

VOUCHERS, INEQUALITIES AND THE CHILEAN EXPERIENCE

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Abstract

Vouchers are one of the most discussed educational policies. However, little attention has been given to how the structure of specific vouchers affects the outcome of the system. This article examines Chile's twenty years of experience with a flat voucher from the perspective of social inequality. When vouchers deliver the same resources to children from different socioeconomic backgrounds, there is a design problem that needs to be addressed. We propose a modification of the current voucher applied in Chile to an income related system (a basic voucher plus a means-tested voucher) and estimate the financial resources involved. We also set out general lessons for those interested in introducing a national voucher system.

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VOUCHERS, INEQUALITIES AND THE CHILEAN EXPERIENCE

A growing literature discusses how to improve educational services. One general lesson is that each system needs a careful and detailed design that emphasizes proper accountability and consistency between different incentives.

Vouchers have been one of the most analyzed educational policies, with two widely debated hypotheses: (a) vouchers will allow improvements in efficiency by, on the one hand, transferring students from public to private schools and, on the other hand, by generating competition between schools by which all schools improve their efficiency; (b) vouchers will have negative consequences for the educational system's equality because they encourage stratification and discriminate against low ability and poor students. A less studied topic relates to how the outcomes of voucher systems stem from their specific design.

This paper concerns the second hypothesis, that is the distributive consequences of voucher systems, and how the structure itself can have distributional effects, with the Chilean case as the context for the analysis and discussion.

Specifically, the paper reviews Chile's twenty years of experience with a voucher system from the point of view of social inequality. We argue that the equality of voucher systems depend on their design. In a society with very unequal income and wealth distribution, a flat voucher tends to perpetuate existing inequalities. If an educational system has the objective of compensating for initial social differences, then educational vouchers should be income dependent.

As is well known, one of the key variables to explain student performance is the family's socioeconomic status. If the government provides the same financial resources to poor, middle or high income families, schools will prefer to enroll high or middle income students because their results are likely to be better and will improve peer composition.¹ So when vouchers for the same value are delivered to children of families with distinct socioeconomic levels (SES), as in Chile, there is a problem that should be addressed. This study analyses how to correct Chile's voucher system, estimates the monetary amounts involved, and suggests lessons for those interested in introducing a national voucher program.

Although there are other experiences with vouchers, the Chilean case has characteristics that make it of special interest: it is a national system, applied for a long time, with high private participation, and a significant presence of for-profit schools.

In the first section of the paper, we review the literature dealing with voucher models, identifying differences between voucher structures and examining common criticisms, most of them referring to discrimination issues. The second section briefly describes the voucher system in Chile. The third section shows different dimensions of inequality in the Chilean educational

¹ In voucher systems, the need to increase school enrollment should push schools to improve quality. Nevertheless, if the schools can show spurious quality because of a better student selection, the system produces a serious bias. This issue has been raised by, among others, Glennerster (1993), Ladd (2002), Gauri and Vadwa (2003) and Hsieh and Urquiola (2003).

system and stresses the need to link vouchers with family income. The fourth section examines how to implement an income related voucher, analyzing whether it should be targeted by student or by school. The fifth section estimates the amount of additional resources that such a policy might require. The final section presents a summary of the conclusions.

I. CONCEPTUAL FRAMEWORK: VOUCHER MODELS

In voucher systems, funds to finance education are allocated to parents, thus they can choose which school to send their children. School choice, financial resources depending on enrollment, together with the possibility of losing students (exit, in Hirschman's 1973 terminology) are key characteristics for voucher models. On the other hand, as experience has increased, we have learned that some elements differentiate one voucher program from another.

In this section, first, we discuss the types or characteristics of voucher schemes; second, we emphasize inequality problems, briefly reviewing not only the concerns expressed in the theoretical literature but also those from empirical cases. Finally, we conclude this section with some recommendations, suggested by both types of literature on what the design of a voucher scheme ought to do to correct inequality.

a. *Voucher Types*

The basic characteristics that differentiate voucher structures are,²

(i) *The form in which the resources are delivered (to whom and how)*: the funds are distributed directly to the parents as a stipend, cash, or as a certificate vs. the funds are delivered to the school, as a function of the number of children that attend (enrollment). This second type is the most common and is known in the literature as the "funds follow the child" system³.

(ii) *Open (schools) vs. a restricted system for eligible schools*: in an open system any school can participate vs. a restricted system where only eligible schools that comply with certain requirements can participate; for example, a system restricts itself to public schools only, or includes private non-fee charging schools only.

(iii) *Open (students) vs. selective or means-tested vouchers by students*: in an open system vouchers are available to all families vs. a selective or targeted system where only poor families, with income below an established threshold, can obtain them.

² Authors that identify some of these voucher types are: Bearse *et. al.* (2000), Blaug (1984), Fernandez and Rogerson (2003), Gaudi and Vadwa (2003) and West (1997), among others.

³ The "funds follow the child system" has been adopted in Bangladesh, Belize, Colombia, Guatemala, Lesotho, Poland, Sweden, the United Kingdom and the United States. See, West (1997).

(iv) *Flat or lump-sum vs. progressive, income related or means-equalizing vouchers*: in a flat or lump-sum system, all students receive the same amount of resources *vs.* a progressive system where the funds are inversely related to student's income.⁴

(v) *Only voucher vs. supplementable or top-up voucher*: schools can receive funds (vouchers) only from the government *vs.* parents can make additional contributions to the school, known as "top up" above the value of the voucher. The supply of additional resources by parents allows an increase in educational expenditures; on the other hand, the potential for the system's inequality is greater.

In addition to vouchers, there are other types of demand side transfers from government to schools. Probably the most typical way by which funds are delivered to social programs is through *categorical-aid*: funds as a function of the proportion of low-income students in a school or in a program. However, in contrast to the voucher, benefits of a categorical aid program are not portable.

Little attention has been given to how specific vouchers' structure affect the outcome of the system. Many of the criticisms about discrimination of voucher systems derive from the flat voucher type.

b. Equality Concerns Regarding Vouchers

The main critical comments that arises from the theoretical literature on vouchers, refers to the potential discrimination or socioeconomic and racial segregation, which it could produce in an educational system⁵. Most of applied research analyzes the effects of choice (vouchers) on achievement and other educational results⁶. Few studies concentrate on discrimination, among them: Fiske and Ladd (2000), Berry, Jacob and Levitt (2000), and Hsieh and Urquiola (2003).

One of the reasons why there are few empirical studies about discrimination is that most of the experience with vouchers in the United States affects a small and homogeneous percentage of the population. Discrimination issues are more relevant in large scale experiments, a reason why Chile's experience is particularly illustrative.

⁴ It must be noted that there are some differences between the latter terms. Fernandez and Rogerson (2003) point out that in a means-equalizing voucher the payment depends both on family income and on the fraction of their income devoted to education. In the progressive voucher, the amount is a decreasing function of household income.

⁵ See, Manski (1992); Epple and Romano (1998); Fernandez and Rogerson (1996, 1998); and, Hsieh and Urquiola (2003). For critics of the effects of vouchers on equality, see Henig (1994) and Ladd (2002) among others.

⁶ See for example, Levin (1998) for an early review. Peterson *et. al.* (2003) evaluate voucher programs in New York, Washington D.C., and Dayton, Ohio. Hoxby (2002) examines vouchers in Milwaukee and charter schools in Michigan and Arizona. Rouse (1997) analyze the case of Milwaukee, and King *et al.*, (1999) and Angrist (2001) *et. al.* analyze the voucher program in Colombia.

i) *Equality Problems in Theoretical Models*

There are basically three reasons behind discrimination or “cream skimming” in a voucher model⁷: (i) better off families take better advantage of choice than poorer families; (ii) schools prefer students from high income families and with high ability; (iii) parents choose schools with a higher socioeconomic level, because they prefer a better peer group environment owing either to plain discrimination, or because they expect that a high socioeconomic environment (better peers) has a positive effect on educational results or other outcomes.

Nechyba (1996) points to the tendency of schools to select students from higher SES families and with higher previous educational accomplishments. Epple and Romano (1998) develop a model with student selection, open enrollment in public schools and peer effects concluding that vouchers increase the relative size of the private sector and the extent of sorting and benefit high-ability relative to poor-low ability students.

Epple and Romano (1996) and Nechyba (1999) analyze vouchers allocated on the basis of income, ability, residence and school type. Bearse *et. al.* (2000) compare uniform and means tested vouchers and conclude means testing reduces the inequality of educational expenses. Caucutt (2002) studies the effects of voucher policies on the sorting of children across schools, and demonstrates that switching from the public school system to a voucher system leads to an increase in income inequality, regardless of the measures of inequality applied.

Another concern is that the voucher system will benefit high income families that will transfer from private to government funded schools, see for example West (1997). This, also, would have negative consequences on the system’s equality.

ii) *Empirical Evidence on Segregation and Vouchers*

In recent years, voucher systems have been implemented in various countries. The principal cases are Belgium, Chile, Colombia, Czech Republic, Holland, New Zealand, Scotland, Sweden and experiences within the United States in states and cities such as Cleveland, Dayton, Florida, Milwaukee, New York, and Washington D.C. Research that examines these experiences include West (1997), Levin (1998), Patrinos (1999), Ladd (2002) and Gauri and Vadwa (2003).

Levin (1998) undertook an extensive review and concluded from the cases of New York, Scotland, Belgium and Holland, that choice lead to greater socioeconomic and racial segregation of students. West (1997) lists twenty cases of voucher experiences, finds no significant evidence of voucher systems increasing discrimination and argues that middle-income parents have not switched to the private sector. Ladd (2002) using evidence from Chile and New Zealand considers that large-scale universal voucher programs could be detrimental to disadvantaged students, and she favors more narrowly targeted means-tested programs. According to Gauri and Vadwa (2003), Chile and New Zealand’s voucher systems creates strong incentives for schools to select advantaged students, even though class segregation is difficult to prove with statistical analysis.

⁷ Levin (1998) develops the first two reasons.

There are additional papers that have analyzed the relationship between vouchers and discrimination and valuable examples for a country or region are: Fiske and Ladd (2000), Ladd and Fiske (2001), Hsieh and Urquiola (2003), Lankford and Wyckoff (1999), Clotfelter (1999), Ladd and Hanson (1999), and Berry, Jacob and Levitt (2000).

The papers by Ladd and Fiske (2001) and Hsieh and Urquiola (2003) are large-scale studies at the national level for the cases of New Zealand and Chile respectively. For New Zealand, Ladd and Fiske (2001) concluded that with the implementation of a voucher model, students tended to gravitate away from low-decile schools toward higher decile ones and so increased the disparities among schools, in terms of student race, SES and performance. Hsieh and Urquiola (2003) consider that the first-order effect of the voucher program in Chile is sorting, as choice facilitated the exit of middle class families from the public school system, without improving average educational outcomes. In sum, according to these studies, choice tended to increase school stratification.

iii) Inequality and Design of Voucher Systems

The theoretical literature is clear to point out that the way to face up inequality is to design a voucher as a function of income or to restrict the vouchers to poor families. For example, Epple and Romano (1998) claim that less-able students will need more financial assistance and vouchers will need to be income dependent, if they intent to avoid an increase in ability segregation. Hoxby (1996) notes that vouchers are particularly important for poor households, and that private school vouchers should be means-tested and categorical. Bearnse *et. al.* (2000) state that if uniform and universal vouchers lead to more socioeconomic segregation, one obvious policy response is to use means-tested or selective vouchers.

While empirical cases have been analyzed with less frequency, the literature makes similar recommendations regarding compensation formulas. For example, Gauri and Vadwa (2003) point out that it makes sense to include in a compensation formula, factors that correct for the social effect on the composition of the student body, and, if not feasible, then eligibility for voucher programs should be restricted to the poor.

Thus, voucher systems must have certain characteristics to minimize segregation: the quantity of resources provided to families should be inversely proportional to their income; and, access should be –explicitly or implicitly- restricted to families with an income below a certain level. It should be noted that high or medium income families can be restricted from voucher systems by explicitly establishing a means test (an income ceiling) or implicitly by setting a ceiling to the top-up voucher.

II. THE CHILEAN VOUCHER SYSTEM

In the early 1980s Chile's education system underwent a far-reaching reform, whose key feature was the transfer of public school administration to the municipal level. The reform also facilitated private-sector participation in the market for education supply, via the introduction of a per-student subsidy mechanism (voucher). This subsidy or voucher finances both private subsidized

and public schools, and is supposed to cover the school's operating costs, while at the same time promoting competition between schools to attract and retain students.⁸

After the reform, the Chilean educational system is characterized by,

- Three types of schools: (i) public schools financed with the voucher and run by the municipalities; (ii) private subsidized schools, also financed by the voucher and operated by the private sector; (iii) private fee-paying schools, financed exclusively out of fees paid by parents and run by the private sector.
- The school system has three sources of funds: (i) the voucher from the government (municipal and private subsidized schools); (ii) additional funds from local government or municipalities (only municipal schools)⁹; (iii) fees paid by parents (principally for private fee-paying schools, but also there are parental contributions to voucher type schools).
- The voucher or subsidy is a “funds follow the children” type.
- The amount of the voucher differs by type of education. The voucher is higher for secondary than primary level, and is also higher for rural as against urban schools to compensate for higher costs. However, the voucher is flat with respect to student socioeconomic characteristics.
- The voucher is a top-up type, but has a ceiling – approximately 1,6 times the value of the voucher.¹⁰ This parents’ payment is voluntary and the schools to which it is applied are known as “*shared-financing schools*”¹¹. However there are restrictions for municipal schools, which can only charge this fee at the secondary level¹². Shared-financing schools must devote up to 10% of their additional income to finance scholarships.¹³ The percentages of schools under shared-financing by 2000 was: 45% of private subsidized schools at primary level and 71% at secondary level; while the participation of municipal schools was 17% at the secondary level.
- Additionally, since 1990 Chile has implemented some targeted programs aiming to improve the equity and quality of the educational system. This type of programs can be

⁸ Table A.1 in the Appendix presents the value of the voucher according to level and types of education.

⁹ Municipalities contribute to their schools’ district using their own municipal funds; also they are able to contribute with other resources if they obtain regional government funds to finance school investment.

¹⁰ To be precise the highest amount is 4 SSU, where SSU (monthly school subsidy unit) is a monetary index that expresses the voucher value. See Appendix, Table A.1.

¹¹ They are known as “*colegios con financiamiento compartido*”.

¹² Initially, when the reform was implemented in 1981, it was prohibitive for private subsidized schools to charge parents (because this sum was discounted from the government voucher). Since 1993, the voucher discount is inversely proportional to the amount of shared-financing but no greater than 35%. Table A.2 in the Appendix sets out the details of the voucher discount and the contribution of the scholarship fund.

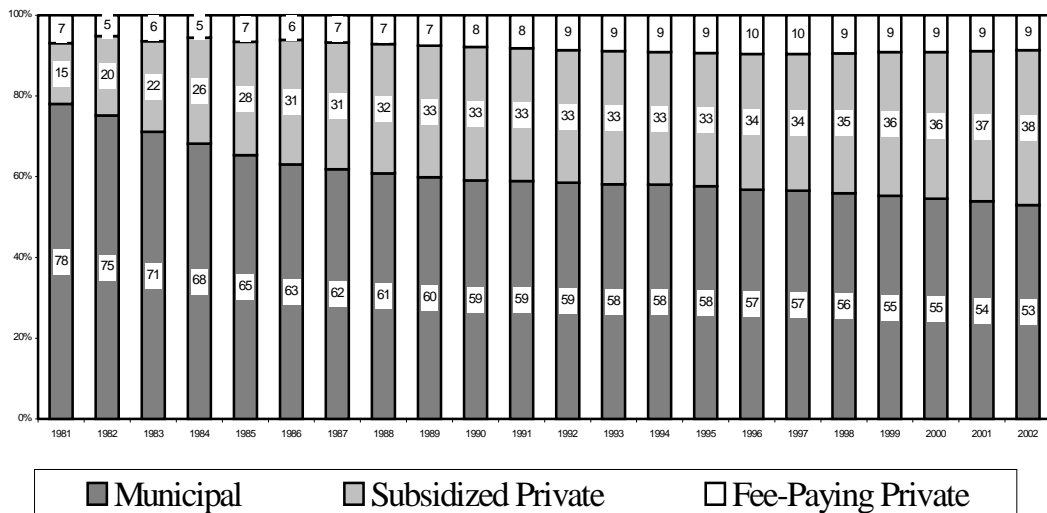
¹³ The fraction that must be diverted to finance scholarship is increasing with the amount charged to parents. See Table A.2 in Appendix.

described as categorical aid and has been targeted to certain types of subsidized schools (public and private) or geographic regions.

Not only can parents choose between schools, but private schools might also select from their pool of applicants. While private schools (both subsidized and fee-paying) establish their own rules for student selection, municipal schools have to accept all students when they have vacancies and can establish their own selection criteria only if oversubscribed.

Graph 1 shows the increase in private subsidized school enrollment in Chile, which accounted for 38.4% of total enrollment in 2002. In contrast, municipal schools now represent 53% of enrollment. The private fee paying schools have remained relatively stable during the last years with small enrollment fluctuations around a 9% average.

Graph 1
Distribution of Enrollment by Type of School: 1981-2002
 (percent)



Source: Ministry of Education.

III. THE DIMENSIONS OF INEQUALITY IN THE CHILEAN EDUCATIONAL SYSTEM

This section examines educational inequality in Chile, with a twofold purpose. On the one hand, it presents a snapshot of the voucher system after 20 years experience and, on the other hand, it establishes the need to implement an income related voucher.

We will refer in particular to: the differences in educational results among schools; the differences between the type of school attended by pupils according to their socioeconomic origin; and the schools' economic resources by pupils socioeconomic level. Finally, we show that despite the significant socioeconomic differences set out, there is some degree of social integration within schools.

a. Uneven Quality of Test Results

There is a strong relationship between students' SES and educational achievement, as measured by standardized testing. According to SIMCE, Chilean Educational Quality Measurement System, poor students -classified by a SES index¹⁴- obtained on average 223.7 points in math and 222.9 point in language, while the children from the richest households obtained on average 295.2 points in both test for 4th grade; the difference corresponds to 1.43 and 1.45 standard deviations (the test had an overall average of 250 and a standard deviation of 50 points). Similar results have been obtained for other tests and educational levels (Table 1), with a small increase in the dispersion in secondary levels, when the difference between the poorest and richest children reach 1.48 and 1.50 standard deviations.¹⁵

Table 1
Students SES and SIMCE Test Scores
(test scores)

<i>Test</i>	<i>Students' SES Decile</i>									
	1	2	3	4	5	6	7	8	9	10
<i>4° grade, 1999</i>										
Math	223.7	229.4	232.7	237.7	242.6	250.1	256.4	265.1	275.8	295.2
Language	222.9	228.7	232.5	236.8	242.1	250.2	257.9	266.3	277.5	295.2
<i>10° grade, 1998</i>										
Math	228.3	234.2	234.2	239.1	242.8	247.7	254.2	265.2	277.6	302.3
Language	224.4	231.3	232.9	238.9	245.6	251.2	259.5	269.2	280.4	299.2

Source: Authors' calculations, based on SIMCE test results.

¹⁴ The socioeconomic indicator (SES) is estimated by factorial analysis, based on parent's education and income; the school average also includes an estimate of school social vulnerability, calculated by the agency which provides food supplements to schools.

¹⁵ It must be noted that the percentage of age-school children enrolled in school was 97% for primary and 84% for secondary schools.

b. Family Income and School Type

Table 2 shows an estimation of school enrollment by family income deciles and school type, based on Household Surveys for 1990 and 2000 (last available survey).

Table 2
Enrollment, Family Income Decile and Type of School: 1990 and 2000
(percent)

Income Decile	1990			2000		
	Municipal	Private Subsidized	Private Fee-paying	Municipal	Private Subsidized	Private Fee-paying
1	20.9	12.7	2.2	23.7	9.9	1.2
2	16.8	11.0	2.0	22.8	11.4	1.4
3	14.7	11.7	1.5	18.6	13.0	1.6
4	11.9	11.8	2.6	14.2	10.9	1.7
5	9.5	10.7	2.8	12.1	13.1	3.9
6	8.5	11.4	7.0	9.0	12.0	3.8
7	6.0	9.1	5.9	6.7	9.8	4.6
8	5.5	9.3	9.7	4.9	9.7	12.4
9	3.9	6.9	22.5	2.9	7.0	23.8
10	2.2	5.5	43.7	1.4	3.1	45.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' calculations, based on socioeconomic household survey (CASEN- *Caracterización Socioeconómica Nacional*) 1990 and 2000.

In 1990, after near 10 years following the implementation of the voucher system, municipal 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. The 2000 snapshot is very similar: 56% of municipal school enrollment came from deciles 1, 2 and 3, while 59% of private fee-paying school enrollment came from the 9 and 10 deciles. However, pupils from private subsidized schools are distributed across deciles 1 to 8 in a relatively equitable way, with slightly greater participation among the intermediate deciles.

c. Family Income and School Resources

As noted, schools receive income from three sources: the government, the municipalities and parents. The government sends funds to the municipal and private subsidized schools; municipalities transfer resources only to municipal schools; and, parents contribute in shared-financing schools (basically private subsidized) and pay the total cost of education in private fee-paying schools.

In order to estimate the degree of inequality in the resources (funds) received by schools, we estimated a Gini index according to school SES; the index refers to both municipal and private

subsidized schools, for which the Ministry of Education has the required data. The distribution of these resources among school SES deciles is also presented in the Appendix (Table A.3).

The Gini has a value of 0.170 when we consider only government funds; it increases to 0.180 when we add municipal funds, and decreases to 0.150 when we include parents' contribution through shared-financing. Overall, the degree of inequality (0.150) seems low when compared, for example, to Gini values for income distribution. Also, it calls attention the fact that Gini decreases when adding parents' funds; the reason being that government and municipal funds are progressive.

Rural, technical schools and boarding schools are more expensive and attract the poorest students, therefore the lowest deciles receive a higher percentage of government funds; for example, decile 1 receive 12.6 % of total government funds. The schools that typically attract wealthier students and have shared-financing received 8.5% of government funds.¹⁶ In addition, funds received by schools from the municipalities are small and only slightly progressive so that the Gini increases to 0.180. These results contradict earlier studies, which have stated that extra municipal funding resulted in notable school inequities in school expenditures between poor/rich schools in Chile (Patrinos, 1999 and Winkler and Rounds, 1993).

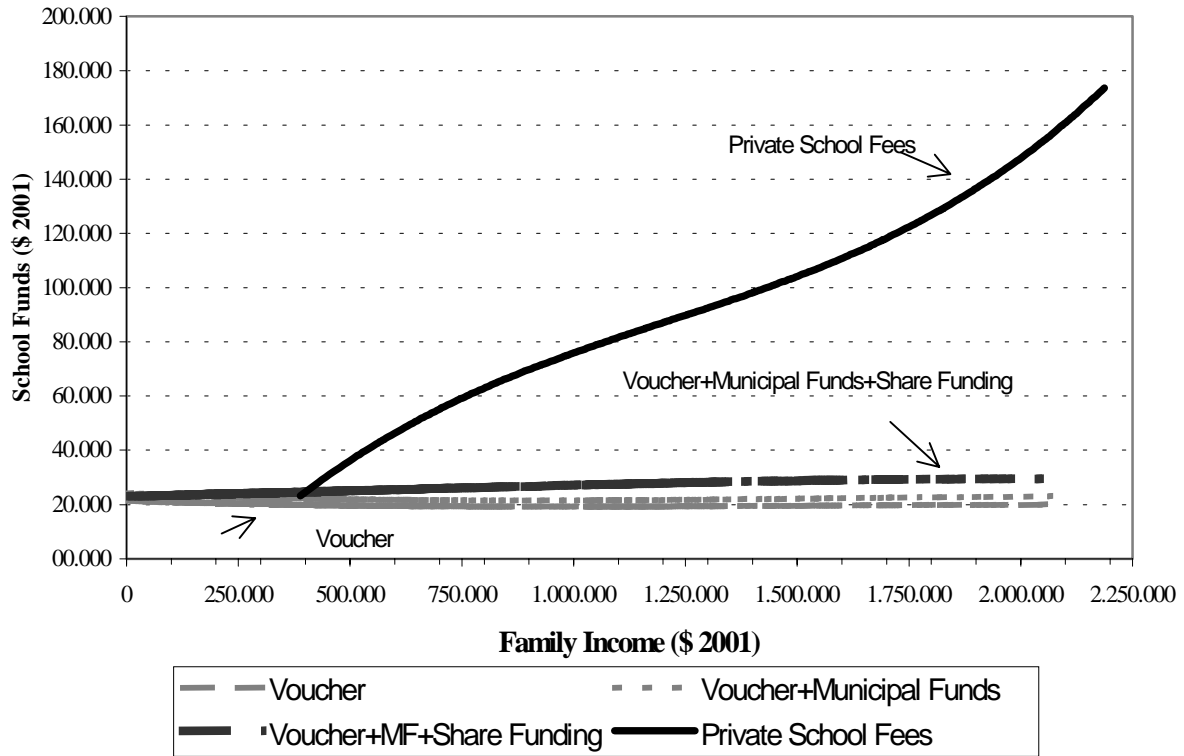
Funds that are the result of shared-financing are regressive although their effect on inequality is limited and diminishes the Gini value to 0.150. Overall, the resources received by (voucher-type) schools are very similar in the sense that they are independent of the student's socioeconomic level.

However, it is well understood that the main source of educational inequality lays in the difference between private fee-paying schools and the rest. We have estimated parents expenditures, through a school survey for private schools in the Metropolitan Region (RM).¹⁷ This information supplements that of the Ministry of Education so allowing us to see a more complete picture (Figure 2).

¹⁶ Given that Chile's voucher is flat type, there should be no differences in the resources supplied by the government to the schools by family income. However the voucher differs by type of education (See Table A.1) and these characteristics are negatively correlated with family income levels. Also there is a progressive effect of the voucher discount in schools under shared-financing. The amount of the voucher discount is presented in Table A.2.

¹⁷ The authors undertook a telephone survey of 148 private fee-paying schools in the Metropolitan Region (RM) about student fees and monthly payments. The sample was stratified by income levels and represented 33% of schools in RM in 2001; the RM accounts for 39% of Chilean students.

Figure 2
School Funds (per student) and School Family Income. RM. (Ch \$)



Note: Data is smoothed by a cubic function, which relates school resources and school family income.

Source: Authors' calculation, based on administrative data from Ministry of Education and a survey to 148 private schools. Database refers to the Metropolitan Region (RM).

The figure confirms that voucher type schools receive similar funding. The voucher is their basic financial resource; municipal transfers are small; and shared-financing, while growing with family income, does not close the resource gap between voucher type and private fee paying schools.

In sum, the biggest resource difference is to be found in family contributions to education through fees for private fee paying schools. Shared-financing (parent's contribution on top of the voucher) has two effects on the educational system's equality: it increases inequality (or diminishes the progressiveness of state contributions) inside the voucher system, but decreases overall inequality as middle class schools move near to private schools, in resource terms.

Overall, the main differences are between subsidized schools – where per-student monthly resources were on average Ch\$ 34,000 (US\$ 53.5)- and fee-paying private schools, with average resources of Ch\$ 108,000 (US\$ 170).¹⁸ This ratio of 3.2 also increased as a function of family income, showing the huge differences in available resources between the richest students and the rest.

¹⁸ Figures refer to 2001, estimated at the annual average of 1 US\$ to 634.94.Chilean pesos (\$Ch).

d. Social Differences Within and Between Schools

In order to evaluate the level of social integration or social mix within schools, we first perform an analysis of variance, and then examine a cross-table between schools' SES and students' SES deciles.

Table 3 decomposes the SES variance between and within schools. In primary schools the socioeconomic differences within schools (51.6%) are somewhat greater than the differences between schools (48.4%); at the secondary level, the percentage of SES explained within schools declines to 36.7%. These figures show a relevant degree of social mix at the primary level, however schools become more homogenous at the secondary level.

Table 3
Variance Decomposition of Student SES
(percent)

<i>Grade</i>	<i>% SES Variance Explained by</i>	
	<i>Between Schools</i>	<i>Within Schools</i>
Primary (4 th grade)	48.4 %	51.6%
Secondary (10 th grade)	63.4%	36.7%

Source: Authors' calculations, based on SIMCE data.

Tables 4 and 5 show within school SES heterogeneity by a cross tabulation between the SES indicator's decile from the school (school's SES) and the SES decile from students attending these schools (student's SES) for 4th grade and 10th grade respectively.

¹⁹ The socioeconomic indicator (SES) is estimated by factorial analysis, based on parent's education and income; the school average also includes an estimate of school social vulnerability, calculated by the agency which provides food supplements to schools.

Table 4
Schools vs. Students' SES Deciles. 4th grade, 1999
(percent)

Schools' SES Decile	Students' SES Decile										Total
	1	2	3	4	5	6	7	8	9	10	
1	45.8	27.3	13.7	6.4	3.9	1.4	*	*	*	*	100
2	31.4	25.7	17.9	11.1	6.7	3.2	1.8	*	*	*	100
3	25.1	22.1	18.4	13.0	9.1	5.6	3.6	1.7	*	*	100
4	19.9	19.1	17.8	14.3	11.2	7.3	5.3	2.8	1.6	*	100
5	14.8	15.7	16.1	15.2	13.4	10.0	7.6	4.2	2.3	*	100
6	10.2	12.4	13.2	14.5	14.2	12.7	10.7	7.1	3.8	1.2	100
7	5.6	8.1	9.8	12.4	13.9	15.0	14.4	11.4	7.2	2.3	100
8	2.4	4.0	5.6	8.1	11.2	14.6	17.3	18.1	14.0	4.8	100
9	*	1.2	1.9	3.1	5.0	9.1	13.6	21.6	27.4	16.4	100
10	*	*	*	*	*	*	1.5	5.8	19.6	71.2	100

Note: (*) : the percentage is less than 1%.

Source: Authors' calculations, based on SIMCE parents' surveys.

Table 5
Schools vs. Students' SES Deciles. 10th grade, 1998
(percent)

Schools' SES Decile	Students' SES Decile										Total
	1	2	3	4	5	6	7	8	9	10	
1	38.0	19.8	16.1	9.2	6.5	4.3	3.0	1.9	1.1	*	100
2	23.4	18.0	17.5	12.7	10.3	6.8	6.0	3.0	1.9	*	100
3	16.4	14.5	15.7	14.3	12.9	8.8	8.9	5.3	2.5	*	100
4	11.5	10.9	13.6	14.3	14.6	11.5	12.3	7.0	3.4	*	100
5	6.6	8.7	10.6	12.5	14.5	12.1	15.9	11.1	6.4	1.7	100
6	3.4	4.2	5.5	9.0	12.7	12.2	19.1	17.7	12.8	3.5	100
7	1.2	1.7	2.4	4.2	7.2	8.6	18.5	22.9	24.6	8.7	100
8	*	*	*	1.6	3.1	4.2	10.9	20.6	34.4	23.1	100
9	*	*	*	*	*	*	2.2	8.9	28.9	58.0	100
10	*	*	*	*	*	*	*	1.2	8.2	89.9	100

Note: (*) : the percent is less than 1%.

Source: Authors' calculations, based on SIMCE parents' surveys.

The data show important levels of socioeconomic heterogeneity within schools. Cells identified by gray are those that contain at least 10% of the population, and numerous cells lie outside the diagonal (where there would be a complete correspondence between pupil and school SES). For example, a school in the 5th decile has 6.6% of students from the poorest (1st)decile; 8.7% from the 2nd decile; and, 6.4% from the 9th decile. Only in the wealthy schools (10th decile) there is a

high correspondence: 90% of students come from the wealthiest households. However, the data also show that social homogeneity increases in secondary schools compared to primary schools²⁰.

Therefore, in spite of the strong relation between family income, school type and school resources, there exists evidence of social mix within Chilean schools, except for the highest SES decile.

These results imply that in order to reach, for instance, the 20% of the poorest population, it is not enough to focus in the 20% poorest schools because an important proportion of the poorest pupils attend schools classified between deciles 3rd and 6th.

IV. HOW TO TARGET A VOUCHER

The method or eligibility criteria for allocating more resources to disadvantaged students might be distinguished according to the objective population: by student SES, by school SES, or by municipality SES.

When a country has a voucher policy, it would seem natural that if authorities wish to deliver more resources to economically poorer students, they should target the additional resources by student. However, policies that seek to help equity in Chile have been applied through categorical-aid schemes, directed towards the poorest schools or municipalities. Hence, it is useful to compare the advantages and disadvantages of these three targeting mechanisms.

When comparing these targeting mechanisms, it is important to examine exclusion and inclusion errors. Exclusion error (type I error) is the probability of excluding students who should be included, because they have the characteristics of the objective population; while the probability of including students who should be excluded is known as error of exclusion or leakage (type II error).

We have undertaken an exercise assuming that policy aim is to deliver greater resources to the poorest 20% of the students within the school system. We then estimate inclusion and exclusion errors that would result if the target were to be the 20% of the poorest schools or the 20% of the poorest municipalities. The results are shown in Table 6.

²⁰ This could be result of several factors: an important percentage of poor pupils leave the school system at secondary level; fees for share-funding are higher in secondary schools; and, parents are more concerned with the peer effect.

²¹ There are many examples of compensatory policies that are targeted by school or geographic area: the program P-900, which initially targeted the 900 poorest schools; the supplementary meals for poor schools; and support programs for rural areas in Chile. In Latin America, we can find numerous examples of programs for rural zones or poor areas such as PARE in Mexico and the New School in Colombia (see Reimers, 2000, and Winkler, 2000).

Table 6.
Inclusion and Exclusion Errors:
Targeting by School & Municipality vs. Targeting the 20% poorest students
 (percent)

<i>Targeting by:</i>	<i>Inclusion Errors</i>	<i>Exclusion Errors</i>
<i>School</i>		
- Primary level	50%	50%
- Secondary level	48%	48%
<i>Municipality</i>		
- Primary	58%	62%
- Secondary	64%	62%

Source: Authors' calculations, based on CASEN survey 2000.

If the resources were provided to the poorest 20% of schools, then 50% of the pupils in primary level who do not belong to this population group would also benefit and, because they do not attend these schools, 50% of poorest children would be excluded. If the poorest municipalities are the target group, then the errors are even greater, as the target is broader. Similar results are obtained in secondary education.

However, if the targets are the poorest students, then errors should become minimum or non-existent, providing there is an instrument or filter that allows a suitable identification of these students. Therefore, a voucher program that targets the poorest students (in contrast to schools or municipalities) has the potential to minimize inclusion and exclusion errors.²²

Further, the literature mentions other problems the alternative targeting schemes can face. Table 7 summarizes these problems or criteria and their relevance when targeting by student or school. Given that targeting the poorest municipalities is high cost, it is not considered in this table.

²² Figlio and Page (2000), using data for the state of Florida, also conclude that school-based eligibility are much less efficient at targeting low-income children than eligibility criteria based on student income levels.

Table 7
Issues Regarding Targeting by School or Student

<i>Criteria</i>	<i>School</i>	<i>Student</i>
Exclusion error	Percentage of the target students enrolled in other schools: High	Percentage of the target students filtrated by mistake: Low
Inclusion error	Percentage of covered students who should be excluded: High	Percentage of covered students which are not filtered (excluded) by the instrument: Low
Mobility and Competition	Affects negatively	Affects positively
Empowerment	Low	Medium/High
Administration	Cost of schools' surveys: Low	Cost of students surveys: High
Stigma	Low	Medium/High

Source: Authors' summary, based on Reimers (2002), Sen (1995) and Cornia and Stewart (1995).

Social mobility is greater when targeting by student, given that it would allow poor students access to better quality schools, with greater social capital. This not only reinforces competition to improve the quality of subsidized schools but empower parents. On the other hand, if the additional resources are delivered to the school, they are not portable and therefore discourage the student transfers between low and high quality schools. Nor does it generate parent empowerment, as they do not perceive that the school gets additional resources to educate their son/daughter because of their school choice decision.²³

This discussion is similar to that stated by Hoxby when comparing vouchers and categorical aid: "The limitation of categorical aid is that it only provides money for the district in which the student is currently enrolled. Households cannot use the aid associated with their children to support their move to another district even if this is the most effective way of obtaining a better school experience".²⁴

Administration costs are higher with a student target voucher scheme partly because of the expense of developing and applying an instrument designed to identify the objective population. If the goal is to identify the poorest 20% of pupils, then a more sophisticated instrument is needed than that which identifies the poorest schools; information must be collected for a greater

²³ Encouraging the "voice" of beneficiaries (Hirschman, 1973) or their participation as active agents (Sen, 1995) are considered benefits, which strengthen social capital and improve the efficiency and effectiveness of social policies (World Bank, 2003).

²⁴ Hoxby (1996), pp. 66.

number of agents. Of course, the better the quality of social information available in the country, the lower the costs to develop a new instrument.²⁵

Further, there is a cost -even a stigma- that could be associated with student socioeconomic identification and which is likely to be less under a school based system. A poor student attending a higher income school might have difficulties of social insertion. However, this cost would be the other side of the coin of social integration that allows poorer children to attend better schools with greater social capital.

Summing up, we think that the advantages of a student-based system exceed their limitations and seem the better targeting policy.

V. THE AMOUNT OF RESOURCES REQUIRED FOR A MEANS-TESTED VOUCHER

We have used a typical educational production function -relating socioeconomic factors and educational achievement- in order to estimate the amount of resources needed to compensate the poorest 20% of the students²⁶.

The specification is the following, using data from SIMCE tests:²⁷

$$Simce_{ij} = \alpha_0 + \alpha_1 School_type_j + \alpha_2 Income_i + \alpha_3 Income_i^2 + \alpha_4 \sigma_Income_j + \alpha_5 AA_i + \alpha_6 Educ_P_i + \alpha_7 Size_j + \alpha_8 Size_j^2 + \alpha_9 (Student/Teacher)_j + \alpha_{10} Exp_j + \varepsilon \quad [1]$$

i= pupil

j: school

School_type: dummy that identifies if the school is municipal or private subsidized
Income: family income (pesos)

σ_Income : standard deviation of family income in each school

AA = per pupil school resources (total resources received by the school -from the government, municipality and parents-, divided by the number of students in the school)

Educ_P : parents' education

Size: school size (average enrollment)

Student/Teacher : student-teacher ratio

²⁵ Chile has social policy instruments that allow the identification of the poorest students from data collected by the organization responsible for the school food program, (JUNAEB- *Junta Nacional de Auxilio Escolar y Becas*); and data about the poorest families with access to social assistance and subsidized housing by using the CAS-MIDEPLAN (*Ministerio de Planificación y Cooperación*) socioeconomic profiles.

²⁶ Most literature discusses how to better assign resources to schools or school districts, using aggregate estimation methods or efficiency indices, which unfortunately are not useful if the compensatory funds are based on student income levels; see for example, Duncombe and Yinger (2000). On the other hand, production functions are difficult to estimate, particularly when there are no controls for student ability and the school socioeconomic environment, see for example, Unnever *et. al.* (2000).

²⁷ The complete regression results are set out in the Appendix, Tables A.4 and A.5. Apart from the variables noted in the equation [1] dummies are included for the length of the school day, school courses (general or technical), whether the school participates or not in MECE (Educational Quality Improvement Program).

Exp: teacher's average years of experience

The model considers that lower family income negatively affects test scores and this effect ought to be compensated through an increase in per student resources received by the school. The exercise sets the amount of additional income (ΔAA) necessary to compensate the difference in test scores between the poorest 20% and the average students, according to the formula:

$$\Delta I \alpha_2 + \Delta I^2 \alpha_3 = \Delta AA \alpha_5 \quad [2]$$

where ΔI is the difference in family income between the poorest 20% and the average household income.²⁸

Equation [1] was estimated for the two grades (4th and 10th grade) and for language and mathematics tests; the full results are presented in the appendix, tables A.2 and A.3. Replacing the parametric values for α_2 , α_3 , α_5 in equation [2] we obtain the monetary value for ΔAA , presented in Table 8, which also is expressed as a percentage of the value of a voucher.²⁹

Table 8
Amount of Compensatory Income
(Ch\$ 2001 and percentages)

<i>Tests</i>	<i>4th grade</i>	<i>10th grade</i>
Language	Ch\$ 11,560 (45%)	Ch\$ 13,207 (43%)
Mathematics	Ch\$ 13,345 (52%)	Ch\$ 7,993 (26%)

Notes: The percentage refers to the voucher value, for schools with full-time day/ general education / urban, at the 4th and 10th grades respectively. See Appendix A.1

1 US\$ = Ch\$ 634.94 Chilean pesos (2001).

Source: Authors' calculations.

The exercise shows that, for the poorest sectors of the population, the value of a voucher should increase by between 26% and 52 %, providing a possible cost range to be further explored.³⁰

In terms of the budget of the Ministry of Education, a means-tested voucher for the 20% poorest students will increase between 4.6% to 7.6% the total budget.³¹ Given the amount of resources involved, it is likely that the replacement of the flat voucher for an income related voucher (the current basic voucher plus a means-tested voucher) should be implemented gradually, for

²⁸ The values are : ΔI 4th grade: Ch\$ 126.326; ΔI 10th grade: Ch\$ 160.271 in Chilean pesos of 2001.

²⁹ We note the differences in the mathematics and language results in 10th grade. We tried out different specifications for equation [1] and similar values were obtained. Our hypothesis is that math achievement is more influenced by students innate abilities and teaching quality than by the family socioeconomic environment, compared with language test in secondary schools.

³⁰ The authors undertook interviews in 12 schools from the Metropolitan Region (RM) concerning attitudes to accepting children from the lowest 20% of the population and what their estimate of the voucher value which would leave them neutral between acceptance and rejection. The range estimated by the production function is consistent with the interview results.

³¹ Table A.1 of the Appendix shows the Ministry of Education's budget together with the table of vouchers values.

example, by grade beginning with the 1st and up to 12th grade or by group of students beginning with the poorest 5%, for example.

VI. FINAL COMMENTS

The analyses of voucher models emphasize the advantages of income related vouchers, which are preferred by different authors. However, a flat voucher scheme has been applied in Chile; a type of voucher that reinforce a critical aspect for these programs: a bias against poor and disadvantage children.

The snapshot of the Chilean educational system, 20 years after introducing a voucher reform, shows the strong inequalities that exist within the system. However it must be acknowledged that the inequality picture that arises is more complex than the simplistic view prevalent in policy discussions.

The students from the poorest households obtain the worse results, showing the strong association between SES and test results. The poorest students are concentrated in municipal schools: 40% of their students come from the poorest 20% of the population. However, it would be an exaggeration to think that there is a complete segregation between pupils that attend municipal and private subsidized schools. Pupils at private subsidized schools come – in relatively similar ways – from the first eight socioeconomic deciles. That is to say, the demand for places at private subsidized schools comes from a broad spectrum of the population. The exceptions are the richest households, whose school age children are concentrated in private fee paying schools.

This article argues in favor of modifying currently Chilean flat voucher by an income related system (the current flat-basic voucher plus a means-tested voucher), which would compensate for the higher challenge of educating poor students. Then, the targeting mechanism is discussed. The fact that there is not complete social segregation, or that the cross-table between school and students SES shows a significant dispersion, infer that the targeting criteria are important. We prove that significant inclusion and exclusion errors exits if additional resources are targeted by school rather than by student' socioeconomic levels. Therefore, there is a strong case for selecting an eligibility criteria based on student income levels.

This analysis also helps to clarify other issues discussed in the literature about vouchers . First, Chile's experience does not show a significant transfer of students from fee paying to voucher schools, contradicting the authors that claim that higher social classes will receive a windfall gain with a voucher system. Moreover, in Chile there is no means test; therefore, students from the richest households self-targeted out from voucher type schools. Secondly, there are authors who propose that vouchers systems should be limited to the poorest segments of the population. Chile's experience shows a strong voucher demand coming out from middle-income families. Then a voucher scheme that restricts itself to poor children will limit access to important population sectors. But to avoid increasing greater social segregation, the vouchers should be inversely related to family income.

Overall, the article argues in favor of a detailed analysis of the design of a voucher system before implementation; after 20 years much more is known today on how to mitigate and address the challenges or problems that the system faces.

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APPENDIX

Table A-1.
Voucher Values, according to School Type. 2001 ^(a)

<i>Voucher Types</i>	<i>Value US\$ (b)</i>	<i>Value Ch\$</i>	<i>Value SSU Index(c)</i>
<i>Without Full School Day</i>			
Primary Schools. Grades 1 th to 6 th	30.3	19,218	1.7096
Primary Schools. Grades 7 th and 8 th	32.8	20,857	1.8553
Secondary Schools	36.6	23,262	2.0693
Technical Schools: Agriculture	54.3	34,456	3.0650
Technical Schools: Industrial	42.3	26,888	2.3918
Technical Schools: Commercial	40.0	24,122	2.1458
<i>With Full School Day</i>			
Primary Schools. Grades 1 th to 6 th	40.7	25,859	2.3000
Primary Schools. Grades 7 th and 8 th	40.9	25,963	2.3095
Secondary Schools	48.7	30,899	2.7486
Technical Schools: Agriculture	66.2	42,025	3.7383
Technical Schools: Industrial	51.6	32,789	2.9167
Technical Schools: Commercial	48.7	30,953	2.7534
Rural Voucher (d)	+ 11.1	+ 7,023	+ 0.6247
Boarding Voucher (d)	+ 40.8	+ 25,874	+ 2.3016
Ministry Voucher Expenses : Ch\$ 1,080,992 (millions) – (US\$ thousands : 1,702,510) Ministry of Education Budget: Ch\$ 1,687,861 (millions) – (US\$ thousands: 2,658,230)			
N° of Students 2001 : Primary Education : 2,361,721; Secondary Education: 850,713			

Notes:

- (a) Voucher value depends on the grade and type of education, and other school characteristics, mainly: full school day vs. half school day; rural schools; and, boarding schools.
- (b) Values expressed in \$US use the exchange rate of 1\$US = Ch\$634.94.
- (c) SSU: Monthly school subsidy unit (USE-*Unidad de Subvención Escolar*) corresponds to a monetary index value for the voucher. SSU value in 2001: Ch\$ 11,241.676 (pesos).
- (d) Additional vouchers funds that are delivered to rural schools or to boarding schools.

Source: Ministry of Education.

Table A-2.
Share-Funding: Voucher Discount and Scholarship Fund
(percent)

Parents – Share Funding Fee (as % of SSU value) ^(a)	% Voucher Discount ^(b)	Scholarship Fund	
		Government Contribution: % of voucher discount ^(c)	School Contribution: % Parents' Share-Funding Fee ^(d)
Up to 0,5 SSU	0	0	5%
0,5 to 1 SSU	10%	100%	5%
1 to 2 SSU	20%	50%	7%
2 to 4 SSU	35%	20%	10%

Notes:

(a) SSU monthly school subsidy unit (USE-*Unidad de Subvención Escolar*) corresponds to a monetary index value for the voucher.

(b) The government applies a voucher discount for share funding schools; the discount relates to parents fee value (expressed as SSU index value)

(c) The percentage discounted by the government from vouchers (voucher discount) which is returned to schools for a scholarship fund.

(d) Schools have the obligation to dedicate a percentage of the funds collected from parents for school scholarships.

Source: Based on Ministry of Education regulations.

Table A-3.
Distribution of School Funds per Capita, and School SES Decile
(percent)

Income Category	Government (Voucher)	Parents Fees for Share-Funding	Municipal Funds	Total School Resources
Decile 1	12.6	0.2	15.1	11.2
Decile 2	11.5	0.8	11.5	10.1
Decile 3	11.2	1.8	12.1	10.0
Decile 4	10.3	3.1	12.7	9.5
Decile 5	9.9	5.2	8.9	9.2
Decile 6	9.1	6.4	10.0	8.8
Decile 7	9.6	10.4	8.3	9.6
Decile 8	9.0	13.2	5.8	9.3
Decile 9	8.5	24.0	7.0	10.4
Decile 10	8.5	34.9	8.6	11.9
Total	100.0	100.0	100.0	100.0

Note: The data on vouchers funds and parents share-funding fees are recollected by the Ministry of Education for each school. Municipal funds are authors' calculations based on administrative data, corresponding to educational expenditures per municipality (we assume that each municipality allocates expenditures on a per pupil basis).

Source: Authors' calculations, based on Ministry of Education data.

Table A-4
Regressions of Student Achievement and Family and School Resources:
SIMCE test 4th grade, 2000

<i>Variable</i>	<i>Language</i>	<i>Mathematics</i>
Constant	174.895 (229.709)**	179.783 (234.182)**
School Type (Private Subsidized =1)	13.712 (47.20)**	11.794 (40.24)**
School Day (Full = 1)	- 1.031 (-3.84)**	- 1.083 (-4.01)**
Enrollment	5.062E-02 (13.50)**	6.337E-02 (16.76)**
Enrollment ² (squared)	- 7.63E-05 (-9.21)**	- 9.24E05 (-11.07)*
Student-teacher ratio	- 0.168 (-10.28)**	- 0.129 (-7.86)**
Teacher experience	0.553 (26.88)**	0.408 (19.66)**
Years of Parents Education	4.246 (107.40)**	3.956 (99.20)**
Family income	4.037E-05 (33.45)**	4.018E-05 (33.03)**
Family income ² (squared)	- 2.49E-11 (-28.44)**	- 2.38E-11 (-27.02)**
Standard deviation of Family income	3.007E-05 (23.61)**	2.862E-05 (22.27)**
School funds per pupil	4.068E-04 (21.89)**	3.359E-04 (18.77)**
R ² adjusted	0.159	0.143
F	3484.938**	3075.568**
n	202,754	202,492

* Significant at the 5 percent level.

** Significant at the 1 percent level.

t-statistics are in parentheses.

Notes: Estimates are from ordinary least squares. The database refers to private fee paying and municipal schools. Added dummies for school courses (general –technical); and school participation in MECE (Educational Quality Improvement Program).

Table A-5
Regressions of Student Achievement and Family and School Resources: SIMCE test 10th grade, 1998

<i>Variable</i>	<i>Language</i>	<i>Mathematics</i>
Constant	182.763 (76.00)**	188.237 (78.56)**
School Type (Private Subsidized =1)	11.902 (22.64)**	11.352 (21.37)**
School Day (Full = 1)	7.197E-02 (0.14)	- 2.756 (-5.30)**
Enrollment	5.180E-03 (5.50)**	4.530E-03 (4.76)**
Enrollment ² (squared)	- 8.26E-07 (-2.96)**	- 7.23E07 (-2.562)*
Student- teacher ratio	- 0.222 (-8.64)**	- 0.241 (-9.37)**
Years of teacher experience	0.674 (14.40)**	0.823 (17.42)**
Gender (female=1)	6.002 (16.89)**	- 3.870 (-10.781)**
Years of Parents education	2.980 (45.25)**	2.241 (33.74)**
Family income	3.195E-05 (16.34)**	3.058E-05 (15.68)
Family income ² (squared)	- 1.75E-11 (-13.49)**	- 1.71E-11 (-13.37)**
Standard deviation of family income	6.601E-05 (25.14)**	5.971E-05 (22.92)**
School funds per pupil	3.537E-04 (11.68)**	5.613E-04 (18.36)**
R ² adjusted	0.216	0.179
F	840.935**	667.949**
n	58,028	58,031

* Significant at the 5 percent level.

** Significant at the 1 percent level.

t-statistics are in parentheses.

Notes: Estimates are from ordinary least squares. The database refers to private fee paying and municipal schools. Added dummies for school courses (general –technical); and school participation in MECE (Educational Quality Improvement Program).