income was obtained from the 2004 SIMCE survey and the student's adult wage is obtained from their wages in 2016, 2017, and 2018 from the Ministry of Labor. Appendix III shows a detailed explanation of the calculations. The students in the treatment and control groups correspond to students in middle school in the surrounding areas of the subway lines, totalling 13,802 students.

TABLE 2— STUDENTS USED IN THE STUDY

	Population	Wage Information
Initial Cohort	249,373	181,912
Treated and Control	13,802	10,437

Source: Authors' own work

The variables of interest of this study are test scores, parental income, parental education, student education and wages as described in Table 3. Table 3 presents the statistics of the main variables for the students and their families. Note that we only have adult incomes for 10,437 of the sample of students out of 13,802, as not all young people are employed in Chile, particularly low-income female individuals.

TABLE 3—VARIABLES OF INTEREST AND SAMPLE SIZE

Variable	Obs.	Mean	Std. D	Min	Max
Income Rank Child	10,437	0.538	0.28338	0.00030	1
Income Rank Parents	13,802	0.575	0.25666	0.00010	1

7 Acording to the 2017 CASEN survey in Chile, 8% of the individuals of this cohort are in the informal sector.

SIMCE Test Score	13,802	255	45.5478	121.245	388.115
Parental Education (level)	11,470	2.2	1.215	1	8
Students Forced to Switch	13,802	.504999	0.49999	0	1

Source: Author calculations using data sets from the Ministry of Education and Labor.

C. Methodology

This paper uses a DID approach to estimate the ITT effect of the subway and the potential increase in school choice. The exposed group is defined as students who attend middle schools in the catchment areas of the new subway. The control group are students who were affected by a second subway expansion in 2011 after they graduated (Figure 1A). Therefore, these individuals had similar positive neighborhood effects of the increase in connectivity, but did not benefit from increased access to different high schools.

The initial formulation follows the literature of intergenerational mobility that uses administrative data sets (Chetty et al., 2014). Where y_{i0} is the rank of the family in 2004, and $y_{i1}$the rank of the child in 2017, and the variable $Exposure_{it} = 1$ indicates the students affected by the subway expansion, X_i are other covariates such as academic performance, parental education[8] etc.

To run the regressions using a DID approach, the data is transformed into a panel data set. A time measurement variable is created where the period is *t*, the initial period (t=0) is 2004, and the following period (t=1) is 2017. T_{it} is a dummy variable that indicates the year 2017. The interaction term $T_{it}Exposure_{it}$ will allow for measurement of the shock, and β_3 will be the DID estimate. Equation (2) shows the equation for the DID estimation.

$$y_{it} = \beta_0 + \beta_1 Exposure_{it} + \beta_2 T_{it} + \beta_3 T_{it} Exposure_{it} + \varepsilon_{it}$$

8 Parental education level refers to the highest education level between both parents.

This regression then calculates how much of the change in rank is associated with the subway expansion. The DID estimate will measure the change in rank position between the child and their parents (Child Wage Rank 2017 – Parental Income Rank 2004), with respect to the control group.

To further refine the argument, we divide the sample and estimate the ITT[9]. The two groups are the students that were in middle schools that ended in 8th grade (aprox. 50% of the sample) and therefore forced to choose a new high school (Figure 1, D), and students that were in schools that included 9th through 12th grade. Moreover, different co-founding variables (parental education, SIMCE test scores, family income) are included in the analysis to check the robustness of the estimations. The comparison between those who were forced to change schools and those who could either continue with their school or change provides a useful comparison to understand the nature of the changing schools. Table 4 provides a summary of the intersection of the treatment and being forced to change schools versus having a choice.

TABLE 4— TREATED STUDENTS AND SWITCHED STUDENTS

	Treated		
Forced To Switch	No	Yes	Total
No	2,357	4,475	6,832
Yes	2,323	4,647	6,970
	4,680	9,122	13,802

Source: Authors' own work

The main hypothesis of this paper is that the increased accessibility of school options will increase the intergenerational income mobility, beyond neighborhood environments. Nevertheless, the channels that could promote social mobility are varied. The first direct channel of transmission could be increased educational quality as measured in standardized tests. Higher test scores have been found to be correlated to increased enrollment in and graduation from tertiary education (Blanco et al., 2018). It can also improve college selection tests scores and college applications, leading to access to better colleges and therefore increased future income (Hastings et al., 2013).

9 However, this estimation does not allow for the calculation of the intergenerational transmission coefficient, only the ITT of the subway.

There are two other channels of transmission, which are related to peers and role models. Role models and peers may affect students' decisions to enroll in higher education or to choose different areas of study that can have different labor market outcomes. This paper also evaluates enrollment rates, graduations rates, and areas of study to analyze these possible channels of transmission.

IV. Results

The results of the DID estimation with covariates are included in Table 4, estimating the differences between the income ranking of student and their parental income ranking (see Chetty et al., 2014). The results show that overall the students in the affected areas had no increase in intergenerational mobility with respect to their parents when controlling for parental income, parental education and SIMCE test scores. However, the results show that students who were in middle schools that forced them to choose a new high school present an increase in their intergenerational income mobility ranking of 1.8%, with respect to their control group. On the contrary, there is no intergenerational mobility effect in the schools that did not force students to choose new schools. This result would point that when individuals are nudged/forced to change schools, and their educational options are expanded, they will present higher income mobility.

TABLE 4—DID REGRESSION RESULTS ON INTERGENERATIONAL INCOME MOBILITY

	DID	DID	DID
	All	Not forced to	Forced to Switch [a]
DID Estimator	0.00637	-0.00824	0.0183*
Observations	17,418	8,402	9,016

Source: Author calculations using diff command in Stata:

* Parental Income, Parental educational level and SIMCE test scores as controls.

[a] Schools that ended in 8th grade.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

V. Channel of transmission

This section will analyze the factor that could explain the changes in social mobility. Table 5 shows the results for the proportion of students who graduate from tertiary education. The DID results show that students who were forced to switch schools do not present statistically significant changes in their higher education graduation rates. Therefore, it's not evident that increases in college graduation explain the higher intergenerational mobility.

TABLE 5—DID REGRESSION RESULTS ON HIGHER EDUCATION GRADUATION

	DID All Students	DID Not forced to	DID Forced to Switch [a]
DID Estimator	0.00639	0.00339	0.0132
Observations	17,418	8,402	9,016

Source: Author calculations using diff command in Stata: Parental Income, Parental educational level and SIMCE test scores as controls.

[a] Schools that ended in eighth grade.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

The second possible channel that could explain the higher intergenerational mobility is educational quality. To test this possible explanation this paper compares the SIMCE test scores of students in 8th grade to those of students in 10th grade. The DID results in Table 6 show overall negative results, driven mainly by students who were forced to switch schools. There are several possible explanations regarding these negative results. The first possible explanation is the socio-emotional and adjustment costs of switching schools (Asahi, 2014), or that parents choose low

quality schools (Abdulkadiroglu et al., 2015). An although these results are similar with other papers in the literature (Abdulkadiroglu et al., 2015; Asahi, 2014) they do not explain the higher intergenerational mobility or graduation rates, and suggest that other factors are playing a role[10].

TABLE 6—DID REGRESSION RESULTS SIMCE IN 10TH AND 8TH GRADE

	DID All Students	DID Not forced to	DID Forced to Switch [a]
DID	-2.943***	-2.389**	-3.483***
Observations	13,994	7,068	6,926

Source: Author calculations using diff command in Stata: Parental Income, Parental educational level and SIMCE test scores as controls. Outlier with over 2 SD of difference in tests were excluded.

[a] Schools that closed in eight grades:

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

It's possible that the intergenerational mobility of students is not simply affected by educational quality, but by changes in students' professional paths or fields of study. In Chile, students choose their specific major before entering college, and while higher education is very good investment, some degrees generate higher economic rents than others. In particular, engineering and sciences generate higher future income compared to social sciences, humanities or art, particularly for low income students (SIES 2015). Thus, two different students with the same college selection test scores and grades, could have completely different earning paths if they decide on different paths of study.

10 Another possible explanation one could be sample selection bias. That low-performing students, who drop-out in the control group, continue in the treated group.

This type of thinking is more closely related to the literature on role models and peers having influence on the expectations and desires of students (Hastings et al., 2013). It could be possible that the new schools provide opportunities through guidance, expectations, peer pressure and changed beliefs about the future that are simply not measured in test scores, something that has already been found the literature (Krishna, 2017; Lafortune et al., 2018; Mani & Riley, 2019; Nguyen, 2008; Paredes, 2014).

After reviewing all the areas of knowledge differentiated by the OECD, this paper found that treated students study less humanities, arts and social sciences. Th results in Table 9 shows a reduction in the proportion of treated students that study social sciences, business, law, humanities and arts, degrees that are less profitable compared to other areas like health or engineering. This result is particularly relevant for students that were forced to switch schools. If students attend college and vocational degrees that are highly profitable, this could be the channel of transmission of intergenerational mobility. Students seemed to have moved to schools – beyond their neighborhoods- that steered them towards more profitable career paths.

The results in this subsection showed that there is a negative "quality" effect measured by the SIMCE tests scores, however, there are changes in the areas of study of the students, leaving low-profitable degrees towards higher income paying career paths. These results generate new research questions, making it relevant to ask if the test scores are the adequate measure to analyze what parents are looking for when analyzing schools, and if researchers should be relying heavily on these scores.

The impact of the subway station and school choice policy could be evaluated in the future with the inclusion of previous cohorts of students as controls, students in other geographical locations an in different policy spaces.

TABLE 7—DID REGRESSION RESULTS ON SOCIAL SCIENCES, HUMANITIES AND ARTS

	DID All Students	DID Not forced to Switch	DID Forced to Switch [a]
DID Estimator	-0.0149**	-0.00424	-0.0238***
Observations	22,960	11,334	11,626

Source: Author calculations using diff command in Stata: Parental Income, Parental educational level and SIMCE test scores as controls.

[a] Schools that closed in eight grades:

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

VI. Discussion

Low intergenerational mobility, which entrenches inequality, in developed and developing nations warrant an in-depth examination particularly into the factors that could be modified by policy solutions. While neighborhoods have been used as an explanatory factor in the intergenerational mobility literature, they tend to encompass several variables including educational opportunities. This is especially the case in the United States, the study of which tends to dominate the literature. In the context of the high valuation of the neighborhood environment in the current intergenerational mobility debate, it is extremely important to disentangle those variables. Using a quasi-experiment of new subway lines in Chile, this paper analyzes education outside of the neighborhood of residence as a possible policy solution for promoting intergenerational income mobility through reduced transit costs. It builds upon previous research that examined how students used the subway line to travel to high schools beyond their neighborhood (Asahi, 2014).

Using a DID approach, this paper shows that the subway expansion in the context of a school choice policy increased the intergenerational income mobility of students by two points more than their control group. This overall positive effect is mainly driven by students switching schools due to their school ending in 8_{th} grade, requiring the choosing of a new school; however. The results indicate that intergenerational mobility increases when low-income students have higher availability and are nudged to consider schools beyond their neighborhoods of residence. The analysis of the channels of transmission of the effect show that there is no effect on higher education graduation, and a negative effect on standardized test scores. However, treated students are less likely to enroll in less profitable majors in higher education (i.e. Humanities or Arts). Moreover, this paper puts into question the use of standardized test scores as the final measure of educational quality, as the results show that treated students have a drop in test scores, but still increase their intergenerational mobility, which is arguably the aim of public polices and the topic of question for the related literature.

These results open space for further debate in the intergenerational mobility arena, as it suggests that education alone can have impacts outside of neighborhood effects, supporting the public policy promotion of school choice measures over the use of policies aimed at changing neighborhood environments like housing vouchers.

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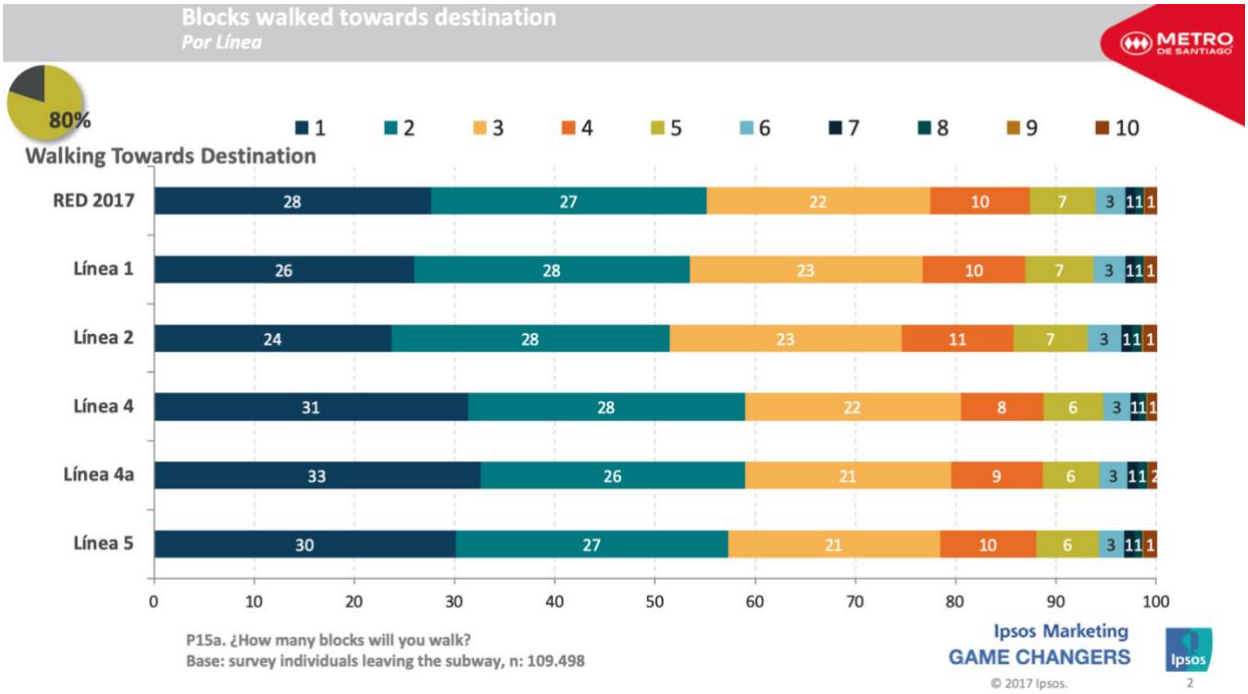
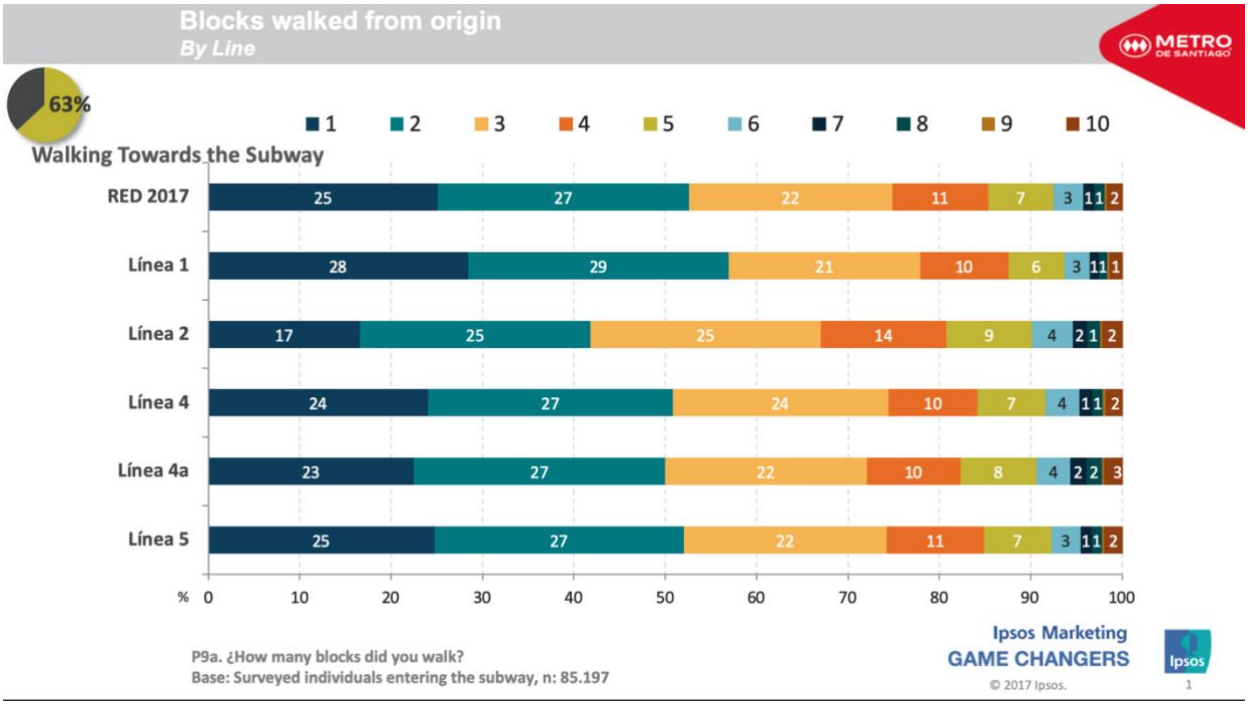
Appendix I: Metro Surveys





Appendix II: Geocoded Students

This paper has a convenient sample of 32 thousand geocoded students in the City of Santiago. The addresses come from the college selection test survey, that students took in 2008. Not all students took the test, therefore this data base is not used in the study. However, this information is used to test the hypothesis that the use of middle schools is a good approximation of household location. This study defined treated student as students that attended middle schools that were 1 km away from a new subway station.

Using the geocoded addresses of this subsample of students, I calculate the distance of the treated students to the new subway stations. I eliminated outliers that appear to be living more than 10 kilometers away.

TABLE A1— DISTANCE FROM HOME TO SUBWAY STATION (KILOMETERS)

	Median	Mean	SD	N
Students in Treated Middle Schools	1.13319	1.653742	1.840893	3,444

Source: Authors' own work

Table A1 shows that for this subsample, the median distance of the students to the closest subway station is 1.1 kilometers and the mean distance is 1.6 kilometers.

Appendix III: Wage Ranking Calculations

The wage calculations where done using the methodology proposed by Chetty et al. 2014. First, parents are ranked according to their income obtained from the SIMCE 2004 survey.

The average wages of students are constructed using the wages from the Ministry of Labor and from the Chile Government transparency web pages. The ministry of labor provided wages in the private sector, while the wages of public workers are public domain and were watching using the names of the individuals. The wage used was the average monthly wage during 2017. If the where no wages in 2017, I use wages in 2016 or the first three months of 2018. Then this wage was sorted and the child income ranking was obtained.

TABLE A2— STUDENTS USED IN THE STUDY

	Population
Parental Income ranking	249,373
Child Income Ranking	181,912

Source: Authors' own work

FIGURE A1. WAGES OF STUDENTS IN 2016-2018

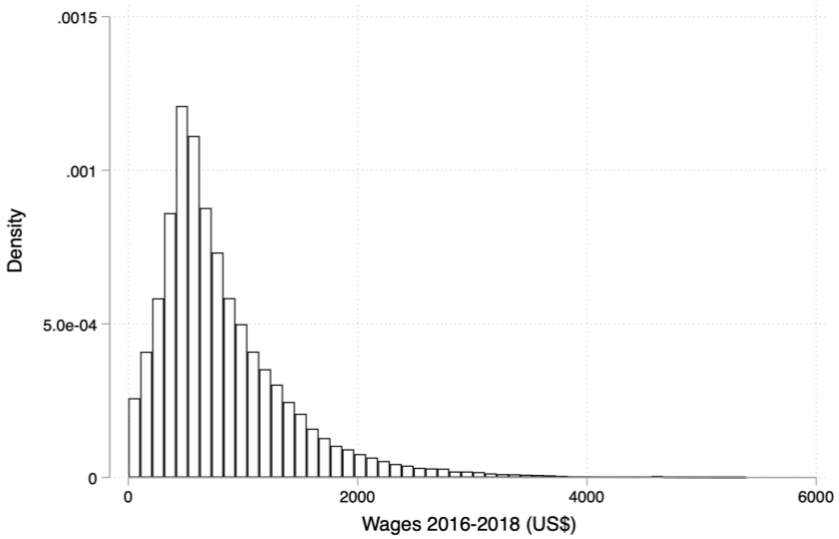


TABLE A3—DESCRIPTIVE STATISTICS FULL COHORT

Descriptive Statistics: Full Cohort of Students

Variable	Obs	Mean	Std.Dev.	Min	Max
Child Wage 2016-2018 (US$)	181,912	832.273	607.731	0	5390.474
Child Income Rank	181,912	.5	.288	0	.999
Parents Income 2004 (US$)	249,373	530.777	708.656	81.967	3770.492
Parents Income Rank	249,373	.5	.289	0	1
SIMCE 2004 Test Scores	249,373	253.167	47.064	110.95	398.88
SIMCE 2006 Test Scores	184,687	258.694	53.685	106.945	412.37
Parental Education	223,955	1.955	1.089	1	8
School Switch	249,373	.637	.481	0	1
Higher Education Enrollment	249,373	.673	.469	0	1
Higher Education Graduation	249,373	.368	.482	0	1

TABLE A4—DESCRIPTIVE STATISTICS STUDENTS

Descriptive Statistics: Treated and Control

Variable	Obs	Mean	Std.Dev.	Min	Max
Child Wage 2016-2018 (US$)	10437	887.113	599.781	0	4657.092
Child Income Rank	10437	.538	.283	0	.999
Parents Income 2004 (US$)	13802	548.376	561.333	81.967	3770.492
Parents Income Rank	13802	.575	.257	0	1
SIMCE 2004 Test Scores	13802	255.418	45.548	121.245	388.115
SIMCE 2006 Test Scores	10503	257.742	52.122	113.975	412.37
Parental Education	11470	2.2	1.215	1	8
School Switch	13802	.505	.5	0	1
Higher Education Enrollment	13802	.74	.439	0	1
Higher Education Graduation	13802	.402	.49	0	1

TABLE A5—DESCRIPTIVE STATISTICS STUDENTS

Descriptive Statistics: Treated

Variable	Obs	Mean	Std.Dev.	Min	Max
Child Wage 2016-2018 (US$)	6848	896.11	618.517	0	4657.092
Child Income Rank	6848	.538	.286	0	.999
Parents Income 2004 (US$)	9122	554.586	585.581	81.967	3770.492
Parents Income Rank	9122	.572	.258	0	1
SIMCE 2004 Test Scores	9122	257.001	46.371	126.795	388.115
SIMCE 2006 Test Scores	6879	258.631	53.12	123.845	412.37
Parental Education	7632	2.211	1.221	1	8
School Switch	9122	.509	.5	0	1
Higher Education Enrollment	9122	.735	.441	0	1
Higher Education Graduation	9122	.402	.49	0	1

Descriptive Statistics: Control

Variable	Obs	Mean	Std.Dev.	Min	Max
Child Wage 2016-2018 (US$)	3589	869.946	561.988	.75	4657.092
Child Income Rank	3589	.537	.279	0	.999
Parents Income 2004 (US$)	4680	536.272	510.616	81.967	3770.492
Parents Income Rank	4680	.579	.254	0	.999
SIMCE 2004 Test Scores	4680	252.333	43.74	121.245	377.87
SIMCE 2006 Test Scores	3624	256.054	50.137	113.975	403.58
Parental Education	3838	2.177	1.202	1	8
School Switch	4680	.496	.5	0	1
Higher Education Enrollment	4680	.75	.433	0	1
Higher Education Graduation	4680	.401	.49	0	1

TABLE A6—DESCRIPTIVE STATISTICS STUDENTS

Descriptive Statistics: Treated forced School Switch

Variable	Obs	Mean	Std.Dev.	Min	Max
Child Wage 2016-2018 (US$)	3562	838.121	566.789	.171	4657.092
Child Income Rank	3562	.516	.278	0	.999
Parents Income 2004 (US$)	4647	385.406	326.889	81.967	3770.492
Parents Income Rank	4647	.499	.243	0	.997
SIMCE 2004 Test Scores	4647	248.884	44.07	127.255	388.115
SIMCE 2006 Test Scores	3330	247.839	50.224	123.845	400.595
Parental Education	3908	1.889	.944	1	8
School Switch	4647	1	0	1	1
Higher Education Enrollment	4647	.652	.476	0	1
Higher Education Graduation	4647	.323	.468	0	1

Descriptive Statistics: Control forced School Switch

Variable	Obs	Mean	Std.Dev.	Min	Max
Child Wage 2016-2018 (US$)	1829	805.876	512.226	3.932	4612.422
Child Income Rank	1829	.507	.271	.001	.998
Parents Income 2004 (US$)	2323	402.532	337.739	81.967	3114.754
Parents Income Rank	2323	.511	.247	0	.974
SIMCE 2004 Test Scores	2323	245.675	43.531	121.245	368.7
SIMCE 2006 Test Scores	1723	248.218	50.054	113.975	403.05
Parental Education	1914	1.892	.991	1	8
School Switch	2323	1	0	1	1
Higher Education Enrollment	2323	.673	.469	0	1
Higher Education Graduation	2323	.322	.467	0	1

TABLE A6—DESCRIPTIVE STATISTICS STUDENTS

Descriptive Statistics: Treated not forced School Switch

Variable	Obs	Mean	Std.Dev.	Min	Max
Child Wage 2016-2018 (US$)	3286	958.97	664.489	0	4483.816
Child Income Rank	3286	.562	.292	0	.998
Parents Income 2004 (US$)	4475	730.268	726.296	81.967	3770.492
Parents Income Rank	4475	.649	.252	.001	1
SIMCE 2004 Test Scores	4475	265.43	47.195	126.795	387.35
SIMCE 2006 Test Scores	3549	268.757	53.773	125.33	412.37
Parental Education	3724	2.548	1.377	1	8
School Switch	4475	0	0	0	0
Higher Education Enrollment	4475	.821	.383	0	1
Higher Education Graduation	4475	.484	.5	0	1

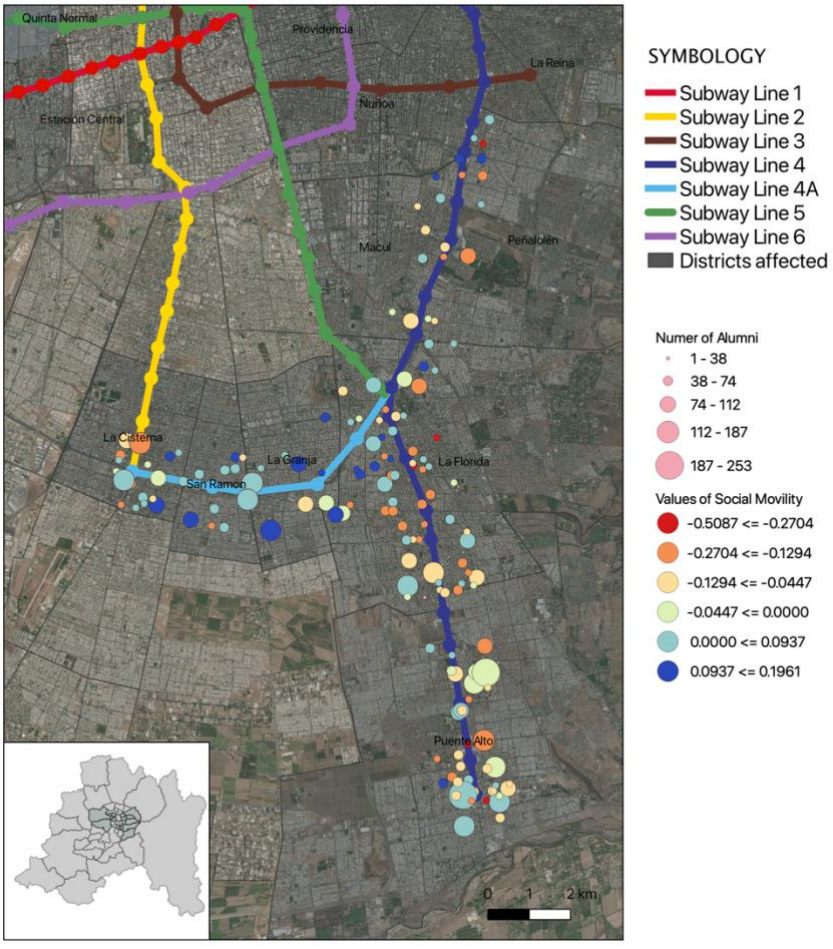
Descriptive Statistics: Control not forced School Switch

Variable	Obs	Mean	Std.Dev.	Min	Max
Child Wage 2016-2018 (US$)	1760	936.528	602.377	.75	4657.092
Child Income Rank	1760	.568	.284	0	.999
Parents Income 2004 (US$)	2357	668.083	608.578	81.967	3770.492
Parents Income Rank	2357	.646	.243	0	.999
SIMCE 2004 Test Scores	2357	258.894	42.956	135.38	377.87
SIMCE 2006 Test Scores	1901	263.157	49.157	115	403.58
Parental Education	1924	2.462	1.321	1	8
School Switch	2357	0	0	0	0
Higher Education Enrollment	2357	.826	.379	0	1
Higher Education Graduation	2357	.48	.5	0	1

Appendix IV: Effect Per Middle School

After estimating positive effects on the treated students, it is of interest to see which students are responsible for the positive intergenerational mobility results. Figure 2 shows the average intergenerational income mobility (rank child – rank parents). It is possible to see that the positive intergenerational mobility results are driven mainly by students in the municipalities of San Ramon, La Granja, while there are mixed results in la Cisterna, la Florida and Puente Alto, and more negative results in Macul and Peñalolen.

FIGURE 2. INTERGENERATIONAL INCOME MOBILITY PER MIDDLE SCHOOL [A]



Source: Author calculations estimating child income rank – parental income rank

A Average results per middle school