The Public–Private School Controversy in Chile

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The Private–Public School Controversy: The Case of Chile.

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Introduction.

Marked-oriented strategies have increasingly been proposed as an effective and efficient way to increase both quality and equity in education. Academic and political debates have attempted to predict the most probable consequences that market incentives might have on educational systems. A key issue on those analyses has been the comparative study of the public and private schools' effectiveness, in terms of students' academic achievement. In this paper, I critically review the research about whether Chilean students attending private schools obtain larger learning outcomes than their peers studying at public schools.

Chile constitutes a paradigmatic case to the debate about the relative efficacy of private and public schools, and research on its experience might shed light on such a controversy. Its nationwide school-choice system finances both public and private subsidized schools under the same funding system, a type of voucher program. Considering the small-scale of most of the U.S. voucher and school-choice programs, Chile is a particularly interesting case to study. Strikingly, previous research on the Chilean case has obtained very contrasting findings.

The paper begins with (I) a brief description of the Chilean education; then, it reviews the research on both (II) systemic effects of school-choice and (III) private vs. public schools' effectiveness. Section (IV) analyzes some key methodological issues that account for the contrasting findings of previous

research; section (V) describes the data I used, and sections (VI), (VII), and (VIII) provide empirical evidence about the consequences of the identified methodological limitations. A final section summarizes the main conclusions of the analysis, elaborates some interpretative hypothesis, and states some educational policy implications.

I. School choice and market oriented institutions in the Chilean Public Education[1].

For more than two decades, Chilean education has operated under an institutional design where fundamental decisions do not rely on national authorities, but on the combination of family preferences (school choice) and (public and private) school competition for attracting such preferences. This system –which is an attempt to make education a self-regulated market-, was created during the 1980s as a part of a large economic and institutional neo-liberal reform.

The core of the reform was the inception of a common public funding system for all public and private subsidized schools: the educational voucher, which is a monthly payment to the schools, of a fixed fee per each student who is enrolled and regularly attends the school. Additionally, the reform included several changes oriented to promote competition among public and private schools. Families do not have restrictions to choose a school (whether public or private, near or distant from home), and schools must compete to attract families'

preferences. The administration of public schools was decentralized to the municipal level, and the management of schools (including the curriculum, human and financial resources) was strongly deregulated. Finally, reformers created a national evaluation system of students' learning (*SIMCE*, Spanish acronym for System of Measurement of Educational Quality), aimed at informing families about school quality.

Since 1990, the Chilean governments have attempted to combine the market institutions with stronger state regulations and interventions. Thus, while some educational policies have been oriented to strengthen the market-oriented model (e.g. creation of a "price discrimination" system among subsidized private schools, and publication of SIMCE results in the newspapers), others have tried to restrict it, through the active promotion of social equity and educational quality (e.g. implementation of compensatory programs, creation of a teacher labor statute, and the universal provision of computers, textbooks, and teacher training).

There are three kinds of schools in Chile: public schools, private voucher schools, and private non-subsidized schools. All primary and most secondary public schools are free; about 90% of private voucher schools are not free (they have a co-pay system), and private non-subsidized schools are elite schools, totally paid by families[2]. This paper focuses on the comparison between public and private voucher schools (although occasional references will be made to the private non-subsidized schools). The evolution of enrollment has showed a highly

responsive system. The proportion of Chilean students attending a public school has decreased systematically, from 78% in 1981, to 58% in 1991, and 47% in 2006; simultaneously, students attending private voucher school have increased from 12% in 1981, to 32% in 1991, and 45% in 2006. The enrollment in non-subsidized private schools has remained as a minor part of the Chilean school population.

Finally, the testing system has pointed out a systematic pattern: private voucher students' score –on average- higher than public schools' students by about 0.3 to 0.4 S.D. Whether or not this observed gap represents a genuinely greater private school effectiveness has been a controversial academic and political question in the Chilean educational debate.

II. *Systemic effects* of school choice.

There are two competing theories about *systemic effects* (i.e. the impact of the voucher mechanism on the effectiveness of the educational system as a whole) of the market mechanisms of Chilean education. One states that subsidized private schools help to improve public schools through a competition effect, predicting an overall improvement of Chilean education. The other theory proposes that the potential productivity effect may be canceled out by unexpected negative effects of sorting on public schools (private schools "skim" the best public students), with no systemic improvement. Unfortunately, there is very little research on this issue.

Gauri (1998) studied the school choice process using a sample of households from Santiago metropolitan area. He found that higher socioeconomic status was positively associated with the probability of attending a school in the top third of the students' achievement distribution. Gauri also found that the probability of studying in a high performing school significantly increased when the student was required to take a cognitive and/or academic test as an admission requirement. Hseih and Urquiola (2003) attempted to evaluate whether the introduction of school choice in Chile improved the productivity of the school system at aggregated levels, and whether it increased the educational and socioeconomic differences between private and public schools. They analyzed 4th grade mathematics and language test scores, repetition rates, and years of schooling among 10-15 years old, between 1982 and 1988, at school and commune level. After controlling for several socioeconomic school and commune factors, they found that communes with higher proportion of private enrollment tended to have lower public school test-scores, higher private/public test-score gap and repetition rate gap, as well as higher students' SES private/public difference at commune level. Finally, at commune level, neither the level of 1990 private enrollment nor the 1982-1990 increase in private enrollment were associated with improvements in students' outcomes. Gauri, and Hseih and Urquiola interpreted those findings as evidence of both negative effects of private school expansion on public schools, and no positive effect on the quality of the system as a whole.

Nevertheless, since these studies are mainly based on cross-sectional data and the information prior to the voucher reform is very limited, it is difficult to make causal claims about the hypothesized relationships.

Gallego (2002) defined each commune as a different school-market. He used 4th (1994, 1996) and 8th grade (1995, 1997) Language and Mathematics school mean as the outcome variables, and controlled for schools' SES composition and other commune variables (level of urbanization, size). Gallego found that the proportion of private enrollment at commune level was positively associated with school performance, and that this *competition effect* was stronger for private schools. The key limitation of this approach is that the level of private enrollment is not an exogenous variable to students' performance, because private schools tend to serve geographical areas with characteristics positively associated with students' achievement. Gallego (2004) attempted to overcome this limitation: he used "priest per capita" as an instrumental variable to identify exogenous variation in private subsidized enrollment at commune level. He estimated that positive differences in private enrollment were associated with higher students' test scores, and higher educational inequity. Nevertheless, priest per capita might not be a valid instrument for private schools in Chile, because priest are actively involved in the expansion of private schools and they might do that selectively, based on the expected educational outcomes of a given educational market. Additionally, Catholic schools account for only a third of the total private

subsidized enrollment, and Catholic schools were precisely those private schools that existed in Chile prior to the introduction of market oriented reforms.

Finally, Auguste and Valenzuela (2004) also estimated the effect of competition at commune level; they used SIMCE-2000 8th grade test-scores and implemented an instrumental variable approach (they used market size and cost of entry as instrumental variables). They found a positive but small effect of competition on test-scores; they also concluded that higher levels of school competition were associated with higher school segregation, which harmed public schools.

Overall, the available evidence is not sufficient to evaluate the theories about the systemic effects of school choice in Chile; nevertheless, the evidence strongly suggests that the size of that potential effect have been extremely small at best (in fact, not noticeable at national level). Additionally, the evidence suggests that school choice and competition is linked to an increase in educational inequity. Future research in this area should combine longitudinal studies, analyses of institutional and educational policy contexts, and a deeper understanding of the parents' choice and schools' selection processes.

III. Research on private versus public schools' effectiveness.

A common argument to support market oriented reforms (including public funding of private schools) is that private schools are more effective than public schools,

because they are more innovative, more sensitive to the demand, and less bureaucratized. In fact, most studies about the Chilean case on this area are comparisons between public and private school effectiveness.

In general terms, this research has evolved following three stages. Rodriguez (1988), Aedo and Larrañaga (1994), Aedo (1997), are part of the first phase: they studied unrepresentative samples, analyzed exclusively school-level data (from the eighties or early nineties), and focused on urban primary schools. These studies concluded that -after controlling for school characteristics- private schools scored significantly higher than public schools, on average. Because of their lack of representativeness, it is not possible to generalize those findings to the Chilean school population.

Bravo et al. (1999), Mizala & Romaguera (1999), Carnoy & McEwan (2000), Vegas (2002), and Sapelli (2003) also analyzed exclusively school-level data, but they studied large, nationally representative samples[3]. This research is also focused on primary education (mainly 4th grade), and all of them applied Ordinary Least Squares estimates. These five studies constitute the second phase of this kind of research.

Finally, McEwan (2001), Mizala & Romaguera (2003), Sapelli & Vial (2002), Gallego (2002), and Mizala et al. (2004) constitute a third, more sophisticated stage. These five studies analyzed student-level test scores as the outcome variable, and also included student-level predictors. They used the nation-

level database, and included both primary and secondary education. They incorporated more sophisticated research methods, including Hierarchical Linear Models, probabilistic models of choice, and instrumental variables.

Although some studies analyzed more than one year of students' test scores, none of them is a longitudinal analysis, but a series of cross-sectional estimates. All studies have analyzed Mathematics and/or Language test scores as the outcome variable. Most studies compared public schools with two categories of private schools: voucher and non-subsidized schools, although some of them distinguished between Catholic and non-religious voucher schools.

Surprisingly, there is a noticeable variation in the estimates of the private voucher vs. public schools test score gap: while some authors have found private voucher school advantage (0.05 S.D. to 0.27 S.D.), others have found public school advantage (0.06 S.D. to 0.26 S.D.), and some have found no statistically significant difference between them[4]. An additional puzzle is that several studies differ in their findings even if they analyze the same database. In order to understand those discrepancies, the following sections deepen into methodological issues of the mentioned second and third phase studies.

IV. Methodological issues in the research comparing private and public schools.

Selection bias is the most serious limitation that affects the estimates of the relative efficacy of private and public schools in Chile. As mentioned, the supply of private schools is neither randomly distributed among geographical areas nor among social classes, and finding a good instrument for the supply of private schools has proved to be extremely difficult. Additionally, the unregulated school choice and admission processes are highly complex and there is little information about them.

Based on their preferences and their capacity to pay tuition, parents can select any school. However, schools may also select their students. According to the nationwide SIMCE-2003 survey of 10th graders' parents, 85% of the private non-subsidized, 73% of the private voucher, and 59% of the public schools' respondents stated that their child was selected by the school through an admission process that included some kind of examination or minimum academic requirement. Gauri (1998) found that, in Santiago, 82% of private non-subsidized, 37% of private voucher, and 18% public students had been compelled to take a test to be admitted to their schools. Those tests -focused on basic language, reasoning, psychomotor and social skills- are applied even to pre-school applicants. Finally, student selection is a continuing process, which operates at any time of the students' career. In fact, many schools expel students who have a low academic

achievement or behavioral problems; almost all expelled students are subsequently enrolled in a public school. In these cases, students' selection is based on demonstrated performance.

Selection bias is a crucial problem because students' characteristics related to students' performance are also relevant predictors of the type of schools students attend. Thus, cognitive skills, motivation, and discipline are some relevant unobserved students' characteristics affecting the estimates of private and public schools' effectiveness. Unfortunately, there is no information about students' initial characteristics or previous test scores. Nevertheless, the contrasting findings about the relative efficacy of public and private schools in Chile are explained not only by data limitations, but also by methodological divergences among researchers about how to tackle the confounding effect of selection bias. Moreover, the literature has increasingly recognized the potential role of peer-effects on students' achievement. In highly segregated environments (like the Chilean educational system), peer-effect might play an even more influential role on students' performance.

Studies also differ noticeably in the quantity and quality of the covariates. Additionally, researchers measure the same phenomenon in very different ways. Finally, structural or economic variables (e.g. family income) have frequently been included in the analyses, but cultural or social variables (e.g. books at home, peer-effects) have been almost absent.

The appropriate level of data aggregation has been a source of divergence among authors too: while some apply commune-level analysis, others prefer school, classroom, and student-level analyses. This issue is also linked to the covariates: some authors assume that controlling for student-level variables suffices, but others argue that school compositional effects are relevant as well, so that school-level controls should be simultaneously included. Notably, little attention has been given to the multilevel nature of the educational data. Finally, potential heterogeneous effectiveness between private and public schools, according to different contextual (e.g. geographical location), educational (e.g. grade level), or student characteristics (e.g. initial ability) are almost absent.

V. Data.

In the remaining sections –by conducting various regression analyses-, I will empirically demonstrate the sensitivity of the findings to the identified methodological issues.

With that purpose, I analyzed two datasets: SIMCE-2002 and SIMCE-2003. These databases contain individual Mathematics and Language test-scores of 253,463 fourth-grade and 239,649 tenth-grade students respectively, who are the 95% of the corresponding Chilean student population. The findings in both subject matters were very similar; therefore, I will present mainly the Mathematics results. The datasets include 6,145 primary schools and 2,117 high schools,

respectively. Several student-level (based on a parents' survey) and school-level control variables were also included. Table 8.1 provides a description of every variable used in the analyses.

VI. The confounding role of student selection.

Student selection in the admission process.

Comparisons between public and private schools in Chile are difficult initially because public and private school students differ significantly in almost all the variables associated with social-class origin and, accordingly, academic achievement. Table 8.2 shows that students in private voucher schools have –on average- more educated parents, higher family income, and more books at home. The key issue is that those observed differences are almost certainly linked with unobserved differences that also affect students' achievement. For example, private schools have a higher proportion of students selected through an admission process than public schools. Through those processes, schools typically evaluate the academic potential of the applicant. In order to account for those differences, researchers normally control for student's SES characteristics; nevertheless, if during the admission processes schools have additional information about the academic potential of applicant students, controlling for those covariates may be insufficient.

To explore this issue, I used the information presented in table 8.2 to predict the probability that a student will be enrolled in a private voucher school (versus in a public school). I applied logistic regression to conduct this analysis. The results are presented in table 8.3. According to model 1, the fitted odds ratio that a student who was admitted through a selection process will attend a voucher school (versus a public school) is 2.07 times the odds for a student who was not selected by an admission process; model 2 shows that, after controlling for SES characteristics, the mentioned fitted odds decreased to 1.78 times, but it remained statistically significant. This finding indicates that, although SES characteristics are associated with the probability of being a selected student in a private school, they are not enough to account for the unobserved differences between selected and non-selected students. This strongly suggests that private schools use additional information (plausibly associated with students' ability) to make their admission decisions. In fact, I will later show that, even after controlling for several school, family, and student characteristics, selected students score significantly higher than non-selected students.

Student selection during the schooling process.

None of the analyzed studies have considered the student selection that affects some students during their schooling process. In this section, by using SIMCE-2002 database, I will analyze some recently available information related to this issue.

About 27% of the public and 33% of the private voucher Chilean 4th-graders did not start their primary education in their current school. Additionally, while the proportion of students who have repeated a grade is about 15% in public schools, in private schools is only 8%[5]. Since some Chilean schools do not admit students who have previously repeated a grade and others expel their students who are repeating the grade (thus, this practice accounts for some proportion of the students who have moved to a different school since 1st grade), it would be misleading to infer about school quality based on the current proportion of retained students. In fact, while 31% of private voucher school parents affirm that their school expels retained students, only 14% of the public school parents assert so.

In order to explore whether the higher exclusion of retained students among private schools explains part of their observed advantage, table 8.4 contains the parameter estimates of multiple regression models that relate this information with students' test scores. Baseline model 1 shows that the raw difference in Mathematics achievement between public and private voucher 4th-grade students is about 0.34 S.D.[6] Model 2 controls for some basic student and school characteristics. As expected, students who have repeated a grade score significantly lower than their non-retained peers; additionally, students who attend a school with higher proportion of retained students tend to score significantly lower. Unfortunately we can not be confident about the causal relationship between both measures of student grade retention and the private-public test-score

gap, because they can be either measures of students' previous ability or measures of school quality. Finally, schools that expel retained students score about 0.19 S.D. higher than schools that do not expel them, which suggests that the selection of the abler students and the rejection of the less skilled students during the schooling process account for some of the private voucher school advantage, after controlling several student and school characteristics.

Models 3 and 4, and 5 and 6 in table 8.4, replicate this analysis for the sub-sample of students who have always studied in the same school and for those students who have moved to a different school, respectively. Although the general pattern is similar in both sub-samples, there are some interesting differences. The positive association between attending a selective school that expels retained students and test-scores is stronger for students who have changed school than for students who have remained in the same school (0.26 S.D. vs. 0.14 S.D. respectively). Conversely, the negative association between the percentage of retained students in the school and student's test scores is stronger for students who have moved to a different school than for students who have remained in the same school. Both results point in the same direction: students who change school seem to be more sensitive to the selective nature of their new school. Note that this can be the result of schools selecting the best students and families choosing more selective schools.

As shown in table 8.4, while there is not statistically significant difference between public and private school students within the population who have not changed school, among students who have changed school, students in public schools score slightly higher than their peers in voucher schools (0.03 S.D.). Consequently, part of the private schools' advantage can be based on their capacity to select and attract more skilled students. Finally, although the gap between private-non-subsidized and public schools is reduced for both groups of students, it remains statistically significant, suggesting that there is little transfer of students between public and private non-subsidized schools.

VII. Alternative ways of controlling for differences in student's and school's characteristics

How to control for parents' education?

Because of public and private schools serve students with markedly different levels of parents' education, all studies control for this aspect; nevertheless, they diverge noticeably in the way this variable is introduced into the analysis. In order to show how those discrepancies may affect the estimates of the private/public test score gap, table 8.5 shows six regression models, all of them present in the reviewed literature.

Model 1 is a base-line model: private voucher schools score about 0.36 S.D. higher than public schools. Models 2 and 3 incorporate student-level parents'

education covariates. As expected, controlling for mother's education –model 2- reduces the private/public test score gap (to 0.27 S.D. and 1.16 S.D. respectively); but this gap remains statistically significant. Also, when father's education is added –model 3- the private school advantage is reduced slightly and remains statistically significant.

Models 4, 5, and 6 also control for parents' education, but measured at school level. Model 4 estimates the private/public gap by controlling for the school average of mothers' years of education. The results indicate that students in private voucher schools obtain lower test-scores than students in public schools; although statistically significant, the difference is very small (0.02 S.D.). More recently, some researchers have introduced the heterogeneity of the student population as a different control variable for parents' education. Thus, model 5 controls only for the school standard deviation of mothers' years of education: interestingly, compared to model 1, this variable *per se* has almost no effect on the estimate of the private/public school gap. Nevertheless, model 6 shows that when the school mean of mothers' education is also present in the model, the effect of the school standard deviation of mothers' education changes its sign and increases its effect (i.e. at similar levels of school mothers' education, more homogeneous schools tend to score higher than more heterogeneous schools). According to model 6, public schools score significantly higher than private voucher schools (0.03 S.D.) when both school-level variables are simultaneously included, and this difference

is larger than the estimated in model 4, which only controls for the level, not the variation in mother's education (observe that a similar pattern is identified when comparing public and non-subsidized private schools).

How to control for schools' socioeconomic status?

There are several hypotheses about how the socioeconomic characteristics of the student population at aggregated level can affect the student's academic achievement: the socioeconomic status of the student population might affect teachers' expectations and teaching practices; it might also represent a measure of the available material and symbolic resources at school level; and, finally, it might be a measure of peer-effects (students might benefit from their peers' family resources and personal abilities through their interaction). Since Chilean public and private schools differ in the socioeconomic status of their student populations, researchers have controlled for this aspect in order to reduce the bias of the estimates of the private/public schools gap. Nevertheless, there is huge disparity on the appropriate level of data aggregation, the specific covariates, and the type of measurement of school's socioeconomic status. I will illustrate how those divergences affect the results by analyzing alternative regression models, all of them present in the literature.

Table 8.6 shows the estimates of ten regression models containing exclusively school-level measurements of students' SES (models 2 to 11). These

models combine six different school-level controls[7]. Model 1 is the base-line model.

Model 2 to model 7 were estimated by including a single control variable each time. The introduction of these control variables significantly increases the capacity of the models to predict students' test scores: the proportion of the variation explained for the models ranges from 0.14 in the base line model to 0.25-0.29 in models with a school SES control variable added. Based on the R^2 statistics, the six controls have similar effects on the regression models; nevertheless, their effects on the estimated test-score gaps are markedly different.

Model 2 controls for schools' SES by using an official classification, which sorts schools in five SES groups (four dummies were incorporated; omitted category: "Low-SES"). This classification has been regularly used by researchers. The introduction of this covariate dramatically reduces the positive difference between private voucher over public schools (to 0.04 S.D), although it remains statistically significant.

Models 3, 4, and 5 control for family income, but measured in three different school-level indicators: income quintiles, the income natural logarithm, and the income standard deviation. As shown, the size of the estimated gap is noticeably different depending on the covariate: private voucher schools advantage over public schools ranges from 0.01 S.D. in model 3 to 0.12 S.D. in model 5. Finally, model 8 shows that when the level of family income is taken into account

(i.e. log of school mean of family income), the introduction of a variability measure (i.e. S.D. of income) has almost no impact on the private voucher effect estimate (compare models 8 and 4).

Models 6 and 7 introduce control variables referred to cultural capital (as opposed to economic capital, included in previous models): school mean of parents' years of education, and school mean of books at home. When parents' education is incorporated as a covariate, private voucher schools score lower than public schools, by 0.01 S.D.; in turn, when books at home is the covariate, private voucher students obtain lower test scores than public students (0.03 S.D.). Finally, when both control variables are added simultaneously (model 9), private voucher schools obtain statistically significant lower students' achievement than public schools, and –compared to model 6- this difference increases (0.04 S.D.).

Models 10 and 11 evaluate the impact of using simultaneously economic and cultural capital covariates. The estimated negative differences in academic achievement between private voucher schools and public schools on models 10 and 11 are almost the same as the estimated by model 9. This suggests that cultural differences between the student populations are the key factors that explain the observed advantage of private voucher over public schools (note that models 9, 10, and 11 also estimate a public schools' advantage over private non-subsidized schools).

In summary, the divergences on the way researchers have attempted to control for parents' education and school's SES have had decisive effects not only on the size but also on the sign of the estimated test-scores gap between private and public schools in Chile.

VIII. Level of data aggregation and data analysis.

Student-level versus School-level covariates.

Although since 1997 student-level data (both test scores and background information) is available in Chile, researchers still disagree on what is the best level of aggregation of control variables: while some use exclusively school-level controls, others use exclusively student-level controls, and some use both. In table 8.7, I present six regression models to demonstrate the consequences that this disagreement has on the estimates of the test score gap between private and public schools.

Model 1 is the baseline model. A set of student-level covariates was added to model 2; all those control variables significantly predict students' test-scores. Student-level control variables noticeably reduce the gap between private and public schools, but this gap remains positive and statistically significant (0.21 S.D. for private voucher schools). Model 3 incorporates an additional student-level covariate, which is an indirect measure of student's ability: whether the student was selected through an admission process. I incorporated this variable separately

for two reasons: firstly, to estimate whether it adds information to the traditionally used student-level controls; secondly, given that better schools can attract abler students, this variable is potentially endogenous and its effect can be confounded with school quality. This indirect measure of student's ability has a strong relationship with students' achievement, even after controlling for the mentioned student's characteristics: on average, selected students score 0.34 S.D. higher than students who were not selected through an admission process. Additionally, the introduction of this covariate slightly reduces the positive test-score difference between private voucher schools and public schools (to 0.18 S.D.).

Model 4 uses exclusively school-level control variables. As noted, those covariates have a huge effect on the estimate of the private/public test scores gap; in fact, after controlling for them, public school students score higher than private voucher students (0.04 S.D.). Correspondingly, the school-level selectivity measure was added to model 5, which slightly increased this estimated public school advantage over private voucher schools to 0.06 S.D.

Finally, model 6 includes covariates at student and school level. When both types of controls are simultaneously present, school-level predictors' parameter estimates tend to be more stable than student-level predictors (especially pronounced is the decrease in the *selected student* coefficient). As shown, this full-model estimates that –on average- public school students score higher than private voucher students by 0.06 S.D. (similar to the estimate by using exclusively school-

level covariates). Note that according to this full-model, there is not statistically significant difference between private non-subsidized and public school students. Finally, the R^2 of the full-model is slightly larger than the R^2 obtained by using only one-level control variables, suggesting that both kinds of predictors are needed to better explain students' test scores.

Between versus within schools' test-score variation.

The sensitivity of the findings to the choice of covariates at student versus school level can be additionally explored by using a multilevel analysis. Multilevel models are recommended to study student achievement because the regression assumption that residuals are independent is not satisfied in educational settings. There are two hypotheses to explain that: school effectiveness (within their schools, students share common educational experiences that significantly affect their outcomes), and school segregation (students enrolled in the same school share unobserved previous characteristics, which are related to their academic performance). My aim is to propose that the highly segregated nature of Chilean education entails an additional challenge to study the test-score gap between private and public schools.

Table 8.8 contains multilevel regression models for Mathematics and Language test-scores. The multilevel analysis allows me to separate the total variation of students' test scores in between-schools and within-schools variation. As reported, there is a very large between-schools variation in the Chilean

education: about half of the mathematics test-scores variation and more than a third of the Language test-scores variation occur between schools[8]. This very large between-schools variation explains why school-level predictors are so successful to estimate students' test-scores: Chilean students' academic achievement is highly predictable depending on the schools they attend.

Models 1 and 4 incorporate exclusively school-level variables; as shown, they explain 72% of the Mathematics and 80% of the Language total between-schools variation[9]. When school-level predictors are taken into account, public schools score higher than private voucher schools in both Language and Mathematics.

In order to explain some of the within-school variation, models 2 and 5 use exclusively student-level covariates (note that *type of school* is a school-level variable). According to those models, private voucher schools score higher than public schools in both Language and Mathematics. Nevertheless, these variables account for an extremely small proportion of the within-school variation: 3% in Mathematics and 2% in Language. Thus, once within-schools variation is distinguished, it becomes apparent that the available standardized information is insufficient to understand individual achievement in a context of highly segregated schools.

Finally, full-models 3 and 6 include both student-level and school-level predictors. The findings indicate that public schools score higher than private

voucher schools in Language and Mathematics. Note that, compared to models 1 and 3, student-level variables do not increase the proportion of between-schools explained variation.

To sum up: the size and the sign of the estimated test-score gap between private and public Chilean schools are highly sensitive to the level of aggregation of covariates included in the analyses. Additionally, the segregated feature of the Chilean educational system causes a very large between-school variation in students' performance; as a result, Chilean students' academic achievement is highly predictable depending on the schools they attend. This explains the very strong statistical relationship between school-level predictors and students' achievement.

IX. Conclusions and discussion.

Chile is a paradigmatic case of school choice and market oriented educational system: private and public schools openly compete for capturing family preferences and public subsidies. Unfortunately, several data limitations and methodological divergences have affected the research on the comparison between private and public school effectiveness, and on the systemic effects of school choice; as a result, previous research has obtained noticeably contrasting conclusions. This paper identified some threats to the validity of this research. The most important one is selection bias: the parents' school-choice process and the

schools' students-selection process introduce severe biases that researchers have not been able to overcome satisfactorily. Additionally, how to control for the enormous differences in schools' and students' characteristics between private and public schools, what the appropriate level of data aggregation and data analysis should be, and how to tackle the multilevel nature of educational data, are some supplementary sources of divergences among researchers.

By conducting exemplary data analyses, this paper demonstrated that the discussed methodological issues can affect not only the size but also the sign of the estimated comparative efficacy of private and public schools on students' academic achievement. For that reason, the answer to the question about whether private or public schools are the most effective in Chile is extremely sensitive to those methodological decisions. Although my analyses were based on OLS estimates of cross-section data, they introduced new measures of the *sorting* processes, the key source of bias on these studies. In fact, as hypothesized, both *sorting* mechanisms –selective admission processes and rejection of retained students- were significant predictors of the students' test scores and were more disseminated among private schools, accounting for some proportion of their observed advantage. Based on those analyses, my most precise estimates (see models 3 and 6 in table 10) indicate that private schools are not more effective than public schools, and that they may be less effective.

The reasons why private schools are not more effective than public schools in Chile are beyond the scope of this study. One hypothesis is that, although in the past voucher schools were more effective, public schools have reacted to the competition by improving their quality, and –consequently- they closed the previous gap. As explained, there is little –if any- evidence to support this hypothesis. An alternative hypothesis is that the institutional design of the Chilean educational system has structural deficiencies, because schools can improve their *market* position without improving the quality of their educational service.

The theory underlying this last hypothesis is as follow: competition among schools has not improved educational quality, because schools (mainly the private ones) have competed to attract the best students, rather than to increase the value-added of their educational service, which created a "zero-sum game": improvements of some schools are annulled by declines of others. Additionally, because of parents' choices have not necessarily been oriented to educational quality (because of information deficiencies and parents' use of non-academic criteria), schools have not received from their customers signals towards the educational improvement, but towards the use of status symbols and social segregation. Finally, deregulation and free competition have tended to increase school segregation through a process of mutual reinforcement between schools and families. From the supply side, schools have responded to the incentives of the competence, by distorting the indicators of quality through the rejection of

students who are less likely to succeed in school (applying admissions tests), and those who have demonstrated low capacities (expelling them). These sorting and re-sorting mechanisms, massively applied for two decades, have shaped the Chilean school system in its current segregated features. From the demand point of view, middle and high social-class families have found that schools' social and academic selectivity provide them a large profit of "peer effects" within schools: given the high correlation between learning outcomes and student's social background, when Chilean families aim at social selectivity, they obtain academic selectivity by extension.

The current evidence and the main findings of this paper provide partial support to this theory. Nevertheless, this study has also some limitations. First, although this study exploited new data on the student selection processes to eliminate the selection bias, we cannot be completely confident that the regression models overcame this threat to validity. Second, because SIMCE does not evaluate the same students over time, it was not possible to develop longitudinal analyses or create value-added models that control for previous student achievement. Finally, the lack of data on students' academic achievement prior to the voucher reform severely constrains the analysis about potential effects on the system as a whole.

If my conclusions are correct, they do not imply that private schools cannot be positive partners of Chilean public education, but it does suggest that, in order to contribute to improve educational quality and equity, voucher programs must be

carefully designed. In this sense, the Chilean experience provides some relevant lessons from an educational policy perspective.

Firstly, every school that receives public resources should guarantee non-discrimination to applicant students; thus, admission tests, academic and economic requirements, and other forms of sorting should be prohibited. Secondly, bad information can be as harmful as no-information: if the evaluation system does not estimate the actual effectiveness of the school, it can orient families and policy makers to a wrong direction. Thirdly, funding system, public policies and other institutional regulations should recognize that some students (e.g. low-income students, ethnic minorities) are more challenging to educate than others. This implies that schools that serve more disadvantaged students should receive additional resources. Fourthly, it is overoptimistic to expect that families' demand will improve educational quality by itself; complementarily, some public incentives, pressures, and regulations should also be in place in order to *push* schools toward genuine processes of school improvement. Finally, Chilean private schools include for-profit and nonprofit institutions, and the current system does not make this distinction at all, and parents do not have this information. Legislation and educational policies should differentiate these two kinds of schools, in order to give priority in the access to publicly funded school improvement programs and other public resources (texts, computers, teaching materials, teacher training, etc.) to schools serving public goods.

[1] See Bellei and Mena (2000) for details.

2 The average tuition of the co-pay system is about half of the public voucher, while the average tuition of the elite schools is about four to five times the public voucher.

3 Vegas (2002) is an exception: she analyzed 1999 data, and used a unique database on teachers' characteristics.

4 Catholic schools have been estimated to be –on average- more effective than public schools. Unfortunately, in my analysis I cannot distinguish between Catholic and non-catholic private schools.

5 Note that this repetition rate is at the middle of 4th grade. According to the Chilean rules, students should not repeat 1st grade; thus at that point, students could have repeated only 2nd and 3rd grades.

6 I will report the test-score gap in S.D. units. I divided the regression coefficients by the population S.D. (Mathematics S.D. = 56; Language S.D.= 48)

7 I did not include the most used School SES index, which is the percentage of students "at risk". This index is an administrative tool used by the Ministry of Education to distribute free lunch among schools. The index is mainly based on physical health indicators; it uses only information of the first grader students, and is self-reported by the schools. All private non-subsidized and many private

voucher schools have no information on this index (researchers assign 0% to these schools). Thus, I consider this index is not a good measure for research purposes.

8 As a point of reference, consider that the PISA (OECD-UNESCO 2003) –an international survey on students' performance in Language, Mathematics, and Science- found a negative relationship between the level of students' achievement and the level of between-school variation. For example, the three countries with the highest students' performance, Finland, Canada, and New-Zealand, had between-schools variations of 12%, 18%, and 16% respectively; United States had 30% between-schools variation; in that test, Chile had one of the highest levels of between-schools variation: 57%.

9 It is important to note that the proportion of explained variation is relative to the respective proportion of explainable between and within school variations.

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Tables Chapter 8.

Table 8.1. Variable definitions.

Variable	Definition
Student-level variables	
Mathematics	Standardized IRT test score
Language	Standardized IRT test score
Mother's education	Years of education of the student's mother
Father's education	Years of education of student's father
Family income	Natural LOG of student's family income
Books	Number of books at student's home, scale ranging from 0 (0 books) to 5 (> 200 books)
Gender	Dummy variable for student's gender (omitted category: woman)
Repetition	Dummy variable indicating whether the student has repeated a grade
Selection	Dummy variable indicating whether the student was selected by the school through an admission process (e.g. tests, grades requirements)
Parent's expectation *	Parents' expectation about the future student's educational attainment, scale ranging from 1 (4^{th} grade) to 8 (graduate studies)
School-level variables	
Type of school	Dummy variables indicating whether the school is public (omitted category), private voucher, or private non-subsidized
Mean mothers' education	School average of years of education of students' mothers
S.D. mothers' education	School standard deviation of years of education of students' mothers
Mean parents' education	School average of years of education of both students' parents
Mean books at home	School average of the individual variable "books at home"
Selected students	Proportion of students who sere selected by the school through an admission process
School SES level	5 dummy variables that classify schools in Low, Middle-Low, Middle, Middle-High, High students' socioeconomic status (categories are based on parent's education, family income, and proportion of at-risk students in the school)
Quintile income	Quintile classification of schools based on the school average of family income
LOG school families' income	Natural LOG of the school average of student's family income
S.D. families' income	School standard deviation of the students' family income
% repitent students in school *	Percentage of students in the school who have repeated at least a grade
School expels repitent students *	School that (according to parents) expels students who repeat a grade
Students always in this school *	Proportion of students who have been in the same school since 1^{st} grade
Years attending the current school (school mean)*	School average of years that students have attended the current school

Note: * Only available in SIMCE-2002, 4^{th}-grade.

Table 8.2. Comparing public and private voucher school students. Student-level characteristics: Mean (S.D.).

	Public N=109,624	Private voucher N=96,585
Mathematics	230.1 (55.2)	250.3 (57.4)***
Language	241.5 (48.0)	257.4 (48.5)***
Mother's education	9.3 (3.6)	10.8 (3.7)***
Father's education	9.7 (3.8)	11.1 (3.9)***
Books at home	1.7 (1.2)	2.1 (1.2)***
Selected student	59.1% (47.4%)	71.9% (43.4%)***
LOG Family income (original scale: 1 to 13)	0.5 (0.6)	0.7 (0.7)***
Gender (Male)	49.3% (49.9%)	49.8% (49.9%)

Source: author elaboration, based on SIMCE-2003. Key: ~p<.10; *p<.05; **p<.01; ***p<.001

Table 8.3. Predicting private voucher school attendance: the effect of student selection through an admission process. Logistic regression models for the relationship between whether a student attends a private voucher school (vs. public school) as a function of whether he was selected by the school, and some family characteristics.

Dependent variable: Private voucher school attendance (vs. public school attendance)		
	MODEL 1	MODEL 2
Selected student	0.73***	0.58***
	(0.01)	(0.01)
Mother's education		0.04***
		(0.00)
Father's education		0.02***
		(0.00)
Family income		0.04***
		(0.01)
LOG Family income		0.25***
		(0.03)
Books at home		0.11***
		(0.01)
Constant	-0.47***	-1.28***
	(0.01)	(0.02)
Max-Rescaled R^2	0.04	0.09
N (students)	237,492	237,492

Source: author elaboration. Key: ~p<.10; *p<.05; **p<.01; ***p<.001

Table 8.4. Identifying the effect of student selection during the schooling process. Relationship between school type and Mathematics achievement. Additional covariates include: Gender, Father's and Mother's education, LOG Family income, Books at home, Parent's expectation, and School SES level. Omitted category: Public schools.

	Outcome variable: 4th grade students' Mathematics test score, SIMCE-2002					
	All students		Students who have not changed school		Students who have changed school	
	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
Private voucher	18.83***	-0.31	20.55***	0.28	16.34***	-1.75***
	(0.24)	(0.27)	(0.29)	(0.33)	(0.45)	(0.49)
Private non-subsidized	61.11***	7.33***	62.47***	8.22***	55.99***	4.51***
	(0.45)	(0.59)	(0.52)	(0.72)	(0.92)	(1.08)
Student repeated at least a grade		-21.66***		-23.77***		-19.30***
		(0.38)		(0.52)		(0.63)
% repitent students in school		-0.33***		-0.26***		-0.40***
		(0.02)		(0.02)		(0.03)
School expels repitent students		10.54***		7.82***		14.74***
		(0.72)		(0.86)		(1.40)
% students always in this school		15.99***		32.11***		0.06
		(1.40)		(1.93)		(2.43)
Years attending the current school (school mean)		1.30***		0.05		2.90***
		(0.39)		(0.48)		(0.71)
Constant	238.2***	188.2***	239.9***	180.7***	234.8***	192.6***
	(0.16)	(1.02)	(0.19)	(1.37)	(0.32)	(1.82)
Additional control variables	NO	YES	NO	YES	NO	YES
R^2	0.10	0.25	0.11	0.26	0.07	0.25
N (students)	199,112	199,112	137,181	137,181	54,895	54,895

Source: author elaboration. Key: ~p<.10; *p<.05; **p<.01; ***p<.001

Table 8.5. Regression models that relate school type and students' Mathematics achievement, controlling for parents' education variables. Omitted category: Public schools.

	Dependent variable: 10th grade students' Mathematics test score, SIMCE 2003					
	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
Private voucher	20.35***	14.82***	13.66***	-1.21***	20.41***	-1.69***
	(0.25)	(0.24)	(0.24)	(0.24)	(0.25)	(0.24)
Private non-subsidized	86.77***	64.99***	59.11***	-0.30	87.01***	-2.27***
	(0.45)	(0.47)	(0.47)	(0.55)	(0.46)	(0.57)
Mother's education		3.82***	2.58***			
		(0.03)	(0.04)			
Father's education			2.05***			
			(0.04)			
School mean mothers' education				13.49***		13.55***
				(0.06)		(0.06)
School SD mothers' education					0.67*	-4.32***
					(0.33)	(0.30)
Constant	230.07***	194.56***	186.32***	107.25***	227.92***	120.50***
	(0.17)	(0.33)	(0.36)	(0.55)	(1.06)	(1.06)
R^2	0.14	0.20	0.21	0.30	0.14	0.30
N (students)	237,492	237,492	237,492	237,492	237,492	237,492

Source: author elaboration. Key: ~p<.10; *p<.05; **p<.01; ***p<.001

Table 8.6. Regression models that relate school type and students' Mathematics achievement, controlling for school SES variables. Omitted category: Public schools.

	Dependent variable: 10th grade students' Mathematics test score, SIMCE 2003										
	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6	MODEL 7	MODEL 8	MODEL 9	MODEL 10	MODEL 11
Private voucher	20.42***	2.30***	0.53*	1.34***	6.79***	-0.52*	-1.59***	1.54***	-2.09***	-2.58***	-1.93***
	(0.25)	(0.24)	(0.25)	(0.25)	(0.24)	(0.24)	(0.25)	(0.25)	(0.24)	(0.24)	(0.24)
Private non-subsidized	86.75***	3.95***	41.44***	8.56***	10.70***	-1.95***	3.54***	4.04***	-4.05***	-11.16***	-7.03***
	(0.45)	(0.79)	(0.47)	(0.56)	(0.59)	(0.56)	(0.55)	(0.58)	(0.56)	(0.79)	(0.58)
Middle-Low SES		10.46***								-14.61***	
		(0.30)								(0.38)	
Middle SES		49.95***								-9.29***	
		(0.34)								(0.67)	
Middle-High SES		82.04***								-4.79***	
		(0.53)								(1.02)	
High SES		105.91***								-6.33***	
		(0.92)								(1.43)	
Quintile school income			22.33***								
			(0.11)								
Log school family income				37.57***				30.13***			-8.01***
				(0.18)				(0.33)			(0.52)
SD school family income					35.24***			9.27***			7.13***
					(0.19)			(0.34)			(0.34)
Mean school parents' education						12.99***			7.80***	7.65***	7.68***
						(0.06)			(0.13)	(0.17)	(0.16)
Mean books at home							49.12***		22.15***	24.90***	25.18***
							(0.22)		(0.51)	(0.51)	(0.55)
Constant	230.1***	215.1***	186.1***	227.9***	184.1***	109.8***	148.5***	216.2***	121.0***	127.1***	108.3***
	(0.17)	(0.25)		(0.16)	(0.30)	(0.56)	(0.40)	(0.46)	(0.61)	(1.07)	(1.30)
R^2	0.14	0.27	0.27	0.27	0.25	0.29	0.29	0.27	0.30	0.31	0.30
N (students)	237,427	237,427	237,427	237,427	237,427	237,427	237,427	237,427	237,427	237,427	237,427

Source: author elaboration. Key: ~p<.10; *p<.05; **p<.01; ***p<.001

Table 8.7. Regression models that relate school type and students' Mathematics achievement, controlling for students' and schools' variables. Omitted category: Public schools.

	Dependent variable: Mathematics 10th grade student's test score, SIMCE 2003					
	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
Private voucher	20.35***	11.89***	10.06***	-2.40***	-3.15***	-3.51***
	(0.25)	(0.24)	(0.24)	(0.25)	(0.24)	(0.24)
Private non-subsidized	86.77***	49.85***	47.64***	-5.45***	1.29*	-0.52
	(0.45)	(0.51)	(0.50)	(0.58)	(0.58)	(0.59)
Mother's education		1.90***	1.71***			0.74***
		(0.04)	(0.04)			(0.04)
Father's education		1.34***	1.24***			0.35***
		(0.04)	(0.04)			(0.04)
LOG Family income		4.81***	4.86***			1.20***
		(0.20)	(0.20)			(0.19)
Books at home		6.71***	6.29***			3.65***
		(0.10)	(0.10)			(0.10)
Gender (Male)		7.66***	7.77***			9.11***
		(0.22)	(0.22)			(0.20)
Selected student			18.84***			3.96***
			(0.24)			(0.27)
School mean parents' education				7.91***	7.17***	5.97***
				(0.13)	(0.13)	(0.13)
School SD mothers' education				-3.47***	-0.88**	-0.48
				(0.30)	(0.30)	(0.29)
School mean books at home				21.79***	16.17***	13.93***
				(0.51)	(0.51)	(0.51)
% Selected students in school					33.44***	29.52***
					(0.46)	(0.51)
Constant	230.1***	181.8***	174.0***	131.7***	119.99	112.0***
	(0.17)	(0.37)	(0.38)	(1.08)	(1.08)	(1.08)
R^2	0.14	0.23	0.25	0.30	0.32	0.33
N (students)	237,492	237,492	237,492	237,492	237,492	237,492

Source: author elaboration. Key: ~p<.10; *p<.05; **p<.01; ***p<.001

Table 8.8. Multilevel regression models. Relationship between school type and students' Mathematics and Language achievement, controlling for students' and schools' variables. Omitted category: Public schools.

	Dependent variable: 10th grade student's test score, SIMCE 2003:					
	MATHEMATICS			LANGUAGE		
Initial Between schools variation	49%			37%		
Initial Within schools variation	51%			63%		
	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	MODEL 6
Private voucher	-2.89*	24.26***	-3.30*	-1.78*	18.56***	-1.87*
	(1.42)	(1.65)	(1.43)	(0.89)	(1.12)	(0.88)
Private non-subsidized	4.32~	70.25***	3.56	-4.35**	47.69***	-3.42*
	(2.49)	(2.09)	(2.49)	(1.58)	(1.44)	(1.56)
School mean parents' education	4.97***		4.39***	4.23***		3.63***
	(0.56)		(0.56)	(0.36)		(0.35)
School mean books at home	17.35***		14.23***	15.00***		10.89***
	(2.13)		(2.14)	(1.37)		(1.36)
% Selected students in school	39.00***		35.79***	25.25***		22.79***
	(2.31)		(2.32)	(1.46)		(1.45)
Mother's education		0.87***	0.84***		1.04***	1.00***
		(0.03)	(0.03)		(0.03)	(0.03)
LOG Family income		-0.69***	-0.78***		-1.06***	-1.20***
		(0.17)	(0.17)		(0.16)	(0.16)
Books at home		4.09***	4.02***		4.10***	4.00***
		(0.09)	(0.09)		(0.08)	(0.08)
Gender (Male)		10.36***	10.39***		-4.29***	-4.28***
		(0.21)	(0.21)		(0.19)	(0.19)
Selected student		4.01***	3.63***		2.99***	2.49***
		(0.24)	(0.24)		(0.22)	(0.22)
Percentage of explained variation:						
Between Schools	71.6%	48.1%	71.6%	79.7%	55.0%	80.2%
Within Schools	0%	2.8%	2.8%	0%	2.4%	2.4%
Number of students (schools)	237,629	237,629	237,629	237,629	237,629	237,629
	(2,105)	(2,105)	(2,105)	(2,105)	(2,105)	(2,105)

Source: author elaboration. Key: ~p<.10; *p<.05; **p<.01; ***p<.001