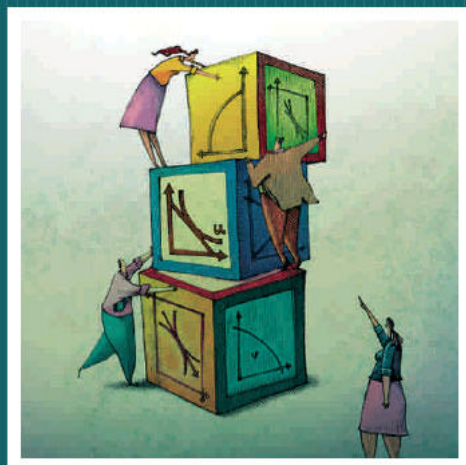


DOCUMENTOS DE TRABAJO

Serie Economía



N° 258 EFFECTIVE SCHOOLS DO EXIST: LOW INCOME CHILDREN'S
ACADEMIC PERFORMANCE IN CHILE

FRANCISCO HENRÍQUEZ - BERNARDO LARA - ALEJANDRA MIZALA - ANDREA REPETTO

Effective Schools do Exist: Low Income Children's Academic Performance in Chile

Francisco Henríquez
Universidad Católica de Valparaíso and Ministry of Education

Bernardo Lara
Center for Applied Economics, Department of Industrial Engineering,
University of Chile

Alejandra Mizala¹
Center for Applied Economics, Department of Industrial Engineering and Center for
Advanced Research in Education, University of Chile

Andrea Repetto
School of Government, Universidad Adolfo Ibáñez

December 2009

Acknowledgements: We thank Lily Ariztía and Bernardita Muñoz who provided valuable information about the SIP schools, as well as comments and suggestions. We also thank Magdalena Álvarez and Javiera Martínez for valuable assistance. We are grateful to the SIMCE office at Chile's Ministry of Education for providing us with the data. Funding from Fondecyt (#1070316) and PBCT-CONICYT Project CIE-05 is gratefully acknowledged. The authors bear sole responsibility for the views expressed in the paper.

¹ Corresponding author: República 701, Santiago, Chile. E-mail address: amizala@dii.uchile.cl
Phone: (56-2) 978-4072. Fax: (56-2) 978-4011.

Abstract

The aim of this paper is twofold. First, we show that despite students' disadvantaged backgrounds and despite not having more financial resources than similar schools, there are schools in Chile that serve low income students and that obtain superior academic outcomes. Second, we present qualitative evidence to identify school and classroom processes that might explain these good results. Specifically, we analyze a network of Chilean private voucher schools called *Sociedad de Instrucción Primaria* (SIP). In the econometric analysis we use a number of propensity score based estimation methods, to find that SIP students' achievement is not due to observables or selection on measured variables. We also performed a number of interviews to SIP schools and other neighboring schools. Our qualitative analysis suggests that having children's learning as a central and permanent goal, an aim that is shared and that drives the community's efforts, seems to best summarize what makes SIP schools special.

Keywords: Educational quality, effective schools, school effect, propensity score methods.

I. Introduction

At least since the publication of the Coleman report in 1966, educational researchers and policymakers have struggled in their efforts to understand whether schools matter and whether there are policies that lead to increased educational achievement.² A large body of literature provides mixed results on the role of school level resources such as classroom size and teachers' experience on student performance.³

At the same time, educational systems display great variation in the distribution of student achievement as measured by test scores, dropout rates and college attendance (OECD, 2009). The enormous observed diversity in results is certainly correlated with students' family backgrounds and experiences. However, it cannot be fully accounted for by variation in household characteristics.

Chile's educational system is no exception: it is also characterized by a large heterogeneity in results, differences that are not completely associated with the socio-economic level of the students (Mizala and Romaguera, 2005). Despite the sweeping reforms that were introduced into Chile's educational system over almost three decades ago, as of today schools with stagnant scores still co-exist with schools that show continuous progress. More specifically, starting in the early 1980s, Chile's government began to provide subsidies to schools to finance students wishing to attend private schools.⁴ It also delegated

² See Coleman et al (1966).

³ Literature reviews include Hanushek (1989, 1997) for developed countries and Fuller (1990), Fuller and Clarke (1994) and Hanushek (1995) for developing countries.

⁴ Along this paper we will refer to these schools as private voucher or private subsidized schools. Although the subsidy is paid directly to schools on a per-student basis, the system simulates a voucher-type demand subsidy.

public education to local governments (municipalities), tying the budget of schools to enrollment. Although the reform intended to generate competition between schools, thus promoting more efficient and better quality education services, large differences in the performance of students attending different schools are still observed. This, in turn, has consequences for income distribution, as primary and secondary school quality is an important predictor of the access to university education, good jobs and high wages (Card and Krueger, 1996).

This great and persistent heterogeneity in school performance has important research and policy implications. If the lesson were that all the schools suffer from poor performance, one could conclude that responsibility for these results does not depend so much on schools but, instead, on policy makers, parents or even children. In contrast, if some schools progress while others are left behind, different questions arise. What characteristics distinguish high performing schools from those with low levels of student achievement? What are the determinants of high performance? What lessons can be drawn from the schools that show significantly better scores and that serve populations with similar characteristics? And can these lessons be applied to improve the performance in schools with poor achievement?

This paper intends to add evidence on the strategies that are effective for students from disadvantaged economic backgrounds. That is, we first provide statistical evidence that there exist schools attending low income children that consistently produce outstanding results. Then we provide insight on the reasons behind the relative success of these schools on the basis of information gathered in a number of interviews.

Specifically, we concentrate the analysis on the relative performance of children attending schools that belong to the *Sociedad de Instrucción Primaria* (SIP), a non-for profit organization that serves low income students in Santiago, Chile, since 1856. The network consists of 17 private voucher schools attending about 18 thousand students. SIP schools are also known as Matte schools, in honor of the founding family. Students at these schools stand out because of their systematic superior performance in national standardized SIMCE tests (Educational Quality Measurement System). Despite their students' disadvantaged family background and despite not having more financial resources than similar schools, SIP schools obtain math scores in the national standardized achievement tests that are 102 percent of one standard deviation higher than those obtained by public/municipal schools and 69 percent of one standard deviation higher than private voucher schools in Santiago. Similar results are found for language test scores (see Table 1). Furthermore, the performance of SIP schools is very similar to that of private non-voucher schools that typically serve the most elite families in Chile. In other words, SIP's education seems a cost effective way of improving school quality.

In this paper we intend to answer the types of questions above through an analysis of SIP schools. That is, the main goal of this paper is to shed light on the factors that contribute to a better education for low-income students attending Matte schools. The experience of students at these schools shows that it is possible to create an environment in which low-income students can achieve high academic standards. The lessons of this analysis can help improve the performance in schools with poor achievement.

In the first part of this paper we analyze whether the superior performance of Matte students can be explained by observable factors, such as schools, students and family

characteristics. Using a number of propensity score based estimation methods we find that after controlling for observables and selection on measured variables, SIP students perform much better in SIMCE tests than students at private voucher and municipal schools. In fact, we show that they even perform better than those attending private non voucher schools; i.e, students enrolled at the schools that attend the children of the elite families in Chile. The estimated effect is not only statistically significant, but economically relevant. That is, we find differences in test scores up to 0.9 standard deviations compared to students in public/municipal schools, and up to 0.7 standard deviations compared to students in private voucher schools. Thus, compared to other education interventions, SIP appears as quite effective.⁵

After showing that SIP students' superior performance is not spurious, we look further into understanding the unmeasured variables that explain differences in performance. In order to do so, we conducted a series of interviews with SIP schools' principals and with the principals of schools that compete with them. For each Matte school and within the same municipality, we chose schools that are close in terms of the average socioeconomic background of the students, enrollment and the availability of financial resources. Our interviews reveal a number of relevant differences across schools. Perhaps the most striking difference is that SIP schools have had children's learning as their primary and permanent goal, an aim that is shared and that drives the community's efforts.

⁵ For instance, according to Angrist et al. (2002), the introduction of vouchers targeted to low income students in Colombia increased academic achievement in 0.2 standard deviations.

The remainder of the paper is organized as follows: Section II provides a general view of the Chilean Educational System and reviews the related literature. Then Section III introduces SIP schools and analyzes the robustness of its superior performance to controlling for observables and for selection on measured variables. Section IV describes the results of our interviews. Finally, Section V concludes.

II. The Chilean educational system

In the early 1980s sweeping reforms were made to Chile's educational system: the public sector school system was decentralized and school management was delegated to local government –municipal- authorities.⁶ The reform also paved the way for the private sector to enter the market as a provider of education by introducing a voucher-type demand subsidy to finance municipal and private voucher schools. The voucher, which is paid directly to schools on a per-student basis, is intended to cover running costs and generate competition between schools to attract and retain students, thus promoting more efficient and better quality education services.⁷ Since 1993, private voucher schools have been allowed to charge tuition on top of the voucher that is received from the government.

Moreover, a system of standardized tests for measuring educational attainment, known as the SIMCE, was established in order to evaluate the success of the reforms, inform parents about the quality of their schools and provide a basis for future political decision.

⁶ For a more detailed description of the Chilean educational system see Mizala and Romaguera (2000).

⁷ The monthly voucher for primary school students amounted to slightly over \$51 in 2002. As a reference, the average monthly after tax wage in Chile was about \$570 according to the 2003 CASEN Household Survey. We refer to 2002 data because the empirical section of this paper uses data from the 2002 SIMCE test in the Metropolitan Region of Santiago.

As a result of these reforms, the number of new schools in the private sector has increased rapidly over the past twenty years. In 1985, there were 2,643 private voucher schools in Chile; this number grew to 3,640 in 2002 and to 5,054 in 2007. The resulting three-legged school system comprises of:⁸

1. Private non-voucher schools, which are financed by fees paid by parents and accounted for 8.5 percent of all students in Chile and 12.7 percent of all students in the Metropolitan Region of Santiago in 2002.
2. Private voucher schools, which are financed by the per-student subsidy provided by the government and may be co-financed by monthly fees paid by parents. These schools are owned and ran by the private sector. These accounted for 37.8 percent of total enrollment in Chile and for 47.6 percent of students in Santiago in 2002.
3. Public schools, which are financed by the voucher but are owned and managed by municipal authorities. They represented 52.1 percent of the enrollment in Chile and 37.6 percent of students in Santiago in 2002.

The system has proven highly effective in terms of coverage. As a result of the voucher system the secondary school enrollment increased from 65% in the early 1980s to almost 90% by 2003. Graduation rates have also increased sharply, whereas secondary school dropout rates have declined.⁹ Nevertheless there is still a substantial gap between the

⁸ The remaining of the school population attends schools run by educational corporations linked to business organizations or professional-technical secondary schools.

⁹ Primary school coverage had already reached levels over 95% before the reform (Mizala and Romaguera, 2005).

average test scores of Chilean students and those of students from other countries in international assessments of student learning (Martin et al., 2004, and OECD, 2004).

A number of papers have examined the performance of the Chilean students based on SIMCE data. Most of these papers have studied the relative effectiveness of private versus public schools, while others have investigated the effect of school competition on student academic outcomes. Using a number of statistical techniques --including OLS, Heckit, propensity score based methods and change-in-changes--, most studies using individual-level data, have found that students attending private voucher schools have higher educational outcomes than those from public schools.¹⁰ However, papers that have tried to identify the effect of inter-school competition on students' achievement in Chile have reached mixed results.¹¹

More recently, a number of qualitative case studies have discussed the characteristics that distinguish high performing schools in poor areas. These papers have found that variables correlated with high performance are not easy to measure and usually are not observed by an econometrician. Instead, they have found that effective schools have, among other characteristics, clear goals and objectives, committed and highly professional teachers, an instructional leader at the school who evaluates and supports teachers in their classroom practices, a well-respected principal, clear rules, and multiple approaches to reach a

¹⁰ Mizala and Romaguera (2001), Sapelli and Vial (2002 and 2005), Anand, Mizala and Repetto (2008) and Lara, Mizala and Repetto (2009) find a statistically significant effect of private voucher education on SIMCE test scores that ranges from 4% to 45% of one standard deviation. However, McEwan (2001) finds that non-religious private voucher schools, --that is, the typical private voucher schools-- are less effective than municipal schools. Similarly, when using changes-in-changes techniques, Lara et al (2009) find no difference in the performance of municipal and private voucher schools students.

¹¹ Gallego (2002 and 2006), Hsieh and Urquiola (2006), Auguste and Valenzuela (2003) and Gallego and Hernando (2008).

heterogeneous student population (Bellei, Muñoz, Pérez and Raczynski, 2004; Raczynski and Muñoz, 2005; Eyzaguirre and Fontaine, 2008, Pérez and Socias, 2008).

Two other papers have addressed SIP students' performance. García and Paredes (2006) use a case study approach to describe a series of practices performed by this network and analyze the cost of implementing them. Their findings suggest that with an appropriate management, low income students can perform well with the resources brought up mainly by the voucher system, complemented by a smaller fraction provided by the fee paid by parents.

In a related paper, Mackenna (2006) uses propensity score matching and Heckman selection correction to find that SIP students outperform those attending public and other private voucher schools. The differences are large ranging between 70 percent and 80 percent of one standard deviation when compared to municipal students, and between 56 percent and 72 percent of one standard deviation when compared to other private voucher schools. Moreover, and contrary to the literature that compares private subsidized and public schools, the paper does not find evidence of selection in SIP schools.

In the two stage estimation, Mackenna (2006) uses as instruments the number of SIP schools and the number of municipal schools in the provincial department. That is, the paper assumes that school selection is affected by local school supply but that these school densities do not affect achievement. Although this is a standard identification strategy in the literature, it is likely that private schools are not randomly assigned across neighborhoods. That is, private schools locate in communities with families characterized by unmeasured variables that may positively influence achievement.

Moreover, when using propensity score matching, it is important to account for the fact that since there are only a number of SIP schools, the treatment group has a small number of observations relative to the control group. This could entail lack of overlap on the covariates, and thus bias and large variance in the estimated average treatment effect (Crump, et al., 2009).

In this paper we perform our analysis using propensity score based methods to estimate the effect of SIP education and to circumvent the problems described above. The estimation methods are based upon two main assumptions: unconfoundedness and overlap. The first assumption implies that participation in the treatment program does not depend on the outcome after controlling for differences in observed variables, such as socioeconomic status. It is a very controversial assumption (Imbens and Wooldridge, 2009), but still very popular, especially since Dehejia and Wahba (2002) showed good results in comparing experimental data and matching results in the evaluation of a training program.

The second assumption states that individuals should have positive probabilities of being observed in both treatment and control groups. Although it seems a less controversial assumption, recent literature has proposed new methods to improve overlap. In particular, in order to overcome the lack of overlap due to the smaller number of individuals in the treatment group *vis a vis* the control group, in this paper we implement the trimming strategy proposed by Crump et al (2009).

We use three estimation methods based upon propensity scores. First, we use matching, estimating the effect using as the counterfactual the observation with the closest propensity score. A second method is propensity score weighting. This method weights the

observations using the propensity score and the treatment status. The idea is to balance the sample between treated and non treated individuals based on the probability of treatment. Specifically, we use the inverse probability weighting (IPW) estimator proposed by Hirano, Imbens and Ridder (2003). Finally, we use the propensity score weighted regression, introduced by Robins and Rotnitzky (1995), Robins et al (1995), and Robins and Ritov (1997), which allows us to directly account for the correlation between covariates and outcomes.

III. SIP schools and their relative performance

SIP schools are private voucher schools. Out of a total of 17 schools, 15 serve children at the primary level. Our study is based on the performance of children attending these primary level schools.

The direction of the schools is under central management, comprised of the offices of General Management, Accounting, Human Resources, Computing Services, and the Pedagogical Department. These central offices delineate the aims and mission, leaving each school enough autonomy to attain the required goals in different ways.

The Pedagogical Department plays a key role in SIP schools. It defines the standards, goals and the progress expected from each school. It also monitors the performance of each school, and evaluates and measures the students' achievement. Furthermore, it organizes the remedial measures in case the goals are not met. A unit of the Pedagogical Department, the Family Orientation Unit, is in charge of ensuring the participation of families in the educational process.

SIP schools are mainly financed by the state voucher, which represents about 80% of all revenue. About 20% of revenues come from fees charged to parents, and from donations, typically targeted to specific projects, such as libraries and new infrastructure.

Table 1 shows the outstanding performance of SIP's 4th graders in the 2002 Math and Language SIMCE standardized tests compared to children in all types of schools – public/municipal, private voucher and private non voucher schools. Students at SIP schools not only outperform students attending public and private voucher schools; their performance is quite similar to those at private non voucher schools which typically serve only the most elite families in Chile. SIP students also show a lower level of heterogeneity in results, as suggested by the lower standard deviation of SIMCE scores. Figure 1 displays the distribution of SIMCE scores in the Metropolitan Region of Santiago, urban areas, compared to the distribution for SIP students. Statistical tests show that SIP distributions first-order stochastically-dominate the aggregate distribution of SIMCE scores.¹² Figure 2 decomposes the aggregate distribution into the distributions by school type. The graphs show that SIP students achieve results that better resemble the performance of students at elite schools in Chile rather than the performance of students at public and at other private voucher schools.

In what follows we show that the superior performance of students enrolled at SIP cannot be fully attributed to observable variables and selection on measured variables. In later

¹² Our econometric results are based on the 2002 SIMCE test. However, SIP students have systematically displayed superior performance in every SIMCE test.

sections we look into qualitative differences that might explain the higher achievement of SIP students.

a. Comparing the performance of children at SIP and at other schools in the Metropolitan Region of Santiago: data and methodology

In this section we study whether the gap in performance between SIMCE and otherwise similar students is robust to controlling for selection on observables and for the characteristics of schools, students and their families. To answer this question, we use the 2002 SIMCE test scores, taken by all 4th grade children in Chile. We use the 4th grade test since most SIP schools offer primary education only. We do not use the 8th grade SIMCE test because many of the best students at these schools move to high achievement secondary schools at the end of 6th grade.

The SIMCE data set is complemented by data from a questionnaire that is answered by the parents of students that participated in the test. This questionnaire provides information on the socio-economic characteristics of each student, such as their family income and the education of the parents, as well as their educational history. In addition, we use data from the Ministry of Education and the Under-secretary of Regional Development to calculate the per pupil resources that were available to each school.

Modifications were made to some of the variables in the database in order to make them compatible with our analyses. First, we only analyze students that reside in the urban areas of the Metropolitan Region of Santiago because this is the region in Chile where SIP schools are. Second, on the parental questionnaire, parents reported the highest level of education that they had attended. These levels were converted into the corresponding

number of years they had been in formal education: the maximum time a parent could spend in basic education is 8 years, high school is 12 years, technical institute is 14 years, professional institute is 16 years, college is 17 years, a masters degree is 19 years, and a doctoral degree is 23 years. Third, parents also reported their monthly income as a range (for example, a parent could report that their income is between 400,000 to 500,000 pesos). These ranges were replaced with the midpoint of the range, which means in the prior example the parent would have an income of 450,000 pesos. Furthermore, the income was divided by 1,000 to simplify the interpretation of results.

Table 2 provides a summary of the main characteristics of schools, students and their families in our data base. Students at public schools belong to less advantaged households. Their household income is lower, parents have reached lower levels of education and have access to fewer educational resources at home – measured by the number of books and the availability of computers at home—and financial resources at school. Students attending SIP schools seem quite similar to those attending other private voucher schools in a number of relevant characteristics such as household income and maternal education. Nevertheless, they are more likely to have a computer at home and on average own a larger number of books. This gap might capture differences in the motivation of parents. In addition, teachers at SIP schools have more years of experience. Finally, Table 2 shows how different students attending private non voucher schools are. Families have incomes that are almost 5 and almost 8 times larger than families whose children attend private voucher and municipal schools respectively. Mothers of children at private non voucher schools have on average 4 to 6 more years of completed education, and there are twice as many books at home. We do not have information on the total

amount of resources per child at school in these elite schools, but tuition charges can reach up to 10 times the state voucher.

The main goal of this section is to evaluate the treatment effect of attending a SIP school on students' performance. The main challenge is to address selection bias – students that attend SIP schools may have characteristics that are correlated with academic achievement - since parents are free to choose a school for their children, and at the same time, private schools are free to choose the students they admit. To address this problem, we use a number of propensity score based techniques identifying groups of similar students attending different types of schools. In all cases we define as the treatment having attended a SIP school, and then compare the outcome of these students in the treatment group with those attending either municipal, private voucher or private non voucher schools. That is, we perform three sets of comparisons across treatment and control groups, with each control group defined by students attending a different type of school.

More specifically, as any paper that intends to identify treatment effects with a treated-nontreated formulation, this study faces the classical problem of only observing the post-treatment outcome in the observed treatment status. As in the usual Rubin model (Rubin, 1974), we only observe:

$$Y_i = Y_{i1} \cdot D_i + Y_{i0} \cdot (1 - D_i)$$

where

Y_i = Observed post-treatment outcome for individual i .

Y_{i1} = Post-treatment outcome for individual i in case of receiving the treatment.

Y_{i0} = Post-treatment outcome for individual i in case of not receiving the treatment.

D_i = Dummy indicating whether individual i did receive the treatment or not.

Propensity score matching is a technique used for non-experimental data to identify a control group that exhibits the same distribution of covariates as the treatment group.

Propensity score matching is often used by statisticians and is becoming increasingly popular among economists as a method to measure the impact of training programs. The most common application of propensity score matching is to estimate the impact of job training programs (Heckman et al., 1997; Dehejia and Wahba, 2002). This paper applies a similar methodology to estimate the impact of private school education on academic achievement.

There are three important assumptions that make propensity score matching a feasible model. The first is the statistical independence of (Y_0, Y_1) and D conditional on X :

Assumption 1: $(Y_0, Y_1) \perp D \mid X$

where Y_0 is the SIMCE score of a student in the control group, Y_1 is the SIMCE score of a student in a SIP school, D is the type of school the student attends, and X is the students' characteristics. This first assumption allows us to use the outcome of a student in the control group with X characteristics as a proxy for $E(Y_0 \mid D=1, X)$. However, matching students based on X is a complex process given the high dimensionality of X . According to Rosenbaum and Rubin (1983), an alternative to matching based on X is to use the propensity score, which they define as "the conditional probability of assignment to a particular treatment given a vector of covariates." Rosenbaum and Rubin argue that if the

matched observations have homogenous propensity scores, then they will also have the same distribution of X . Let the propensity score be denoted by $P(X) = \Pr(D=1 | X)$. In situations in which $P(x)$ is not known, it can be estimated by models such as the probit or logit.

The second assumption for propensity score matching is

$$\text{Assumption 2: } 0 < P(x) < 1$$

If $P(x)$ equals 1, then students with those characteristics always attend a SIP school and therefore no match in the control group can be found. The same logic applies if $P(x)$ equals 0. As a result, the assumption that $P(x)$ lies between 0 and 1 is an important condition to guarantee that matches can be found for all students. This condition is typically achieved by imposing common support. In this paper we go further and follow Crump et al (2009) in implementing a strategy for selecting the group with overlap that minimizes the asymptotic variance of the efficient estimator of the average treatment effect. This strategy, called trimming, is one way of solving the lack of overlap in the covariate distributions between treatment and control groups due to limited number of observations. This problem can lead to imprecise estimates that are sensitive to the specification chosen (Imbens and Wooldridge, 2009). In practice, the strategy is a very simple one: it discards observations that are less than α away from zero and one. As in Crump et al (2008), we use α equal to 0.1.

The practical implementation is as follows. First, we estimate the propensity score. Then we trim the observations with estimated propensity score below 0.1 or above 0.9. With this new sample, we reestimate the propensity score to then apply the estimation methods

described below. Figures 3a, 3b and 3c show pre- and post-trimming propensity score distributions for the treatment group (SIP schools) and the different control groups. In general, propensity scores are very close to zero and do not seem to have an adequate common support in the pre-trimming histograms, a situation that considerably improves post-trimming.¹³

The propensity score is estimated on the basis of a number of observable variables, but we must also consider the unobservable characteristics that are typical of students in private schools. The third assumption states that the unobserved characteristics that are captured by the error term, U_0 , have the same distribution regardless of whether the student is in the treatment or control group.

$$\text{Assumption 3: } E(U_0 | D = 1, P(X)) = E(U_0 | D=0, P(X))$$

As emphasized by Heckman et al. (1997), this assumption does not imply that $E(U_0 | P(X)) = 0$; rather, it assumes that the distribution of the unobservables is the same for the treatment and control groups.

Assumptions 1 and 3 are important for the consistency of the estimator. If these assumptions are not valid, then our results may be biased. For instance, if SIP schools admit students on the basis of unobserved measures or if the most motivated parents –in unmeasured ways-- enroll their children to SIP schools, then our estimated effects may overestimate the true effect of SIP education.

¹³ Tables with descriptive statistics after trimming are available from the authors upon request.

Based on these assumptions, we implement three estimators of the effect of SIP education. The first one is the one-to-one estimator with replacement. The second one is propensity score weighting. This method weights the observations using the propensity score and the treatment status. The idea is to balance the sample between treated and nontreated individuals based on the probability of treatment (Imbens and Wooldridge, 2009). Specifically, we use the inverse probability weighting (IPW) estimator proposed by Hirano, Imbens and Ridder (2003):

$$\sum_{i=1}^N \frac{D_i \cdot Y_i}{\hat{r}(X_i)} \bigg/ \sum_{i=1}^N \frac{D_i}{\hat{r}(X_i)} - \sum_{i=1}^N \frac{(1-D_i) \cdot Y_i}{1-\hat{r}(X_i)} \bigg/ \sum_{i=1}^N \frac{1-D_i}{1-\hat{r}(X_i)}$$

where $\hat{r}(X_i)$ stands for the estimated propensity score.

The third propensity score based method considered in this paper allows us to directly account for the correlation between covariates and outcomes. The method is the propensity score weighted regression, introduced by Robins and Rotnitzky (1995), Robins et al (1995), and Robins and Ritov (1997).¹⁴ Specifically, we estimate the propensity score and obtain its predictor $\hat{r}(X_i)$. Separately we fit a regression of the test score on the baseline variables for the treatment group, $\hat{m}_1(X_i)$, and the control group, $\hat{m}_0(X_i)$. Then we estimate the effect of the treatment as

$$\frac{1}{N} \sum_{i=1}^N \frac{D_i \cdot Y_i - (D_i - \hat{r}(X_i)) \cdot \hat{m}_1(X_i)}{\hat{r}(X_i)} - \frac{1}{N} \sum_{i=1}^N \frac{(1-D_i) \cdot Y_i + (D_i - \hat{r}(X_i)) \hat{m}_0(X_i)}{1-\hat{r}(X_i)}$$

¹⁴ Further details on this method can be found in Imbens (2004) and Imbens and Wooldridge (2009). A generalization of this method is described in Wooldridge (2007).

This method also has a double-robustness feature: it provides consistent estimators if either the probability of treatment or the outcome regressions are incorrectly specified, implying some safeguard against model misspecification.

Our implementation of the inverse probability weighting (IPW) and double-robust (DR) estimators follows the steps suggested by Emsley et al. (2008).¹⁵

b. The decision to attend a SIP school: results

The first stage of our strategy is the estimation of the propensity score using all observations. Then, following Crump et al (2009), we discard observations with high or low predicted propensity score to then reestimate the probability that a student attends a SIP school. Table 3 provides these estimates before and after trimming the relevant samples. When the alternative is attending a public school, our results suggest that family income, maternal education, household size, age, having attended pre-school, the number of books at home, the availability of a computer at home, the school financial resources and the teachers per pupil ratio, all have a statistically significant effect on the probability of attending a SIP school. However, when compared to other private voucher schools, family income, household size, age, preschool education and teachers per pupil show no statistically relevant effect. The number of years of teacher experience now does. Finally, when comparing to students attending private non voucher schools, maternal education, resources at home and at school and the child's age are the variables that have a statistically significant effect on the probability of attending a SIP school.

¹⁵ The estimations are performed using the *dr* Stata command, which gives the sandwich estimators of the errors.

As expected, when the sample is rebalanced and the remaining individuals are more alike, the model loses explanatory power. However, the balancing allows for the construction of treated and non treated groups that gain in comparability, as suggested by the distributions of propensity scores shown in Figures 3a, 3b and 3c.

c. Student performance by school type

We next estimate the second stage of our model in order to estimate the effect of attending a SIP school. Table 4 summarizes our results. The first panel compares the SIMCE scores of students enrolled at a Matte school relative to similar students enrolled at a public school. The differences are very large and always statistically significant. They range from 0.48 to 0.57 standard deviations in the language test, and from 0.74 to 0.87 standard deviations in the math test depending on the estimation method.

When compared to similar students at other private voucher schools, the effect of SIP education is estimated to be somewhat smaller but still very large. The smallest gains for the language test are predicted by the double-robust model, which estimates an effect of 0.25 standard deviations; the largest is 0.44 standard deviations predicted by the matching approach. Similarly, in the math test the smallest gains are also predicted by the double-robust model (0.45 standard deviations) and the largest by the matching method (0.70 standard deviations).

Finally, we estimate the effect of attending a SIP school relative to a private non voucher school, even though these schools are not a realistic option for most students as they serve the most elite families in Chile. Still, we find very large estimates of the effect of attending a Matte school. The effect ranges from approximately 14 to 16 points in the language test

(0.27-0.32 standard deviations in test scores), and from 25 to 28 points in the math test (0.47-0.52 standard deviations).

These results taken jointly indicate that SIP schools are able to provide high quality education to low income students; children at SIP outperform similar students attending any other type of school. Although the point estimates vary from method to method, they all suggest that the effect is large and economically and statistically relevant. The effect is large even when compared to students that belong to the richest families in Chile and that are enrolled in schools that charge tuition fees that are many times the voucher provided by the government.

Summing up, given their financial resources, SIP's methods seem a cost-effective way of improving the quality of education among low income students. In other words, students from disadvantaged family backgrounds can achieve high performance. Interestingly, a similar result has been reported for countries with high PISA results. According to Barber and Mourshed (2007), there is little correlation between student outcomes and family background variables in countries with high PISA scores. That is, in the best educational systems around the world, schools are able to compensate for students' background disadvantages.

In what follows, we look further into understanding the estimated differences in performance. In order to do so, we conducted a series of interviews with principals at SIP and at other similar schools. In the next section we describe our methodology and results.

IV. A qualitative comparison of SIP and similar schools in Santiago

So far we have shown that students attending SIP schools perform much better than similar students in other schools, even after controlling for observable characteristics and after dealing with selection on measured variables. The aim of this section is to identify school and classroom processes that might explain the reasons that underlie the successful performance of children at SIP schools. As it was already mentioned, previous research on factors affecting the effectiveness of school attending low-income students have found that variables correlated with high achievement are not easy to measure and usually not observed by an econometrician; thus, a qualitative analysis is needed.¹⁶

Therefore, in order to gain some insight on the reasons behind the relative success of students at SIP schools, we performed a number of interviews with the director of the Pedagogical Department and with the principals of each school of the network. As a complement to our statistical analysis based on matching similar students across different types of schools, we also conducted interviews with principals of schools that serve populations with similar observable characteristics within the same neighborhoods. We were able to interview 15 schools, one “neighbor” for each SIP school in Santiago attending primary level children. The guideline we prepared for the interviews is based on previous research about effective schools. The questionnaire included questions on the use of specific teaching methodologies, the goals of the directors, the tasks they engage in, the

¹⁶ See, for instance, Belleï, Muñoz, Pérez and Raczynski (2004); Raczynski and Muñoz (2005), Eyzaguirre and Fontaine (2008), Pérez and Socias (2008).

characteristics of teachers and students, and school practices in general terms. The guideline is presented in the appendix.

To choose the schools to interview, we generated a “similarity index”, one for each school in the neighborhood served by a SIP school. This index was constructed on the basis of observable characteristics: the vulnerability index of the population at the school, constructed by the JUNAEB, which summarizes socioeconomic characteristics of the student’s families; the average family income at the school; maternal years of schooling; enrollment, and the monthly fee charged by the school.¹⁷

Let x_{ijk} represent variable i of the vector of characteristics in the index, where j represents the school, and k the municipality where the school is located. Let x_{isk} be the mean of variable x_i in SIP schools located at municipality k . Finally, let d_{ijk} be the difference between x_{ijk} and x_{isk} . Our similarity index is defined as

$$I_j = \sum_{i=1}^n \frac{1}{\left| \frac{d_{ijk} - \bar{d}_{ik}}{s_{dik}} \right|}$$

That is, the index is the sum over i of the inverse of the absolute value of normalized d_{ijk} . In this way, we obtain an index for each school that reaches its highest value for schools that display characteristics that are most similar to those of the average SIP school in the area.

¹⁷ The JUNAEB, National School Support and Scholarship Board, calculates this vulnerability index at the school level to target school meal subsidies. The index is based on students’ socioeconomic characteristics.

Once we constructed the index, for each municipality where there are SIP schools we contacted the principal of the school in the municipality that had the highest index. If we were unable to contact the principal or to schedule an interview, we contacted the principal of the school placed second in the similarity ranking, and so on until we were able to conduct the interview. Table 5 presents the characteristics of the schools of which principals were interviewed, along with their position in our similarity index.

a. Interviews with *Sociedad de Instrucción Primaria*

From the analysis of the fifteen SIP primary school interviews it is possible to sketch some features which help us better understand their academic results.

1. Principals

Most principals began their careers as classroom teachers, then as department heads, as deputy principals and finally as principals. The majority has held their positions for a considerable number of years --the shortest being 6 years, while the majority has over 20 years of experience. Many of the principals have worked in SIP schools and have gained their administrative training as principals through courses provided by the *Sociedad*, and by following postgraduate diplomas and masters programs related to the management of educational institutions.

The persons below the principals are designated by SIP, mainly by competition, only in few cases in consultation with the principal. In terms of teachers, most principals regard themselves as autonomous to hire and fire teachers, although some note that these actions must be consistent with SIP criteria.

In terms of financial management, most principals note that their involvement in financial decisions has increased recently, although not all claim autonomy in spending decisions.

The principals call attention to the following job characteristics: mission and standards are clearly defined; they work in teams with SIP's Pedagogical Department; there is great commitment, and work is planned jointly and guided by results. Neither principals nor teachers are immovable from their jobs.

2. *Teachers*

Teachers are constantly evaluated on the basis of a number of instruments. One is a self-evaluation process developed by SIP. Another is the so called 'formative evaluations' through which teachers monthly discuss their activities with the principal and the deputy principal. Finally, class observation is also used; i.e., directors and under directors attend some lectures in order to provide feedback and help. Moreover, the best evaluated teachers participate in these observations in order to share the best practices within the school and even across the network of schools. The results of these evaluations provide feedback to teachers and the administration, and are also used for the definition of bonuses, training, and dismissal.

Teachers' pay consists of a basic salary plus an additional amount for meeting goals. In addition they receive payments from the general teachers' incentive scheme established by the Ministry of Education.

All teachers work for the SIP only and show low rotation and very low absenteeism rates.

The exception is one school where the absenteeism rate is very high and where teachers are

reluctant to take training courses in those periods when there are no classes. Teachers also undertake additional training and courses both inside and outside SIP.

3. *Students*

The pupils begin their schooling at pre-school level and continue there; most of those who leave the school do so because of a change of residence. In the 6th grade, however, many of the students hope to enter elite public schools, point at which they also leave the network. A small fraction of older students leave because they do not adapt to the required level of work and discipline. Some of the principals interviewed admit that their schools do expel students on the basis of behavioral or academic problems.

All students have to take a maturity test for kindergarten admission. Moreover, ten out of the fifteen schools state they have excess demand and thus select their pupils. This selection process requires students to take a subject knowledge test.

Class attendance is good even if in some cases some students tend to arrive late to school. Parents and guardians also demonstrate a high attendance record -- over 85 percent-- at parent meetings and at meetings with specific teachers. However, in two of the schools the directors report that the school is set up within a highly vulnerable environment and that a number of parents or guardians are drug addicts or linked to drug traffickers.

Student behavior is recorded in a book that marks positive and negative observations.

Although principals state that they want to reinforce the positive observations – because they are concerned with student self esteem-, most of the comments are negative. These annotations are used to inform parents and to supply personality reports. The agreements

and commitments between the students, their parents and the school are documented in the same book.

4. *Methodology used*

SIP schools can rely on monthly counseling by the central Pedagogical Department which is principally delivered as methodological instructions. The schools plan their objectives, content and activities, and they progress according to the fulfillment of these objectives. Goals are common across schools and are clearly established. For example, in language learning, students are expected to read a book per month, learn a given number of new words per week and spend at least an hour a week in the library. Discipline is also considered as a key to teaching.

Students normally work in groups using blueprints. The educational process involves parents, who are periodically informed about the students' performance, and requested to participate in parents' meetings. Workshops are held for parents including teaching them to read if needed.

A Diagnosis Center – *Centro de Diagnóstico Arturo Matte*—provides lectures to students that lag behind at each of the schools in the network. These are reinforcement lectures in addition to the regular class schedule.

5. *Data driven decision making in schools*

SIP schools undertake continuous and systematic evaluations of their students beginning with a diagnostic test at the start of every school year and then again at the end of the year. This test, designed by SIP's Pedagogical Department, provides the necessary information to

assess the strengths and weaknesses of students' learning. The information is shared with teachers who can change the focus and content of their lectures according to the specific needs of the students. Subject advisors --internal or external teachers appointed by the Pedagogical Department-- provide extra support to teachers and classes that need reinforcement according to the evaluations performed. The tests results are also used to identify the areas which students that lag behind need to strengthen, and for teachers to talk to parents and ask them for support and extra involvement. The information is further used to identify the more advanced students who can benefit from special workshops.

In summary, schools' academic actions are based on the information gathered from these periodic evaluations.

b. SIP's "neighbors"

1. Principals

There is wide heterogeneity in terms of how long the school director has been in place and the way the post was filled. In most cases, the owner or the municipality directly appointed the director; in only three out of fifteen cases the principal reports having competed for the post. In many private voucher schools, the director is the owner herself or a relative. In about half the cases, the director knew the school before taking charge, most commonly working as a teacher.

All interviewed directors have teaching experience -- although not all of them have a university degree-- and a long trajectory in the educational system, many times in charge of the Academic Unit (*Unidad Técnico Pedagógica* or UTP). Two thirds report having

advanced studies or formal training in management. Some of them report advanced studies in the management of educational institutions.

In most cases, the directors do not have the power to choose the directive team that works with him or her. Contrary to principals at SIP, they cannot appoint or dismiss teachers. It's either the municipality or the owner of the school who takes the decisions.

Most principals report having control over the definition of teaching methodologies. Only four state that this is a process done jointly within the school or discussed with external authorities, such as a *Fundación* or the municipality.

When they have control over financial resources, it happens in a very limited manner. They mention as examples the resources from renting a snack bar or classrooms, which most likely represent a very small share of all resources available at the school level. Whenever they refer to the use of resources, they address school maintenance. That is, as opposed to SIP schools, directors at these schools do not tend to have financial autonomy.

We also asked school directors to describe their typical working day. All start the day receiving teachers and students and checking that all classes develop normally. Some also state that they check whether the school is clean. Some follow up over the break or at students' lunch time. They all state they spend a portion of the day talking to parents, in particular those of children that have "critical behavior" and to those of children that arrive late in a systematic manner. In many times, they state that discipline is the principal's responsibility. All spend time at meetings -- held mostly outside the school--, and filling out reports and surveys mainly sent out by the Ministry. Some teach. All seem to feel that everyday overall supervision depends upon the director. But some do not seem to like this

task. One director states “This is the part of the job I like the least. I used to have a very dynamic job: creating material, working with teachers,... but now the job is mainly about meeting people to make sure things actually work”. It is interesting to note that only one of the interviewed schools has an under-director, so directors may feel they do not have someone on whom they can delegate a number of tasks.

All coincide with respect to the importance of the UTP coordinator and of the tasks assigned to him or her. According to the responses of the directors, this person is in charge of the supervision, the organization, and evaluation of the pedagogical activities. All UTP coordinators seem to work closely with teachers, revising their material, tests, and results. All directors assign a crucial role to this unit. One director states that “the UTP coordinator is the engine of the school in terms of learning and performance”. In a number of cases, this person also teaches, and is in charge of talking to the parents of children who are not performing as expected, in particular those at risk of repeating a grade.

We also inquired about whether they feel their directing team is special, and if so, how is it different from other teams at other schools. Almost all respond that their school is characterized by a good organizational climate, a climate you do not find in any school. Directors seem to feel they have good organizational skills and believe that a good climate is crucial to getting things done. “Organizational climate is more important than methodologies; things do not work if there is no commitment,” as one states. They talk about trust, frankness and loyalty as values worth investing on: “we have no quarrels, everything is stated clearly and frankly, and nobody seems offended,” says another.

Three school directors also state that they are different because their main goal is to attend the needs of the students. In all these cases, they say that although the children at their school are poor and live in aggressive environments, their goal is to make children believe in themselves, and to give them the skills and tools they need to overcome poverty. Two directors state that an additional goal is to make children feel protected and taken care of within the school.

Finally, one director states that their school is different because its main goal is to teach values and a way of life -- fraternity, respect and laboriousness. Another director states that they are different because they care about extracurricular activities, and that they would like the children they serve to excel in sports, music and other areas.

These answers strike as quite different to SIP's stated objectives and method, such as learning, a common methodology, discipline, and evaluation.

2. *Teachers*

Almost all directors state that teachers' absenteeism rates are extremely low. Teachers do not go to work only when one of their children or themselves is sick. One director points out at this fact as a signal of the commitment teachers have with their job. However, in three cases, the director says that absenteeism rates are high –even up to 20%. Similar to their counterparts, they interpret these high rates as teachers who do not care much about the educational project.

In almost all interviewed schools, teachers receive a fixed income, according to the minimum payment scheme all Chilean teachers in the public sector must receive. This is

another source of differences with SIP schools, where incentive payment schemes are in place. One director states that “we are against monetary incentives, because they generate a competitive environment and tension among the professionals in the school”. On the contrary, in 4 out of the 15 schools, teachers are eligible to receive a bonus related to their effort and performance within the school. One of the directors believes that these bonuses play a key role: “if we play the market game, we have to fight in order to attract good teachers.” In one case, the bonus consists of a plane ticket to travel to another Chilean city.

In all schools, a number of teachers have followed training and specialization courses, some paid by the schools. They mention on-line courses provided by Chilean universities, summer sessions and training courses given at the Ministerial level. A number of teachers in some schools have followed post graduate studies.

Only two school directors respond that there is ongoing and continuous training for at least some teachers, as opposed to the training that teachers at SIP are systematically exposed to. Some say that neither the school nor the teachers can afford to pay for these training activities. In four schools, directors interpret their within school meetings and discussions as “self-perfecting” activities. Two schools receive external help (from the *Corporación* or *Fundación* that sustains the school) to work with teachers on their pedagogical practices. This is valued: “it has been a good tool, to have someone come from outside to help, and not from within the school”.

Another source of differences with respect to SIP schools is teachers’ performance evaluation. All “neighbor” schools evaluate their teachers, but not all of them follow a formal evaluation procedure. Some rely on the ministerial or municipal evaluations, or on

procedures adopted from external institutions. Some have plans for creating formal mechanisms. One director states that they cannot put forward an evaluation method that has not been agreed upon with teachers. In that particular school, the director says that the evaluation process within the school is not mandatory. In the same line, another director states that “we are all reluctant to being evaluated based upon a guideline”. So evaluations are subjective, on the basis of the director’s observations and given out to the teachers through conversations.

3. *Students*

Most students attending these schools were enrolled at the preschool level. In contrast to most Matte schools, about half of the principals indicate that there is excess supply and so there is no need for admission policies. Schools that do need to select, tend to admit students on a “first in-first served” basis. At most, families are interviewed. Only one school performs admission tests to higher level students. Most admit students that were expelled from other schools no matter the reason of expulsion, e.g., behavioral or academic problems.

Very few students leave the school, mainly because they moved to another municipality or they switched to a secondary level school. Some smaller children move looking for a school that offers after-school programs where they can be taken care of while parents work.

Principals tend to describe their students as coming from middle to low income families, with parents who have achieved very little formal education. They call into attention that there is a significant rate of children living with single mothers, who in turn work a lot and

have little time to take care of their children or to help them out with their school work. Some say they serve highly vulnerable children who live in families with problems of alcoholism and violence. Some also say that the education of children is not a priority within the households. Still, the principals say they are able to identify parents that care the most for their children. They indicate that those are the best students, who work on their homework, and whose parents attend meetings and are involved in the school's activities.

Whenever a student lags behind, all principals state that either the teacher or the principal talks to the parents to ask for help. Only a handful of schools have access to psychological and pedagogical resources; even one receives help from young volunteers who take care of these students. In one school, these students are evaluated using a lower standard.

Therefore, the method and resources devoted to leveling students that lag behind is another source of differences with SIP schools.

Student behavior is recorded in order to inform parents and to supply personality reports, but, as opposed to some SIP schools, students are not expelled on the basis of behavioral problems.

There is dispersion on student attendance rates, some with rates as high as 95%. Some use rewards at the child or at the classroom level, such as grade bonuses or admission tickets to the movies, as a way to motivate attendance. Others punish low attendance rates and late arrivals with extended hours, notices to parents and extra work.

Parental attendance to meetings varies most widely. Most record a 70 to 85% rate, being highest among the lower grades and at the beginning of the school year. However, one principal states that the rate drops to even below 20% over the school year.

4. Teaching and evaluation methods

Most principals are able to identify a specific methodology, although in sharp contrast to SIP's approach, many state the teachers are free to teach the way they feel most comfortable. Many have adopted the guidelines created by the Ministry of Education.

All schools permanently evaluate the performance of their students. However, half the schools only use the tests that routinely each teacher uses to grade the achievement of their students, having no systematic evaluations that allow for comparisons across classrooms and over time. Another group uses grade by grade evaluations up to 4 times a year, allowing for a comparison across classrooms within a given level. In two cases the tests are performed and developed by external institutions, typically hired at the municipal level. These evaluation approaches are also in sharp contrast with SIP, where systematic and common evaluations are performed on a routinely basis.

Whenever grade level tests are used, the goal is to determine whether the minimum advancement required by the Ministry has been reached. They are also used to identify students that are lagging behind and to determine the areas in which general reinforcement is needed.

5. Their knowledge and opinion about SIP schools

All of them know the existence of these schools. Many say they do not know them in detail, but many of them talk about the school for which they have been chosen as a comparison; i.e., they have an idea about which school in SIP they compete against.

There are heterogeneous responses with respect to what they think of SIP schools. Some of them admire the way they work and the results they achieve. They refer to student discipline and rigor as something worth mentioning. A director also states that SIP schools have been coherent over time, having applied systematically the same methodology since their foundation.

However, in a number of cases, school directors describe SIP schools as too rigid, allowing for only one type of teaching approach. They describe them as hierarchical, vertical, and with little room for teachers' participation and opinion. A director states that SIP schools put a lot of pressure on teachers, who actually feel afraid of not conforming. One director, though, states that teachers at SIP schools work in systematic manner, a skill that is lacking at his own school.

When asked about why SIP students perform better than students in many other schools, most of them point at resources. More than half believe that SIP's superior results are due to the selection of the students, not only when they enter the school, but also along the way. Some also say that students at SIP come from more advantaged socio-economic backgrounds, whereas others state that SIP schools have plenty of resources to train their teachers in a continuous manner. One director states that SIP directors have teams to work with, whereas in her school the directors and UTP coordinators are on their own. Finally, one school director states that SIP schools perform better not because of better students or resources, but because they put more effort into the task of teaching children.

Two directors of municipal schools also point out at the flexibility that private sector schools enjoy also allows SIP schools to dismiss bad teachers. Municipal schools are

banned from doing so due to the Teachers' Statute that regulates labor contracts in the educational market. One of these directors also states that SIP schools use open competitions to hire teachers, instead of informal hiring channels.

V. Concluding remarks

Can low income children achieve good academic results? Indeed they can. In this paper, we have shown that SIP students perform much better in national standardized tests than students at other similar schools even after correcting for observables and selection on measured variables. That is, the observed differences in students' performance cannot be not fully explained by family socioeconomic background, teachers' experience or resources within the school. Moreover, SIP students display a lower level of heterogeneity in results, perhaps due to their method for leveling children whose learning lags behind.

In order to better understand the unobserved characteristics of schools that might explain our results, we performed a number of interviews gathering qualitative information.

Although our interviews do not pin point to one key aspect that makes the full difference, we can say we observed differences in:

- Method of selection of directors and teachers
- Tasks and autonomy assigned to directors
- Directors autonomy to hire and fire teachers
- Academic performance of students as the main goal, with an emphasis on the directive team's role towards learning over administrative tasks.
- Clear and shared methodology

- Team work and collaboration between teachers and directors; sharing of the best practices
- Presence of an under director
- Systematic evaluation of teachers and students; actions taken based on the information gathered
- Incentive pay and the recognition of the best evaluated teachers
- Continuous training of teachers
- Strategies and resources devoted to leveling children that lag behind
- Possibility of exploiting economies of scale, in particular through the Pedagogical Department

Some of these strategies have been already described in the literature as relevant for success. For instance, the literature review in Barber and Mourshed (2007) points at the quality of teachers, which is informed thorough evaluation processes. Training and learning from peers are also emphasized as means for improving the quality of teachers. Moreover, Välijärvi et al (2002 and 2007) suggest that the leveling of lagging students is a strategy that helps all children in the classroom.

It is worth noting that some of the low performing schools do implement a number of these strategies. This suggests that there are characteristics that also matter but that are not fully captured by our interviews. These may include the intensity and perseverance in the application of these strategies, their coherence and how strongly are they shared by teachers, staff, parents and children. Still, having children's learning as a central and shared

goal -- a goal that for a long period of time has driven the school community's efforts-- seems to best summarize what makes SIP schools special.

Alternatively, it could be argued that SIP's results are, at least in part, driven by the fact that it is a network of schools and that many of the practices that make it successful are too expensive for stand-alone schools. However, public/municipal schools also constitute a network with a central management at the municipal level that can take advantage of economies of scale. Nevertheless, they have significantly lower academic outcomes than SIP schools. Indeed, it could be interesting for public/municipal schools to replicate the model of this successful network of Chilean voucher schools.

The main result of this paper, though, is that schools that successfully serve low income students do exist. The success of these schools does not hinge on a better access to resources or selection, but on a number of strategies that if systematically applied, might improve the performance of students attending low achievement schools.

References

- Anand, P., Mizala, A. and Repetto, A. (2009). Using school scholarships to estimate the effect of private education on the academic achievement of low income students in Chile”, *Economics of Education Review*, 28, 370-381.
- Angrist, J. D., Bettinger, E., Bloom, E., King, E., and Kremer, M. (2002). Vouchers for private schooling in Colombia: Evidence from a randomized natural experiment. *American Economic Review*, 92(5), 1535-1558.
- Auguste, S. and Valenzuela, J.P. (2003). ”Do students benefit from school competition? Evidence from Chile”, Mimeo, University of Michigan.
- Barber, M. and Mourshed, M. (2007) “How the World’s Best-Performing School Systems Come-Out on Top”, McKinsey & Company.
- Bellei, C., Muñoz, G., Pérez, L. M. and Raczynski, D.(2004). *¿Quién dijo que no se puede? Escuelas Efectivas en Sectores de Pobreza*, UNICEF.
- Card, D., and Krueger, A. (1996). “School Resources and Student Outcomes: An Overview of the Literature and New Evidence from North and South Carolina.” *The Journal of Economic Perspectives* 10(4): 31–50.
- Coleman, J., Campbell, E., Hobson, C., McPartland, J. Mood, A., Weinfield, F., and York, R. (1966) *Equality of Educational Opportunity*, Washington, D.C.: US Government Printing Office.
- Crump, R. K., Hotz, V. J., Imbens, G. W and Mitnik. O. A. (2009). “Dealing with Limited Overlap in Estimation of Average Treatment Effects” *Biometrika* 96:187-199.
- Dehejia, R.H, and S. Wahba (2002), “Propensity Score Matching Methods for Non-Experimental Causal Studies,” *Review of Economics and Statistics*, Vol. 84(1): 151-161.
- Emsley, E., M. Luna, A. Pickles and G. Dunn (2008). “Implementing double-robust estimators of causal effects,” *Stata Journal*, Vol. 8(3), pages 334-353.
- Eyzaguirre, B. and Fontaine, L. (2008), “Las Escuelas que Tenemos”, Puntos de Referencia, *Centro de Estudios Públicos* 299, October.
- Fiszbein, A. and Psacharopoulos, G. (1995) “Income Inequality Trends in Latin America in the 1980s,” in N. Lustig (ed.) *Coping with Austerity: Poverty and Inequality in Latin America*, The Brookings Institution, Washington, D.C.

- Fuller, B. (1990). "Raising school quality in developing countries: What investment boost learning? World Bank Discussion Paper N°76, Washington DC, World Bank.
- Fuller, B. and Clarke, P. (1994) "Raising schools effects while ignoring culture, local conditions and the influence of classroom tools, rules and pedagogy", *Review of Educational Research*, 64(1), 119-157.
- Gallego, F. (2002). "Competencia y Resultados Educativos: Teoría y Evidencia para Chile." *Cuadernos de Economía* 39(118): 309-352.
- Gallego, F. (2006). "Voucher-school competition, incentives and outcomes: evidence from Chile". Mimeo Department of Economics, MIT.
- Gallego, F. and Hernando, A. (2008). "School Choice in Chile: Looking at the Demand Side", *Economia, The Journal of LACEA*, Spring.
- García, C. and Paredes, R. (2006). "Reducing the Educational Gap in Chile: Good Results in Vulnerable Groups". Mimeo Escuela de Ingeniería, Universidad Católica de Chile.
- Hanushek, E. (1989). "The impact of differentials expenditures on school performance". *Educational Researcher* 18(4), 45-51.
- Hanushek, E. (1995). "Interpreting recent research on schooling in developing countries" *The World Bank Research Observer* 10(2), 227-246.
- Hanushek, E. (1997). "Assessing the effects of school resources on student performance: An update" *Educational Evaluation and Policy Analysis* 19(2), 141-164.
- Heckman, J.J., H. Ichimura, and P. Todd (1997), "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Program," *Review of Economic Studies* 64: 605-654.
- Heckman, J., Tobias, J., Vytlačil, E. (2001). "Four parameters of interest in the evaluation of social programs. *Southern Economic Journal* 68 (2), 210–223.
- Hirano, K., Imbens, G. and G. Ridder (2003). "Efficient Estimation of Average Treatment Effects Using the Estimated Propensity Score," *Econometrica*, Vol. 71(4), 1161–1189.
- Hsieh, C., and Urquiola, M. (2006). "The effects of generalized school choice on achievement and stratification: evidence from Chile's school voucher program", *The Journal of Public Economics* 90, 1477-1503.
- Imbens, G.W. (2004). "Nonparametric estimation of average treatment effects under exogeneity: a review." *Review of Economics and Statistics*, Vol 86(1): 4–29.
- Imbens, G.W. and J. Wooldridge (2009), "Recent Developments in the Econometrics of Program Evaluation" *Journal of Economic Literature*, 47(1): 5–86.
- Lara, B., A.Mizala and A.Repetto (2009), "The Effectiveness of Private Voucher Education: Evidence from Structural School Switches", CEA Working Paper, University of Chile.

- Mackenna, C. (2006). “Desempeño relativo entre escuelas y selección de alumnos en Chile: La red SIP como un punto de referencia del sistema subvencionado” BA Thesis, Pontificia Universidad Católica de Chile.
- Martin, M.O., Mulis, I.V.S. and Chrostowski, S.J. (2004). *TIMSS 2003 Technical Report*, Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- McEwan, P.J. (2001). The effectiveness of public, catholic, and non-religious private schools in Chile’s voucher system. *Education Economics* 9(2), 103-128.
- Mizala, A. and Romaguera, P. (2000). “School performance and choice: the Chilean experience”, *Journal of Human Resources*, 35(2), 392-417.
- Mizala, A. and Romaguera, P. (2001). “Factores socioeconómicos explicativos de los resultados escolares en la educación secundaria en Chile”, *El Trimestre Económico* 68(4), 515-549.
- Mizala, A. and Romaguera, P. (2005). “*Calidad de la Educación Chilena: el Desafío de la Próxima Década*”, en P.Meller (ed.) *La Paradoja Aparente*, Taurus, Santiago, Chile.
- OECD (2004), *Messages from Pisa 2000*, OECD.
- OECD (2009). *Education at a Glance 2009*, OECD
- Pérez, M. and Socias, M. (2008) “Highly successful schools: what do they do differently and at what cost?”. *Education Finance and Policy* vol 3(1), 109-129.
- Raczynski, D. and Muñoz, G. 2005. *Efectividad Escolar y Cambio Educativo en Condiciones de Pobreza en Chile*” Ministerio de Educación de Chile.
- Robins, J. M., and Y. Ritov (1997). “Toward a Curse of Dimensionality Appropriate (CODA) Asymptotic Theory for Semi-parametric Models”, *Statistics in Medicine*, Vol. 16(3): 285–319.
- Robins, J. M., and A. Rotnitzky (1995). “Semiparametric Efficiency in Multivariate Regression Models with Missing Data.” *Journal of the American Statistical Association*, Vol. 90(429): 122–29.
- Robins, J. M., A. Rotnitzky, and L. P. Zhao (1995). “Analysis of Semiparametric Regression Models for Repeated Outcomes in the Presence of Missing Data.” *Journal of the American Statistical Association*, Vol. 90(429): 106–21.
- Rosenbaum, P.R., and D.B. Rubin (1983), "The Central Role of the Propensity Score in Observational Studies for Causal Effects," *Biometrika* 70: 41-55.
- Rubin, D.B. (1974). “Estimating Causal Effects of Treatments in Randomised and Non-Randomised Studies.” *Journal of Educational Psychology*, Vol. 66(5), 688-701.
- Sapelli, C., and Vial, B. (2002). The performance of private and public schools in the Chilean voucher system. *Cuadernos de Economía*, 118, 423-454.

- Sapelli, C. and Vial, B. (2005). Private vs public voucher schools in Chile: new evidence on efficiency and peer effects. Working Paper, 289. Instituto de Economía, Catholic University of Chile.
- Väljörvi, J., Kupari, P., Linnakylä, P., Reinikainen and Arffman, I. (2002) *The Finnish success in PISA, and some reasons behind it*. PISA 2000. Institute for Educational Research, University of Jyväskylä.
- Väljörvi, J., Kupari, P., Linnakylä, P., Reinikainen, P., Sulkunen, S., Törnoos, J. and Arffman, I. (2007) *The Finnish success in PISA, and some reasons behind it*. PISA 2003. Institute for Educational Research, University of Jyväskylä.
- Wooldridge, J. (2007). "Inverse Probability Weighted M-Estimation for General Missing Data Problems" *Journal of Econometrics* 141:1281-1301.

**Table 1. Average 2002 4th grade SIMCE Scores by School Type
Metropolitan Region of Santiago, Urban Areas**

	Language		Math	
	Mean	SD	Mean	SD
Public	239.0	51.5	235.5	52.0
Private voucher schools	258.8	52.1	253.6	51.8
Private non-voucher schools	297.2	42.8	295.2	44.4
SIP schools	282.9	42.1	290.6	43.5
All	251.4	53.7	247.4	54.0

Source: SIMCE 2002 database.

Table 2. Descriptive Statistics of Students and Schools by School Type

	SIP	Public	Private voucher	Private non voucher
Number of schools in student's neighborhood	49.27	46.29	59.08	45.72
	19.49	28.92	31.87	25.36
Mother's education in years	12.33	9.80	11.83	15.36
	2.39	3.17	2.93	2.34
Family income (thousands chilean pesos)	266.84	163.13	270.12	1248.73
	197.09	162.91	232.93	607.05
Number of people at home	4.78	5.08	4.82	5.05
	1.62	1.87	1.59	1.58
More than 10 people at home	0.02	0.03	0.02	0.01
	0.13	0.18	0.12	0.11
Attended preschool	0.99	0.96	0.98	1.00
	0.12	0.20	0.14	0.07
Age	9.54	9.67	9.56	9.71
	0.52	0.71	0.59	0.54
Female	0.46	0.48	0.49	0.50
	0.50	0.50	0.50	0.50
Student has a computer at home	0.46	0.15	0.36	0.85
	0.50	0.35	0.48	0.35
Number of books at home	61.25	34.59	53.72	110.77
	61.70	48.47	58.65	78.16
School's enrollment 2002	1176.83	1053.14	1343.30	1026.86
	220.35	728.29	1286.75	669.57
School's resources per student (Ch\$)	27591.87	9679.59	31324.37	
	2567.65	16068.08	7978.73	
Teachers per pupil ratio	0.03	0.04	0.03	0.06
	0.00	0.01	0.02	0.03
Teacher's experience in years	23.78	22.78	16.64	17.46
	7.75	9.98	10.03	9.21
Number of observations	849	19281	22921	6806

Source: SIMCE 2002 database.

Table 3. Propensity Score Before and After Trimming

	SIP vs. Public schools		SIP vs. Private voucher schools		SIP vs. Private non voucher school	
	Before	After	Before	After	Before	After
N schools in student's neighborhood	0.002 (0.008)	2.68E-04 (0.010)	-0.007 (0.008)	0.005 (0.018)	-0.014 (0.015)	-0.006 (0.017)
Mother's education	0.176 *** (0.019)	-0.008 (0.035)	0.084 *** (0.011)	-0.033 (0.038)	-0.074 * (0.040)	-0.065 (0.041)
Family income	4.28E-03 *** (1.39E-03)	2.95E-03 *** (1.13E-03)	1.46E-03 (9.98E-04)	8.66E-04 (2.37E-03)	-4.35E-03 ** (1.86E-03)	4.46E-03 ** (1.90E-03)
Family income squared	-4.17E-06 *** (1.34E-06)	-3.09E-06 *** (9.56E-07)	-1.35E-06 * (7.68E-07)	-2.01E-06 (2.06E-06)	-1.04E-06 (1.42E-06)	-1.41E-05 *** (3.08E-06)
Number of people at home	-0.098 ** (0.046)	-0.052 (0.050)	-0.054 (0.036)	0.049 (0.048)	0.133 * (0.070)	0.136 (0.086)
More than 10 people at home	-0.376 (0.363)	-0.085 (0.558)	-0.320 (0.343)	0.706 (0.523)	0.970 (0.674)	1.107 (0.841)
Attended preschool	0.952 ** (0.48)	0.356 (0.62)	0.492 (0.41)	0.203 (0.67)	0.709 (0.48)	0.454 (0.45)
Age	-0.147 ** (0.059)	-0.019 (0.084)	-0.011 (0.052)	0.115 (0.096)	-0.213 ** (0.091)	-0.096 (0.101)
Female	-0.163 (0.400)	0.099 (0.476)	-0.157 (0.409)	-0.530 (0.352)	0.157 (0.449)	0.157 (0.430)
Student has a computer at home	0.815 *** (0.100)	0.064 (0.194)	0.549 *** (0.098)	0.651 *** (0.117)	-0.028 (0.143)	-0.081 (0.141)
Nº of books at home	0.002 *** (0.001)	0.000 (0.001)	0.002 *** (0.000)	0.002 *** (0.001)	0.001 (0.001)	0.001 (0.001)
School's enrollment 2002	-2.69E-04 (3.02E-04)	-4.16E-04 (4.01E-04)	-8.58E-05 (1.81E-04)	5.64E-04 (5.31E-04)	1.61E-03 * (8.54E-04)	1.94E-03 * (1.10E-03)
School's resources per student	3.56E-05 *** (1.14E-05)	-3.07E-06 (1.02E-05)	-1.08E-04 *** (3.62E-05)	-1.04E-06 (8.04E-05)		
Teachers per pupil ratio	-136.865 *** (38.253)	-13.833 (35.443)	-16.088 (17.046)	35.292 (24.061)	-63.420 *** (18.200)	-52.526 ** (23.407)
Teacher's experience	0.029 (0.024)	-0.013 (0.023)	0.062 *** (0.015)	-0.037 (0.024)	0.071 *** (0.026)	0.065 *** (0.025)
Constant	-1.322 (1.60)	0.051 (1.30)	-2.040 ** (0.92)	-4.232 * (2.50)	2.517 (2.28)	-0.448 (2.41)
Number of observations	22287	1983	25913	1670	8758	1868
Pseudo R ²	0.291	0.021	0.115	0.075	0.656	0.234

Table 4. The Estimated Effect of SIP Education. 4th grade SIMCE scores, 2002

	Language		Math	
SIP vs. Public Schools				
OLS	27.942 (3.203)	***	41.859 (3.403)	***
Matching	30.517 (3.476)	***	42.041 (3.705)	***
IPW	26.132 (2.188)	***	39.824 (2.273)	***
DR	30.617 (2.351)	***	46.741 (2.674)	***
SIP vs. Private Voucher Schools				
OLS	21.643 (3.501)	***	34.951 (2.761)	***
Matching	23.403 (4.700)	***	37.712 (4.589)	***
IPW	20.762 (3.101)	***	34.237 (3.162)	***
DR	13.653 (3.075)	**	24.158 (3.375)	***
SIP vs. Private Non Voucher Schools				
OLS	15.052 (3.838)	***	26.160 (4.196)	***
Matching	17.173 (3.230)	***	28.240 (3.198)	***
IPW	14.205 (2.995)	***	25.419 (3.020)	***
DR	16.214 (2.805)	***	26.778 (2.870)	***

Table 5. Characteristics of SIP Schools and its Neighbor Schools

Municipality	Number of SIP schools in municipality	SIP schools mean characteristics					Interviewed Neighbor Schools							
		Mother's years of education	Household's income	Enrollment	Vulnerability Index	Fee (\$)		Mother's years of education	Household's income	Enrollment	Vulnerability Index	Fee (\$)	Ranking in Similarity Index by Municipality	Number of schools in municipality
LA GRANJA	1	14.1	205512	1332	15.7	4825	Public	10.0	102632	419	17.6	0	1	22
LA PINTANA	1	12.4	193333	1124	16.7	3906	Private Voucher	10.4	134756	874	30.1	4057	7	39
RECOLETA	1	13.7	323577	1553	11.2	8070	Private Voucher	11.6	179710	707	33.4	0	3	28
PEDRO AGUIRRE CERDA	1	13.1	201899	1277	13.1	4817	Private Voucher	12.2	173333	298	37.7	1746	1	26
LO ESPEJO	1	12.3	186641	1338	21.4	0	Private Voucher	10.8	139063	953	36.7	998	2	22
QUINTA NORMAL	1	13.0	296429	1215	14.5	5912	Public	10.9	158333	1146	41.4	0	3	22
SAN RAMON	1	12.2	149206	1139	31.0	0	Private Voucher	11.3	158974	344	41.7	0	2	22
INDEPENDENCIA	2	13.1	302815	1223	14.8	6443	Private Voucher	12.7	268182	153	19.8	5250	1	18
							Public	12.0	178125	956	22.5	0	4	
SANTIAGO	4	13.8	258761	944	15.2	6358	Private Voucher	13.0	249342	653	12.0	6755	1	32
							Public	14.4	286250	702	12.3	0	8	
							Public	13.2	250000	529	20.8	0	15	
							Private Voucher	10.6	178846	269	31.6	0	30	
RENCA	2	10.9	169963	1157	33.3	0	Private Voucher	11.2	225000	635	36.0	2819	2	28
							Private Voucher	11.2	164615	656	38.5	2195	3	

Figure 1. Math and Language 4th grade SIMCE Test Scores Distributions, 2002

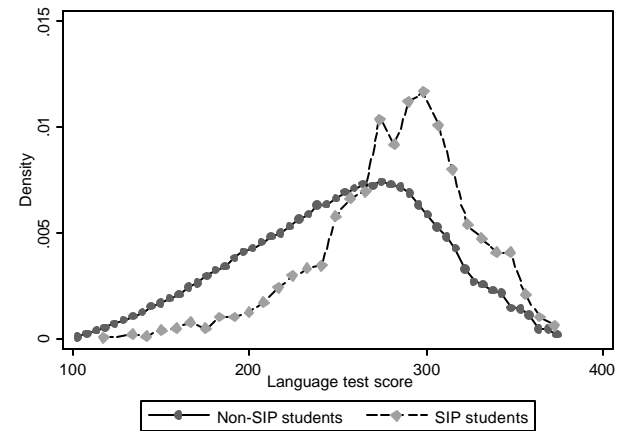
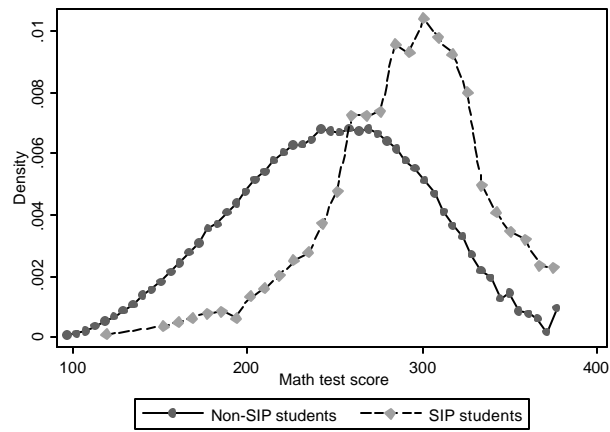


Figure 2. Math and Language 4th grade SIMCE Test Scores Distributions by School Type, 2002

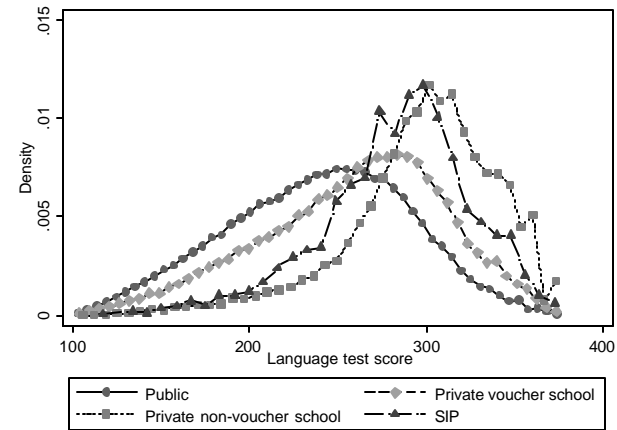
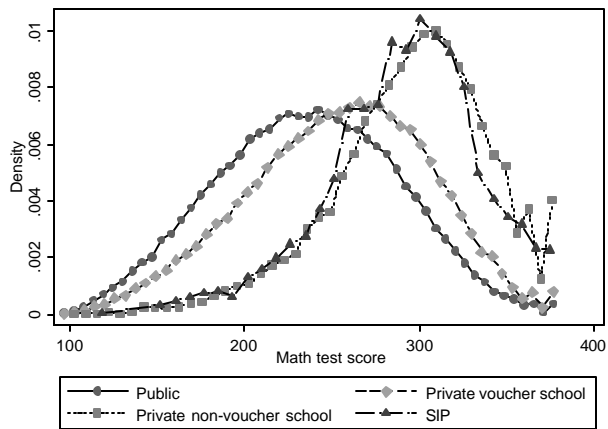
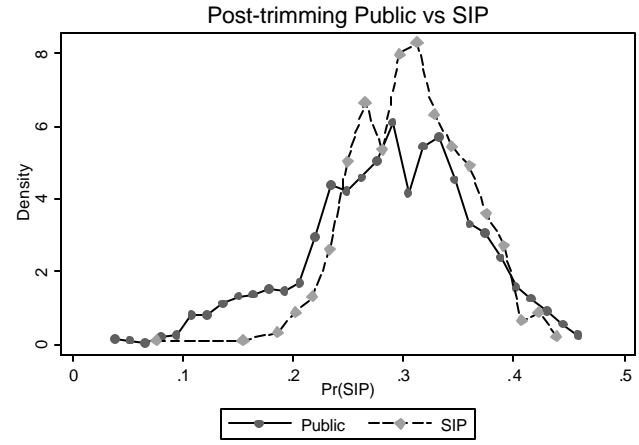
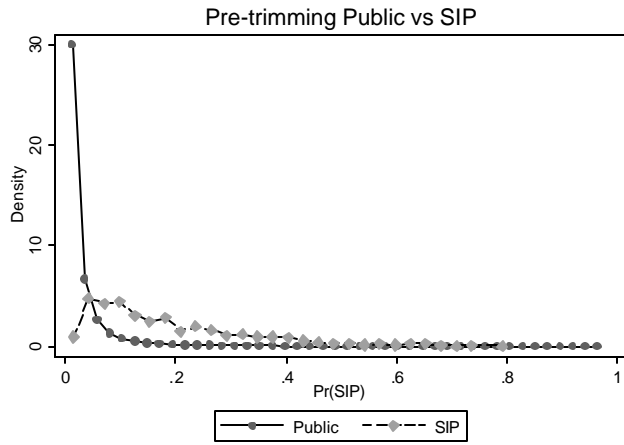
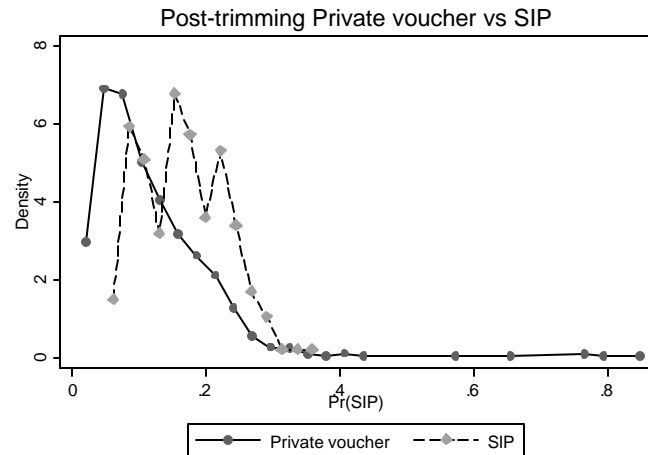
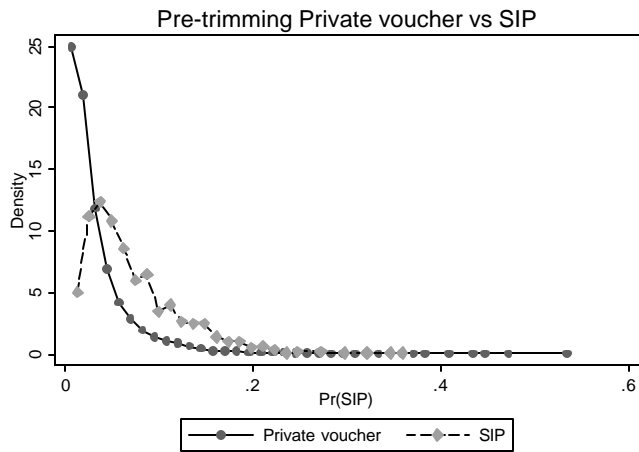


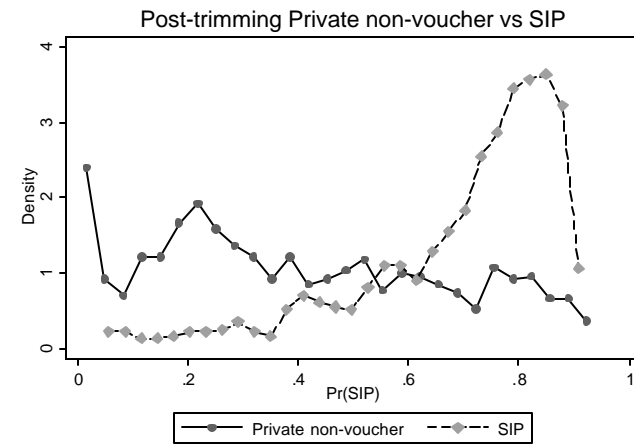
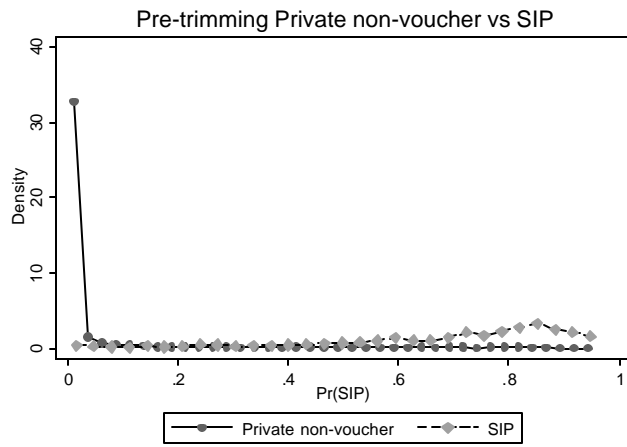
Figure 3. Propensity Score Distributions
a. SIP vs. Public Schools



b. SIP vs. Private Voucher Schools



c. SIP vs. Private Non Voucher Schools



Appendix

Table A.1. Description of Variables Used (all schools)

Name of Variable	Description	Source
Student characteristics		
SIMCE math score	Student's score on the math section of the SIMCE	SIMCE database
SIMCE language score	Student's score on the language section of the SIMCE	SIMCE database
Female	1 if the student is female, 0 if male	Parental questionnaire
Mother's education	Number of years of education of the student's mother	Parental questionnaire
Income (Thousand \$)	Family income divided by 1,000 pesos	Parental questionnaire
Age	Age of the student	Parental questionnaire
Attended preschool	1 if the student attended preschool, 0 if not	Parental questionnaire
Number of people at home	Number of people living at home	Parental questionnaire
Computer resources at home	1 if yes, 0 if not	Parental questionnaire
Number of books at home	Number of books at home	Parental questionnaire
School characteristics		
Enrollment	Enrollment of school	Min. Of Educ.
Teacher's Experience	Average of years of teaching experience at the school	Min. Of Educ.
Per Pupil Teacher	Enrollment of school divided by number of teachers	Min. Of Educ.
# of schools in school's neighborhood	Number of schools in the school's neighborhood	SIMCE database
Per pupil resources of the school	Amount spent per pupil (includes school and state resources)	Min.of Educ. and Under-secret. of Reg.Develop.

Appendix: Interview guideline

1. General

1. Are there specific pedagogical methods can you identify within your school?
2. Do you take tests to follow your student's achievement? If so, how is the information gathered used?
3. Are there remedial actions taken towards students with low achievement? Which?
4. Do you follow students discipline and behavior? How? Do you write personality reports?

2. About the principal and the directive team

5. How many years of experience do you have as a principal?
6. How did you become a principal?
7. Do you have any special and/or formal training in school management?
8. How were the other directive positions filled?
9. Do you have autonomy in (1) the appointment of your subordinates, (2) pedagogical methodologies and (3) use of financial resources?
10. Which are the main duties you have as a principal? How do you distribute your time?
11. Describe the tasks assigned to the director of the UTP, and to the school's under director.
12. Describe the profile of the directive team at your school. What makes your team different from the rest of the system?
13. Do you know any SIP school in your neighborhood? What do you know about them? (*Only for non-SIP principals*)
14. How do you describe a SIP's principal and how is him or her different from the rest? (*only for SIP principals*)
15. Can you mention the differences and similarities between your school and SIP schools? (*Only for non-SIP principals*)

3. About teachers

16. What is the absenteeism rate of your teachers? What are the reasons for absenteeism?
17. How do you evaluate your teachers? Who evaluates them?
18. Describe the teachers' compensation scheme? Is it fixed or variable? Under what criteria are variable earnings distributed?
19. Describe the education level achieved by the school's teachers? (college, graduate, internships, etc.)
20. Is there a continuous training system for teachers? Describe it.
21. Can you mention the differences and similarities between your school's teachers and SIP's teachers? (*Only for non-SIP principals*)

4. About the students and their families

22. What is the absenteeism and late arrival rates of your students?
23. How do you deal with late arrivals?
24. What is the attendance rate of parents to parental meetings?
25. Do parents participate in addition to school meetings?
26. How many students on average have attended preschool?
27. Do some students abandon this school? Why?
28. Where do new students come from? Why did they choose your school?
29. Are there extra-curricular opportunities for parents?
30. How do you identify involved and motivated parents?
31. Can you mention the differences and similarities between your school's students and SIP's students? (*Only for non-SIP principals*)

5. About the school

32. Is the number of applicants greater than the available enrolment?
33. Does the school need to select student in pre-school or first grade?
34. If the previous answer is yes, which criteria does the school use to select?
35. Which criteria does the school use to select students in upper level grades?

**Centro de Economía Aplicada
Departamento de Ingeniería Industrial
Universidad de Chile**

2009

258. **Effective Schools for Low Income Children: a Study of Chile's Sociedad de Instrucción Primaria**
Francisco Henríquez, Alejandra Mizala y Andrea Repetto
257. **Public-Private Partnerships: when and how**
Eduardo Engel, Ronald Fischer y Alexander Galetovic

2008

256. **Pricing with markups in industries with increasing marginal costs**
José R. Correa, Nicolás Figueroa y Nicolás E. Stier-Moses
255. **Implementation with renegotiation when preferences and feasible sets are state dependent**
Luis Corchón y Matteo Triossi
254. **Evaluación de estrategias de desarrollo para alcanzar los objetivos del Milenio en América Latina. El caso de Chile**
Raúl O'Ryan, Carlos J. de Miguel y Camilo Lagos
253. **Welfare in models of trade with heterogeneous firms**
Alexandre Janiak
252. **Firm-Provided Training and Labor Market Policies**
Felipe Balmaceda
251. **Emerging Markets Variance Shocks: Local or International in Origin?**
Viviana Fernández y Brian M. Lucey
250. **Economic performance, creditor protection and labor inflexibility**
Ronald Fischer
249. **Loyalty inducing programs and competition with homogeneous goods**
N. Figueroa, R. Fischer y S. Infante
248. **Local social capital and geographical mobility. A theory**
Quentin David, Alexandre Janiak y Etienne Wasmer

247. **On the planner's loss due to lack of information in bayesian mechanism design**
José R. Correa y Nicolás Figueroa

246. **Política comercial estratégica en el mercado aéreo chileno**
Ronald Fischer

245. **A large firm model of the labor market with entry, exit and search frictions**
Alexandre Janiak

244. **Optimal resource extraction contracts under threat of expropriation**
Eduardo Engel y Ronald Fischer

2007

243. **The behavior of stock returns in the Asia-Pacific mining industry following the Iraq war**
Viviana Fernandez

242. **Multi-period hedge ratios for a multi-asset portfolio when accounting for returns comovement**
Viviana Fernández

241. **Competition with asymmetric switching costs**
S. Infante, N. Figueroa y R. Fischer

240. **A Note on the Comparative Statics of Optimal Procurement Auctions**
Gonzalo Cisternas y Nicolás Figueroa

239. **Parental choice and school markets: The impact of information approximating school effectiveness**
Alejandra Mizala y Miguel Urquiola

238. **Marginal Cost Pricing in Hydro-Thermal Power Industries: Is a Capacity Charge Always Needed?**
M. Soledad Arellano and Pablo Serra

237. **What to put on the table**
Nicolas Figueroa y Vasiliki Skreta

236. **Estimating Discount Functions with Consumption Choices over the Lifecycle**
David Laibson, Andrea Repetto y Jeremy Tobacman

235. **La economía política de la reforma educacional en Chile**
Alejandra Mizala

234. **The Basic Public Finance of Public-Private Partnerships**
Eduardo Engel, Ronald Fischer y Alexander Galetovic
233. **Sustitución entre Telefonía Fija y Móvil en Chile**
M. Soledad Arellano y José Miguel Benavente
232. **Note on Optimal Auctions**
Nicolás Figueroa y Vasiliki Skreta.
231. **The Role of Outside Options in Auction Design**
Nicolás Figueroa y Vasiliki Skreta.
230. **Sequential Procurement Auctions and Their Effect on Investment Decisions**
Gonzalo Cisternas y Nicolás Figueroa

2006

229. **Forecasting crude oil and natural gas spot prices by classification methods**
Viviana Fernández
228. **Copula-based measures of dependence structure in assets returns**
Viviana Fernández
227. **Un Análisis Econométrico del Consumo Mundial de Celulosa**
José Ignacio Sémbler, Patricio Meller y Joaquín Vial
226. **The Old and the New Reform of Chile's Power Industry. (Por aparecer en el International Journal of Global Energy Issues (forthcoming 2007)).**
M. Soledad Arellano
225. **Socioeconomic status or noise? Tradeoffs in the generation of school quality information. (Por aparecer en el Journal of Development Economics).**
Alejandra Mizala, Pilar Romaguera y Miguel Urquiola.
224. **Mergers and CEO power**
Felipe Balmaceda
123. **Task-Specific Training and Job Design.**
Felipe Balmaceda
122. **Performance of an economy with credit constraints, bankruptcy and labor inflexibility**
Felipe Balmaceda y Ronald Fischer

121. **Renegotiation without Holdup: Anticipating spending and infrastructure concessions**
Eduardo Engel, Ronald Fischer y Alexander Galetovic
220. **Using School Scholarships to Estimate the Effect of Government Subsidized Private Education on Academic Achievement in Chile**
Priyanka Anand, Alejandra Mizala y Andrea Repetto
219. **Portfolio management implications of volatility shifts: Evidence from simulated data**
Viviana Fernandez y Brian M Lucey
218. **Micro Efficiency and Aggregate Growth in Chile**
Raphael Bergoeing y Andrea Repetto

2005

217. **Asimetrías en la Respuesta de los Precios de la Gasolina en Chile**
Felipe Balmaceda y Paula Soruco
216. **Sunk Prices and Salesforce Competition**
Alejandro Corvalán y Pablo Serra
215. **Stock Markets Turmoil: Worldwide Effects of Middle East Conflicts**
Viviana Fernández
214. **The Competitive Role of the Transmission System in Price-regulated Power Industries**
M. Soledad Arellano y Pablo Serra
213. **La Productividad Científica de Economía y Administración en Chile. Un Análisis Comparativo (Documento de Trabajo N° 301. Instituto de Economía, Pontificia Universidad Católica de Chile)**
Claudia Contreras, Gonzalo Edwards y Alejandra Mizala
212. **Urban Air Quality and Human Health in Latin America and the Caribbean**
Luis A. Cifuentes, Alan J. Krupnick, Raúl O’Ryan y Michael A. Toman
211. **A Cge Model for Environmental and Trade Policy Analysis in Chile: Case Study for Fuel Tax Increases**
Raúl O’Ryan, Carlos J. de Miguel y Sebastian Millar
210. **El Mercado Laboral en Chile Nuevos Temas y Desafíos**
Jaime Gatica y Pilar Romaguera

* Para ver listado de números anteriores ir a <http://www.cea-uchile.cl/>.