Equity and Achievement in the Chilean School Choice System

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Abstract

The aim of this paper is to analyze student achievement and equity in the social distribution of achievement across school sectors in the Chilean educational system, where a nation-wide school choice program has been implemented for more than 20 years. Using data from a standardized achievement test, which includes the entire population of 4th grade students and schools of the country, we investigate the association between students' socioeconomic status and achievement, within and between schools. We also investigate up to what extent different categories of schools enjoy advantages in educating low-income students.

Introduction

A school choice system exists when governments make payments directly to families that permit them to select the school, private or public, of their choice. These payments can be made directly to the family or indirectly to the school of their choice. The purposes are to increase parental choice, to promote school competition and to allow low income family access to private schools.

The assumption is that all parents would sort themselves into different schools based on their preferences, creating the conditions for the development of effective school communities, which would in turn deliver a high quality education. However, in practice the issue of stratification cannot be put aside lightly. In fact, it represents one of the central issues in the debate over school choice.

This argument almost always carries class and/or race considerations. If more educated parents are the ones that demand more from schools, then choice may lead to stratification, concentrating the children of parents with the best education and the highest socioeconomic status (SES) in a few schools, and leaving those from lower socioeconomic backgrounds in the worst schools (Henig 1994; Levin 1998; Ladd 2002; Ladd and Fiske 2001; Berry, Jacob and Levitt 2000; Hsieh and Urquiola 2002).

The aim of this paper is to analyze student achievement and equity in the social distribution of achievement in the Chilean educational system, where a nation-wide school choice program has been implemented for more than 20 years. The Chilean case is interesting because unlike the limited voucher programs in the US, vouchers in Chile are available to all families, and indeed used by a wide range of families.[1]

As an outcome of the Chilean school choice reform of the early 1980s, three types of schools emerged, public schools, private subsidized schools and private fee-paying schools.

In this paper we intend to look beyond average achievement, also considering inequality in achievement across and within the different types of schools. This research issue is motivated by earlier research findings of Coleman et al (1982 a and b), which suggested that academic achievement had more equitable social distribution in the Catholic

[1] See West (1997), Patrinos (1999) and Gauri and Vadwa (2003) for a review of school choice experiences around the world.

than in the public sector in the U.S., later Raudenbush and Bryk (1986) and Lee and Bryk (1989) further explore this hypothesis. More specifically, we use the results from a standardized achievement test to answer the following questions: (i) Do some types of schools (public, private subsidized and private fee paying) have higher mean achievement than others? Do some kinds of schools demonstrate advantages in educating low-income students? (ii) What is the association between students' SES and achievement by school type? What school characteristics predict the within school relationship between SES and achievement? and (iii) Are there differences between the students-level effects and compositional or contextual effects among the three types of schools?. [2]

To answer the above questions, related to how organizations affect the individuals within them, we use a hierarchical linear model (HLM). In this case we use a two-level HLM, at the first level the units are students (within-school model), and each student's outcome is represented as a function of a set of individual characteristics. At the second level the units are schools (between-school model). The regression coefficients in the level-1 model for each school are conceived as outcome variables that are hypothesized to depend on specific school characteristics.

This methodology explicitly recognizes the clustering of students within schools and allows simultaneous consideration of the effects of school factors, not only on average school achievement but also on structural relationships within schools. An example of a structural relationship within a school is the association between students' socioeconomic level and students' achievement, i.e., the equity in the social distribution of achievement. The strength of this relationship may vary from school to school and this variation can be explained on the basis of the schools' characteristics. The HLM model permits a separation of within-school from between-school phenomena, and allows the decomposition of students-level effects and compositional or contextual effects (Bryk and Raudenbush, 1992; Seitzer 1995; Raudenbush and Bryk 1986; Lee and Bryk 1989; Alexander, Fennessey, McDill and D'Amico 1979).

Moreover, the use of HLM makes it possible to approach the conceptual and technical problems that arise when working with multilevel data: (i) aggregation biases, which result from variables that have different meanings at the different levels at which the

[2] Compositional effects occur when the aggregate of a person-level characteristic is related to the outcome even after controlling for the effect of the individual characteristic.

data are generated; (ii) misestimated standard errors, which reflect the failure to take into account the dependence among students responses within the same school; and (iii) heterogeneity of regression, which occurs when the relationships between individual characteristics and outcomes vary across schools (Bryk and Raudenbush 1992).

The Chilean Educational System

Beginning in the early 1980s, far-reaching reforms were implemented in the Chilean educational system, involving the decentralization of the public school system and the handing over of school administration to local government authorities (municipalities). The reforms also instituted public financing of private schools through a per-student subsidy mechanism. The per-student subsidy, which is equal value for public and private schools, is intended to cover running costs and, at the same time, generate competition among schools to attract and retain students[3], thereby promoting more efficient, better quality educational services.[4]

A key policy outcome was the creation of a system characterized by three types of schools: fee-paying private schools that operate on the basis of fees paid by parents, which represent 9.5 percent of the enrollment of children and young people; private subsidized schools financed by the per-student subsidy provided by the state, but privately owned and operated, which account for 33.4 percent of enrollment; and public (municipal) schools financed through the per-student subsidy and run by municipalities, which make up 55.6 percent of the enrollment.[5]

There is no restriction on the location of the school the child can attend. Except for the time constraint and safety issues, children can travel free of charge to any part of town to attend the school of their choice. This freedom of choice is smaller for students in primary schools since their families will be less willing to let them travel around the city.

Schools receive income from three sources: the central government, the municipalities and parents. The central government allocates funds to public and private

[3] This is a voucher-type system in which funds are allocated to the school according to their enrollment i.e. according to parents' choices.
[4] This reform also introduced standardized achievement tests; however, test results were only made public in 1995.
[5] The three types of schools together account for 98.5 percent of all enrollments. The remaining 1.5 percent of schools students attend is run by educational corporations linked to business organizations.

subsidized schools (a flat per-student voucher); municipalities transfer resources only to the public schools they manage depending on the local availability of resources; and, parents might contribute in shared-financing private subsidized schools[6] and pay the total cost of education in private fee-paying schools. Elementary municipal schools are forbidden of charging tuition.

Thus, the amount of resources available to schools differs. The fees of private fee-paying schools, where high SES students attend are, about three times the per-student subsidy; whereas, low SES students go to schools where the uniform per-student voucher is the main source of finance. For this reason private fee-paying schools, which have always existed, do not compete with public schools, as their fee is, on average, about three times the per-student subsidy.

Also, it should be noted that the regulations for admitting and expelling students differ between public and private schools. While public schools must admit all their applicants (as long as there are vacancies) and have serious restrictions for expelling students, private subsidized and private fee-paying schools are free to establish their own admission and expulsion policies. In fact, they intensively use selection mechanism such us entrance exams and parental interviews to screen-out students.

As regards job contracts, teachers in municipal schools are governed by special legislation (the Teacher Statute), involving a centralized collective-bargaining process, wages based on uniform pay-scales with special bonuses for training, experience and working under difficult conditions, and with restrictions on dismissal. Private schools (both subsidized and fee-paying) operate as firms, and their teachers come under the Labor Code like all other private-sector workers in the country.[7]

Some of the above features implied a significant socioeconomic stratification between school types. Table 1 shows an estimation of school enrollment by family income deciles and school type, based on CASEN Household Survey for 2000.

[6] There are continuums of private subsidized schools, from those that charge no fees until those which charge around US$ 167 per month. However, some of the private subsidized schools that do not charge fees are church schools or belong to foundations or private corporations, thus they can obtain funds from other sources.

[7] There are certain minimal (labor) contractual rules from the Teacher Statute that are applied to the private sector, such as minimum wages, length of the working day, holidays and severance payments.

(Place table 1 about here)

In 2000, after near 20 years following the implementation of the voucher system, public schools enrollment is concentrated in the poorest families, while the private-subsidized schools served all segments of the population, except high-income students that attend private fee-paying schools. 65.1 percent of public school enrollment came from deciles 1st, 2nd and 3rd, while 69.4 percent of private fee-paying school enrollment came from the 9th and 10th deciles. However, pupils from private subsidized schools are distributed across deciles 1st to 8th in a relatively equitable way, with slightly greater participation among the intermediate deciles.

A number of studies have examined the results obtained by Chilean schools. In general, they all conclude that families' socioeconomic characteristics are statistically significant to explain student performance in the different types of schools. However, when the performance of public and private schools is compared, the studies arrive to contradictory results because of the aggregation level of the data (student vs. school level data), tests considered (year and grade), the size of the school samples, and the methodology used to evaluate school performance.

Using school-level data McEwan and Carnoy (2000) concluded that, on average, non-religious private subsidized schools produce lower academic achievement than public schools, while Catholic private subsidized schools produce higher achievement by spending more money than their non-religious counterpart. Mizala and Romaguera (2000) argue that when sufficient control variables and the whole universe of schools are considered there are no consistent differences in achievement between public and private subsidized schools, similar result is obtained by Bravo, Contreras, and Sanhueza (1999). Moreover, Tokman (2002), also working with aggregate school level data, finds that public schools have advantage in educating students from disadvantaged family backgrounds. Nonetheless, Gallego (2002) evaluates the impact of competition on school quality, measured using standardized test results, and concludes that the effects are bigger for private subsidized schools than for public schools.

Student level analysis became possible in 1998, when the Ministry of Education began to administer a questionnaire to all parents of students who participated in the

country's standardized SIMCE (Education Quality Measurement System) test. McEwan (2001) using student level data finds that there is no consistent difference between student achievement in public and non-religious private subsidized schools, although private subsidized fee-paying schools and Catholic private subsidized schools have higher achievement than public schools. In contrast, Mizala and Romaguera (2001) and Sapelli and Vial (2002) argue that private subsidized schools have higher achievement then public schools.

All these studies used traditional econometrics models (OLS with or without Heckman correction) that do not consider the multilevel structure of the data.

In contrast with the previous studies, this paper analyzes in detail the variation in the effect of individual SES and school SES on achievement across school sectors, differentiating between and within school effects. Also, in the context of a multilevel analysis, the paper investigates if some type of schools enjoys advantages in educating low income students.[8]

Empirical Analysis

Our analysis is based on the standardized math test applied to 4th grade students in 1999 and the survey of parents applied at the same time of the test, in order to collect socioeconomic data from the students. This test is applied nationally and includes the entire population of 4,949 schools and 226,860 students. Tables A1 and A2 in the appendix present descriptive statistics for the student and school-level data.[9] The survey of parents provides information on the characteristics of each student, such us their family income, parents' education, etc. Although it is not mandatory for parents to complete the questionnaire, there is a high response rate. Table A3 in the appendix shows the response rate to the survey for several variables that are used in the analysis, the response rate ranges from 83 to 86 per cent, which is reasonable high.

[8] Tokman (2002) using a different methodology (OLS) and only school average data investigates a similar question using the 4th grade SIMCE test of 1996.

[9] The test and the survey are administered by SIMCE (*Sistema Nacional de Medición de la Calidad de la Educación* - Educational Quality Measurement System). The SIMCE test uses a mean of 250 points and a standard deviation of 50 points.

To begin the analysis, we partition the variance in the SIMCE test results into its within and between-schools components by estimating a one-way ANOVA with random effects.[10] The between-school variance is 663.04 and the within-school variance is 1864.11, i.e., 26% percent of the variance in the SIMCE mathematics test results is between-schools.

Then, a full HLM model is estimated to explore the effects of student and school socioeconomic status on educational results. The variables included at each level (students and schools) are those which the literature on educational production functions has revealed to influence educational achievement. Since the pioneering work by Coleman et al (1966), many studies estimate educational production functions which link output (achievement results) with school educational inputs (teacher characteristics, class size, infrastructure, and so forth) and family and student characteristics.[11]

In the case of developing countries, literature reviews by Fuller (1990), Fuller and Clarke (1994) and Hanushek (1995) allow us to conclude that family characteristics are not the only thing that matters and that the school has a lot to do with student achievement. The empirical evidence seems to show that some school characteristics are significant to explain educational achievement, including instruction time, availability of textbooks, teacher experience and certain teaching methods.

In the Chilean case, previous studies have found that besides the students socioeconomic status, some school characteristics, such us, instruction time, school size, school gender, teacher experience and school location, among others, play a relevant role in explaining educational achievement.[12]

Therefore, we specify the within school-model (student-level) as:

$$Y_{ij} = \beta_{0j} + \beta_{1j}\, SES_{ij} + \beta_{2j}\, \text{hours of study}_{ij} + \beta_{3j}\, fail_{ij} + \beta_{4j}\, preschool_{ij} + r_{ij} \quad (1)$$

where Y_{ij} is the test result of student i who attends school j, r_{ij} is a level-1 random effect $r_{ij} \sim N(0, \sigma^2)$, in which σ^2 represents the residual variance at level 1.

[10] This is a fully unconditional model, it involves no level-1 (students) or level 2 (schools) predictors.
[11] Good literature reviews include Hanushek (1996 and 1997) for developed countries and Fuller (1990), Fuller and Clarke (1994), and Hanushek (1995) for developing countries.
[12] See Rodríguez (1988); Aedo and Larrañaga (1994); Aedo (1997); McEwan and Carnoy (2000), McEwan (2001); Mizala and Romaguera (2000, 2001); Bravo, Contreras, and Sanhueza (1999); Tokman (2002); Sapelli and Vial (2001); Gallego (2002), Hsieh and Urquiola (2002).

This model aims to explain how students' mathematics achievement is influenced by their socioeconomic status (SES)[13], the number of hours they study at home, a dummy variable equal to 1 if they have failed a grade and a dummy variable equal to 1 if they have had preschool education. We include grade-failed as a proxy for past achievement.[14, 15]

In the between-school model (school-level), the variation in the adjusted mean mathematics achievement and the SES-achievement relationship is explained as a function of school characteristics; the coefficients corresponding to hours of study at home, grade failure and preschool education are modeled as a constant.[16]

We estimate two school-level models; in model A the adjusted mean math achievement is explained by the type of school (public, private subsidized (PS) and private fee paying (PFP)) and the interactions of the school SES with the school type[17], the students' SES-achievement slope is only explained by the school type. We differentiate by school type to test whether the socioeconomic level has a differentiating effect on the three different school sectors existing in the country. This specification is based on previous research for the U.S, which showed that the strength of the relationship between students's SES and achievement may vary from school to school (Raudenbusch and Bryk, 1986; Lee and Bryk (1989) and Bryk and Raudenbusch, 1992).[18]

Between-school model A (school level):

$$\beta_{oj} = \gamma_{00} + \gamma_{01}\,PS + \gamma_{02}\,PFP + \gamma_{03}\,\text{school SES}j \text{ x PUBLIC} + \gamma_{04}\,\text{school SES}_j \text{ x PS} + \gamma_{05}\,\text{school SES}_j \text{ x PFP} + \mu_{j0} \quad (2)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}\,PS + \gamma_{12}\,PFP + \mu_{j1}$$

[13] The student SES was obtained using factorial analysis with a weighted average for the variables mother's education, father's education and family income. These data were obtained from a household survey of children taking the SIMCE test. The student SES is a variable with zero mean and standard deviation equal 1.
[14] The variables students' SES and hours of study at home are centered on their grand means.
[15] When we include these student-level predictors in the model, the between school variance in the math test decreases from 663.04 to 293.51 (a 55.7% reduction). In Appendix 2 we present the results of estimating a model that consider explanatory variables at the student level only, i.e., the regression coefficients in the level-1 model for each school are modeled as constant or as a constant plus a random error.
[16] There were initially hypothesized as random but no evidence was found to sustain this and thus are treated as fixed.
[17] The variable school SES is obtained as the average of the students' SES for each school. This variable is included at the school level to identify any contextual effects.
[18] They found that the within school math achievement-SES slopes are significantly less steep in Catholic sector than in the public sector. Bryk and Raudenbusch (1992) also found, for both sectors, a tendency for high-SES schools to have steeper slopes math achievement-SES than low-SES schools.

$\beta_{2j} = \gamma_{20}$

$\beta_{3j} = \gamma_{30}$

$\beta_{4j} = \gamma_{40}$

where γ_{00}, γ_{01}… γ_{40} are level-2 coefficients and μ_{j0} and μ_{j1} are level-2 random effects assumed to multivariate normally distributed with mean 0 and variance τ_{qq} and covariance $\tau_{qq'}$ between any two random effects q and q'.

In model A we only include school SES and type of school to explain the adjusted schools mean math achievement, because we want to determine the effect of these variables on the between school variance in the test results before including the rest of the school characteristics.

In model B we incorporate other school characteristics to explain the adjusted schools mean math achievement; the rest of the model stays the same: school location (dummy for urban schools), school gender (dummy for only boys and only girls schools), instruction time (dummy for full day schools), teachers' years of experience, student-teacher ratio, school size (natural log of the number of students enrolled in the school), percentage of students with similar achievement in the school.[19]

The two specifications show very robust results. Once a correction has been made for the effect of SES in model A and other school characteristics in model B, estimations of fixed effects show significant differences in the average scores of the different school types. Private fee-paying schools have higher mathematics mean achievement than subsidized private schools and these in turn have higher achievement scores than public schools. We conclude that higher SES schools tend to have high math achievement scores; also, and very important for the purpose of this paper, the effect of SES on achievement is different in the three types of school. The effect of SES on the school's mean math achievement is greatest in private subsidized schools, followed by municipal and then private fee-paying schools (Table 2).

The SES-achievement slope (β_1) regression shows that within-school achievement slopes are flatter for private fee-paying than for private subsidized and public schools. Thus private fee-paying schools have a weaker association between students' SES and

[19] This variable intends to capture an achievement peer effect. It is measured as the percentage of students in the school obtaining math test scores within the range given by the mean achievement of all schools plus or minus 0.5 standard deviation.

achievement than private subsidized schools and the latter demonstrate weaker association than public schools (Table 2).

The inclusion of school SES and type of school at the school level (model A) significantly decrease the between school variance in the test results from 293.51 to 193.82 (a 34 percent reduction). When more school characteristics are included (model B) only a slight additional reduction (5.6 percent) of the between school variance is obtained (Table 3).

(Place Table 2 about here)

(Place Table 3 about here)

In order to disentangle the effects of student-level and school-level SES on student outcomes we calculate for model A and B the within-school (student-level) relationship between SES and math achievement (β_w), the between-school SES-achievement relationship (β_b) and the compositional effects (β_c). The compositional effect is the extent to which the magnitude of the school-level relationship differs from the student-level effect. This effect occurs when the aggregate of a student-level characteristic (SES in this case) is related to achievement, even after controlling for the effect of the individual characteristic. Table 4 presents student-level, school-level and compositional effects for models A and B, the estimates from the two models are similar.

(Place Table 4 about here)

As noted previously, there is a lower correlation between the socioeconomic factors and the SIMCE results within a typical private fee-paying school than it is within the typical private subsidized or public school; the difference in β_w for private subsidized and public schools, although statistically significant, is small (Table 4). Figure 1 shows the within-schools effects for model B where the relationship between students' socioeconomic level and math achievement is displayed for private fee-paying, private subsidized and

public schools.[20] The graph uses the actual students' SES for each type of school; for this reason the line representing students from private fee-paying schools fades at low students' SES, while the opposite occurs with public schools which do not have high SES students.

(Place Figure 1 about here)

Figure 1 also shows differences in the three types of schools by mean student achievement. Students of low, medium and high-SES obtain better educational results in private fee-paying than in private subsidized or public schools. Moreover there is a significant achievement gap between students in private fee-paying schools and the rest. Students in private subsidized schools do better than students in public schools, although the achievement difference is small and the gap tends to disappear for high-SES students.

The between-school SES-achievement relationship (β_b), i.e., when the school is the unit of analysis, shows a different behavior than the within-school one. Overall the relationship between school SES and achievement is stronger than the SES-achievement relationships within schools, showing that a school's social-class composition has a substantial effect on math achievement, greater even than individual student-level effects (Table 4).

Moreover, the strength of the SES-achievement relationship for the different school types changes compared with the student-levels. Private fee-paying schools still show the weakest between-schools SES-achievement relationship, followed by public schools; private subsidized schools have the steepest slope between these two variables (table 4). Figure 2 shows between-schools effects for model 2; the graph is built using the actual school-SES data.

As it was pointed out before, private fee-paying schools have a very different social-class composition than public schools, while private subsidized schools have a broader social class composition and, more resemble public than to private fee-paying schools. Indeed, the degree of social class homogeneity among a specific school sector explains the strength of the relationship between school-SES and achievement. The lowest impact of social class on achievement is to be found in more homogeneous private fee-paying school

[20] These within-school differences are based on a model that includes control variables at the within-school and at the between-school level.

sector, followed by the public school sector and finally private subsidized school sector which is more heterogeneous with respect to social-class composition.

(Place Figure 2 about here)

Public schools with low social-class composition have better mean math achievement than public subsidized schools with a similar social-class composition; this relationship is inverted for schools of higher social class composition. Thus, public schools have advantages at educating students in schools with low average SES.[21] Moreover, private subsidized schools, with the same social class composition, tend to have better educational results than private fee-paying schools.[22] In the small range where public and private fee-paying schools have a similar social class composition, the private fee-paying schools have better average math test scores.

The compositional effects (β_c) are larger for private subsidized schools than for public and private fee-paying schools (Table 4). These effects are open to several interpretations; one possible interpretation is that the higher values represent peer-group effects that influence achievement even after controlling for the effect of the individual student-SES.[23]

Final comments

HLM is a powerful tool that permits a separation of *within-school* from between–school phenomena while simultaneously examining the effects of school factors not only on school mean achievement but also on structural relationships within schools. This methodology expands the analysis of the Chilean case beyond the relative test performance of public and private schools (applied to 4th grade math students in 1999), to the relationship between SES and achievement for the different school sectors.

[21] Tokman (2002) using a different methodology (OLS + Heckman selection correction) and only the school average results obtains a similar conclusion from the 4th grade SIMCE test of 1996.
[22] This result is obtained after including control variables at the within-school and the between-school level in the model.
[23] They may also reflect the fact that average school SES acts as a proxy of variables omitted from the model, mainly schools' resources, Bryk and Raudenbush (1992).

The within-school analysis shows there are large and significant differences in achievement and equity between private fee-paying schools and the other two types of schools. Private fee-paying schools have significantly higher math mean achievement results and have a more equitable social distribution of achievement than private subsidized and public schools. At the within-school level, public and private subsidized schools show a similar pattern. Two elements can explain this finding; first, private fee-paying schools have a higher and more homogeneous socioeconomic student composition. Second, the fees of private fee-paying schools are about three times the per-student subsidy paid by the government, which is the main source of finance of many public and a number of private subsidized schools.

Nonetheless, other elements can also explain an equitable social distribution of achievement. Research on Catholic high schools in the U.S. has found that the weaker relationship between social background and academic achievement, compared with public schools, can be explained by a constrained academic structure, embedded in a normative environment, which provides a supportive school life for most students, regardless of their backgrounds and abilities.[24]

The *between-school* analysis shows a more complex picture; first, there is high social class stratification between private fee-paying and public schools; only the private subsidized sector includes schools with broad range of social-class composition. It is important to note that private subsidized schools, created as a result of Chile's voucher system, have not "specialized" in a specific socioeconomic group but provide educational services to broad representation of the population. The claim by school choice critics that the new schools will concentrate children of parents with high socioeconomic status is not supported.

Second, when schools with different socioeconomic composition are compared, the private subsidized schools show greater differences in educational achievement than public and private fee-paying schools. One possible explanation for this finding is that private subsidized schools are more heterogeneous among themselves not only in terms of the class composition of their students but also in terms of academic achievement.

Third, public schools with a low social-class student composition are more effective than private subsidized schools with a similar student base; that is, public schools

[24] See Lee and Bryk (1989)

demonstrate advantages at educating students in schools with low average SES. Differences in school environment could explain this result since poor public schools might have more academic support from the central ministry and the municipality than private subsidized schools. Conversely, this relationship is reversed for schools of higher social-class composition; this could be a result of student selection among the high income segment of the population by private subsidized schools. Rounds Parry (1996) when interviewing a random sample of schools in Santiago, the capital city, found that private subsidized schools make greater use of examinations and parental interviews in their student selection process than other schools.

Hence it can be concluded that the SES-achievement relationship between schools is stronger than the SES-achievement relationship within schools: that is, the social-class composition of the school has a substantial effect on mean achievement, even larger than the individual student-level effect. Put another way, the average background of the other students in the school is more important than individual socioeconomic background in explaining student achievement.

This finding implies an explanation based on student selection by which the differences in the SES-achievement relationship is a result of differences between school types in the process by which students are assigned to schools. Here it should be recalled that the regulations for admitting and expelling students differ between public and private schools. While public schools must admit all their applicants and have serious restrictions about expelling students, private subsidized and private fee-paying schools are free to establish their own admission and expulsion policies.

The analysis shows that additional research is needed to fully comprehend the findings of this paper; in particular, it will be important to analyze which schools characteristics, -normative environment, academic organization, etc.-, could produce an equitable distribution of achievement. At present, available school information does not permit such analysis. It is important to develop good measures of the school environment which is difficult, as most current information is based on the case-study literature which is not suitable for the statistical analysis required to derive appropriate and comprehensive policy inferences.

References

Aedo, C. 1997, "Organización industrial de la prestación de servicios sociales." Working Paper R-302. Washington: Inter-American Development Bank.

Aedo, C. and O. Larrañaga. 1994, "Educación privada vs. pública en Chile: calidad y sesgo de selección." Santiago, Chile: ILADES/Georgetown University, Economics Department. Mimeographed.

Alexander, K., Fennessey, J., McDill, E. and R. D'Amico. 1979, "School SES influences - - composition or context? *Sociology of Education* vol. 52(4): 222-237.

Berry, J., Jacob B. and S. Levitt. 2000, "The Impact of School Choice on Student Outcomes: an analysis of the Chicago Public Schools", *NBER Working Paper* N°7888.

Bravo, D, Contreras, D. and C. Sanhueza. 1999, "Rendimiento educacional, desigualdad y brecha de desempeño público/privado: Chile 1982–1997." Working Paper 163. Santiago: Universidad de Chile, Departamento de Economía.

Bryk, A. and S. Raudenbush. 1992, *Hierarchical Linear Models: Applications and Data Analysis Methods.* Thousand Oaks, California: Sage Publications.

Coleman, J.S., Hoffer, T and S. B. Kilgore, 1966, *Equality of Educational Opportunity.* U.S. Government Printing Office.

Coleman, J.S., Hoffer, T. and S.B. Kilgore. 1982a, *High School Achievement: Public, Catholic and other schools compared.* New York: Basic Books.

Coleman, J.S., Hoffer, T. and S.B. Kilgore. 1982b, Cognitive outcomes in public and *private* schools, *Sociology of Education*, 55: 65-76

Fuller, B. 1990. "Raising School Quality in Developing Countries: What Investment Boosts Learning?" *Discussion Paper 76*. Washington: World Bank.

Fuller, B. and P. Clarke. 1994. "Raising Schools Effects While Ignoring Culture, Local Conditions and the Influence of Classroom Tools, Rules and Pedagogy." *Review of Educational Research* 64(1): 119–57.

Gallego, F. 2002, "Competencia y resultados educativos: teoría y evidencia para Chile", *Cuadernos de Economía* 39(118): 309-352.

Gauri, V. and A. Vawda. 2003, "Vouchers for Basic Education in Developing Countries. A Principal-Agent Perspective", *World Bank Policy Research Working Paper* 3005.

Hanushek, E. 1995. "Interpreting Recent Research on Schooling in Developing Countries." *World Bank Research Observer* 10(2): 227–46.

Hanushek, E. 1996. "A More Complete Picture of School Resource Policies." *Review of Educational Research* 66(3): 397–409.

Hanushek, E. 1997. "Assessing the Effects of School Resources on Student Performance: An Update." *Educational Evaluation and Policy Analysis* 19(2): 141–64.

Henig, J. 1994, *Rethinking School Choice: The Limits of the Market Metaphor*, Princeton University Press, Princeton.

Hsieh, C. y M. Urquiola. 2002, "When Schools Compete, How do they Compete?: An assessment of Chile´s nationwide school voucher program", NBER Working Paper N°10008.

Ladd, H. 2002, "School Vouchers: a critical review", *Journal of Economic Perspectives* 16(4): 3-24.

Ladd, H. and E. Fiske. 2001, "The Uneven Paying Field of School Choice: Evidence from New Zealand", Journal *of Policy Analysis and Management*, vol. 20 (1): 43-64.

Lee, V. and A. Bryk, 1989. "A multilevel model of the social distribution of high school achievement" *Sociology of Education,* vol. 62(3): 172-192.

Levin, H. 1998, "Educational vouchers effectiveness, choice and costs", *Journal of Policy Analysis and Management* 17(3): 373-392.

McEwan, P. and M. Carnoy. 2000, "The Effectiveness and Efficiency of Private Schools in Chile's Voucher System." *Educational Evaluation and Policy Analysis* 22(3): 213–239.

McEwan, P. 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 P. Romaguera. 2000, "School Performance and Choice: The Chilean Experience." *Journal of Human Resources* 35(2): 392-417.

Mizala, A. and P. Romaguera. 2001, "Factores explicativos de los resultados escolares en la educación secundaria en Chile." *Trimestre Económico* 272 (October-December): 515-549.

Patrinos, H. 2002, "A Review of Demand-Side Financing Initiatives in Education". Mimeo World Bank.

Raudenbush, S. and A. Bryk. 1986, "A hierarchical model for studying school effects" Sociology of Education 59(1): 1-17.

Rodríguez, J. 1988. "School Achievement and Decentralization Policy: The Chilean Case" *Revista de Análisis Económico* 3(1):75-88.

Rounds Parry, T. 1996, ""Will pursuit of higher quality sacrifice equal opportunity in education? An analysis of the education voucher system in Santiago" *Social Science Quarterly* 77(4): 821-841.

Sapelli, C. and B. Vial. 2002, "The performance of private and public schools in the Chilean voucher system" *Cuadernos de Economía* 39(118): 423-454.

Seitzer, M. 1995, "Furthering our understanding of the effects of educational programs via a slopes-as-outcomes framework", *Educational Evaluation and policy Analysis* 17(3): 295-304.

Tokman, A. 2002, "Is Private Education Better? Evidence from Chile." Working paper Central Bank of Chile.

West, E. 1997, "Education vouchers in principle and practice: A survey". *The World Bank Research Observer* 12.

Table 1. Enrollment, Family Income Decile and Type of School, 2000
(Percent)

Income decile	Public	Private Subsidized	Private Fee-paying
1	23.7	9.9	1.2
2	22.8	11.4	1.4
3	18.6	13.0	1.6
4	14.2	10.9	1.7
5	12.1	13.1	3.9
6	9.0	12.0	3.8
7	6.7	9.8	4.6
8	4.9	9.7	12.4
9	2.9	7.0	23.8
10	1.4	3.1	45.6
Total	100.0	100.0	100.0

Source: Authors´ calculations, based on socioeconomic household survey CASEN 2000 (C*aracterización Socioeconómica Nacional*)

Table 2

Full HLM model of mathematics achievement, 4th grade, 1999. Fixed effects

(N = 4,949 schools)

Variables	Model A	Model B
For intercept β_o (adjusted school mean achievement)		
Intercept	250.063** (0.604)	247.618** (2.266)
Dummy private subsidized	3.477** (0.631)	4.060** (0.751)
Dummy private fee paying	13.546** (2.857)	14.033** (2.924)
SchoolSESj x PUBLIC	7.334** (0.875)	11.359** (0.959)
SchoolSESj x PS	20.175** (0.824)	20.962** (0.833)
SchoolSESj x PFP	10.164** (1.385)	9.529** (1.392)
Dummy urban		-4.970** (0.873)
Dummy full day school		1.806** (0.557)
Dummy girls school		3.017** (1.054)
Dummy boys school		8.351** (1.459)
Teachers' years of experience		0.226** (0.046)
Student-teacher ratio		0.0002 (0.003)
Ln total enrollment		-0.894* (0.405)
% students similar achievement		16.040** (3.162)
For slope β_1 (SES-achievement slope)		
Intercept	11.414** (0.230)	11.503** (0.229)
Dummy private subsidized	-1.320** (0.368)	-1.366** (0.367)
Dummy private fee paying	-5.446** (0.521)	-5.566** (0.521)
For slope β_2 (hours of study at home)	0.978** (0.030)	0.979** (0.030)
For slope β_3 (failed a grade)	-18.425** (0.319)	-18.381** (0.319)
For slope β_4 (preschool education)	1.967** (0.379)	2.468** (0.378)

Standard errors in parenthesis, ** statistically significant at 1%, * statistically significant at 5%.

Table 3

Full HLM model of mathematics achievement, 4th grade, 1999.

Random effects

(N= 4,949 schools)

Random Effects	Variance component	df	Chi-squared[1]	Reliability
Model A				
Intercept	193.820	4914	17067.882**	0.553
SES Slope	14.850	4917	5672.278**	0.110
Level-1 effects	1752.961			
Model B				
Intercept	182.874	4906	16477.856**	0.543
SES Slope	15.525	4917	5671.307**	0.114
Level-1 effects	1752.717			

Notes: Chi-square statistics are based on 4,920 of 4,949 schools.

** statistically significant at 1%.

Table 4

Student-level, school-level and compositional SES-achievement effects

	Between schools effects β_b	Within schools effects β_w	Compositional effects β_c
Model A	(only SES variables)		
PUBLIC	18.751	11.414	7.337
	(0.863)	(0.230)	(0.875)
PS	30.269	10.094	20.175
	(0.807)	(0.285)	(0.824)
PFP	16.133	5.969	10.164
	(1.358)	(0.467)	(1.385)
Model B	(SES plus other school characteristics)		
PUBLIC	22.862	11.503	11.359
	(0.942)	(0.229)	(0.959)
PS	31.099	10.137	20.962
	(0.822)	(0.286)	(0.833)
PFP	15.467	5.938	9.529
	(1.349)	(0.467)	(1.392)

All the effects (βs) are statistically significant at 1%. Standard errors are in parenthesis.

Figure 1: Within – School effects

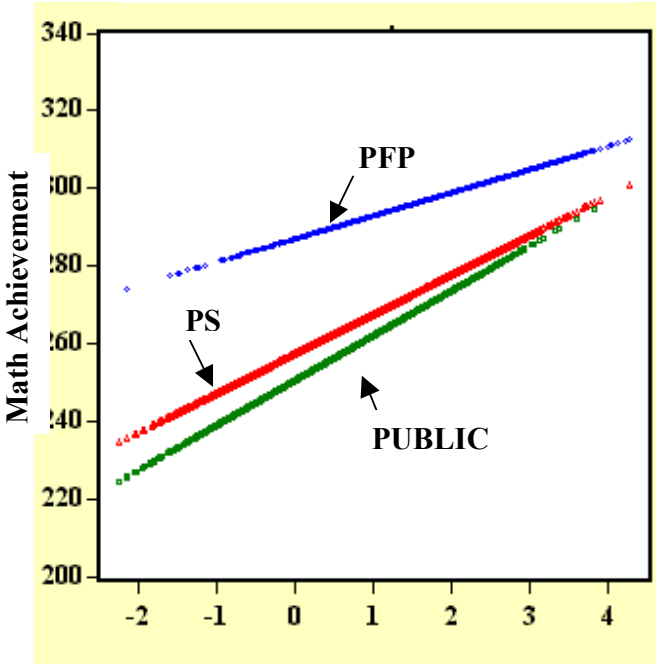
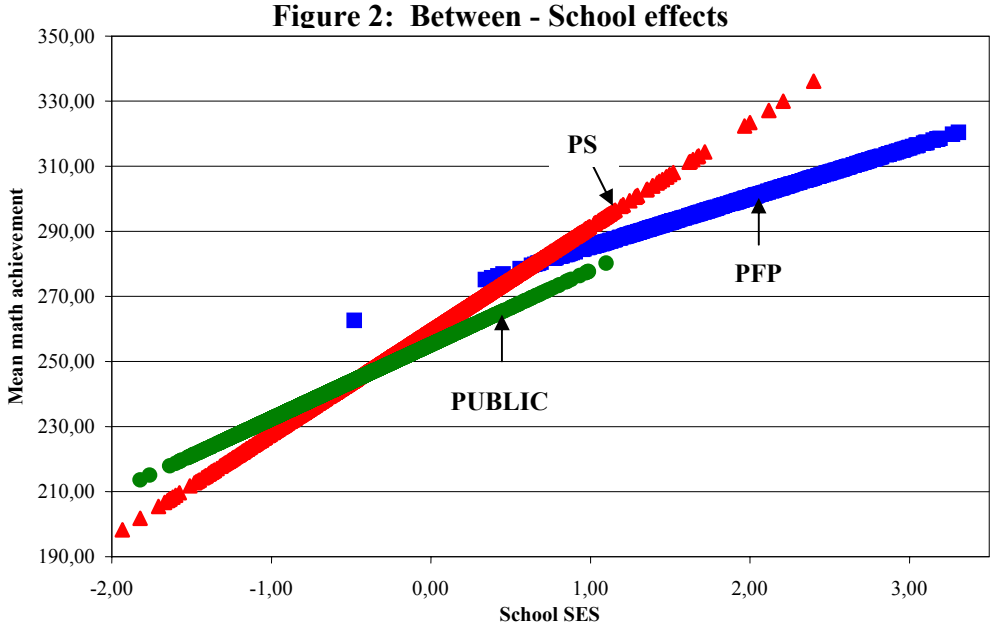


Figure 2: Between - School effects



Appendix 1: Descriptive Statistics

Table A1

4th Grade Student-level data, 1999

	Mean	Std. Deviation
SIMCE math test scores	250.02	49.99
Students' SES	0	1.00
Hours of study at home	4.85	3.29
Failed a grade	.11	.32
Preschool education	.78	.41
Number of observations	226,860	

Table A2

4th Grade School-level data, 1999

	All schools		Private subsidized schools		Public schools		Private fee-paying schools	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
SIMCE math test scores	246.18	28.56	250.69	26.98	236.40	22.12	292.99	18.61
Urban school	.67	.47	.85	.35	.52	.50	.98	.15
Teacher - years of experience	15.62	6.46	11.35	6.26	18.41	4.91	10.71	5.67
Full day school	.39	.49	.32	.47	.40	.49	.50	.50
Girls schools	.04	.20	0.07	.25	.02	.13	.12	.32
Boys schools	.03	.17	0.04	.20	.01	.10	.09	.29
Student/teacher ratio	34.09	48.28	42.25	62.83	30.62	40.60	28.45	27.53
Ln enrollment	3.63	.93	3.79	.84	3.55	.99	3.61	.71
School SES	-.19	.87	-. 03	.62	-.60	.41	1.87	.64
% students with similar achievement	.38	.12	.38	.10	.37	.12	.42	.10
Number of observations	4949		1530		3057		362	

Table A3

Response rate to parent's questionnaire, 1999

Variables	%
Fathers' education	82.97
Mothers' education	85.94
Household income	84.95
Hours of study at home	86.36
Attend preschool education	85.71
Failed a grade	84.85

Source: MINEDUC, SIMCE

Appendix 2: A within school HLM model

We investigate how student's characteristics, mainly their social and academic background, influence the standardized test results in each school. With that purpose we estimate a student level model as:

$$Y_{ij} = \beta_{0j} + \beta_{1j}\, SES_{ij} + \beta_{2j}\, \text{hours of study}_{ij} + \beta_{3j}\, fail_{ij} + \beta_{4j}\, preschool_{ij} + r_{ij} \quad (1)$$

where Y_{ij} is the test result of student i who attends school j, r_{ij} is a level-1 random effect $r_{ij} \sim N(0, \sigma^2)$, in which σ^2 represents the residual variance at level 1.

The school level model is:

$\beta_{0j} = \gamma_{00} + \mu_{j0}$

$\beta_{1j} = \gamma_{10} + \mu_{j1}$

$\beta_{2j} = \gamma_{20}$

$\beta_{3j} = \gamma_{30}$

$\beta_{4j} = \gamma_{40}$

This model aims to explain how students' mathematics achievement is influenced by their socioeconomic status (SES), the number of hours they study at home, a dummy variable equal to 1 if they have failed a grade and a dummy variable equal to 1 if they have had preschool education.[25] This is a within school model only, because it does not include explanatory variables at the school level. Table A4 shows the results.

Each student characteristic is significantly related to math achievement. The test score is positively and significantly related with the student's socioeconomic status (SES), the amount of hours he/she studies at home and attendance to preschool education, but if the student has failed a grade his/her score in the test is lower.

Chi-square tests of the HLM parameters indicate significant variability among schools in both the average achievement and the SES-achievement slope. We can conclude that average educational achievement and its distribution among students of different SES vary significantly among schools.

[25] The variables students' SES and hours of study at home are centered on their grand means.

Table A4

Within-school HLM model. 4th grade mathematics achievement.

(N = 226,860 students in 4,949 schools)

Fixed effects Variable	Coefficient	Standard error
Intercept	245.390	0.460**
Students' SES	12.472	0.150**
Hours of study at home	0.988	0.030**
Failed a grade	-18.518	0.320**
Preschool education	3.257	0.374**

Random Effects	Variance component	df	Chi-squared	Reliability
Intercept	293.514	4919	22551.428**	0.615
SES Slope	12.080	4919	5944.109**	0.103
Level-1 effects	1753.299			

Notes: ** Statistically significant at 1%.