

**Distributional Equity and School Location
in the Chilean Education Voucher System**

May 10, 2005

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Abstract

This paper examines distributional equity issues related to school location in the educational voucher system in Santiago, Chile. I investigate the relationship between municipal socioeconomic characteristics and school location patterns for public, voucher, and private non-voucher schools. I determine that the number of schools of each type in a municipality is not significantly related to municipal wealth. School quality is positively related to municipal wealth, although this result is less significant after controlling for school type. In poor municipalities, voucher and non-voucher private schools tend to have a higher value-added than municipal schools. However, there are high levels of student socio-economic segregation between school types within municipalities, suggesting that factors other than school location may preclude poor students from having equal access to educational opportunities.

Many thanks to my advisors, Rick Hanushek and Martin Carnoy, for their enthusiasm and advice. I am indebted to Cristian Cox of the Chilean Ministry of Education for helping to broaden my understanding of Chilean educational politics and policies. Special thanks also to Geoff Rothwell for his guidance throughout this endeavor, and above all to my family for their endless support and encouragement.

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1. Introduction

The Chilean economy has become famous for its remarkable political stability and rapid economic development in the past two decades, attributable in part to the influences of University of Chicago economists on the controversial dictator Augusto Pinochet. The economic reforms that took place in Chile throughout the 1970's emphasized the reign of the free market and implementation of free trade policies. These policies were controversial because they often entailed gross violations of human rights, while at the same time leading to economic stability and welfare gains for certain sectors of the population.

One lesser-known component of those economic reforms was the implementation of a nation-wide educational voucher system in 1980. Educational vouchers in their modern form were first proposed by Milton Friedman as an alternative to the traditional governmental control over education. Friedman claimed the educational system would attain greater efficiency if schools were privately administered, because competition between schools would encourage improvement in educational quality and reduction in overall cost. He advocated a free-market approach to education in which the government was less involved. He proposed that students be allowed to choose between public and private schools, and that the government provide funding for private schools on a per-student basis through educational "voucher" grants to families (Friedman 1980).

Some proponents of vouchers in the United States advocate limited programs that would allow poorer students to escape from ineffective urban school systems by providing them with government funding to attend private schools. These limited voucher programs have been implemented in Milwaukee and Cleveland, as well as a handful of other cities that utilize privately funded voucher schemes. In the United States, private schools have been shown to have small benefits for educational

attainment (Levin 1998), with larger gains for African-Americans (Howell et al., 2002). However, reliable data is difficult to find on the effectiveness of these programs, in large part because of the short time span since program implementation and the small number of students involved.

In contrast, Chile's voucher system provides a much richer data set for analysis. Chile's educational voucher system has been in place since 1980 and allows all school-age children to attend certain private and religious schools with the aid of "voucher" funding from the Chilean government; these vouchers cover most or all of the tuition at eligible schools. The Chilean government allows enrollment in both secular and religious schools, in line with the country's doctrine of "educational freedom" (*libertad de enseñanza*) which supports government funding of schools with different values, objectives, and religious affiliations (MINEDUC).

Researchers in the United States have investigated both the effectiveness and efficiency of Chile's educational voucher system. McEwan and Carnoy (2000) conclude that Chilean Catholic voucher schools are marginally more effective than public schools; non-religious private schools, although somewhat less effective, operate at a lower overall cost, leading to small efficiency gains. Levin (2002) counters these efficiency claims by arguing that although voucher programs may lead to a decrease in individual schools' operative costs, the overhead of implementing the entire voucher infrastructure might outweigh those efficiency gains.

Voucher systems sometimes raise questions of distributional equity. Voucher systems are often proposed with the hope of improving educational quality for poorer students, but often the poorest students are not active participants in the new system. Evidence from Chile and New Zealand (Parry 1996, Ladd and Fiske 2001) suggests that voucher systems may propagate existing socioeconomic inequalities through the ability of desirable schools to selectively admit students. By admitting the most able students,

schools (perhaps inadvertently) also admit students of the highest socioeconomic classes. Therefore, more privileged students may tend to concentrate themselves in the most desirable schools. Although such socioeconomic segregation may also occur in traditional public education systems, it may be more difficult to address in the decentralized voucher environment.

Even in the absence of school selection effects, incentives inherent in the voucher system may lead to increased social stratification. In particular, private schools in a voucher system retain their characteristic autonomy; indeed, this autonomy is what allows them to operate more efficiently. However, it is unclear whether market incentives necessarily encourage autonomous schools to act in the public interest. For example, school location patterns in a privatized context may not reflect the public interest, because schools may face incentives to locate in certain areas because of property values (and thus lease prices), or conversely the ability to attract better students, avoid crime, or provide a better municipality in which teachers live and work. These incentives may work in opposite directions, but it is unclear that they would balance out to serve the public interest. Responding to such incentives may benefit each individual school; it may not benefit society at large, because certain students could suffer from reduced access to schools within the voucher system.

This study examines the location patterns of primary schools (grades 1 through 8) in Santiago's education voucher system. This study is motivated by an interest in identifying the educational opportunities for individual students, and particular in how those opportunities might vary by student socio-economic status. Because data is not available at the individual student level, I use school-level data and information about the socio-economic composition of each school. I focus on the opportunities created (or diminished) by geography and investigate the proximities of different schools to geographical areas with different socio-economic characteristics.

This project was originally intended to look at the relationships between school proximity and socio-economic status on a “micro-geography”, neighborhood level; however, due to limited data availability, I use (larger) municipalities as the basic geographic unit of the study. The data available at this time is not sufficient to allow the isolation of causes of equity or inequity, and therefore this study is intended to serve only as a first step in describing educational opportunities. When data becomes available, further studies could investigate the sources of any patterns uncovered here.

The study is limited to Santiago schools for a number of reasons. First, this avoids having to control for differences between urban and rural areas, as school choice and the voucher system might have different meanings in areas with low population density. Second, limiting the study to Santiago avoids the necessity of controlling for large and small cities, where the system might have different effects. Third, the large number of municipalities included in the Santiago metropolitan area allows me to control for effects that may vary by municipality, because household and school data is identified by municipality. Finally, Santiago comprises approximately one third of Chile’s population (approximately 6 million out of 15 million total residents), and therefore the study is relevant for a large portion of the population even though it is limited to the Santiago area (Censo 2002).

This study compares the location patterns of public and private schools, as well as the location patterns of high and low value-added schools. In this manner, this study investigates how the location patterns of different types of schools reflect incentives in the private education market and considers how these incentives affect the distributional equity of Santiago’s education voucher system. In addition, this study assesses socioeconomic segregation between school types and within municipalities.

2. Background Information on Chilean Education

2.1 Reforms of the 1980s

The Chilean education system was historically highly centralized, with the Ministry of Education controlling all administrative and pedagogical matters. Education was a major goal of the state, and Chilean teachers were a dominant political force and gained power in the Ministry of Education. This centralized system was relatively successful in many respects, and achieved near-universal primary education by the 1960s (Gauri 1998).

The educational reforms of the 1980s were a major departure from this state-centered, highly centralized system of education. The reform package included two components: municipalization and privatization. The municipalization component involved transferring power over public schools from the central ministry of education to local military leaders. The privatization component essentially changed the funding mechanism for the majority of schools. It involved the establishment of a per-student subsidy as the means of financing all public schools and most private ones as well, essentially functioning as a quasi-voucher system (Gauri 1998). At the time of program inception, all governmentally-funded schools (municipally-administered public schools and private “voucher” schools) were free to all students, although this changed during the 1990’s. The per-student subsidy mechanism maintained a centralized funding base but created certain elements of a decentralized, privatized system.

The military government had two main goals in its educational reforms. The first goal was ideological: the military government hoped, as much as possible, to dismantle the state (OECD 2004). By transferring power from the central ministry to local military mayors, the military was able to alter historical power structures and avoid conflicts with highly centralized and powerful groups, such as the teachers’ union. The second goal was economic: the government hoped to stimulate competition and economic efficiency

(OECD 2004). The Chilean military government was heavily influenced by a group of neo-liberal economists from the United States who believed in the power of market forces to improve economic efficiency, and Chile's voucher-like school choice scheme was meant to bring market forces—and thus efficiency—into the educational sector.

The Chilean educational reforms faced severe setbacks during the 1980s. A number of problems arose because of the military structure of the government which was responsible for program implementation. Many of the new policies lacked legitimacy because they were imposed by the military government, a non-democratic regime. Local authorities were not elected, and therefore the educational system remained unaccountable to local actors and their priorities (OECD 2004). In addition, purported efforts to bring power closer to the people had little meaning, because local military leaders lacked experience in educational matters: even if they did have this experience, they had little autonomy because they were expected to execute the decisions made by their superiors (Gauri 1998). Finally, although decentralization and privatization are often intended to increase heterogeneity of options, the military regime, anxious to avoid subversive practices, increased monitoring to the point of increased homogeneity (Gauri 1998). Thus mechanisms for local creativity, accountability, and responsiveness did not exist in the 1980s in large part because of the authoritarian regime which implemented the reforms.

Several features of the reforms themselves detracted from potential educational benefits. Severe financial shortages due to a falling real value of the voucher combined with falling enrollments in the public sector meant that many municipal schools could not function on voucher income alone, and were forced to approach the government for additional funds (OECD 2004; Gauri 1998). In addition to their loss of influence over educational decisions, teachers faced falling wages and benefits (OECD 2004). This under-funding of both schools and teachers, which might have been problematic even in

a centralized system, destroyed any autonomy and creativity which the decentralized structure could have fostered (Gauri 1998). The voucher mechanism of the 1980s therefore was not able to fulfill promises of increased educational diversity or quality.

2.2 Reforms of the 1990s

Chile experienced a major governmental regime change in 1990, when the military government was replaced by a more liberal, democratically elected government. The new democratic government chose to maintain the basic voucher-based educational structure established by the military regime, but hoped to address some of its shortcomings. The democratic government believed that the decentralized voucher system was particularly well-suited to connecting with the diverse educational needs and demands of the people. The government saw the potential for increased accountability in the public sector of the education system in the new democratic context, especially as local actors became elected officials rather than military appointees (OECD 2004). The government hoped to work toward the goals of progressivism and equality within the structure provided by the per-student subsidy (Gauri 1998).

The democratic government instituted a number of agenda and policy changes. These centralized reforms were meant to improve both educational quality and equity within the voucher-based funding and decentralized administrative structures which were already in place. The democratic government dramatically increased funding for education in general, as under-funding had been a major drawback of the military regime's policies (Gauri 1998). In addition, the new government began to use results from the national SIMCE education test, which had been instituted in 1988, to streamline their centralized policy design and evaluation procedures, as well as for curriculum development (OECD 2004). Finally, the new government implemented a number of new programs meant to improve quality and equity: the P-900 program, to provide additional

resources for the lowest-achieving 10% of schools, and the SNED teacher award, to create monetary incentives for high-quality teaching (OECD 2004).

The equity programs and increased funding implemented during the 1990s were meant to allow the education system to benefit from aspects of both centralized and decentralized systems. The subsidy mechanism served to expand access to underserved populations and provide incentives for schools to ensure student attendance. The increasing value of the voucher meant that schools were able to function within the funding structure created by the government, as opposed to relying on debt coverage as was common in the 1980s. The new government worked to provide schools with both the resources and the incentives to succeed (OECD 2004).

However, Chile continues to face a number of challenges in its educational system. In particular, certain institutional characteristics seem to exacerbate educational inequities. The system faces socio-economic stratification, partly attributable to the ability of private schools to select their own students (OECD 2004). In addition, a law passed in 1993 created a system of “shared financing” (*financiamiento compartido*) which allows all private voucher schools and public secondary schools to charge tuition to their students (Gauri 1998). The system of “shared financing” altered the basic educational structure in a fundamental way. Previously, all government-subsidized education had been free, but after the passage of the bill, family willingness- or ability-to-pay became an important factor in the private subsidized “voucher” sector. The ability of voucher schools to select their own students and to charge tuition add-ons created the potential for increased socioeconomic segregation within the system.

The “shared financing” mechanism was originally proposed by conservatives as a mechanism for bringing additional private resources into the educational sector. As previously mentioned, private voucher schools and public secondary schools are allowed to charge limited tuition to students. As the amount of the tuition rises, the

amount of the government subsidy declines slightly. In 1999, complaints of inequity in this mechanism led to the institution of a compulsory grant program, with the minimum number of grants rising as tuition increases (OECD 2004). Criticism remains about the functioning of this shared financing mechanism, in part because the schools allocate their grants to students as they so choose, usually either based on academic merit or financial need.

The grant program in shared financing schools is funded jointly by the school and the government, based on a formula mandated by law (summarized in Table 1, below). This formula has three main components. As the tuition increases, the per-pupil subsidy from the government to the school decreases (Table 1, Column B). A portion of this deduction is not lost to the school, but instead is diverted into a grant fund (Table 1, Column C). In addition, the school must contribute a certain percentage of the money they receive as student fees/tuition to the grant fund (Table 1, Column D). The total amount of money available for grants is a combination of these governmental and school-based sources (the sum of monetary amounts of Columns C and D).

Table 1. Relationship between tuition add-ons and mandated grants¹

A. Tuition Charged by Shared Financing School	B. Reduction in Per-Student Subsidy	C. Government Contribution to Grant Fund (Percent of Column B)	D. School Contribution to Grant Fund (Percent of Student Fee Receipts)
Up to 0.5 USE ²	0%	N/A	5%
0.5 to 1 USE	10%	100%	5%
1 to 2 USE	20%	50%	7%
2 to 4 USE	35%	20%	10%

¹ Table from OECD 2004, p. 64.

² One USE is equivalent to the value of the per-pupil subsidy in that year. In the year 2004, this was equivalent to CLP 12,246 per month in primary education (OECD 2004). Converted to USD (2004), this is equivalent to \$19.70 per student per month (USD = 621.67 CLP). Exchange rate data is from Oanda Historical Currency Exchange Rates, <http://www.oanda.com/convert/fxhistory>.

Chilean educational reform since the early 1980s has had a number of lasting effects. First, the funding mechanism shifted from central funding decisions for public schools to per-student funding for both municipal and most private schools. This administrative-budgetary change is the main legacy of the 1980s reforms, and created the quasi-voucher system which is in place today. In the 1990s, certain equity-enhancing programs were implemented and the real value of the per-student subsidy was increased. Private resources began to come into the education system through the controversial mechanism of shared financing in private voucher schools and public secondary schools. These policies provide the basis for the analysis in this study, which focuses on the equity implications of the program as a whole.

3. Literature Review

The literature on educational vouchers provides information on possible methods of evaluating voucher systems, as well as empirical evidence on voucher systems' efficiency, effectiveness, and equity. In this section, I begin by noting the difficulty of evaluating voucher systems; these systems have many diverse goals, and may succeed in some areas while falling short in others. I follow by discussing evidence surrounding the three major goals of educational voucher systems: increasing efficiency in the education sector, increasing overall effectiveness of schools, and improving or maintaining distributional equity within the educational system.

3.1 Methods of Evaluating Voucher Systems

The many diverse goals of educational voucher systems make determining appropriate methods of evaluation difficult. Levin (2002) presents one framework in which competing claims surrounding educational vouchers can be addressed. He notes the dual responsibility of the educational system: on the one hand, to allow parents to determine the upbringing and education of their children, and on the other, to ensure that all students have the opportunity to become productive members of society. He lists four goals of the educational system that reflect those conflicting responsibilities: parental freedom to choose, efficient resource allocation, equity, and social cohesion. The last three of these reflect the social goal of providing quality education to students at the lowest possible social cost.

According to Levin, the design of an individual voucher scheme has important implications for how well each of the four goals of schooling is addressed. Productive efficiency and freedom of choice are best served with minimal regulation by allowing people to make unhindered decisions and maximize their own utility. However, regulation may help address the other three goals. The extent of program funding can

have a large effect on its equity, because poorer people tend to have fewer resources to supplement vouchers that are too small to provide full tuition. Regulatory decisions may also have a large impact on a voucher system's equity and its success in social cohesion, particularly if that regulation includes randomized or progressive admissions criteria. Finally, regulation of the availability of support services (such as information, transportation, and special education services) may have a large impact on equity, as this may help determine who knows about the voucher schools and who has the actual capability of going to those schools (Levin 2002).

3.2 Efficiency Arguments

Educational vouchers began as a theoretical concept, meant to improve the efficiency of the educational system by allowing for competition between schools. Because voucher systems are rare and relatively new in practice, much of the economic literature centers on this theoretical concept of efficiency. Efficiency is difficult to measure directly because it requires full information about a population's preferences. However, a necessary component of efficiency is cost-effectiveness: achieving a given level of educational attainment at the lowest possible social cost. Cost-effectiveness of educational voucher systems is much easier to quantify, and is therefore sometimes studied although by itself it does not ensure efficiency.

McEwan and Carnoy (2000) present information on the cost-effectiveness of different types of schools in Chile. This study suggests that voucher schools, especially Catholic schools, may be marginally more cost-effective than public schools. Although educational attainment at private voucher schools and public schools are relatively similar, private voucher schools produce those levels of achievement at a lower cost. The authors attribute the cost differential to regulatory constraints on public school wages and infrastructure that are not present in privately run schools. The study

suggests that vouchers schemes may marginally increase efficiency by encouraging deregulation and local resource allocation.

Levin (1998) counters the cost-effectiveness argument by claiming that although private schools seem to have lower per-student costs, they actually have higher costs when similar measures are compared—private school costs do not include special education students, transportation, food services, health services, and capital costs. In addition, there are costs inherent in a large-scale voucher system: transaction costs, as the government has to deal with paying for each student individually; information costs, to ensure that all families can make informed decisions; transportation costs, because students could be traveling longer distances; adjudication costs, if a student wanted a refund to change schools mid-year; and monitoring costs, to establish eligibility of students and schools.

3.3 Effectiveness Arguments

A number of studies have also focused on the effectiveness of private schools, and voucher schools in particular. Alexander and Pallas (1985) argue that private Catholic schools have little or no positive impact on educational attainment as compared to public schools. Levin (1998) argues that private schools self-select for a group of higher-achieving students, and because this self-selection bias is difficult to account for, studies over-state private school value-added. Levin also argues that students who remain in private schools, or in private school voucher programs, for an extended period of time also tend to be the students who are successful there—a double selection bias.

In an effort to overcome some of these sampling biases, Howell, Wolfe, Campbell, and Peterson (2002) conducted another study on the effectiveness of voucher systems by using randomized field trials in three cities: New York City; Dayton, Ohio; and Washington, DC. The study recognizes that voucher research can be hindered by

self-selection biases that make it difficult to differentiate between inherent ability and school value-added. Many voucher programs also have high attrition rates, making it difficult to determine whether the students who complete the program have the same characteristics as those who began it. The Howell, et al. study avoids these problems by randomizing the recipients of educational vouchers, and providing incentives to remain in the program and participate in data collection sessions.

Howell, et al. (2002) concludes that the voucher program is ineffective in raising the average student's test scores, but notes that test scores do rise significantly for African-American voucher recipients, which suggests that voucher systems may benefit certain groups of students. However, this finding has not been substantiated by other researchers. Results from the Howell, et al study emphasize how little is understood about the "black box" of teaching and learning, and thus the reasons that certain educational environments might selectively benefit specific groups of students.

3.4 Equity Arguments

Regardless of the efficiency and effectiveness of voucher programs, some argue that the programs are inequitable because the people who are most able to negotiate the voucher system are those who are already advantaged in society. Levin (1998) argues that school choice tends to exacerbate both socioeconomic and racial segregation.

3.4a School Selection Effects and Co-Production

One method of promulgating inequities is through schools' selection of students. Parry (1996) suggests that educational production functions are different from the production functions of other goods because the quality of education produced is so highly dependant on the inherent abilities of the student. He calls this phenomenon

"coproduction" and suggests that it leads schools to select for inherently better students, especially when driven by fierce competition. Parry concludes that popular schools in a voucher system must somehow select their students because they do not have the capacity to admit all applicants. Profit-maximizing schools have an incentive to select students with greater innate ability. He predicts that large-scale voucher programs will tend to concentrate students with low coproductive ability (those with learning disabilities, low socioeconomic status, low parent involvement, etc.) into the least desirable schools.

Ladd and Fiske (2001) study equity issues in New Zealand's voucher system. The study concludes that the school choice program in New Zealand was less beneficial for lower income and minority students because of the increase in racial and socioeconomic segregation in schools. The results of this study show a form of "white flight" in which upper-class white students tended to move to more highly ranked schools when given the opportunity; poor and minority students were kept out of those schools because schools could admit the students of their choice. The study suggests that school choice may lead to increased socioeconomic and racial stratification, especially as voucher systems become implemented on a larger scale.

Student selection biases are problematic for two reasons. First, students who are already disadvantaged may be relegated to low-quality schools where they are kept even further behind. Second, peer group effects may mean that these students may learn even less than they would if the same school were not segregated. McEwan (2003) argues that the classroom mean of mothers' education is an important determinant of student achievement. This means that voucher programs that encourage students from well-educated families to leave the public school system or to concentrate in certain private voucher schools could decrease the educational attainment of students left in the public schools, even if the quality of the public schools does not change.

3.4b School Location

Another way in which voucher programs may affect educational equity is through the location of voucher schools in the program. In a public school system, the government has control of where schools are located, and (presumably) those locations are consistent with maximizing the social good. In contrast, private schools in a voucher system independently decide where to locate, although the schools are still funded with government money and expected to achieve the same maximized social good. Voucher schools are therefore given two (perhaps contradictory) missions: increase efficiency by independently making profit-maximizing decisions, while at the same time participating in an equitable aggregate system.

Downes and Greenstein (1996) examine the related question of private school location in California. The California system is not a voucher system, so private schools do not receive funding from the government. However, the study provides information about the differing incentives of private schools and how those incentives can affect school location. Downes and Greenstein conclude that private school location is dependent on the level of educational attainment of adults in the community, the racial/ethnic composition and religious compositions of the community, and the mean income of families in neighboring communities. While this study does not show that school location in voucher systems is affected by these same factors, it does suggest that private school incentives may affect their location patterns -- an important consideration when private schools are funded by the government and are expected to function toward the public good.

The current school choice literature does not address the question of how schools in a voucher system respond to market incentives in their location decisions. This study investigates patterns in the location of public and private schools in Chile. This study will also attempt to identify patterns in the location of high value-added

schools in general and of each funding type. Finally, this study will examine socioeconomic sorting of students within defined geographical areas. In this manner, this study evaluates some of the equity considerations associated with school location in educational voucher systems.

4. Data

4.1 Measure of School Quality

Data measuring school quality comes from the Chilean Ministry of Education, which administers standardized tests each year to all students in a given grade level. This test, known as the SIMCE (*Sistema de Medición de la Calidad de la Educación*), measures student achievement toward national curriculum goals set by the Ministry of Education. The subjects tested vary by grade level, but consistently include a few core subjects, such as math and Spanish. The test is given to a single grade each year, and is given to every student in that grade throughout Chile. The data used in this project include test scores for both math and Spanish for the years 1996 (for grade 4) and 2000 (for grade 8); due to the high level of correlation between math and Spanish scores in a given year, I report results for math scores only (see Section 6.2, Table 3, for correlation coefficients).

SIMCE results are compiled for each school and are publicized throughout Chile. Test scores are provided to teachers to give them information about student achievement in their own classrooms. They are also provided to parents to allow them to chart their own child's progress and compare their child's school with others in Chile. Test results help the Ministry of Education determine which schools might benefit from focused programs of assistance, and also to reward teachers and schools with particularly high levels of achievement. Finally, results are used by researchers to evaluate the performance of the Chilean education system (SIMCE).

The SIMCE data set includes information about each school (in addition to its average test score) that was useful in this project. The data set includes school location information, which allows the school to be matched with the municipality (*comuna*) within which it is located. In addition, the data set includes information on the socioeconomic

status of students in the school, expressed in the percentage of students who receive subsidized school lunch.

The SIMCE test was administered to fourth graders in the year 1996 and eighth graders in the year 2000. Because Chilean primary school is comprised of grades one through eight, the results from the tests given in 1996 and 2000 essentially track one cohort of students through their final four years of primary school. I use the math and Spanish scores of students in these two years to track achievement gains at each school over time.

Data from the SIMCE test has a number of limitations. Test scores can be a somewhat problematic measure of student understanding. While acknowledging this limitation, I use test scores because no better measure of student knowledge in Chile is available at this time. Furthermore, because of Chile's nationalized curriculum, test scores in Chile may provide a more accurate measure of student understanding than in countries that lack a national curriculum.

Another limitation of the data available from the SIMCE test in these years is that these data are provided at the school level rather than at the student level. This means that the school must be taken as a unit and differences between individual students, and between students of different teachers, cannot be observed. Additionally, data are not available on which students change schools over time, so little is known about the number of these students or their characteristics. This study assumes that overall patterns are not significantly affected by these students who change schools, but, if and when student-level data becomes available, it would be important to investigate this assumption.

Finally, although math and Spanish are the only subjects that I address in this study, other subjects are also very important; some of these subjects are not even included in the SIMCE test. Notable examples are computer literacy and English, which

may have a large impact on a student's future opportunities, particularly in high-level or technical positions, although national statistics for these subjects are not collected.

4.2 Municipality Socio-Economic Data

Data relating to municipality socio-economic characteristics are taken from a national household survey called *CASEN (Encuesta de Caracterización Socioeconómica Nacional)*, which is conducted by the Chilean Ministry of Planning and Cooperation (known as *MIDEPLAN*). This survey collects information about family income, education, and standard of living for a sample of families throughout Chile. The survey also includes data on household location, including the municipality (*comuna*) where the family lives. In this study, I use family monthly income, as reported in the *CASEN* survey from the year 2000, to generate a measure of community wealth (average household income) at the municipal level.

The *CASEN* survey also includes information about which families are below the poverty line, defined by the Chilean government as double the income required to cover basic nutritional needs. I use the data on poverty to generate a second measure of municipality wealth: poverty rate, or percentage of the population below the poverty line. This measure is related to mean household income but emphasizes the lower portion of the income distribution, which could be masked by high-income families in areas of high socioeconomic diversity.

4.3 Demographic Data

The *CASEN* survey provides information about socioeconomic status, but because it is a population sample, it does not provide information about the total number of people in each municipality. For this demographic data, I use Chilean census data, which is collected by the Chilean National Institute of Statistics. The Chilean census is

conducted every ten years, and in this project, I use data from the census taken in the year 2002.

The Census data includes total population information for each municipality (*comuna*) which allows me to examine the number of schools in each municipality after taking into account population size. In addition, the census data includes information on the size of the rural and urban populations in each municipality. Some municipalities on the outer boundaries of the Santiago metropolitan area include significant rural populations. School choice may have different meaning in these more rural outlying areas, and therefore I limit this study to municipalities with a high urban concentration (urban population of 95% or higher).

5. Methodology

5.1 Where are schools of each funding type located throughout Santiago?

In the first stage of the project, I create a descriptive measure of where schools of each funding type are located throughout the city of Santiago, and whether the number of schools of each type was related to the socioeconomic status of households in the municipality. To the extent that families value school choice, the presence of high numbers of schools of each type could lead to increased choice and thus increased family welfare.

To get this information, I separate the data by school funding type and ran four distinct regressions. This relationship is examined in separate regressions for each school type because the dependent variable, N , represents the number of schools in each municipality *of a given type*.

$$N = \beta_0 + \beta_1 * POP + \beta_2 * HH_INC + \varepsilon$$

where N = number of schools of particular funding type in municipality

POP = population of the municipality

HH_INC = mean household income in the municipality

These regressions allow examination of the relationship between number of schools and socioeconomic status, controlling for population (a rough indicator of the number of school-age children).

5.2 Where are high quality schools located?

In the second stage of the project, I examine whether school value-added is related to municipality socioeconomic characteristics. There are a number of ways to measure school value-added. In the body of this paper, I use eighth grade test score and control for student fixed effects, including fourth grade test score and average student socio-economic status. Another method of quantifying school value-added is by using a simple difference in normalized test scores for a cohort of students over time. Results from regressions of this type are presented in the appendix, and in this study provide the same general results.

I first examine the relationship between school value-added and student socio-economic status for all schools, in a regression of the following form:

$$\text{SCORE_OO} = \beta_0 + \beta_1 * \text{SCORE_96} + \beta_2 * \text{STUD_SES} + \beta_3 * \text{MUN_SES} + \varepsilon$$

where SCORE_OO = average 8th grade math test score in a school in the year 2000

SCORE_96 = average 4th grade math test score in school in the year 1996

STUD_SES = percentage of students in the school receiving free lunch

MUN_SES = measure of municipality socioeconomic status; two regressions

were run, one in which mean incomes were used, and the other in which

poverty rates were used

This regression allows examination of school value added in relation to municipality socio-economics. The dependent variable is test score for eighth graders in the year 2000. This eighth grade test score is related to school quality and also to personal and family characteristics (unrelated to school quality) that determine how easy it is to teach each student. These individual “fixed effects” are reflected in the student’s test score in

fourth grade (the year 1996) and the student's socioeconomic background. By controlling for these fixed effects, we can isolate the part of student achievement that can be credited to the school, known as school value-added.

This regression does not explicitly measure school value-added. Instead, the relationship between school value-added and municipality wealth is measured as the coefficient on the municipality wealth variable. This coefficient represents the relationship between municipality wealth and student achievement, controlling for student fixed effects. This regression therefore allows an examination of the relationship between school value-added and municipality socioeconomic characteristics to determine whether children in municipalities of differing socioeconomic levels have similar access to high quality education.

5.3 Within each school type, where are the high quality schools located?

In the third stage, I examine the relationship between school value-added and municipality socioeconomics within each school type. This allows an investigation of whether relationships between school value-added and municipality socioeconomics in the aggregate school sample are found within any particular school type. To do this, I run the following regression.

$$\begin{aligned} \text{SCORE_OO} = & \beta_0 + \beta_1 * \text{SCORE_96} + \beta_2 * \text{FREE_V} + \beta_3 * \text{PAY_V} + \beta_4 * \text{PRIV} \\ & + \beta_5 * \text{STUD_SES} + \beta_6 * \text{MUN_SES} + \beta_7 * \text{FREE_V} * \text{MUN_SES} \\ & + \beta_8 * \text{PAY_V} * \text{MUN_SES} + \beta_9 * \text{PRIV} * \text{MUN_SES} + \varepsilon \end{aligned}$$

where SCORE_OO = average 8th grade math test score in a school in the year 2000

SCORE_96 = average 4th grade math test score in school in the year 1996

FREE_V = dummy variable for a free voucher school

PAY_V = dummy variable for a “shared financing” voucher school

PRIV = dummy variable for private, non-voucher school

STUD_SES = percentage of students in the school receiving free lunch

MUN_SES = measure of municipality socioeconomic status; two regressions were run, one using mean incomes, and the other using poverty rates (this variable captures the effect of municipality SES on municipal schools)

FREE_V * MUN_SES = interaction term that equals municipality socioeconomic status if the school is a free voucher school, and zero otherwise

PAY_V * MUN_SES = interaction term that equals municipality socioeconomic status if the school is a “shared financing” voucher school, and zero otherwise

PRIV * MUN_SES = interaction term that equals municipality socioeconomic status if the school is a private paid (non-voucher) school, and zero otherwise

These regressions allow me to perform an analysis similar to the one performed above for the aggregate set of all schools, with the additional allowance that municipality socioeconomic status may have different impacts on different types of schools. Examining the relationship of municipality socioeconomic status on schools of each type allows the isolation of these effects on each school type.

5.4 How do school types differ in their ability to educate students in low-income areas?

In the fourth stage of the project, I examine whether school types have differential abilities to educate students in low-income areas. This information may be relevant even if high quality schools are concentrated in areas of high socio-economic status. For example, even if higher-quality education is more readily available to people

in higher-income areas the voucher subsidy scheme may still increase educational quality for people living in lower income areas. In this case, the system could raise educational quality for everyone, while at the same time contributing to inequality. The social desirability of such a result (rising quality and rising inequality) is a normative consideration, but the nature of the system must be understood before it can be evaluated.

To perform the analysis in this stage of the project, I ran a regression of the following form:

$$\begin{aligned} \text{SCORE_OO} = & \beta_0 + \beta_1 * \text{SCORE_96} + \beta_2 * \text{STUD_SES} + \beta_3 * \text{POOR_MUN} \\ & + \beta_4 * \text{FREE_V} * \text{POOR_MUN} + \beta_5 * \text{PAY_V} * \text{POOR_MUN} + \beta_6 * \text{PRIV} * \text{POOR_MUN} \\ & + \beta_7 * \text{FREE_V} * \text{RICH_MUN} + \beta_8 * \text{PAY_V} * \text{RICH_MUN} + \beta_9 * \text{PRIV} * \text{RICH_MUN} + \varepsilon \end{aligned}$$

where SCORE_OO = average 8th grade math test score in a school in the year 2000

SCORE_96 = average 4th grade math test score in school in the year 1996

STUD_SES = percentage of students in the school receiving free lunch

POOR_MUN = dummy variable indicating the poverty rate in the municipality is

higher than the average municipality poverty rate in greater Santiago; this

variable represents the difference between a municipal school in a poor and a

non-poor municipality

FREE_V * POOR_MUN = interaction term, equaling one for free “voucher”

schools in municipalities with an above-average poverty rate, and zero

otherwise

PAY_V * POOR_MUN = interaction term, equaling one for “shared financing”

voucher schools in municipalities with an above-average poverty rate, and

zero otherwise

$PRIV * POOR_MUN$ = interaction term, equaling one for private paid schools in municipalities with an above-average poverty rate, and zero otherwise

$FREE_V * RICH_MUN$ = interaction term, equaling one for free “voucher” schools in municipalities with a below-average poverty rate, and zero otherwise

$PAY_V * RICH_MUN$ = interaction term, equaling one for “shared financing” voucher schools in municipalities with a below-average poverty rate, and zero otherwise

$PRIV * RICH_MUN$ = interaction term, equaling one for private paid schools in municipalities with a below-average poverty rate, and zero otherwise

I define a poor municipality with a poverty rate higher than the average poverty rate in all the municipalities, although I also run the regression with an alternate definition of municipal poverty. The coefficients on the interacted poverty variables ($FREE_V*POOR_MUN$, PAY_V*POOR_MUN , $PRIV*POOR_MUN$) represent the difference between municipal schools in poor areas and schools of other types. Comparison of these coefficients allows the determination of which type of school best teaches students in low-income municipalities.

5.5 How prevalent is socioeconomic sorting of students?

The final stage of this project considers the question of socioeconomic segregation of students. This type of segregation may be important for a number of reasons. Politically, socioeconomic segregation may increase social divisions or reduce social mobility through decreased contact between members of different economic classes. Educationally, positive peer effects on student achievement suggest that

students may perform better when they are surrounded by high-achieving peers (see, for example, McEwan 2003).

The Chilean education voucher system, and particularly the shared financing component of the system, has been criticized for allowing high levels of socioeconomic segregation to be maintained in Chilean schools. I address this question by examining the socio-economic characteristics of students of each school type within each municipality, allowing me to identify patterns in socioeconomic segregation while controlling for school location patterns. This measure of socioeconomic segregation is superior to a measure that does not control for school location patterns because it controls for the possibility that school location patterns are a significant factor in socioeconomic segregation.

In order to perform the analysis in this stage of the project, I ran the following regression:

$$\text{STUD_SES} = \beta_0 + \beta_{1i} * \text{MUN}_i + \beta_2 * \text{FREE_V} + \beta_3 * \text{PAY_V} + \beta_4 * \text{PRIV} + \varepsilon$$

where STUD_SES = percentage of students in the school receiving free lunch

MUN_i = dummy variable for each municipality in the Santiago metropolitan area, omitting one municipality for comparison

FREE_V = dummy variable for free voucher school

PAY_V = dummy variable for shared-financing voucher school

PRIV = dummy variable for unsubsidized, non-voucher private school

The results from this regression allow me to compare the socioeconomic status of students in municipal schools (the omitted category) with that of students in the other types of schools within a given municipality. Coefficients on the school type variables indicate the average difference in student socioeconomic status between municipal

schools and other types of schools in the same municipality. A positive coefficient on the free voucher dummy, for example, would indicate a higher percentage of poor students in free voucher schools than in municipal schools in the same municipality.

6. Descriptive Statistics

This section introduces the data by providing descriptive statistics. The first sub-section presents data on test scores for each subject and year. The second sub-section provides information on the interaction between student achievement and school value-added. The third sub-section addresses measures of municipal wealth and their different meanings. The fourth sub-section provides information about the independent variation between student socio-economic status and municipality wealth. The fifth sub-section presents data on student socio-economic segregation by school type.

General data on each municipality (including population, mean income, poverty rates, and number of each school type) is presented in the Appendix, Table B.

6.1 Test Scores

This section provides descriptive statistics for the SIMCE math and Spanish tests used in this study. Table 2, below, presents mean test scores and standard deviations for each subject test in each year for the Santiago primary schools included in the study.

Table 2. Descriptive statistics for SIMCE test scores in 1996 and 2000

Test	Grade Level	Mean Score	Standard Deviation
Math 1996	Fourth	71.24	10.52
Spanish 1996	Fourth	71.79	10.71
Math 2000	Eighth	250.63	31.17
Spanish 2000	Eighth	250.02	29.00

6.2 Student Achievement versus School Value-Added

This section addresses the different meanings of student achievement and school value-added. Student achievement is based on many different factors, including both student characteristics and school characteristics. In particular, students from

certain backgrounds may be easier to teach, or may begin school with more preparation or knowledge from home.

Indeed, student test scores for 1996 and 2000 are highly correlated, suggesting that an important component of eighth grade test score is related to student characteristics rather than the formal schooling context. Table 3, below, demonstrates the relationship between student test scores in math and Spanish over time; the positive correlations indicate that schools whose fourth-grade students performed well in 1996 also tended to have high-performing eighth-graders in 2000. The regressions in this study attempt to control for these student characteristics by including fourth grade test score (year 1996) in regressions that assess school value-added.

Table 3. Correlation between fourth grade (1996) and eighth grade (2000) math and Spanish scores

	Math Test Score 2000	Math Test Score 1996	Spanish Test Score 2000
Math Test Score 1996	0.8120		
Spanish Test Score 2000	0.9387	0.8175	
Spanish Test Score 1996	0.8068	0.9435	0.8253

One way that student background may affect achievement is through student socio-economic status. Students from wealthier families may have more educational resources at home and a home environment more conducive to learning, helping these students to perform better in school. This relationship means that schools with higher SES students may perform better on standardized tests, with part of this achievement due to family characteristics rather than school quality. Table 4, below, shows the relationship between student socio-economic status (as measured by the percent of students receiving free lunch in school) and test scores; the negative correlations indicate that schools with a higher percentage of poor students tend to have lower average test scores.

Table 4. Correlations between student SES and achievement

	% Students with Free Lunch in School
Math Test Score '00	-0.6162
Spanish Test Score '00	-0.6271

Fourth grade test score and student socio-economic status may both embody fixed student characteristics, but both are approximate measures that capture only a part of a student's background. The data used in this study suggest that student SES and fourth grade test score are both inexact measures of student background and therefore are not equivalent measures of student fixed effects (see Table 5, below). Both of these measures explain unique portions of student achievement. In this study, I control for both student SES and fourth grade test score in order to control for student background as fully as possible.

Table 5. Fourth grade test score and student SES as factors in eighth grade student achievement

	Dependent Variable: Math Score (Year 2000)	
Independent Variables	Regression Coefficient	Standard Error
Math Score (Year 1996)	2.0643	0.0633
% Students with Free Lunch in School	-0.3105	0.0354

6.3 Measures of Municipality Wealth

Municipality wealth may be measured in a number of ways, including mean household income and poverty rate. One might expect that poverty rate and mean household income would be correlated, and this is true for the Santiago metropolitan area. However, the relationship between these two measures of wealth in Santiago is relatively low, as shown in Table 6, below.

Table 6. Relationship between different measures of municipality wealth

	Mean Household Income
Poverty Rate	-0.5326

The relatively low correlation between mean household income and poverty rate suggests that the choice of which measure to use could significantly impact results. Poverty rates identify municipalities with students that are particularly at-risk, and therefore this measure allows the evaluation of the impact of policies on the lowest income sectors. However, it may also be important to evaluate the effects of policies on the rest of the population, especially when a significant proportion of families may have relatively low incomes, even if they are above the poverty line. In this study, I use both mean household income and poverty rates as measures of municipality wealth, to allow the evaluation of policies for their effects on the poor and on the population at large.

6.4 Independent Variation between Municipality Wealth and Student

Socioeconomic Status

One of the basic tenets of this study is that independent variation exists between characteristics of students in a school and families in the surrounding community. Student and municipality socioeconomic status must not be perfectly correlated, because student socio-economic status is included in school value-added regressions to control for student fixed effects. If this variation in student SES were to explain all of the variation in municipality wealth, it would be impossible to determine if any relationship exists between municipality SES and school quality.

Within the context of the Chilean school choice system, it is plausible that independent variation does indeed exist between student and municipality SES. One would expect a correlation between student and municipality characteristics, because students may prefer to go to school close to home to avoid transportation and time (opportunity) costs associated with travel. All else equal, students would prefer to go to school closer to home: indeed this preference for a nearby school is what makes the spatial distribution of schools important in the first place. The school choice framework

means that students may attend school in another municipality if they so choose, providing for independent variation between school and municipality characteristics.

Correlations between student SES and municipality wealth are shown in Table 7, below. These correlations could have a number of interpretations, including the one assumed in this paper: that independent variation does indeed exist between student socio-economic status and municipal wealth because students may attend school outside of their own municipality³.

Table 7. Correlations between student SES and municipality wealth

	% Students with Free Lunch in School	Mean HH Income in Municipality
Mean HH Income in Municipality	-0.2364	-
Poverty Level in Municipality	0.4739	-0.4701

6.5 Socioeconomic Segregation between School Types

The fifth phase of this project examines student socioeconomic segregation in different school types throughout Santiago. High levels of student sorting, and in particular socioeconomic segregation, have been a major criticism of Chile's education voucher system. This segregation is demonstrated in Table 8, below, which describes student SES in schools of each type throughout metropolitan Santiago.

Table 8. Summary of Percent of Students Receiving Free Lunch, by School Type

School Type	Avg. % Students with Free Lunch	Standard Deviation
Municipal	33.2741	13.6972
Free "Voucher"	29.4412	19.9833
Shared Financing "Voucher"	12.9925	15.1425
Private Paid	0	0

³ Another potential explanation is that the wealth of parents in a municipality is different from the wealth of the municipality at large. However, this explanation seems unlikely because households with two or fewer members have essentially the same monthly income as those with more than two members (see Appendix, Table C).

7. Results

7.1 Where are schools of each funding type located throughout Santiago?

In the first stage of the project, I investigated the location patterns for schools of different funding types throughout metropolitan Santiago. This descriptive measure is important for understanding, on a general level, the type of educational options which are available to students in different municipalities throughout Santiago. Schools of different funding types may provide different educational environments for students, such that families value having a diverse selection of schools.

To determine whether students' schooling options were related to the socioeconomic status of the municipality in which they lived, I regressed the number of schools of each type on population and mean household income. The coefficient on "mean household income" can be interpreted as the impact of municipality wealth on the number of schools, taking into account differences in population.

Table 9. Relationship between household income and number of schools (by type), controlling for population

		Dependent Variable: Number of Schools of Listed Funding Type					
			# Public Schools ⁴	# Free Voucher	# Shared Financing Voucher	# Total Voucher ⁵	# Private Paid
Independent Variables	Population	Coefficient	0.0000232	<i>8.26E-07</i>	0.0000536	0.0000545	<i>0.0000243</i>
		Standard Error	8.51E-06	<i>4.79E-06</i>	1.38E-05	0.000015	<i>0.0000138</i>
	Mean Household Income	Coefficient	<i>-3.08E-07</i>	<i>-1.33E-07</i>	<i>-2.58E-07</i>	<i>-3.91E-07</i>	6.94E-07
		Standard Error	<i>1.52E-07</i>	<i>8.58E-08</i>	<i>2.48E-07</i>	<i>2.68E-07</i>	2.47E-07

The results of this regression indicate that although the number of each type of government-funded school (municipal, free "voucher", shared financing "voucher") tends to be negatively related to mean household income, none of these relationships is

⁴ Text in **bold** indicates that the coefficient is significant at the 5% level; text in *italics* indicates that the coefficient is not significant at the 5% level.

⁵ The "total voucher" includes both types of voucher schools: "free voucher" and "shared financing" voucher. This regression considers all voucher schools together without differentiating between those that charge fees to students and those that are solely funded by the per-pupil subsidy.

statistically significant. These results suggest that schools do not systematically locate in areas of higher or lower socioeconomic status, and students in high- and low-income municipalities may have essentially the same level of access to the different types of publicly-funded education. The private paid category is the only category that shows a positive relationship between number of schools and municipality wealth. These results suggest that students of different socio-economic groups throughout Santiago may have relatively equal access to different governmentally sponsored (municipal and voucher) schooling options.

The relationships illustrated in Table 9 should be interpreted somewhat cautiously, because total population may not accurately reflect the number of school-age children in each municipality, and this relationship may depend on the socio-economic group being considered. Fertility rates, and thus the number of school-age children relative to the population at large, may be higher in low-income communities. To the extent that this is true, the coefficient on “mean household income” may be underestimated (biased toward zero).

7.2 Where are high quality schools located?

In the second phase of this project, I examined the distribution of high quality (high value-added) schools throughout metropolitan Santiago. This may be important because families may value access to high quality education regardless of the way that high-quality schools are administered; the distribution of high-quality schools may therefore be another measure of educational equity.

To determine the distribution of high-quality (high value-added) schools throughout Santiago, I regressed eighth grade test score (year 2000) on fourth grade test score (year 1996), student socio-economic status, and a measure of municipality socio-economic status (either mean household income or poverty level). The results of this regression are presented in Table 10, below. In this table, the coefficients on “mean

household income” and “poverty rate” show the relationship between school quality (in the aggregate of all school types) and municipal wealth.

Table 10. Relationship between municipal wealth and school quality

Independent Variables		Dependent Variable: Math Score 2000 ⁶	
		Regression 1 ⁷	Regression 2
Math Score '96	Coefficient	2.0282	1.9716
	Std. Error	0.0633	0.0647
% with Free Lunch in School	Coefficient	-0.2933	-0.2587
	Std. Error	0.0353	0.0362
Mean Household Income in Municipality	Coefficient	4.49E-07	-
	Std. Error	1.03E-07	-
Poverty Rate in Municipality ⁸	Coefficient	-	-42.0417
	Std. Error	-	7.7170

The results presented in Table 10, above, suggest that school quality is significantly related to municipality socioeconomic status, whether SES is measured by mean household income or by the poverty rate. This suggests that students of different socio-economic groups may not have equal access to high quality education.

The following graphs (Figures 1 and 2, below) express the relationship between school value-added and municipal wealth in a slightly different way. School value-added in these graphs is defined as the difference between observed math score in 2000 and the predicted score based on math score in 1996 and student SES.⁹ This value-added is then weighted by the number of eighth graders in each school, and a municipal average value-added is taken from these weighted scores. Figures 1 and 2 therefore

⁶ These regressions include data for all schools, including municipal, free voucher, shared financing voucher, and private paid schools.

⁷ Text in **bold** indicates that the coefficient is significant at the 5% level; text in *italics* indicates that it is not.

⁸ Poverty level is defined by the Chilean government as twice the amount of money required to provide adequate nutrition. It is a per-capita measure, as opposed to Mean Household Income, which is a per-household measure

⁹ Value-added is the residual from the following regression: Math score 2000 = $\beta_0 + \beta_1 * \text{Math score 1996} + \beta_2 * \text{Percent of students with free lunch} + \varepsilon$

embody the combination of school value-added and family choices about where to send their children to school. Each observation is a municipality.

Figure 1. School Value Added and Mean Household Income

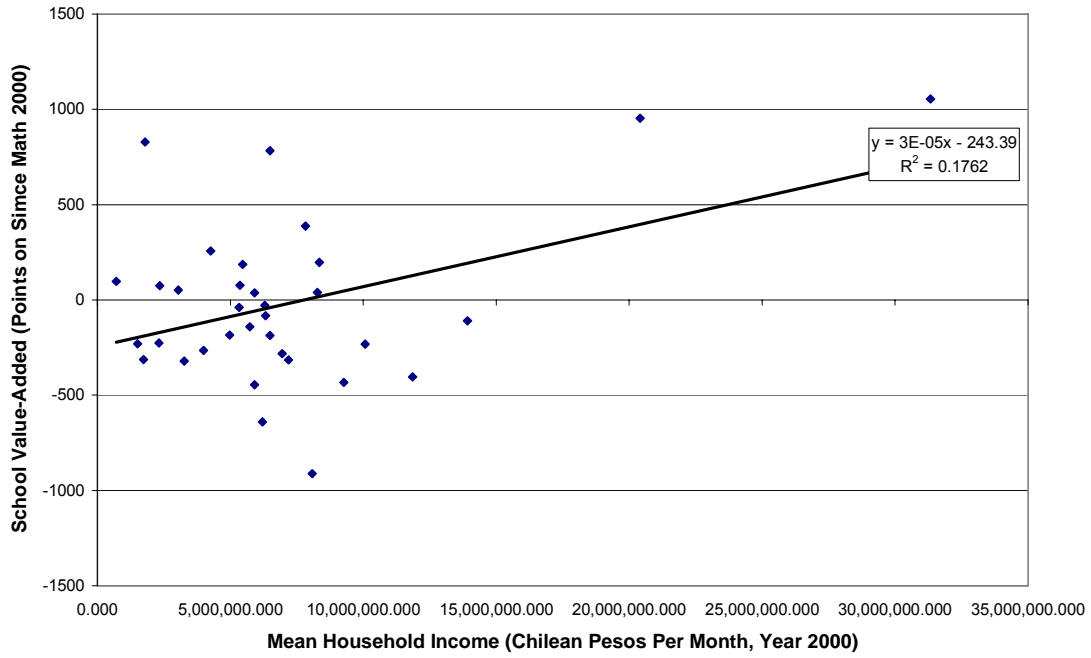
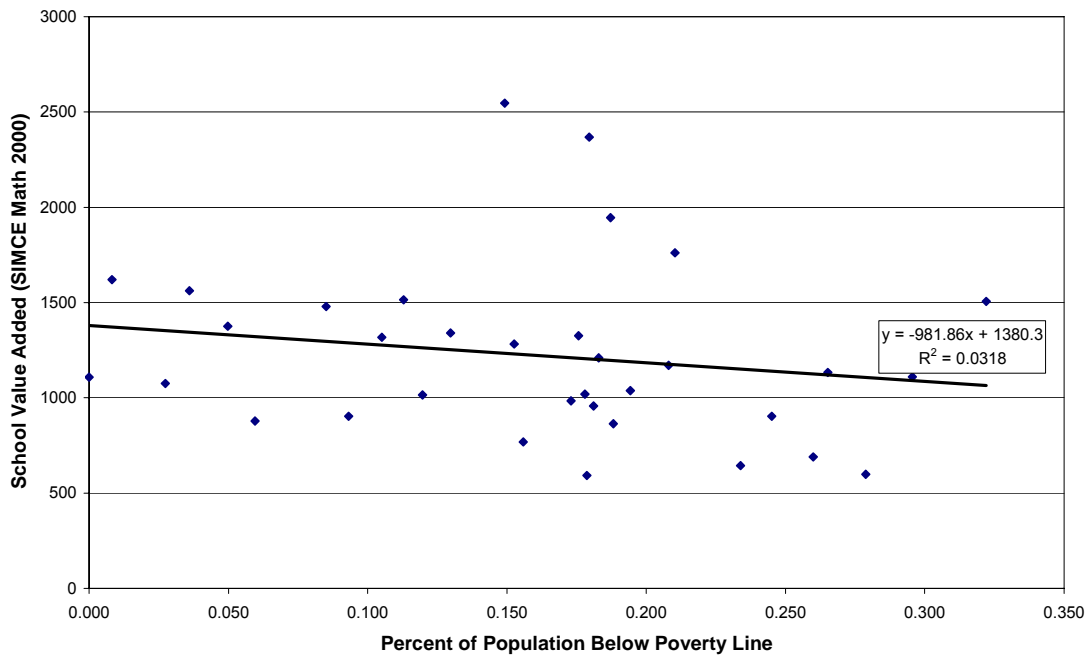


Figure 2. School Value-Added and Poverty Rates



The results presented in Figures 1 and 2 suggest that students in wealthier municipalities may benefit from higher-quality education: when both school quality and school enrollment rates are considered, students in wealthier municipalities, on average, receive a higher-quality education. The results in Figure 1 are heavily influenced by the two wealthiest municipalities, which also have high measures of school value-added, in part due to their high concentration of private paid schools. Indeed, when these two municipalities are removed from the figure, the trend-line no longer shows a positive slope. However, the results in Figure 2 also reinforce the conclusion that municipal wealth (lower poverty rate) is associated with higher educational quality, and this figure is not heavily influenced by any particular municipalities.

7.3 Within each school type, where are the high quality schools located?

In the third phase of the project, I examined patterns of school distribution by school type. This closer examination provides insight into the nature of the distributional inequity apparent in the positive relationship between municipality socio-economic status and school quality presented in the previous section.

The results from this phase can be found in Table 11, following section 7.3b. The coefficients should be interpreted as follows. “Test score from 1996” and “percent of students with free lunch” are meant to control for fixed student effects. Dummy variables for each school type are also included as control variables, allowing differences in educational quality between school types. Mean household income (or municipal poverty rate) reflects the impact of increased municipality wealth on municipal school quality. The interacted variables (such as “free voucher * mean household income”) reflect the relationship between increased municipality wealth and quality of the particular type of school listed. To test the robustness of findings to changing definitions of municipal wealth, two definitions of municipal wealth are used: mean household income and poverty rate.

The results in Table 11 demonstrate that the relationship between municipality wealth and school quality in the aggregate set of all schools is no longer present when the data are divided by school type. In the next sub-sections, I discuss what these results suggest for each school type.

7.3a Voucher Schools

The results in this section support the claim that the voucher system provides education of equal quality to students in all municipalities. Municipal socioeconomic status, as measured in mean household income and poverty rates, is not a statistically significant factor in school quality. For free “voucher” schools, this could have a number of explanations. Schools may not base their location decisions on municipality wealth. Thus, a high quality school would be just as likely to be located in a wealthy as a poor municipality. Alternately, schools may take municipal wealth into consideration, but increasing wealth might have opposing effects—for example, decreased crime but higher property values (and thus higher school costs). Thus, municipal wealth and school quality could be unrelated because two opposing effects balance each other out.

The results have similar implications for “shared financing” voucher schools. However, the results refute an additional potential argument of inequity in the system: that high quality shared financing schools might locate in higher-income areas in order to attract students with higher abilities to pay school fees. These results suggest that the shared financing mechanism does not systematically increase inequity in access to high-quality education through school location patterns.

7.3b Municipal Schools

School quality also appears unrelated to municipal wealth in the municipal education sector. This result has a slightly different meaning than the result for both types of “voucher” schools. Municipal school location is not influenced by private sector

supply and demand forces, but rather by municipal government actions. Therefore, a relationship between school quality and municipal wealth could be attributable to education policies of municipal governments.

Municipal education policies could affect school quality in a number of ways. Municipalities might be able to improve school quality by increasing school funding through municipal property taxes. In this way, municipalities could supplement the budgets of their schools above the level of the per-pupil voucher. The level of this additional funding could be positively related to municipal wealth for two reasons. First, because voting residents of a municipality influence what tax rate is imposed, the tax rate may be higher in municipalities whose residents have more disposable income, or where families have higher educational attainment and therefore might value education more highly for their children. In addition, a given tax rate will generate more revenue in a richer municipality with a larger tax base. However, to the extent that families in wealthy municipalities send their children to private schools, municipality wealth may be linked to lower municipal education expenditures. These considerations suggest that funding differences between municipalities might be related to municipal wealth and could lead to patterns in municipal school quality.

Centrally-funded voucher systems are often viewed as equity-enhancing in comparison to locally funded systems because they avoid the problem of increased wealth leading to increased educational expenditure per student. Many voucher proponents argue that per-pupil spending should actually decrease as family income increases, rather than the opposite, which may occur if municipalities are allowed to contribute funds directly to their own schools.

In contrast to theoretical predictions, municipal wealth does not seem to have an impact on educational equity in Chile. However, data on municipal educational expenditures were not available for this study, meaning that the ambiguous relationship between municipal wealth and expenditure on education could not be determined. If this

data becomes available, future research could investigate the relationships between municipal wealth and educational expenditure and between educational expenditure and school quality.

Table 11. Relationship between municipality wealth and school value-added by school type, controlling for student characteristics

Independent Variables		Dependent Variable: Math Score 2000	
		Regression 1 ¹⁰	Regression 2
Math Score '96	Coefficient	1.8324	1.8083
	Std. Error	0.0637	0.0644
% with Free Lunch in School	Coefficient	-0.1383	-0.1231
	Std. Error	0.0391	0.0398
Free Voucher Dummy	Coefficient	10.9771	<i>4.5966</i>
	Std. Error	3.5436	<i>4.7905</i>
Shared Financing Voucher Dummy	Coefficient	6.3143	6.7975
	Std. Error	2.4685	3.1950
Private Paid Dummy	Coefficient	21.3111	22.4211
	Std. Error	2.81597	2.8630
Mean Household Income in Municipality	Coefficient	<i>2.63E-07</i>	-
	Std. Error	<i>2.08E-07</i>	-
"Free Voucher" School * Mean Household Income ¹¹	Coefficient	<i>-7.91E-07</i>	-
	Std. Error	<i>5.36E-07</i>	-
Shared Financing "Voucher" * Mean Household Income	Coefficient	<i>-2.30E-08</i>	-
	Std. Error	<i>3.42E-07</i>	-
Private Paid School * Mean Household Income	Coefficient	<i>1.15E-08</i>	-
	Std. Error	<i>2.46E-07</i>	-
Poverty Rate in Municipality	Coefficient	-	<i>-20.3170</i>
	Std. Error	-	<i>11.7515</i>
"Free Voucher" School * Poverty Rate in Municipality	Coefficient	-	<i>11.4195</i>
	Std. Error	-	<i>23.6663</i>
Shared Financing "Voucher" * Poverty Rate in Municipality	Coefficient	-	<i>-3.0579</i>
	Std. Error	-	<i>17.5392</i>
Private Paid School * Poverty Rate in Municipality	Coefficient	-	<i>-18.8433</i>
	Std. Error	-	<i>24.2376</i>

¹⁰ Text in **bold** indicates that the coefficient is significant at the 5% level; text in *italics* indicates that it is not.

¹¹ Variable is equal to municipal household income if school is a "free voucher" school, zero otherwise.

7.4 How do school types differ in their ability to educate students in low-income areas?

The fourth phase of the project investigated the ability of different school types to educate children in low-income areas. This phase is meant to address the possibility that Chile's education "voucher" system may benefit students in low-income municipalities by providing schooling options that serve them well, even if inequalities persist between schools in low and high-income areas. This situation could arise if the "voucher" funding system raises overall educational quality while at the same time increasing inequality between schools in rich and poor areas.

To investigate this question, I regressed eighth grade test score (year 2000) on fourth grade test score (1996), student socioeconomic status, a dummy variable indicating the school was located in a poor municipality, and dummy variables for each school type in a poor area. The excluded variable was municipal schools in poor areas, and therefore the coefficients on the other school types can be understood in relation to municipal schools in poor areas. I define "poor municipality" as one with a poverty rate higher than the average rate for all municipalities in the metropolitan Santiago area, and a very poor municipality as one with a poverty rate higher than the 75th percentile of all municipalities in the metropolitan Santiago area. The results of these regressions are presented in Table 12, below.

Table 12. School quality in poor and non-poor areas by school type, controlling for student characteristics

		Dependent Variable: Math Score '00	
		Regression 1	Regression 2
Math Score '96	Coefficient	1.8205 ¹²	1.8291
	Std. Error	0.0642	0.0639
Student SES	Coefficient	-0.1330	-0.1420
	Std. Error	0.0397	0.0391
Dummy for Poor Municipality ¹³	Coefficient	-1.6577	-
	Std. Error	1.7815	-
Free Voucher * Poor Municipality ¹⁴	Coefficient	6.3705	-
	Std. Error	1.9913	-
Shared Financing Voucher * Poor Municipality	Coefficient	5.8718	-
	Std. Error	1.6743	-
Private Paid * Poor Municipality	Coefficient	24.3858	-
	Std. Error	4.1397	-
Free Voucher * Non-Poor Municipality ¹⁵	Coefficient	7.0367	-
	Std. Error	3.4507	-
Shared Financing Voucher * Non-Poor Municipality	Coefficient	6.4134	-
	Std. Error	2.0308	-
Private Paid * Non-Poor Municipality	Coefficient	21.8080	-
	Std. Error	2.1817	-
Dummy for Very Poor Municipality	Coefficient	-	-1.2027
	Std. Error	-	1.6840
Free Voucher * Very Poor Municipality ¹⁶	Coefficient	-	7.6796
	Std. Error	-	2.7316
Shared Financing Voucher * Very Poor Municipality	Coefficient	-	6.2464
	Std. Error	-	2.2669
Private Paid * Very Poor Municipality	Coefficient	-	23.0359
	Std. Error	-	8.5466
Free Voucher * Non-Very Poor Municipality	Coefficient	-	5.5622
	Std. Error	-	2.2023
Shared Financing Voucher * Non-Very Poor Municipality	Coefficient	-	5.8608
	Std. Error	-	1.5746
Private Paid * Non-Very Poor Municipality	Coefficient	-	22.1775
	Std. Error	-	2.0084

¹² Text in **bold** indicates that the coefficient is significant at the 5% level; text in *italics* indicates that the coefficient is not significant at the 5% level.

¹³ “Poor municipality” is defined as a municipality with a poverty rate higher than the average municipal poverty rate.

¹⁴ This variable equals 1 for free voucher schools in poor municipalities, zero otherwise.

¹⁵ “Non-Poor Municipality” is defined as the opposite of “Poor Municipality,” that is, with a poverty rate lower than the average municipal poverty rate.

¹⁶ “Very Poor Municipality” is defined as a municipality with a poverty rate above the 75th percentile of poverty rates. It is included to test the robustness of results to different definitions of “poor municipality.”

The results for these regressions suggest that voucher schools, and in particular free voucher schools, may produce higher levels of educational achievement in poor municipalities than municipal schools in similar areas. The coefficient on free voucher schools in poor areas indicates that free voucher schools on average produce a 5.45 point higher test score than their municipal counterparts, which represents an increase of 0.175 standard deviations. This result, although not practically very large, does indicate that the voucher system may create schooling options—private voucher schools—that provide students in poor areas with equally high quality educational alternatives to municipal schools. These results appear to be robust to different definitions of what it means to be a poor municipality.

7.5 Socioeconomic Segregation

The fifth phase of this project examined student socioeconomic segregation in different school types throughout Santiago. High levels of student sorting, and in particular socioeconomic segregation, have been a major criticism of Chile's education voucher system. In order to isolate the component of student segregation unrelated to school location patterns, I regressed student SES (measured by percentage of students receiving free lunch) on a group of municipality dummy variables and another group of dummy variables for school type. The results of this regression are presented in the Table 13, below. The excluded variable is municipal schools, and the coefficients on the other school types can be interpreted as the difference between "percent of students with free lunch" in schools of the listed type relative to that percentage in municipal schools.

Table 13. Socioeconomic characteristics of students by school type
(Regression also included dummy variables for each municipality; full regression results are presented in the appendix, Table A)

% Students in School with Free Lunch (Omitted variable: Municipal School)		
School Type	Coefficient	Standard Error
Free "Voucher" School	-5.639 ¹⁷	1.391
Shared Financing "Voucher" School	-18.903	0.954
Private Paid School	-26.239	1.435

The results of this regression indicate a significant level of socioeconomic segregation between school types within municipalities. In particular, the percentage of students receiving free lunch is 5.6 percentage points lower than in municipal schools in the same municipality. This difference rises for schools that charge tuition, as the percent of students with free lunch falls 18.9 percentage points in shared financing voucher schools. The percentage of students receiving free lunch decreases further for private paid schools; in fact, no students in private schools receive free lunch (see descriptive statistics table; table 8, section 6.5).

These results suggest that student SES in each school is related to the magnitude of tuition charged by the school, because as tuition rises from free voucher schools to shared financing voucher schools (with a tuition cap), student SES also rises; a similar phenomenon is apparent in the difference between shared financing and private paid schools, which do not have a tuition cap. These results also suggest, however, that tuition charges alone do not explain all of the socioeconomic segregation apparent in Santiago area schools. Free voucher schools do not charge tuition, and yet the SES of their students remains above that of municipal schools. This suggests that either family preference for school type differs by socioeconomic class, or that school selection procedures in private voucher schools lead to significantly increased socioeconomic segregation.

¹⁷ Text in **bold** indicates that the coefficient is significant at the 5% level; text in *italics* indicates that the coefficient is not significant at the 5% level.

8. Discussion

This study has attempted to address five questions relating to the distributional equity of education in the Santiago metropolitan area. The first phase of the project investigated the relationship between the prevalence of schools of each type and municipality socioeconomic status. The second phase investigated the relationship between school quality and municipality SES; the third phase examined this same relationship for each type of school individually. The fourth phase of the project examined the ability of each school type to effectively educate students in poor areas. The fifth phase looked at socioeconomic segregation by school type within municipalities.

The results of this study provide a mixed evaluation of the distributional equity of education in the Santiago area. This study found that education in the Santiago area may be relatively equitable with respect to school location patterns. The study found that the number of publicly funded schools (municipal and all voucher schools) is not significantly related to municipality SES. Further, the quality of voucher schools (both free and shared financing) is not significantly related to municipality wealth. Finally, the private subsidized and private paid sectors educate children in poor municipalities at least as well as municipal schools do. Taken together, these results indicate that in many ways, the voucher system may provide equal access to high-quality schooling alternatives for students in high- and low-income areas.

However, the results of this study suggest that student socioeconomic sorting between school types within municipalities may represent an equity concern; effectively, low-income students are not able to take advantage of the high-quality educational alternatives present in their municipalities. This segregation might be the result of at least two factors. First, the shared financing mechanism might bar students of low SES from being able to afford to attend “shared financing” voucher schools that charge

tuition. Second, either school selection biases or differential family preferences might lead to the observed socioeconomic segregation between municipal and free voucher schools. Educational voucher systems, and all school choice systems, are meant to allow some student segregation based on differential familial preferences, because families who choose the same school might do so because they share a common view of the best way to approach education. However, school selection biases mean that schools may select their students based on a factor correlated with socioeconomic status, denying opportunities to poorer students who would have chosen to take advantage of them. Socioeconomic segregation may also be inherently undesirable for political or educational (peer-group) reasons.

This study has investigated certain distributional aspects of the educational system in Santiago and concludes that the system may have avoided some potential distributional inequities in the special distribution of schools. The system may perform less well in other aspects of equity, especially related to school selection effects and shared financing tuition charges. These results suggest a mixed review of equity in Santiago's educational voucher system.

The results of this study have a number of implications for the larger voucher debate. First, these results reinforce the claim that specific institutional characteristics may have a large—or even definitive—impact on the way that voucher systems affect student experiences. In the Chilean case, the tripartite system of management (municipal, private “voucher,” and private paid) means that the voucher system has no direct effect on the richest group of schools and students, an outcome that might not be the case if all schools are eligible to take vouchers.

The results of this study also reinforce the claim that voucher systems may have both positive and negative effects, and these effects may sometimes fall on the same groups of students. In Santiago, poor students may benefit from increased choice and

potential access to better education; at the same time, they may suffer from increased socioeconomic segregation. These results add to a growing literature on the complex and often conflicting effects of educational voucher systems on different population sectors.

This study faces a number of limitations which caution against generalizing the results to other areas or systems. The data utilized in the study include only schools in Santiago, and do not necessarily accurately represent other Chilean cities or rural areas. In addition, data was only available at the school level, and was only available for two years, precluding this study from investigating effects on individual students or over time. To caution against over-generalization to other areas, equity considerations in voucher systems may be highly dependent on specific attributes of the system as implemented, such as the ways that schools choose students or whether schools may charge tuition add-ons. The results of this study are therefore not meant to address questions of the desirability of voucher systems in general.

Further research could add to the results presented here by using data from a larger geographical area or by investigating the effects of vouchers on rural students. Further research could also investigate the causes of the patterns observed in this study, especially in terms of the specific incentives faced by schools in their location decisions (such as rental prices or crime rates). Finally, additional equity research on voucher systems in other countries might allow a comparison of the ways in which different institutional characteristics affect equity.

Appendix

Table A. Socioeconomic characteristics of students by school type, controlling for municipality

Variable	Dependent Variable: Percent of Students in School with Free Lunch	
	Coefficient	Standard Error
Constant	25.3814¹⁸	1.7328
Free Voucher Dummy	-5.6393	1.3913
Shared Financing Voucher Dummy	-18.9030	0.9538
Private Paid Dummy	-26.2392	1.4353
<i>Municipality Dummy Variables</i>		
Independencia	10.6180	3.1126
Conchalí	8.8393	2.9009
Huechuraba	17.9994	4.0415
Recoleta	9.2108	2.7335
Providencia	-1.0213	2.9425
Vitacura	-3.078	3.4873
Lo Barnechea	9.3815	3.8274
Las Condes	-1.3103	2.6718
Ñuñoa	-3.3953	2.6229
La Reina	1.7184	3.0103
Macul	8.1057	3.0302
Peñolén	11.2483	2.9362
La Florida	3.8815	2.1036
San Joaquín	14.3412	3.1618
La Granja	9.5323	3.0744
La Pintana	14.8872	2.8425
San Ramón	12.0871	3.2708
San Miguel	0.4531	2.8816
La Cisterna	5.2642	2.8257
El Bosque	4.8646	2.6248
Pedro Aguirre Cerda	10.4096	2.9589
Lo Espejo	13.8811	3.2841
Estación Central	8.5614	2.8577
Cerrillos	4.8465	3.9004
Maipú	-0.1934	2.4818
Quinta Normal	2.7491	2.8051
Lo Prado	8.3011	3.3860
Pudahuel	12.1493	3.0000
Cerro Navia	14.2695	2.7876
Renca	14.9470	2.9357
Quilicura	11.6532	4.6987
Puente Alto	9.3256	2.4864
San Bernardo	8.7350	2.5172

¹⁸ Text in **bold** indicates that the coefficient is significant at the 5% level; text in *italics* indicates that the coefficient is not significant at the 5% level.

Table B. Municipality information: population, socioeconomic information, number of schools

Municipality Name	Population	Mean Household Income (Chilean Pesos per Month)	Income Converted to USD ¹⁹	Fraction Poor	Number of Public Schools	Number of Free "Voucher" Schools	Number of Shared Financing "Voucher" Schools	Number of Private Paid Schools
Santiago	200,792	5,359,419.684	9,931	0.085	23	2	27	13
Independencia	65,479	10,076,997.230	18,673	0.113	9	3	12	1
Conchalí	133,256	7,183,178.211	13,310	0.183	18	5	8	0
Huechuraba	74,070	2,354,089.805	4,362	0.234	8	4	1	0
Recoleta	148,220	3,996,446.600	7,405	0.178	15	8	12	2
Providencia	120,874	1,796,837.488	3,330	0.036	5	0	1	27
Vitacura	81,499	31,333,653.540	58,061	0.000	3	0	0	17
Lo Barnechea	74,749	6,498,189.940	12,041	0.060	2	3	1	9
Las Condes	249,893	20,405,210.800	37,811	0.008	6	1	2	37
Nuñoa	163,511	7,834,110.153	14,517	0.027	11	2	9	21
La Reina	96,762	8,350,782.755	15,474	0.050	6	2	6	14
Macul	112,535	708,420.444	1,313	0.153	12	5	6	4
Peñolén	216,060	6,294,089.213	11,663	0.188	14	8	6	2
La Florida	365,674	2,310,611.828	4,282	0.120	25	7	50	18
San Joaquín	97,625	8,268,022.162	15,321	0.179	11	2	11	0
La Granja	132,520	1,731,987.095	3,209	0.265	13	3	10	0
La Pintana	190,085	4,268,638.129	7,910	0.296	14	13	7	0
San Ramón	94,906	3,048,750.431	5,649	0.322	11	4	7	0
San Miguel	78,872	13,927,173.270	25,807	0.093	7	3	13	8
La Cisterna	85,118	6,946,556.112	12,872	0.176	9	4	17	3
El Bosque	175,594	5,733,049.497	10,623	0.210	18	2	22	0
Pedro Aguirre Cerda	114,560	1,508,154.693	2,795	0.173	16	0	13	0
Lo Espejo	112,800	5,463,052.739	10,123	0.245	14	5	3	0
Estación Central	130,394	8,087,672.744	14,986	0.149	14	3	14	1
Cerrillos	71,906	9,270,945.525	17,179	0.130	8	2	4	0
Maipú	468,390	6,205,291.463	11,498	0.105	16	0	25	9
Quinta Normal	104,012	11,856,307.660	21,970	0.194	17	4	11	1
Lo Prado	104,316	4,980,916.104	9,230	0.156	12	1	7	0
Pudahuel	195,653	5,907,554.245	10,947	0.180	13	6	8	1
Cerro Navia	148,312	5,331,914.078	9,880	0.260	21	5	9	0
Renca	133,518	5,906,994.344	10,946	0.279	14	7	9	0
Quilicura	126,518	6,495,304.180	12,036	0.181	4	1	4	0
Puente Alto	492,915	6,326,849.253	11,724	0.187	19	4	23	4
San Bernardo	246,762	3,268,425.744	6,056	0.208	3	0	1	2
Total	5,408,150	-	-	-	411	119	359	194
Average	159,063	7,030,458.740	13,027.412	0.159	12.09	3.5	10.56	5.71
Avg. Weighted by Population	-	6,596,474.605	12,223.242	0.158	13.73	3.61	14.16	6.99

¹⁹ *Income converted to USD* is calculated using the average exchange rate over the year 2000 (1 USD = 539.67 CLP). Exchange rate data is from Oanda Historical Currency Exchange Rates, <http://www.oanda.com/convert/fxhistory>.

Table C. Relationship between number of family members and family income

Number of People in Household	Mean Household Income (Chilean Pesos per Month)	Standard Deviation
0 - 2	5,712,821	2.27E+07
More than 2	5,756,769	2.29E+07

Table D. Relationship between municipal wealth and school quality
School value-added is measured as the difference between normalized fourth grade (year 1996) and eighth grade (year 2000) SIMCE math scores.
This table is analogous to Table 10 in the results section.

	Dependent Variable: Difference in Normalized Math Score between 1996 and 2000	
Independent Variable	Coefficient	Standard Error
Mean Household Income in Municipality	7.65E-09²⁰	3.47E-09
Poverty Rate in Municipality	-0.28055	0.231097

²⁰ Text in **bold** indicates that the coefficient is significant at the 5% level; text in *italics* indicates that the coefficient is not significant at the 5% level.

Table E. Relationship between neighborhood wealth and school value-added, by school type.

School value-added measured as the difference between normalized fourth grade (year 1996) and eighth grade (year 2000) SIMCE math scores.

This table is analogous to Table 11 in the results section.

Independent Variables	Dependent Variable: Difference in Normalized Math Score between 1996 and 2000		
		Regression 1	Regression 2
Free Voucher Dummy	Coefficient	0.4648	0.1993
	Std. Error	0.1287	0.1748
Shared Financing Voucher Dummy	Coefficient	0.04302	0.2407
	Std. Error	0.08415	0.1145
Private Paid Dummy	Coefficient	0.1345	0.4340
	Std. Error	0.0853	0.1004
Mean Household Income in Municipality	Coefficient	-2.73E-09	-
	Std. Error	7.47E-09	-
Free Voucher School * Mean Household Income	Coefficient	-3.90E-08	-
	Std. Error	1.95E-08	-
Shared Financing Voucher School * Mean Household Income	Coefficient	3.99E-09	-
	Std. Error	1.25E-08	-
Private Paid School * Mean Household Income	Coefficient	1.23E-08	-
	Std. Error	8.86E-09	-
Poverty Rate in Municipality	Coefficient	-	0.7182
	Std. Error	-	0.4092
Free Voucher School * Poverty Rate in Municipality	Coefficient	-	0.1451
	Std. Error	-	0.8611
Shared Financing School * Poverty Rate in Municipality	Coefficient	-	-1.0203
	Std. Error	-	0.6376
Private Paid School * Poverty Rate in Municipality	Coefficient	-	-1.63572
	Std. Error	-	0.876922

Table F. School quality in poor and non-poor areas, by school type
 School value-added is measured as the difference between normalized fourth grade (year 1996) and eighth grade (year 2000) SIMCE math scores.
 This table is analogous to Table 12 in the results section.

Independent Variables	Dependent Variable: Difference in Normalized Math Score between 1996 and 2000	
	Coefficient	Standard Error
Dummy for Poor Municipality ²¹	<i>0.117809</i>	<i>0.062804</i>
Free Voucher * Poor Municipality ²²	0.215474	0.071895
Shared Financing Voucher * Poor Municipality	<i>0.023806</i>	<i>0.054252</i>
Private Paid * Poor Municipality	<i>0.196305</i>	<i>0.139773</i>
Free Voucher * Non-Poor Municipality ²³	0.285373	0.125642
Shared Financing Voucher * Non-Poor Municipality	0.155309	0.070313
Private Paid * Non-Poor Municipality	0.335837	0.069395

²¹ “Poor Municipality” is defined as a municipality with a poverty rate higher than the average municipal poverty rate.

²² This variable equals 1 for free voucher schools in poor municipalities, zero otherwise.

²³ “Non-Poor Municipality” is defined as the opposite of “Poor Municipality,” that is, with a poverty rate lower than the average municipal poverty rate.

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