I Would Walk 500 Miles (if it paid)
Vouchers and School Choice in Chile*

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Abstract

One of the pillars of the educational voucher system is that competition among schools to attract students would improve the quality of the education. Surveys to parents and previous work have suggested that families rank the distance of the school from their home as the most important factor for choosing a school. They also suggest that parents largely ignore the results of standardized tests. We use a novel data set which includes precise measures of the distance between homes and schools to analyze the determinants of school choice in Chile. Economic theory suggests, and the estimations confirm, that parents consider quality and the location when choosing schools. The paper quantifies the relevant trade-offs and shows that both, distance to school and the quality of the school, measured by standardized tests are critical factors in this decision.

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1 Introduction

Whilst a number of countries have implemented a voucher system, none is as extended as in Chile. The Chilean experience stands out because it established a country-wide voucher system, while most other countries conducted small experiments in some cities or groups of schools. Moreover, in opposition to most of other experiences, Chile's voucher system is much in line with Friedman's original idea because it does not distinguish between public and private providers. In 2008, around 90% of the Chilean students attending public and private schools received funding via vouchers.

The debate regarding the convenience of adopting a voucher system is intense.[1] Ladd (2002) makes an extensive review of different experiences, both in the US and abroad, and concludes that at best, the gains of a large and massive voucher program are small. In a report on the performance of the DC OSP for low-income voucher students, Wolf et al (2008) do not find that private voucher schools perform better than similar students in public schools.

A key issue to understand the potential effect of the voucher system is related with the conditions in which it operates. The Chilean voucher system was designed assuming that the parents' right to choose their children's school would cause competition among schools and improve the quality of the education provided. Parents would reject low quality schools, which would have a declining number of students, and eventually would be eliminated from the market.

This crucial part of the theory underlying the voucher system has been questioned by several studies. For example, Carnoy and McEwan (2000), McEwan and Carnoy (2000), and Elacqua and Fabrega (2004) consider that the relatively poor results attributed to the Chilean voucher system are due to the parent's lack of capacity for choosing school. This view is supported by some surveys (e.g., CEP, 2006), that show that less than 50% of parents knew the results of the standardized tests of the school of their children and less than 1% considered these results as the most important factor in choosing their children's school. The most frequent response for the most important factor behind the choice of a school was its proximity to the house (25.2%). If correct, this evidence would undermine a crucial feature that is necessary for fostering quality through the voucher system.

This paper constructs and uses a data-set that includes precise measures of distance and it uses a novel specification for addressing the choice of school incorporating distance and quality. It evaluates how important is distance (as compared to other factors) by focusing on how parents actually choose schools (reveled preferences) and not on results of surveys that merely enunciate factors that they consider important.

The paper is organized as follows. Section 2 describes the Chilean voucher system and the main findings regarding it in the literature. Section 3 describes the data-set and presents some descriptive statistics. Section 4 discusses the econometric framework used to evaluate the determinants of the choice of school and reports the results. Finally, Section 5 concludes.

2 The Chilean Voucher System

[1] When John McCain supported the voucher system as the Republican candidate for President of the US, professor Carnoy sent a public letter to Senator McCain stating: "... So I don't get why you are advocating vouchers as a core educational policy you would push in your Administration. If they have no positive effect on low-income pupils' achievement, why bother? Sure, choice is nice, but if there is no evidence students learn more, why keep insisting that choice 'works'?" ("Your Education Policies Don't Figure: An Open Letter to John McCain")

Chile introduced a number of pioneering reforms in the last quarter of the past century (see, e.g., Chumacero et al, 2007 for details). A first wave of basic structural reforms included price liberalization, the reduction of import tariffs, and an overall reduction of the role of the government in the economy. A second wave of reforms "revolutionized" the social security regime shifting from a pay-as-you-go to a privately managed fully funded system, privatized most of the state-owned-enterprises (including public utilities), and introduced the voucher system. The Chilean experience constituted a referent for reforms conducted later elsewhere (see, Aedo and Sapelli, 2001 for details).

Chile's per capita GDP growth was way below the average of East Asia, OECD countries, and the world economy prior to the reforms. After them, and particularly in the past 20 years, Chile's economic performance has been outstanding and is the only country in Latin America that can claim significant progress in reducing income gaps with the developed world and reducing the level of poverty in more than 50%.

Despite these achievements, there are two areas in which little progress has been made. The first is income distribution: Chile presents one of the most unequal distributions in the region and it has remained virtually unchanged. The second is education: Despite huge increases in the budget allocated to this sector, Chile's performance is relatively poor when compared with similar countries.

The last issue is relevant, given that, since 1981, a nation-wide voucher system is in place. Public schools were transferred to municipalities, decentralizing primary and secondary education. Since then, school administration has been carried out by both public (municipalities) and private providers (referred to as administrators) that receive most of their funds from State subsidies and, in some cases, from fees paid by parents.

In line with Friedman (1955), the voucher per student makes no difference among public and private schools. Thus, besides the conventional private schools (called *Particulares Pagados*), a new category of private schools emerged: those financed by the voucher system (called *Particulares Subvencionados*).

As parents are free to choose the school for their children, the core of the reform relies on the incentives that schools would have to compete in order to attract students. In principle, schools are only constrained by the availability of vacancies or by the acceptance to the school.

In terms of enrollment, the share of students attending paid private schools has remain virtually unchanged since 1981, but the enrollment in subsidized schools administered privately has increased steadily; thus, decreasing the share of enrollment in public schools (Author and Pinto, 2008). In 2008 about 90% of students attended schools financed by vouchers, and more than half of them went to privately subsidized schools.

The system has achieved almost universal coverage, and impressive results in terms of increasing the number of schools and their infrastructure. However, and despite the three fold real increase in public expenditure in education over the last 20 years, by international comparisons, the results in terms of quality are rather disappointing.

As documented in several studies, Chile has performed poorly in international tests such as TIMSS or PISA (see Heyneman, 1991, 2004; Bellei and González, 2004; and Brunner, 2005). For instance, the TIMMS-R (Third International Study of Sciences and Mathematics) shows that Chilean eighth graders ranked 35 among 38 countries both in mathematics and science in 1999. In 2003, they ranked 40 and 37 among 45 countries in math and science tests. Chile underperforms even when compared with countries with lower per capita GDP and lower investment in education, such as Jordan and Malaysia. Furthermore, the TIMMS-R 2003 shows that the gap in quality between the low and high income sectors increased between 1990 and

2003 from 120 to 142 points on a scale with a mean of 500 and a standard deviation of 100.[2] In addition, the main tool used to measure and compare schools' results in Chile, a standardized test named SIMCE, shows the existence of a large difference between schools with students coming from low income families and schools with wealthier students.

As stated above, a key element for the voucher system to work is that, if parents made informed choices, competition would induce better quality. Several studies have been conducted to evaluate the determinants of school choice and some other characteristics of the Chilean voucher system.

Mizala and Romaguera (2000), Gallego (2002), and Sapelli and Vial (2002) analyze the economic, educational, and institutional determinants of educational attainment in Chile. Aedo (1997), Carnoy and McEwan (1997), and Mizala and Romaguera (2000), among others, use the results in the SIMCE test to evaluate the determinants of performance of students. They find that conventional socio economic variables (such as income, education of the parents, particularly the mother, and gender) are important.[3] They also tend to conclude that privately managed voucher schools tend to perform better than public schools.

There is also a strand of the literature that has focused on the issue of selection and its effects. Elacqua et al. (2006) analyze school selection made by parents, finding that academic results are key in parents' school choice. Contreras et al. (2007) conclude that schools that select students based on their abilities tend to do better in the SIMCE test than schools that do not. However, they also tend to have more heterogeneous results than schools that do not select. On the other hand, Gallego and Hernando (2008) conclude that selection is basically made by parents and not by schools, and that the selection made by parents is restricted because of the importance of the location of the schools. García and Paredes (2009) estimate that the effect of selection on academic performance is, at most, 1/10 of a standard deviation of the SIMCE test.

The international literature has also addressed the issue of how competition affects academic performance (Hoxby 1994, 2000, 2001, 2005; Rouse, 1998). Using data from a voucher "experiment" in Milwaukee, they find that competition has a positive effect on the average results obtained by students when public and voucher-funded private schools coexist. Ladd and Fiske (2001) study the same issue in New Zealand, but they find a negative effect of competition on test scores. The relationship between competition and scores has also been studied in places without a voucher system. Sander (1999) finds that private schools don't have an effect on public schools' scores in Illinois, and Maranto et al. (2000) find the same result in Florida, except for districts with low income families in which the alternative of private schools is less likely. Bayer and McMillan (2005) measure competition as an elasticity which represents how a reduction in quality would affect school demand. They find a significantly positive relationship between competition and scores with data of an urban area in the USA.[4] On the theoretical side, Epple and Romano (1998, 2002) develop a model of competition between private and public schools in a voucher system. They conclude that this system promotes the growth of the private sector, increases sorting, and tends to benefit high-ability students.

There effects of competition in performance have also been studied for the Chilean case. Hsieh and Urquiola (2003) construct a panel with data from 150 counties between 1982 and 1996, and measure the difference in schools' results before and after the 1981 reform. They

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[2] Based on other international tests such as PISA, IALS, Kimko and TIMMS, Tokman (2004) and Paredes and Ruiz (2008) arrive at similar conclusions.

[3] These results are in line with international studies such as Hanushek (1997), Currie and Duncan (1995), Corman (2003), Baker et al (2003), Kan and Tsai (2005) and Horowitz and Spector (2005).

[4] See Braun-Munzinger (2005) for a review of the evidence.

compare the changes among rural and urban schools assuming that competition, measured by the entrance of the new voucher-funded private schools, was less intense in rural than in urban areas. They conclude that the voucher system did not improve school performance and that, in turn, produced sorting of students. They also argue that competition may have not had an effect on performance because of the way in which parents choose schools. Gallego (2006) tests the existence of a positive relationship between competition and school performance, and whether this relationship is more important for private voucher schools than for public schools. Using cross-section regressions to explain SIMCE scores with a county-level competition index measured as the proportion of students in each county that attend private schools, and other socioeconomic variables, he finds support for both hypotheses. Auguste and Valenzuela (2004) also find a positive effect of competition on schools' results and conclude that competition increases the sorting of students between public and private schools based on students' family income. Benguria and Paredes (2008) use multilevel data, with observations for each student in Santiago, and take into account the interaction between student and school level data. The distance from each school to the closest similar one is taken as a measure of competition. They find a positive but weak relationship between competition and test scores.

Directly related with school choice and distance, Hastings and Weinstein (2007) conclude that information is a relevant variable when parents choose schools. In the context of the No-Child-Left-Behind Act, they find that 16% of the students moved to a different school when their parents were informed about their under-performance.

Only a few studies have directly considered distance to school from the household as a relevant factor to choose school. Hastings et al. (2006) conclude that American parents value proximity and schools' average test scores, and that the importance given by parents to scores is increasing in family income and in student skills. Among the studies applied for less developed countries, Gertler and Glewwe (1989) analyze the role of distance for Peru, and Alderman, Orazem, and Paterno (2001) for Pakistan.

For Chile, Gallego and Hernando (2008) estimate a random utility model and conclude that parents take into account schools' average scores, accessibility (using a rough measure of average distance for districts) and the fees charged by schools. They find that parents with higher expectations about their pupil's skills place a greater value on the schools' test scores.

This paper departs from the literature in two dimensions: First, it uses a novel data set which measures distance more precisely than Gallego and Hernando (2008). Second, it uses a new way to model school choice that is able to efficiently include distance and performance.

3 The Data

Parents consider several factors when choosing a school for their children. Clearly distance from the household is one of them. Measuring distance from the household to the schools is not easy as information of both the location of the household and the school that a child attends to is not readily accessible.

Administrative records for students that take the standardized tests provide information of the results of their tests, characteristics of the school, and socio-economic characteristics of the household. However, as the address of the household can not be recovered from these records, measures of distance can not be obtained.

A different route is taken in this paper. CASEN is a cross sectional household survey taken by the Ministry of Planning of Chile that has detailed information of socio-economic characteristics of Chilean households. The survey used in this study was conducted in the year 2003 to a sample of 73,720 households that is representation at a district level.

As the survey indicates the name of the school attended, we pinned down the precise location of the school through a school directory. To measure distance from the household to the school one needs to identify the location of the household. Regretfully this cannot be done, as the survey does not provide a precise address for the household surveyed. However, the survey does contain information of the block in which the household is located.

We georeferenced these blocks using digital maps provided by the companies DICTUC and Mapcity, which cover the entire city of Santiago.[5] At the same time, using the School Directory 2003 of the Ministry of Education (MINEDUC), which includes all of the schools' addresses, it was possible to georeference 2,310 of the 2,312 schools that exist in the 34 counties of Santiago. With the georeference of the block of the household and the schools, we estimate the Euclidean distances between the centroid of the block and each of the 2,310 schools. We consider this as the distance between the household and each school.[6]

Table 1 provides some descriptive statistics of the students reported as attending school in CASEN 2003 that lived in Santiago. The sample is evenly split between males and females. Parents of students whose children attend to private and subsidized schools have more years of schooling (on average) than those whose children attend municipal (public) schools. The same can be said in terms of income per capita. Of all the students in the sample, 53% attended subsidized schools, almost 34% public schools, and 13% private schools.

[TABLE 1 HERE]

Table 2 provides descriptive statistics (averages) of the distance, quality, and availability of different types of schools. Only 17.6% of the students attend to the nearest school. The share of students that attend public schools that also go to the nearest school is of 24.4%. These shares decrease to 15.5% and 8.9% for students of subsidized and private schools respectively. If we consider schools of the same type, 36.3% of the students of public schools choose the nearest public school, and 24.3% (13.8%) of the students that attend subsidized (private) schools go the nearest school of the same type. Thus, choosing the school nearest to the household is not as prevalent as casual observers and survey suggests.

[TABLE 2 HERE]

Table 2 also shows that the average distance between the household and the school that the student attends is 2.9 kilometers. Students of public schools attend schools closer to the household than students that attend subsidized or private schools. Nevertheless, on average, irrespective of the type of school, the distance between the household and the nearest school is of approximately 0.5 kilometers. In terms of quality, as measured by average scores of the school on standardized tests, private schools tend to perform better than subsidized schools, and these do better than public schools.

As Table 1 shows, students of private schools have, on average, higher per capita income. Thus, as expected, private schools tend to be more concentrated in areas in which students effectively go to private schools. However, households with students attending public and subsidized schools are not clustered in areas with different number of schools of each type. Furthermore, the average quality of the surrounding schools of each type is almost identical regardless of the type of school chosen by the parents.

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[5] Even though CASEN is a national survey, digital maps are available only for Santiago and this paper concentrates its estimations on households of this city.

[6] Gallego and Hernando (2008) use a cruder measure of distance, as they define it as the Euclidean distance between the centroid of the county (*comuna*) of the household and the school that the child attended. When comparing theirs with ours, it can be shown that their measure tends to overestimate the distance in approximately 80% of the cases, and that this discrepancy is significantly related with the income of the household.

As expected, prices paid for attending schools as declared by a survey to parents, as higher for private and subsidized schools than municipal schools.

The average distance between the household and the school attended varies with the age of the child (Figure 1). The schools chosen are nearer to the household in primary education and an almost discrete jump occurs when the student goes to high school (around age 15). This feature is related to both, that there are fewer high schools than schools with primary education, and that as age increases, the cost of traveling diminishes with age as students are more autonomous.

[FIGURE 1 HERE]

The same pattern is observed when considering the frequency of cases in which students choose the nearest school. Broadly speaking, irrespective of the type of school attended, the probability of choosing the nearest school is decreasing in the age of the student. Again, particularly in the case of students attending public and subsidized schools, there is an important decline in this probability when the student reaches high school. Finally, students of municipal schools choose the nearest school more often (Figure 2).

[FIGURE 2 HERE]

This section described the new data base constructed and some stylized facts regarding the distance between the household and the school chosen. The next section uses this information to evaluate the determinants of the choice of school, including distance.

4 The Empirical Model

Parents consider several factors when choosing a school for their children. Some of them are specific to each child but common to every possible school selected (such as the age of the child, the education of the parents, gender of the child, income of the household, or other characteristics of the child or the household). Others correspond to characteristics that are specific to each school and are common to every child and household (such as the type of school, its quality, its costs, and other characteristics of each school). Finally there are other attributes of each choice that are specific to the child and the school (most notably, the distance between the household and the school).

Let $i = 1,\mathrm{K},I$ index the individuals (students) in the sample and $j = 1,\mathrm{K},J$ index the possible choices (schools). Denote by x_i to the vector of characteristics of the student and its household that do not depend on the school, by y_j to the vector of characteristics of the school that do not depend on the student, and by $z_{i,j}$ to the vector of attributes of the school that are specific to each student.

Define $u_{i,j}$ as the (indirect) utility of child i attending school j, such that:

$$u_{i,j} = u(x_i, y_j, z_{i,j}) + e_{i,j}, \qquad (1)$$

where $u(\cdot)$ corresponds to a systematic component and $e_{i,j}$ is a (random) non-systematic component.

Given (1), agent i chooses school h if $u_{i,h} \geq u_{i,j} \quad \forall j \neq h$. Given a functional form for $u(\cdot)$ and a distributional assumption of $e_{i,j}$, parameters can be estimated using quasi-maximum likelihood (QML). When each individual has some factors that are specific to each choice (such

as distance), the empirical literature tends to favor the use of conditional logit models for estimation.[7]

We take a different approach to evaluate the determinants of the choice of school and the relevance of distance. Let $d_{i,j}$, denote the distance between household i and school j. Let d_{n_i} be the distance between household i and the nearest school and u_{n_i} the value of the objective function in (1) associated with choosing that school. On the other hand, let u_{m_i} be the value of the objective function associated to the choice of the school that maximizes (1). Note that the school that minimizes $d_{i,j}$ and the one that maximizes $u_{i,j}$ may be different for each student i. Clearly, when the nearest school maximizes (1), u_{m_i} and u_{n_i} will coincide.

Let

$$v_i = \begin{cases} 1 & \text{if } u_{m_i} = u_{n_i} \\ 0 & \text{if } u_{m_i} > u_{n_i} \end{cases}; \qquad (2)$$

that is, v_i is the (observed) variable that takes the value of 1 when the student attends the school nearest to the household and 0 otherwise.

Evaluating (2) instead of (1) is convenient as now we can focus on modeling the determinants of choosing the nearest school using binary response models. The model considered is:

$$\Pr[v_i = 1 | w_i] = F(b' w_i),$$

where F is a postulated distribution function (say the standard normal), w_i is a vector of determinants, and b a vector of parameters to the estimated.[8]

The vector of potential determinants considers:

i) Individual or household characteristics obtained from the CASEN survey:
   - Gender of the student (1=Female).
   - Age of the student (in years).
   - Years of schooling of the father and/or mother.
   - Log of per capita income (logarithm of the ratio between total income of the household in US$ and the number of members of the household).

ii) Characteristics of the nearest school. The nearest school is defined as the one that minimizes the Euclidean distance between a household and each of the 2,310 schools identified.
   - Price charged by the nearest school (measured in US$).
   - Quality of the school measured by its average score in the standardized tests (SIMCE).
   - Distance of the nearest school from the household measured in kilometers.

iii) Characteristics of the school chosen.
   - Price charged by the school chosen.

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[7] In our case, the data base consists of 2,310 identified schools and 7,479 students in the sample. Thus, in principle, more than 17 million distances would be needed to estimate this model.

[8] As considered in Ferreyra (2007), the choice of school and of residence may be jointly determined. Whilst we have no data to control for the choice of residence, this may not be an important problem in Chile because the vast majority of beneficiaries of the voucher program are from middle income and low income households. They tend to use publicly financed housing programs in which the location of the household is "exogenous" to them.

- Quality of the school measured by the average result in standardized tests.
- Type of the school chosen (public, subsidized, or private).[9]

iv) Competition: This variable is measured by the number of schools in a surrounding area (we use a 2 kilometers radius from the household).

As noted above, the attribute (distance) of each possible choice (school) is specific to each individual (student). The conventional framework in these cases would require modeling the probabilities of choosing each school for each student. This path would not only be computationally demanding, but would make the results difficult to interpret. Our framework directly tackles the question at hand (what are the determinants of choosing the nearest school) and also allows us to use conventional models for binary choice models.

It is expected that the better are the attributes of the nearest school (in terms of quality of distance), the more likely should be that it would be chosen. The probability of choosing the nearest school should also depend on characteristics of the student. When traveling is more costly (for example in terms of safety or autonomy), parents should be more likely to choose the nearest school. On the other hand, it should be less likely to choose the nearest school with better characteristics of alternative schools (in terms of price or quality). Furthermore, more education of the parents and more income in the household should increase the set from which to choose schools and make less likely to choose the nearest school. Finally, when there are more alternatives available (more schools nearby), choosing the nearest school should be less likely.

Table 3 presents the results of estimating a probit model for this choice.[10] The results show that households would (marginally) prefer a closer school if the child is a woman. Consistent with the evidence of Figure 1, the model also shows that, the older the child, the lower the probability of choosing the nearest school and that there is a discrete decrease in the probability of choosing the nearest school when the student attends high school (reaches the age of 15). The model also shows that the probability of choosing the nearest school decreases with household income and the mother's education.[11] Thus, as the education of the parents or income increases, the less likely the family chooses the nearest school.

[TABLE 3 HERE]

Table 3 presents the results of estimating a probit model for this choice.[12] The results show that households would (marginally) prefer a closer school of the child if a woman. Consistent with the evidence of Figure 1, the model also shows that the older the child the lower the probability of choosing the nearest school and that there is a discrete decrease in the probability of choosing the nearest school when the student attends high school (reaches the age of 15). The model also shows that the probability of choosing the nearest school decreases with the income of the household and the education of the mother.[13]

Increasing the number of schools near the household decreases the probability of attending the nearest school. As would be expected, households are more likely to choose the nearest school when its quality is higher, when its price is lower, or when it is closer. Thus, as economic theory predicts, the model shows that there is indeed a trade-off between quality,

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[9] It is not necessary to include distance of the school from the household, as this variable along with the distance to the nearest school would perfectly forecast v.

[10] Marginal effects are computed as the average of marginal effects for each observation.

[11] Models that also include the education of the father have similar results and are available upon request. However, as there are many missing values on this variable, we report the results of using only the education of the mother.

[12] Marginal effects are computed as the average of marginal effects for each observation.

[13] Models that also include the education of the father have similar results and are available upon request.

costs, and distance that parents consider. Consistently, the more quality has the school chosen, the less likely is that the student would attend the nearest school. Finally, as shown in Figure 2, students attending public schools are more likely to attend the nearest school. Apart from the discrete variables (high school or municipal schools), the marginal effects show that distance and quality are also economically relevant factors for choosing schools.[14]

The model reported in Table 3 is estimated considering all the students. It may be argued that parents that choose (say) a public school are less likely to consider a private school as a close substitute. While such separation may be important for distinguishing private and voucher (public and private) schools, it is not that obvious when comparing public and private voucher schools.

We also estimated the same model reported in Table 3 for the case of municipal, subsidized and private schools. The same model was also estimated distinguishing students by gender and/or age. Regardless of the type of school, the results are broadly consistent with what was presented in Table 3.[15]

The panels of Figure 3 show how changes in different factors affect the probability of choosing the nearest school of each type.[16] Apart from the scale (children that attend municipal schools are more likely to attend the nearest school), the probability of attending the nearest school is also more responsive to change in all factors for students attending municipal schools. Particularly important in this case are having more options available near the house.

One by-product of the model estimated, is that rates of substitution between two variables can be readily obtained. For example, consider the case in which the quality of the nearest school is increases by 1 point. According to our model, this would increase the probability that a family chooses it. As the probability of attending the nearest school is decreasing in its price, we could compute how much the price of the nearest school should decrease in order to match the increased probability of attending the nearest school due to the increased quality. In this way we can compute the amount of money that a family would be willing to sacrifice in order to obtain more quality. The same reasoning can be applied to evaluate the substitution between price of the nearest school and its distance.

The results reported in Figure 4 differentiate the results obtained for all students (on the basis of Table 3) and those obtained for students that attend municipal and subsidized schools only. According to them, student would be willing to "walk" between 4 to 7 meters to avoid paying US$ 1 more to attend the nearest school. Furthermore, parents whose children attend municipal schools would be willing to pay almost US$ 4 more to attend the nearest school if it improved 1 point in its standardized test.[17]

[FIGURE 4 HERE]

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[14] Distance to the school chosen can not be included in the model as distance is precisely the attribute used to construct (2). When a household actually chooses the nearest school, all attributes (excluding distance) would coincide. In such case, the relevant factors for determining the choice would be most student and household specific attributes.

[15] Parameter estimates are available upon request.

[16] The probabilities were evaluated in the means of the independent variables corresponding to each sample. Then the variable to be considered was modified.

[17] The gap between the average score of private and public schools is between 40 and 50 points (in favor of the former). Chumacero and Paredes (2008) find that (after controlling for other characteristics) the gap between private and municipal schools can be of up to 15 points. Thus, according to this estimate, roughly half of the gap between the average cost of private and private schools (US$60; 15xUS$4) can be accounted for with this valuation.

Our results, are consistent with surveys that indicate that parents value distance as an important characteristic of the school, but also consistent families valuing quality.

5 Concluding Remarks

Although Chile is the country where the educational voucher system is most widely used, and its application is more in line with Friedman's original idea, many of the recommendations given to improve it come from anecdotal evidence; including surveys that suggests that people do not consider the quality of education at the moment of choosing a school and consequently that the system does not provide incentives for competition.

We used a new data base that accurately estimates the distance between the household and school to test how important are location, price, quality, and competition when choosing schools. We also developed a novel specification to address the issue of how parents choose the school their children attend. This specification allows us to use conventional discrete choice models that in their absence would require computationally intensive and cumbersome methods.

The model estimated considers characteristics of the students, the households, and the schools. We show that location, price, quality, and potential competition are all relevant determinants of the choice of schools and quantify the implied trade-offs. Our results indicate that both quality and distance are highly valued by households.

Whilst we do not evaluate the impact of the voucher system on academic performance, the results provide robust evidence that contradict claims that would undermine the voucher system as a means to improving quality through competition. It is also useful as it present estimates of how valuable quality (particularly for low income families) is. It also suggests that it would probably be more desirable to increase the portability of the voucher (as well as its amount) instead of focusing on targeting on (centrally) improving the quality of public schools in a given area.

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Table 1
Descriptive Statistics by Type of School Administration (Averages)

Variable	Total	Municipal	Subsidized	Private
Share of women (%)	49.3	48.8	49.5	49.7
Years of schooling (father)	12.6	10.9	12.5	16.8
Years of schooling (mother)	12.0	10.5	12.1	15.3
Income per capita (US$ per month)	228.9	123.7	188.3	656.2
Share of students (%)	100.0	33.6	53.1	13.3

Table 2
Distance and Quality by Type of School Administration (Averages)

Variable	Total	Municipal	Subsidized	Private
Distance of school chosen	2.90	2.57	2.78	4.22
Quality of school chosen	256	240	257	296
Price of school chosen	31.68	5.59	22.19	135.34
Distance of nearest school	0.52	0.46	0.55	0.53
Quality of nearest school	248	241	247	272
Price of nearest school	29.79	17.28	22.03	92.26
Distance of nearest municipal school	0.90	0.67	0.93	1.34
Quality of nearest municipal school	232	230	231	246
Price of nearest municipal school	5.26	5.02	4.88	7.39
Distance of nearest subsidized school	0.78	0.71	0.73	1.15
Quality of nearest subsidized school	254	250	252	266
Price of nearest subsidized school	22.00	19.79	21.08	31.22
Distance of nearest private school	1.92	2.08	2.07	0.95
Quality of nearest private school	286	286	287	287
Price of nearest private school	98.18	96.43	91.23	130.30
Number of schools (2 kms radius)	20.8	21.1	21.3	18.2
Quality of schools (2 kms radius)	255	252	253	270
Number of municipal schools (2 kms radius)	4.4	5.2	4.4	2.1
Quality of municipal schools (2 kms radius)	241	239	240	254
Number of subsidized schools (2 kms radius)	13.6	14.0	15.3	6.3
Quality of subsidized schools (2 kms radius)	252	250	252	263
Number of private schools (2 kms radius)	2.8	2.0	1.6	9.8
Quality of private schools (2 kms radius)	286	285	286	287
Share of students that attend to:				
nearest school	17.6	24.4	15.5	8.9
nearest school of the same type	26.9	36.3	24.3	13.8

Notes: Distance is measured in kilometers. Quality is measured as the average score of the students of the school on the standardized test. Price is expressed in US$ per month.

Table 3
Probit Model for Choosing the Nearest School

Variable	Estimate	Marginal Effect
Constant	0.4748 (0.0243)	
Gender (1=Woman)	0.0323 (0.0029)	0.0076 (0.0013)
Age	-0.0232 (0.0006)	-0.0054 (0.0011)
Older than 14	-0.2836 (0.0056)	-0.0664 (0.0018)
Schooling of mother	-0.0164 (0.0004)	-0.0038 (0.0010)
Log of Income per capita	-0.0813 (0.0021)	-0.0190 (0.0012)
Price (school chosen)	0.0019 (0.0001)	0.0005 (0.0010)
Price (nearest school)	-0.0036 (0.0001)	-0.0008 (0.0010)
Quality (school chosen)	-0.0083 (0.0001)	-0.0019 (0.0010)
Quality (nearest school)	0.0082 (0.0001)	0.0019 (0.0010)
Distance (nearest school)	-0.7202 (0.0062)	-0.1686 (0.0019)
Number of schools	-0.0089 (0.0002)	-0.0021 (0.0010)
Type (1=Public school)	0.1742 (0.0034)	0.0408 (0.0014)
Observations=1117132	LRT=87124 [0.00]	Pseudo R^2=0.084

Notes: Standard deviations in parenthesis. LRT = Likelihood Ratio Test for the null hypothesis that all coefficients (except for the constant) are 0. P-value in brackets.

Figure 1
Average Distance (in kilometers) by Age

Figure 2
Probability of Choosing the Nearest School by Age

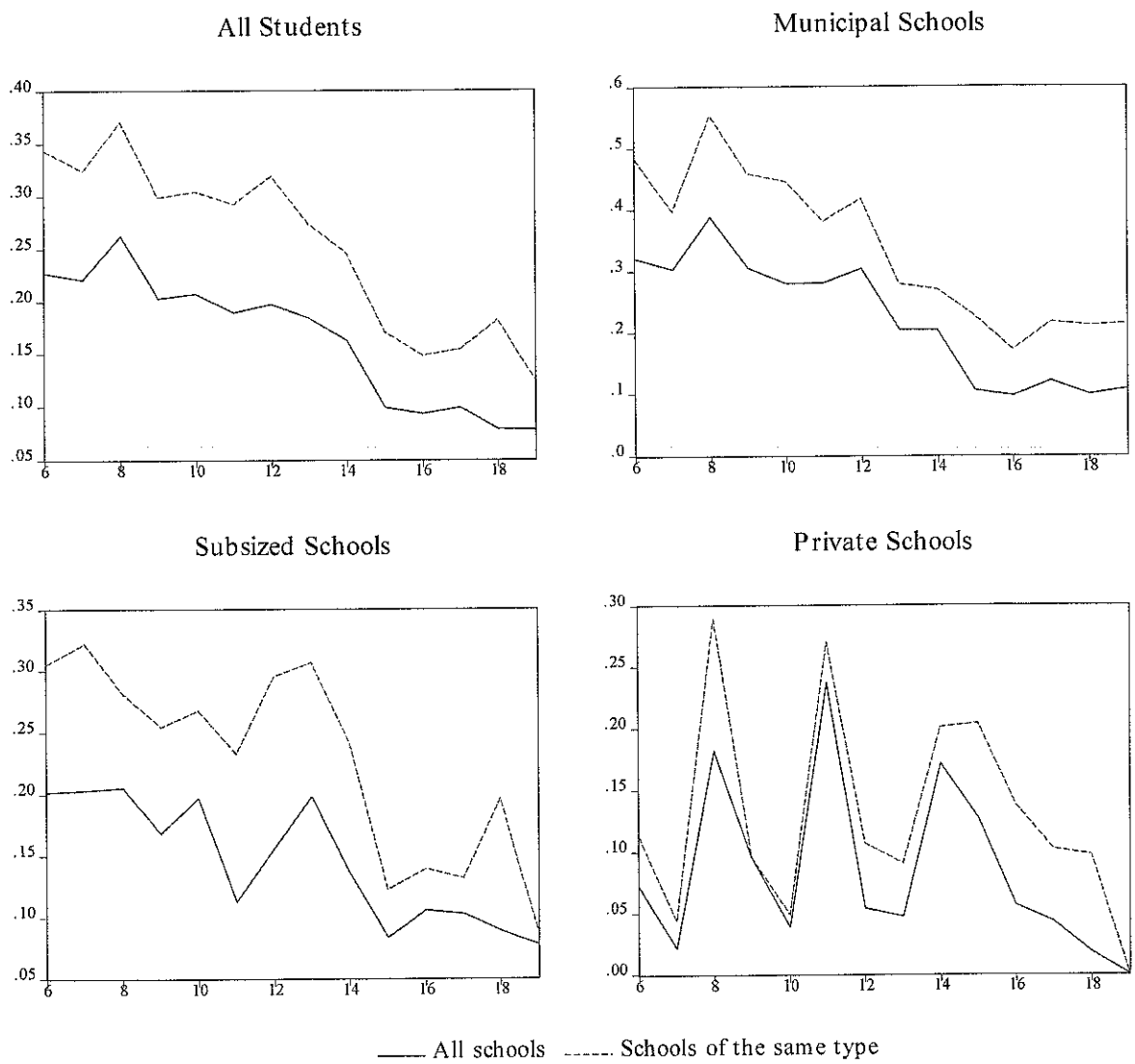


Figure 3
Probability of Choosing the Nearest School by Type of School

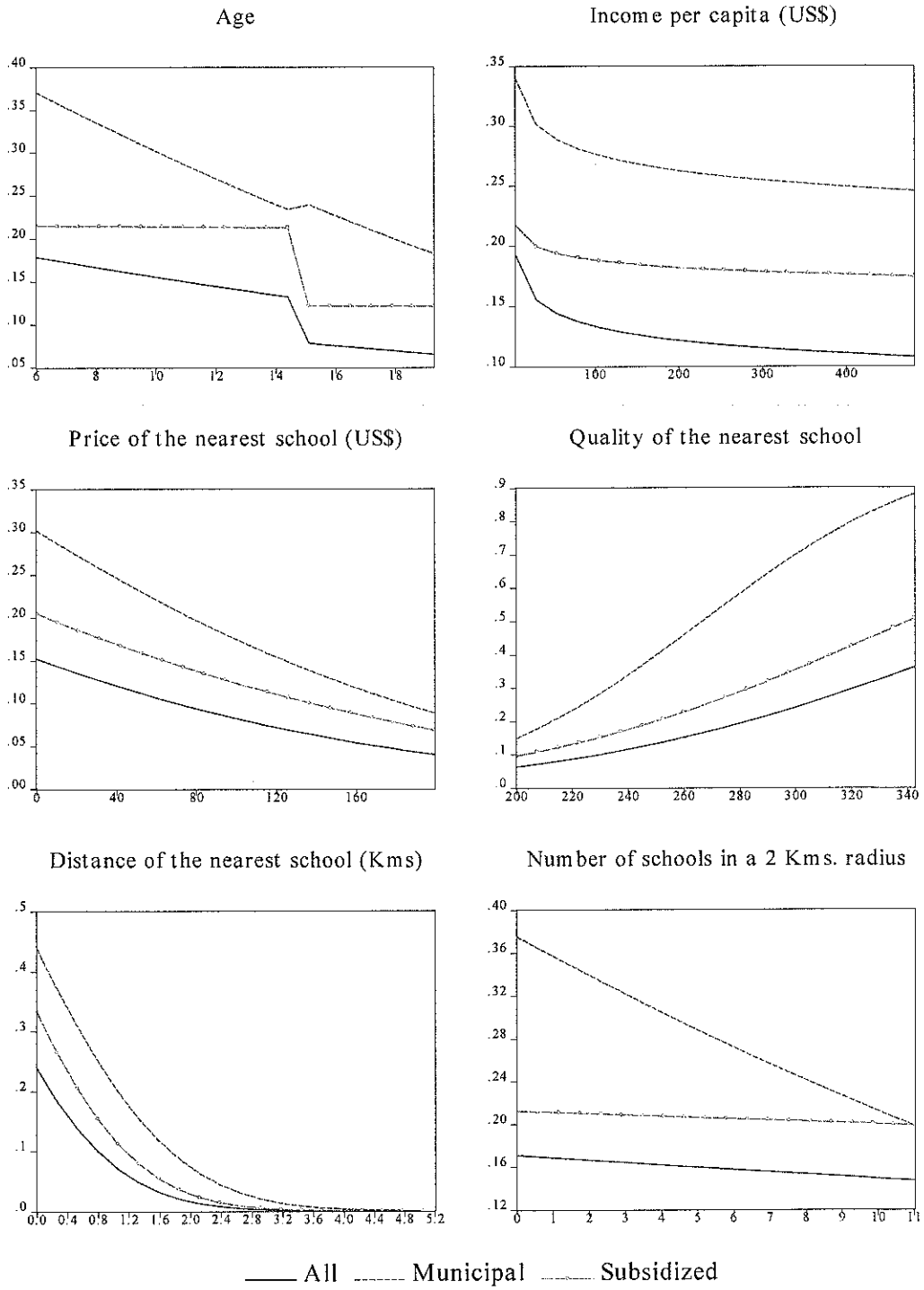
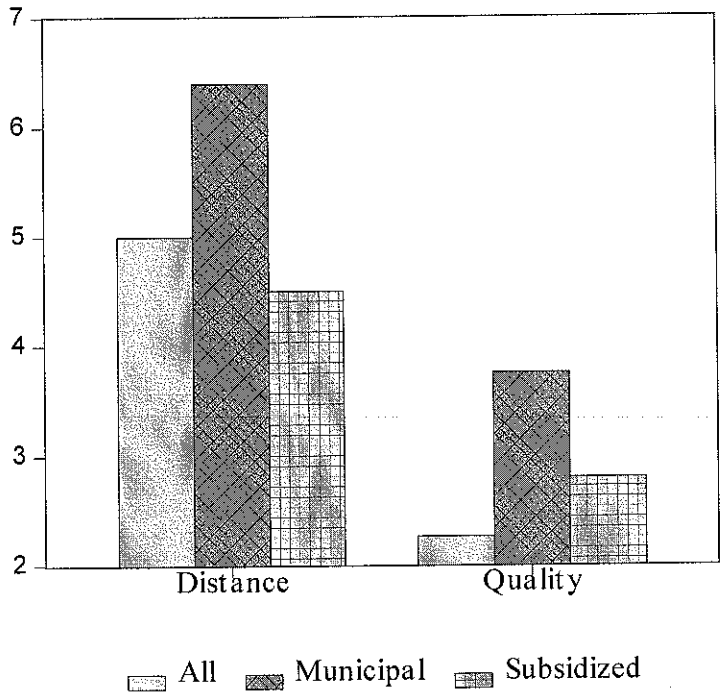


Figure 4
Substitution between Different Factors



Notes: Distance = Increase in meters that the nearest school should move to match a US$ 1 increase in its price. Quality = Increase in price of the nearest school (in US$) needed to match a 1 point decrease in the standardized test of the nearest school.