

Evaluating a Voucher system in Chile. Individual, Family and School Characteristics^{*}

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Abstract

Private provision of education is a topic which has received a great deal of discussion around the world in recent years. Free choice of schools and a voucher system providing public funding to both private and public schools are in place in Chile and have been operating for twenty years. This article provides evidence on the educational determinants of access to higher education and social mobility. The study uses the Academic Aptitude Test (PAA) database, 1998. The PAA is an instrument designed to evaluate the abilities and knowledge of those students who have completed secondary education. This information is used to estimate educational production functions. Three categories of variables (inputs) are hypothesized as explaining educational achievement: individual, family, and school characteristics. The voucher system is “evaluated” by comparing the impact of different school types (privately paid, private subsidized (voucher), and public schools) on academic performance.

The voucher system assumes the competition generated among schools will improve the quality of education. Evidence obtained by using OLS estimates indicates that attending a private subsidized school does increase standardized test scores, but the impact is relatively small. The voucher schools perform more akin to public than private schools. However, when TSLS models are estimated in order to control for school choice, the impact of attending a private subsidized school increases significantly. At the same time the impact of the parent’s education is reduced significantly. Therefore, parental characteristics operate in the selection of school type, and as such their impact has been overestimated with respect to the OLS model. Therefore, the Chilean voucher system succeeds as an instrument that provides social mobility. Policy makers should support a voucher system and increase its availability. Another relevant finding is that while female students are more likely to obtain better grades than their male counterparts during high school, their PAA test scores are significantly lower.

Key words: education, vouchers, gender.

JEL classification:

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1 Introduction

Many studies have shown the importance of education as a source of increased earnings and social mobility. In addition, in many developing countries equalizing education and opportunities is also considered as a factor in reducing income inequality.

There has been intense debate on how to improve the quality of education. Some have tried to achieve this goal by adding more resources to the educational system. However, there is no clear evidence on the success of such policies. Thus, from a theoretical or policy viewpoint there has been increasing interest in analyzing how different types of school administrations might influence educational results. Friedman (1962) proposed the introduction of a voucher system in education. He assumed the competition generated among schools would improve the quality of education. Parents would prefer good schools; as a consequence bad schools would lose enrollment and eventually disappear from the market.

Although the theoretical purpose of such a voucher system is to generate the incentive to increase quality, there has not been sufficient empirical evidence to know whether the system works. The Chilean educational system was decentralized in 1980, and a voucher type subsidy was introduced in order to encourage private providers to enter the market. The system in place provides public funding to both private and public schools

The present paper contributes to an understanding of the functioning of a voucher system, free choice in the selection schools and open competition among them. In addition, the paper contributes to the analysis of the determinants of access to higher education with special emphasis on gender and social mobility in Chile.

Three categories of variables (inputs) are identified that may explain educational achievement. First, individual characteristics including age, gender, academic performance during secondary education, etc. The second group of variables are family characteristics, such as parental education (father and mother), family size and composition, geographical location, etc. Finally, a group of variables describing school characteristics are included, including school financial dependency (privately paid, private subsidized, public), class scheduling (morning, afternoon, night), and school gender composition.

However, many of these variables are endogenous, the most important one for our analysis being the school choice variable. What is the bias of traditional OLS estimates? Are voucher schools good enough to permit access to high education? How do the selection processes work? In order to assess the effect of the endogeneity we estimate the model using different specifications to obtain a measurement of how important the different choice variables are for making OLS estimates. We also estimate an IV model for school choice using as instrument school availability at the community level. This variable is expected to be correlated with school choice, but not with school achievement.¹

The analysis of socioeconomic determinants to higher education is a pioneering effort in Chile and to some extent in developing countries. Application of a previously unused database at an individual level, the most appropriate data set, allows us to examine the determinants of test scores in Mathematics and Reading.

The article is organized as follows. The second section of the paper briefly describes the Chilean voucher system. Section 3 presents a description of the Chilean educational system and how the PAA test works in the selection of students for higher education. Section 4 outlines the methodological issues and reviews the empirical evidence. The fifth section describes the data. Section 6 presents the results. Conclusions are found at the end of the paper.

2 The Chilean voucher system²

Prior to 1980, the administration of the Chilean school system was fully centralized in the Ministry of Education. The Ministry was not only responsible for the curriculum of the whole education system, but also for the administration of the public schools, which accounted for 80 percent of all schools in the country. The ministry also appointed public school teachers and principals, as well as approving and paying expenses and salaries.

The decentralization process initiated in the early 1980s transferred the administration of public-sector schools to the municipalities.² In addition, the reform

¹ Similar instruments have been used in Card (1995b).

² This section is taken from Mizala and Romaguera (2000).

opened the way for the private sector to participate as a provider of publicly financed education, by establishing a voucher-type per-student subsidy.

Three types of schools were established: Municipal schools- financed by the per student subsidy granted by the state and run by municipalities; Private subsidized schools- financed by the per-student subsidy and run by the private sector; and Private fee-paying schools- financed by fees paid by parents and managed by the private sector.

The voucher system gives families complete freedom to choose schools for their children: they can choose a free subsidized school, either municipal or private. Alternatively, they can choose a fee-paying private school if they can afford the tuition fees.

In a traditional voucher system the government makes payments directly to families to enable them to choose which public or private schools their children attend. In the Chilean system, the government subsidizes the school chosen by parents in direct proportion to the size of enrollment. Specifically, the government pays each school one school subsidy unit (SSU) for every child attending classes there. In other words, the size of the subsidy paid per student is the same for both the municipal and subsidized private schools.³

Thus the school dependency (privately paid, private subsidized or public) is a choice variable, which may be correlated with resources at home, location, etc. In addition, many private schools perform admission tests, where only the best students are accepted. These schools also select students on the basis of family characteristics, including parent's education, religion, and family income. However, voucher schools cannot select students in that way. The only constraint for voucher schools is the number of students per class, which is a maximum of 45.

² The total number of municipalities in Chile is 326.

³ The government does not pay any subsidy to fee-paying private schools.

3 The Chilean educational system and access to higher education

The Chilean educational system is divided into three levels. Primary education is mandatory and consists of eight years of schooling. Secondary education covers four or five years of schooling for humanistic and technical (vocational) schools respectively. The technical schools are designed for students who want to achieve a technical diploma in accounting, secretarial work, mechanics, etc. The curriculum for the first two years of a technical school is equivalent to that of the humanistic schools, but for the last three years mostly covers a technical curriculum.

Tertiary education is composed of education in Technical Formation Centers (TFC), Professional Institutes (PI) and both public and private universities.⁴ Upon finishing secondary education students decide to continue studying or enter the labor force. However, most jobs offer and educational institutions require the PAA score.

The Academic Aptitude Test is divided into two groups of tests: aptitude (PAA) and knowledge (PCE). The aptitude test (PAA) is primarily oriented towards identifying innate skills of students. Therefore, they are assumed to be relatively stable over time. This test follows the structure of the Scholastic Aptitude Test (SAT). On the other hand, the Knowledge test identifies the knowledge acquired by students in secondary schools. The results in both examinations are presented in standardized terms, with a score fluctuating between 0-850 points. The PAA is divided into two tests: mathematics and reading. These tests are mandatory for any application to higher education. The Knowledge test is divided into Biology, Physics, Mathematics, Social Sciences, and Chemistry.

Students pursuing a university career need to take this examination process. In particular, the number of tests they need to take is a function of the field of study that to which they want to apply.⁵ For example, Economics students must take the PAA in

⁴ Public universities are not free in Chile. The annual tuition varies depending on the major in which the student is enrolled. For example, Economics costs about 3,000 dollars per year. However, low-income students may apply for public loans, which cover the tuition as a function of the family income. This loan has to be repaid to the university after graduation.

⁵ For some majors additional tests are required.

mathematics and reading. In addition, they also need to take the PCE in mathematics and Social Sciences.

The PAA system provides a ranking of students, which affects their access to higher education. In the test a correct answer is assigned one point towards the final score, while a wrong answer subtracts 0.25 from the score. This procedure generates a “corrected score”. By using the corrected score, the average and standard deviation is calculated for each test. The average of the corrected score is set at 500 points, then the scores are adjusted to a normal distribution with a standard deviation equal to 100 points.

In Chile, only 15 percent of university students come from the poorest 40 percent of families. The selective university entrance process can largely explain this situation. Of the students taking the examination, only 40 percent end up being admitted, only 25 percent are accepted in "traditional" universities, and just 5 percent are accepted by the country's two most prestigious universities: Universidad de Chile and Universidad Católica. Finally, this percentage is reduced significantly if we consider access to the majors having the highest demand, such as Medicine, Economics, Engineering, Law, Psychology and Architecture.⁶

In 1998, 178,526 students were in the fourth year of secondary education, and as such were eligible to take the exam. From this group about 80% actually did so.

The access to higher education has a significant effect on earnings. Contreras, Bravo and Medrano (1999) using data for the last 40 years in Chile show that the return to schooling vary significantly by educational cycles. In particular, the evidence indicates that the return to schooling in Chile not only follows a convex pattern, but also the convexity has been increasing over time. In 1960 the return for an additional year in primary education was equivalent to 7%, the return to secondary and tertiary education were 10 and 13 percent respectively. In 1998, these returns are 7%, 10% and 21% for primary, secondary and tertiary education respectively. Therefore, by accessing higher education, in which a good performance in the PAA test is required, individuals will enjoy significantly higher earnings. In addition, individuals from poor families will have access to move up in the earning scales promoting social mobility.

⁶ See Table 2. Admission figure were obtained from Ministry of Education

4 Methodological issues and empirical evidence

A study of the voucher system and the educational achievement on the PAA could be undertaken from several perspectives. The traditional approach used to analyze the relationship between inputs and outputs of the educational process is designated a production function approach. Most production function studies explain test scores as the output of school inputs, home and individual inputs. Within this context, controlling for other characteristics, a dummy variable identifying private establishments would measure the gap between private and public education.

Previous studies using OLS evidence indicate attending a private subsidized school in primary education does increase educational achievement, but that the impact is relatively small. This type of evidence has been used to argue that parental schooling and attendance in a private school are the most important factors in accessing higher education.

The literature on educational production functions contains a number of controversial results, and at the present time there is further debate fueled by some new studies. The controversial aspects of these results are reviewed in Hanushek (1986, 1996). This author concludes that available studies, which estimate production functions, do not find inputs such as the teacher/student ratio, teacher's education, experience and salary, and expenditure per student on education as having a significant effect.

Additional discussion on these results can be found in Hedges, Laine and Greenwald (1994) and Hedges and Greenwald (1996), where the previous conclusions are questioned. Card and Krueger (1992) evaluate the effect of the available resources at schools on student performance in the labor market. This study finds a significant effect between the cost and quality of the inputs on earnings in the labor market. This study has been scrutinized by other authors (mainly Betts (1996) and Heckman, Layne-Farrar and Todd (1996)). For this reason, it is still premature to suggest a general conclusion on this topic.

The traditional estimates of the private/public school gap in test scores (for example, Chubb and Moe (1990)) have the additional problem of selection bias, besides the bias of omitted input variables. The school type (private, public or voucher) is a choice

variable, which may depend on family resources and the availability of such schools (restrictions). Therefore, estimating a model without considering the endogeneity of school choice would bias the estimates.

There are various econometric studies available for Chile that summarize evidence on the public-private educational gap in primary education. These studies rely as a dependent variable on the average standardized test scores at school level. Among many independent variables a dummy variable is included, which indicates the school category: privately paid, private subsidized or public.

Rodríguez (1988) uses a sample of 281 schools located in Santiago from the 1984 PER test.⁷ This test measured the academic performance of children in the fourth year of primary education. This study used the following as independent variables: the average number of years of parent education at a school level, teacher's experience, the percentage of female teachers, and the number of hours of non-teaching assistants. The study concludes that the educational gap between school dependencies is statistically significant at about 7 to 8 points in favor of private schools.

Aedo and Larrañaga (1994) used a larger sample than Rodríguez, including 500 schools. A regression model is estimated using information on SIMCE 1990 and 1991. In addition, information on socioeconomic characteristics are added by using CASEN 1990. The control variables were: class size, the teacher/student ratio, mother's average years of education, family income, a poverty index, and failure rates. They find evidence similar to that found previously by Rodríguez, i.e.: the private subsidized schools obtain higher test scores than public schools.

Similarly, Carnoy and McEwan (1998) use the SIMCE database to estimate the impact of competition in the educational system on the performance of different types of schools. They use a school panel data with a bi-annual periodicity between 1988-1996, having between 8,000 and 15,000 observations. Competition is defined as the percentage of

⁷ The PER test was a specially designed test to evaluate educational achievement. This test was taken between 1982 and 1984, which is the fore-runner of the test most recently resorted to, the SIMCE: System to Measure Quality of Education. For a discussion see Rodríguez (1988), Aedo and Larrañaga (1994), Carnoy and McEwan (1998), Mizala and Romaguera (1998-2000) and Bravo, Contreras and Sanhueza (1999).

children enrolled in private subsidized schools and the percentage of enrollment in privately paid schools. Surprisingly, after controlling for different variables and using a fixed effect approach, they found that competition reduced school performance.

In a recent paper, Bravo, Contreras and Sanhueza (1999) examine the determinants of educational achievement in primary education. The paper examines both the whole distributions of the scores and the average academic performance at school level. Between the explanatory variables socioeconomic characteristics are included, a measure of infrastructure, family resources, health status, etc. The estimation considers the period between 1982-1998, and the regression analysis was performed separately in the fourth and eighth grades. In order to have a more flexible specification the estimation was implemented separately between Spanish and Mathematics tests.

The econometric studies available for Chile that review evidence on the public-private educational gap are based only on primary education at the school level. These studies rely on the average standardized test scores as a dependent variable. Among many (average) independent variables a dummy variable is included which measures the school category: privately paid, private subsidized, or public.⁸

The most important result of the previous papers is the evaluation of the impact on test scores of attending a public, private subsidized, or private school. Although in gross terms the gap between the school types is often as large as 30 points, the difference is reduced significantly once control variables are incorporated. The differences are not constant over time, and this significance varies depending on the test and course examined (See Bravo, Contreras and Sanhueza, 1999).

The most recent evidence on this topic is in Mizala and Romaguera (JHR, 2000). This paper follows the empirical strategy outlined above. The average test score in primary education is correlated with a vector of average family, school and individual characteristics. They use all the information at the school level in the 1996 SIMCE (more than five thousand schools). They add information on the health status of children from

⁸ These instruments are not free of problems. Migration to communities with voucher schools may reduce (but not eliminate) the power of the instrument. However, in this case the cost of attending a voucher school increases. There are about 298 communities in the data base, which permits a significant variation in estimating the parameters.

JUNAEB (the institution in charge of administering governmental school-food programs). The group of control variables includes a measure of the socioeconomic level, a vulnerability index of the school, a geographical index, experience of the teacher, the student/ teacher ratio, etc. The dependent variable is defined as the average test score between the Mathematics and Spanish tests. The main conclusion of this study is that the initial difference in the average scores between schools from different dependencies, of almost 5 points in favor of the private subsidized schools, disappears when control variables are added into the regression. In addition, the sign is reverted, indicating a difference in favor of the municipal schools.

This paper and the other mentioned above have serious limitations. First, the reports are based on school averages; therefore there is a significant fraction of variation, which is missing from the analysis. In addition, the results are presented for the average score in mathematics and reading; no gender analysis is performed. Second, many of the explanatory variables are endogenous, and no attempt to examine and solve these problems has been made. Finally, the main result is based on an estimated parameter of the school type, which is a choice variable and therefore OLS estimates is not appropriate.

The present paper utilizes an individual level data set that is much more appropriate to this type of estimation. In addition, the methodology used in this paper compares OLS and IV results. Finally the data used is for student graduated from secondary education making a decision to enter to tertiary education which is the level with a more significant impact on earnings. However, this strategy is not completely free of problems.⁹ First, many of the variables defined as inputs are endogenous. For instance, course grades are determined by past academic performance, household resources, preferences, etc. Similarly, the school dependency (privately paid, private subsidized, or public) is also an endogenous choice variable, which may be correlated with resources at home, location, restrictions, etc. Another selection problem arises from the fact that not all potential students take the PAA test, and not all members of a birth cohort complete secondary school to qualify for the test.

In order to solve these problems various steps are taken. First, different models are estimated in order to examine the relative bias caused by introducing endogenous variables. A set of specifications analyzes how the results vary when family size, grades, and school

⁹ For a discussion see Strauss and Thomas. Handbook of Development Economics. Vol. 3.D.

characteristics are added into the model. Additionally, we estimate an OLS model as well as a TSLS model to control for selection bias in the school choice variable.

The TSLS model is estimated as follows. In the first stage a Multinomial Logit is estimated to predict the probability of choosing a private or a voucher school (public schools are used a reference). The model implicitly hypothesizes the school choice as a function of resources at home and restrictions. Household resources are assumed to be a function of parental educational attainment. In addition, restrictions in school choice are defined as two dummy variables, which identify the availability at community level of private and voucher schools. These last variables allow us to identify the choice model given that availability is correlated with school choice, but not with students' ability.¹⁰

Thus the TSLS estimates are based on supply-side innovations. In particular, the availability of different types of schools is the key variable to identify the model.

5 Data

The study uses the Academic Aptitude Test (PAA) database for 1998. The PAA is an examination designed to evaluate the student abilities and knowledge at the end of her/his secondary education. It is a required test taken prior to enrolling in higher education. Table 1 presents the number of students taking the exams between 1994-1998. In 1994 136,712 students were enrolled to take the PAA exam, this figure increased to 142,382 in 1998. On average these numbers represent about 78% of the students who graduated from secondary education. Although this percentage is relatively representative of the total population, it varies significantly across regions, fluctuating between 58-85%.

Table 1A presents the coverage of population in primary and secondary education from a long-term perspective. In 1970 nearly 50% of the population of age to attend secondary education was actually attending. In contrast, this percentage is about 90% for primary education. These figures reach 96% and 82% in 1998, for primary and secondary education, respectively.

¹⁰ These instruments are not free of problems. Migration to communities with voucher schools may reduce (but not eliminates) the power of the instrument. However, in this case the cost to attend the voucher school increases. There are about 298 communities the data base which permits to have a significant variation to estimates the parameters.

Table 2 presents the population distribution for 1998. The first column describes the region from north to south, the second column presents the total population in each region. Regions 5, 8 and RM are the ones with higher concentration of population. The third column describes the population in the age range, which is equivalent of attending secondary education (potential population attending secondary education). Column 4 presents the actual enrollment in the fourth year of secondary education. The next columns describe the number of people eligible to take the PAA test. Finally, the columns 6 and 7 present the students enrolled in the PAA test and its percentage with respect to the eligible respectively.

Table 3 shows some basic descriptive information on the sample. The students taking the exam are on average about 19 years old. Only 2 percent have a spouse and are the head of household. About 16 percent of the students work. Students come from families where parents have mostly secondary education. About 23 percent of the applicants reported that their father has completed at least primary education, while over 40 percent indicated that their father has completed at least secondary education. Finally, students whose fathers have some degree of university education represent about 34%. A similar pattern is shown for student's mothers.

In 1998, from the students enrolled in the PAA test 21% come from private schools, 45 from public and 35 from subsidized private schools. 75 percent of the students attend school of both sexes during secondary education. In contrast, only 10% attended male schools and 15% only females' schools. Finally, 75% of the applicants choose a humanistic school and 90% of these individuals have reported taking classes in daily schedule.

Tables 4 and 5 present statistics on the average score by gender and school types respectively. In table 4, males systematically score higher on the test than females, but they obtain lower grades during secondary school. This pattern is consistent for the whole set of characteristics.

Table 5 presents the average scores by type of schools and for the PAA in mathematics and reading. Private school performs better than private subsidizes and public schools. It is also observed a positive correlation between score and parent's education.

This effect is even greater when both parents exhibit higher education. For each PAA test and type of school males obtain better scores than females.

The previous results are confirmed by Figures 1 and 2. Figure 1 shows the score distribution for the total population and by gender. The data suggest that scores are lower in mathematics, and that this result remains stable by gender. From the numbers can be seen that the distribution of male students is placed to the right with respect to the distribution of females.

Figure 2 presents the score distribution by school type. Private schools show a better performance in both mathematics and reading, while voucher and public schools exhibit a similar distribution. Without further analysis this data would suggest that voucher schools perform more akin to public than to private schools.

6 Results

Tables 6 (6A) and 7 (7A) show the OLS estimates for PAA score in mathematics and reading (and controlling for regional effects) respectively for 1998. The tables include different specifications as a way of examining the stability of the parameters and how the choice variables potentially bias the previous estimates. The estimates are presented separated for males and females. In the bottom part of each specification a Chow test is presented to evaluate if the male specification is statistically equivalent to the female one. For both, PAA mathematics and reading under different specifications, the evidence suggests males and females perform differently in the PAA tests. Consequently, the econometric specifications will be presented separate by gender.

In Table 6, the first specification includes only exogenous variables: age of the student and parent's education. The second specification adds school choice variables. The third model include: school type, school sex composition, humanistic or technical school, and morning or afternoon attendance, as a consequence of the inclusion of such variables the parental education parameters are reduced by half. These results suggest that parental education be correlated with school choice variables. The fourth specification adds family size and other individual characteristics defined using dummy variables. Each dummy variable assigns the value equal to one when the student is head of household, work, and

has a partner. The results remain relatively stable with respect to the previous model. Although these variables are *endogenous*, they are not causing significant bias with respect to the previous estimates. The fifth specification includes average grades during secondary education. In this case the impact of school type is reduced as well as the impact of the other variables, but the impact of parental secondary education. The coefficient associated with grades is very significant and large. This is due to the fact that average grades are expressed in a standardized score which fluctuates between 0-850 points. Although average grades are also endogenous from a dynamic perspective, this problem is reduced in the present context. We are using the average grades during the whole secondary education period.

The previous results remain when we add regional dummies to control for geographical heterogeneity, suggesting that effects between and within regions are similar in their effect on test scores. The results shown in Tables 6A and 7A are similar those for the PAA verbal.

Therefore, the OLS suggest that different specifications are relatively stable in terms of the impact of the school choice on the PAA score. Given such results the next section will be focus on the last specification without regional dummies.

Thus the evidence indicates that after controlling for individual, family and school characteristics, by attending a private school increases the PAA score in mathematics in 49 and 62 points for males and females respectively. The impact of attending a private subsidized school is about 14 and 16 additional points for males and females. In addition, with respect to the PAA reading the results are similar. By attending a private schools males obtain 44 additional points, while females obtain 55 more points. The magnitude is reduced for private subsidized schools. Indeed, males and females obtain additional 15 and 20 more points than students attending public schools do.

As it was mentioned before, the purpose of this paper is to identify the contribution of voucher schools in producing access to higher education. However, a direct interpretation of the previous results is not correct. The type of school is a choice variable. Therefore, the OLS estimates are bias. The sign of the bias depend on the type of the selection process which operate in the educational system. If we believe that more educated

and/or richer parents select the best schools for their children, then after controlling for the endogeneity of the school choice the OLS estimates should decrease. In other words, the OLS estimates would be overestimated.

On contrary, as it was suggested by Card (2000), Kling (2000) and Carneiro and Heckman (2000), the institutional features of the educational system such as the availability of different types of school as the instrument to identify the school choice decision would affect different to different group in the population.¹¹ In that case, the TSLS estimator based on school availability as instrument are most likely to affect the schooling choices of individuals who would otherwise have choose only public schools. In other words, in the hypothetical case where all the children in public schools were moved to private and private subsidized schools, then we would expect that this children would score relatively more than the children already enrolled in private and voucher institution (diminish return to score).

Thus, after correcting the endogeneity the estimated impact of private and voucher schools should increase. Under such circumstances, by using supply-side features to instrument schooling choices would imply to find TSLS estimates bigger than the corresponding OLS estimates¹². In other words, if the marginal benefit of attending a private or a voucher school were higher for the lowest background fraction of the population (student currently attending public schools) this would be consistent with the larger estimates (with respect to the OLS estimates) using availability as an instrument.¹³

The policy recommendations in both cases are significantly different. In the first hypothesis, there would be a matching between good schools and good students, which operates through the parental decision. In that case, the voucher system would not be explaining the improvement in the quality of the student achievement. On the other hand, in the second hypothesis the voucher schools would be making a significant contribution to increase the access of students (a fraction in the population) who without this type of schools would have a lower score and less opportunities to enter in the tertiary educational

¹¹ For instance Card (1995b) speculates that the effect of college proximity is more important for children of less wealthy households.

¹² As it mentioned in Kling (2000), these IV estimates will represent the average marginal benefit from an additional student enrolled in a private/voucher school fro the subgroup affected by school availability instrument. For additional discussion see Angrist and Imbens (1995)

¹³ See Card (2000) for a summary in the literature supporting such findings.

level. If this were the case, the policy recommendation would imply the increase the availability and a support of the voucher system as a tool to promote social mobility and increase in the opportunity set of poor students.

In order to examine this question it is necessary to find an appropriate instrument which permits to identify the model. In order to do so, a Two-Stage Least Square Method (TSLS) is used. In the first stage a MLOGIT model is used to predict the probability to choose a private and a voucher school (the public schools are taken as a reference). These estimated probabilities are used as explanatory variables in the OLS model (second stage).

Table 8 shows the MLOGIT estimates for school choice. The dependent variable is defined as a dummy for the choice of a private school and a voucher school. Public schools are taken as a reference. There are two specifications for such a model. In the second specification *maturity*¹⁴, defined as the number of years that a student completing secondary education postpones taking the exam, is added. The explanatory variables include gender, age, age-squared and maturity. In addition, a proxy for family resources is done using parental education and the restrictions in access to the types of schools are instrumentalized using a dummy variable, which indicates whether the school type is available at the community level. For each choice variable, i.e.: attending a private or a voucher school two dummy variables are used indicating whether in such community a private and a voucher school is available. These last variables are the key to identifying the econometric model in the first stage.¹⁵

The results in Table 8 indicate a positive correlation between the parental education and choosing a private school. A similar effect is observed for males, age, and average grades. As expected the availability of a private school increases the probability of attending a private institution. However, the availability of a voucher school reduces the probability of attending a private school, which may be interpreted as effect of competition in the educational system. These results are similar across the two specifications.

¹⁴ I am still looking for a better word to describe this

¹⁵ There are of course several reasons why school availability at community level may not be a good instrument. Observably equivalent families may have different tastes for education and chose to live in different communities or migrate.

The evidence also shows a negative correlation between attending a voucher school, and being male, having higher average grades, and being older. In addition, a positive correlation is observed between parental education and choosing a voucher school, however, in comparison to private schools, these effects are smaller.

The availability of voucher and private schools increases the probability of attending a private subsidized school. The effect of this variable is positive and significant in explaining the probability of attending a voucher school, but the impact is small. Parental education increased the likelihood of selecting these types of schools. The higher the parental education the greater is the effect on choosing private schools.

The Multinomial Logit estimates provide the expected probabilities of attending private and voucher schools. These probabilities are used as explanatory variables in the OLS equation, which is a TSLS model. The results are presented in Tables 9 and 10 for mathematics and reading respectively. Each table summarizes the estimates divided by gender and type of test. In addition, the OLS and the TSLS under different sampling are included. The first model presents the OLS estimates for males and females. The next three specifications show the TSLS estimates for the whole sample, for the sample composed only for students in humanistic schools in a daily schedule basis and a sample for regions with a higher (over 80%) percentage of students enrolled in the PAA test. The purpose of such sampling is to examine how robust are the results. In particular, when the selection processes operates differently through students who chose to attend certain type of school or schedule or when the regional sampling vary along the country.

Table 9 presents the results for PAA mathematics. While the OLS estimates predict that voucher schools contribute to an increase in the PAA score of 14-16 points, these figures increase significantly when TSLS is used. In Mathematics, while males obtain 130 and 89 additional points by attending private and voucher schools respectively, females score 138 and 67 additional points. In reading (Table 10), the impact of a voucher school is higher for both males and females with respect to the test in mathematics. Males attending private schools score 131 points more than public schools, while students in voucher schools get 115 more points. Females obtain 146 and 104 points in private and voucher schools, respectively.

At the same time, parental contribution to PAA score is reduced significantly when instruments are used. In particular, the most important contribution to the OLS estimates is given by parental higher education. For example, the males in mathematics, such a contribution is reduced from 38 and 32 for father and mother respectively, to 21 and 12. Therefore, the parent's contribution is reduced to half of the OLS estimates. A similar pattern is observed for females and for the PAA reading. Finally, when different samples are used in the TSLS models the results remain relatively stable.

7 Summary and Conclusions

The voucher system assumes that competition generated between schools will improve the quality of the education. The evidence obtained by using OLS estimates indicates that attending a private subsidized school does increase standardized scores, but the impact is relatively small. This finding has been reported on several occasions, but using only school level information and averages of family characteristics.

This paper uses a supply-side instrument to model the school choice. In particular, the instrument is defined as school type availability at community level. The paper presents evidence on the impact of individual, family and school characteristics on the access to higher education in Chile. To analyze the robustness of the results, different specification and empirical strategies are used.

Thus, from the perspective of the traditional OLS analysis the voucher schools perform more akin to public than to private schools. However, when TSLS models are estimated in order to control for school choice, the impact of attending a private subsidized school almost triples with respect to OLS estimates. At the same time, we observe a drop in parental impact. Therefore, parental characteristics operate in the selection of school type, and their impact has been overestimated when OLS estimates are presented.

Thus, by using school availability to instrument schooling choices implied to find TSLS estimates bigger than the corresponding OLS estimates. These IV estimates will represent the average marginal benefit from an additional student enrolled in a private/voucher school for the subgroup affected by school availability instrument. In other

words, if the marginal benefit of attending a private or a voucher school were higher for the lowest background fraction of the population (student currently attending public schools) this would be consistent with the larger estimates (with respect to the OLS estimates) using availability as an instrument.

From the policy recommendation perspective, Policy makers should support a voucher system and increase its availability. The voucher system is a tool that provides students with the opportunity to increase their test scores and have greater access to higher education, and thus future social mobility.

Finally, while female students are more likely to obtain better results than males during high school, their PAA test scores are significantly lower. Special policies should be addressed to females to improve their performance.

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Table 1**Number of students enrolled in the PAA and percentage from graduated from secondary education**

Year	Enrolled PAA I	Graduated High School II	Graduated and Enrolled same Year III	Percentage III/II
1994	136,712	115,943	89,411	77.1
1995	131,297	111,567	85,483	76.6
1996	125,995	104,676	83,749	80.0
1997	140,020	119,844	97,387	81.3
1998	142,382	128,243	97,935	76.4

Table 1A**Population in Primary and Secondary Education
(percentages)**

Year	Primary %	Secondary %
1970	93.30	49.73
1982	95.27	65.01
1992	98.18	79.94
1993	94.45	75.06
1994	93.29	79.72
1995	95.71	79.26
1996	96.05	82.34
1997	96.26	82.45
1998	96.06	81.77

Notes: For years 1970, 1982 and 1992 census population
For 1993-1998 the figures are calculated in basis on projected population prepared by INE, in basis of Census of 1992.

Table 2

Region	Total population (1)	Population 14-17 Sec. Education (1)	Enrolled in 4 year High School (2)	Aproved (2)	Enrolled in PAA graduated 1997 (3)	% Enrolled in PAA graduated 1997 (4)
1	375,705	25,371	4,268	3,970	2,376	59.8
2	441,821	21,863	4,702	4,365	3,488	79.9
3	255,934	11,748	2,471	2,281	1,898	83.2
4	549,337	27,622	5,549	5,199	3,693	71.0
5	1,506,257	77,539	15,062	14,128	11,406	80.7
6	757,687	34,196	7,064	6,666	4,846	72.7
7	884,028	40,650	8,130	7,573	4,367	57.7
8	1,880,469	92,831	16,982	15,822	11,038	69.8
9	832,348	39,271	7,563	7,061	4,597	65.1
10	1,019,490	41,404	8,080	7,501	4,741	63.2
11	85,573	4,836	774	724	535	73.9
12	145,978	7,581	1,536	1,493	992	66.4
RM	5,888,642	289,577	54,436	51,458	43,958	85.4
País	14,623,269	714,489	136,617	128,241	97,937	76.4

(1) National Characterization Survey, CASEN 1998

(2) Ministry of Education

(3) Developed by the author in basis of information DEMRE

(4) Defined as (4)/(3)

Table 3
Descriptive Statistics 1998
(ARITHMETIC MEAN AND STANDARD DEVIATION)

Variables	Mean	SD
a. Individual Characteristics		
Male=1	0.47	0.50
Maturity (1)	0.79	2.05
Age	19.04	3.10
Partner=1	0.02	0.15
Grades (2)	501.32	136.28
Work=1	0.16	0.37
Head of household=1	0.02	0.13
b. Family Characteristics (3)		
Size of Household	4.77	1.50
Father primary Education=1	0.23	0.42
Father secondary Education=1	0.43	0.50
Father superior Education=1	0.34	0.49
Mother primary Education=1	0.25	0.44
Mother secondary Education=1	0.48	0.50
Mother superior Education=1	0.26	0.46
c. School Characteristics		
Private=1	0.21	0.40
Municipal=1	0.45	0.50
Subsidized private=1	0.35	0.48
Male school=1	0.10	0.30
Female school=1	0.15	0.36
Both sexes=1	0.75	0.43
Humanistic=1	0.75	0.43
Daily schedule=1	0.90	0.30
Region 1=1	0.03	0.16
Region 2=1	0.04	0.19
Region 3=1	0.02	0.13
Region 4=1	0.04	0.19
Region 5=1	0.12	0.32
Region 6=1	0.05	0.21
Region 7=1	0.05	0.21
Region 8=1	0.12	0.33
Region 9=1	0.04	0.21
Region 10=1	0.05	0.21
Region 11=1	0.01	0.07
Region 12=1	0.01	0.11
Region 13=1	0.44	0.50

Notes: (1) Number of years from graduation from secondary school (=0 takes the exam the same year of graduation).
(2) Standardized grades from secondary education.
(3) In each parents educational category incomplete level is included

Table 4
Descriptive Statistics – Averages Scores by Gender (1998)

Variables	PAA Mathematics		PAA Verbal	
	Male	Female	Male	Female
Father primary Education=1	470	439	465	442
Father sec. Education=1	501	472	500	484
Father sup. Education=1	573	543	570	557
Mother primary Education=1	472	439	467	442
Mother sec. Education=1	507	478	506	490
Mother sup. Education=1	578	549	576	564
Father/Mother Sup. Education	596	565	591	579
Private=1	584	564	579	573
Municipal=1	492	458	490	467
Partially subsidized=1	509	478	508	492
Male school=1	571	480	566	496
Female school=1	544	510	560	521
Both sexes=1	505	476	504	486
Region 1=1	497	469	501	485
Region 2=1	505	475	493	476
Region 3=1	495	469	479	470
Region 4=1	500	468	496	472
Region 5=1	512	479	514	491
Region 6=1	508	476	500	481
Region 7=1	519	489	503	491
Region 8=1	520	487	507	489
Region 9=1	501	465	499	476
Region 10=1	506	475	505	483
Region 11=1	502	471	504	490
Region 12=1	530	497	527	505
Region 13=1	528	495	532	511
TOTAL	518	486	516	496

Table 5
Descriptive Statistics - Averages Scores by type of Schools (1998)

Variables	PAA Mathematics			PAA Verbal		
	Municipal	Private	Private Subsidied	Municipal	Private	Private Subsidied
Male	492	584	509	490	579	508
Female	458	564	478	467	573	492
Father primary Education=1	445	492	460	441	503	464
Father sec. Education=1	475	529	486	480	533	493
Father sup. Education=1	516	600	535	526	600	544
Mother primary Education=1	446	483	461	443	493	465
Mother sec. Education=1	478	542	489	484	544	497
Mother sup. Education=1	519	604	539	532	605	549
Father/Mother Sup. Education	534	612	552	547	611	561
Male school=1	560	623	535	558	617	529
Female school=1	497	606	488	509	609	501
Both sexes=1	458	562	487	461	565	495
Region 1=1	456	517	502	466	533	508
Region 2=1	458	543	525	450	539	525
Region 3=1	442	598	525	439	583	513
Region 4=1	451	600	513	451	582	517
Region 5=1	454	560	495	461	566	502
Region 6=1	456	584	490	457	576	488
Region 7=1	481	565	513	473	554	511
Region 8=1	475	582	512	471	568	511
Region 9=1	457	582	492	463	587	496
Region 10=1	465	565	505	470	566	505
Region 11=1	442	509	532	455	518	540
Region 12=1	491	561	521	492	561	527
Region 13=1	494	582	479	505	587	492
TOTAL	474	574	492	478	576	499

Table 6
PAA by gender: Different specifications
PAA Math., 1998

ORDINARY LEAST SQUARES										
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Age	-20,97	-17,02	-22,58	-18,3	-11,95	-11,05	-10,86	-10,48	-5,63	-6,13
	[13.9]	[17.2]	[13.4]	[17.6]	[8.6]	[11.4]	[7.9]	[11.0]	[4.4]	[6.5]
Age square	0,21	0,18	0,22	0,19	0,11	0,12	0,09	0,11	0,03	0,05
	[8.2]	[10.1]	[7.9]	[10.5]	[5.2]	[7.4]	[4.7]	[7.2]	[1.3]	[3.2]
Maturity	19,09	15,08	20,34	16,19	15,57	12,71	15,9	13,14	14,25	12,6
	[20.8]	[29.2]	[20.8]	[29.7]	[17.9]	[24.3]	[17.7]	[24.3]	[17.9]	[24.2]
Father sec. Education=1	16,11	16,93	13,59	14,2	8,91	11,24	8,44	10,97	12,54	13,37
	[13.2]	[18.1]	[11.2]	[15.3]	[7.6]	[12.4]	[7.2]	[12.1]	[11.5]	[16.0]
Father sup. Education=1	64,85	62,34	50,97	45,96	39,39	37,92	38,8	37,71	38,49	35,25
	[43.0]	[50.6]	[33.5]	[37.4]	[27.0]	[31.6]	[26.5]	[31.4]	[29.0]	[32.8]
Mother sec. Education=1	15,21	18,93	11,36	14,97	6,75	10,51	6,28	10,02	9,1	11,95
	[12.9]	[20.6]	[9.6]	[16.4]	[5.9]	[11.8]	[5.5]	[11.2]	[8.6]	[14.5]
Mother sup. Education=1	61,37	65	46,51	47,78	35,7	38,98	34,97	38,17	31,48	32,67
	[39.0]	[49.4]	[29.4]	[36.5]	[23.4]	[30.4]	[22.9]	[29.7]	[22.8]	[28.7]
Private=1			58,4	68,44	59,95	73,1	59,57	73,07	48,76	61,7
			[44.2]	[55.7]	[47.7]	[61.5]	[47.3]	[61.4]	[43.3]	[59.3]
Subsidized private=1			9,03	10,78	15,68	16,23	15,45	16,14	13,67	15,83
			[9.3]	[13.9]	[16.7]	[21.3]	[16.4]	[21.1]	[16.0]	[23.1]
Male school=1					46,79	0	46,77	0	42,55	0
					[42.8]	[.]	[42.8]	[.]	[43.2]	[.]
Female school=1					0	25,28	0	25,22	0	19,48
					[.]	[31.4]	[.]	[31.4]	[.]	[27.7]
Humanistic=1					39,55	35,25	38,75	34,31	29,52	26,13
					[40.9]	[44.5]	[40.0]	[43.3]	[32.8]	[34.5]
Daily schedule=1					61,16	49,47	59,13	47,71	23,95	11,32
					[28.6]	[28.6]	[26.9]	[27.1]	[11.6]	[6.0]
Size of Household							-0,56	-1,11	-0,54	-0,88
							[2.0]	[4.8]	[2.1]	[4.2]
Head of household=1							6,57	3,85	-3,03	-10,01
							[1.6]	[0.8]	[0.7]	[2.3]
Work=1							-15,39	-15,59	-13,05	-13,07
							[12.7]	[13.8]	[11.4]	[12.4]
Partner=1							-0,49	1,32	-7,83	-12,85
							[0.1]	[0.5]	[1.8]	[4.8]
Avg.Grades									0,37	0,36
									[85.9]	[91.0]
Constant	771,92	678,98	790,49	692,56	551,05	510,89	543,63	512,4	324,83	309,13
	[39.2]	[54.9]	[36.1]	[53.2]	[27.0]	[37.8]	[26.7]	[38.2]	[17.1]	[22.5]
Observations	56493	63128	56395	63055	56395	63055	56187	62839	56187	62839
R-squared	0,21	0,23	0,24	0,27	0,31	0,32	0,31	0,32	0,44	0,46
Chow Test										
H0: Male=Female										
F-test	4,34		7,79		21,68		16,52		18,04	
P-value	0,00		0,00		0,00		0,00		0,00	

Robust t-statistics in brackets

Table 6A
PAA by gender: Different Specifications (controlling by regional effects)
PAA Math., 1998

	ORDINARY LEAST SQUARES									
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Age	-21,27 [13.8]	-17,13 [16.9]	-22,55 [13.4]	-18,33 [17.5]	-11,92 [8.6]	-11,1 [11.3]	-10,8 [7.8]	-10,52 [10.9]	-5,41 [4.1]	-6,17 [6.4]
Age square	0,21 [8.2]	0,18 [10.0]	0,22 [7.9]	0,19 [10.4]	0,11 [5.2]	0,12 [7.3]	0,09 [4.6]	0,11 [7.1]	0,02 [1.1]	0,05 [3.2]
Maturity	19,55 [20.6]	15,31 [29.0]	20,46 [20.7]	16,21 [29.6]	15,65 [17.8]	12,78 [24.2]	15,98 [17.6]	13,22 [24.3]	14,45 [17.8]	12,77 [24.3]
Father sec. Education=1	15,7 [12.9]	16,81 [17.9]	13,57 [11.2]	14,55 [15.7]	8,68 [7.4]	11,36 [12.5]	8,17 [6.9]	11,05 [12.2]	12,39 [11.4]	13,47 [16.1]
Father sup. Education=1	64,27 [42.6]	62,06 [50.3]	50,9 [33.5]	46,44 [37.8]	38,87 [26.6]	37,96 [31.6]	38,24 [26.1]	37,69 [31.4]	37,86 [28.6]	35,08 [32.6]
Mother sec. Education=1	14,7 [12.4]	18,73 [20.4]	11,25 [9.6]	15 [16.4]	6,62 [5.8]	10,55 [11.9]	6,14 [5.4]	10,04 [11.3]	9,01 [8.5]	12,08 [14.7]
Mother sup. Education=1	60,88 [38.8]	64,68 [49.3]	46,48 [29.4]	47,87 [36.7]	35,39 [23.3]	38,97 [30.5]	34,65 [22.8]	38,15 [29.8]	31,02 [22.6]	32,59 [28.7]
Private=1			57,44	67,87	59,9	72,16	59,37	71,98	47,65	60,09
Subsidized private=1										
Male school=1					46,52 [42.0]	0 [.]	46,34 [41.9]	0 [.]	41,17 [41.6]	0 [.]
Female school=1					0 [.]	23,51 [28.9]	0 [.]	23,39 [28.7]	0 [.]	17,44 [24.6]
Humanistic=1					40,46 [41.6]	36,16 [44.9]	39,67 [40.7]	35,32 [43.8]	30,34 [33.6]	27,44 [35.8]
Daily schedule=1					61,7 [28.7]	50,54 [29.2]	59,73 [27.1]	48,83 [27.7]	24,35 [11.7]	12,3 [6.5]
Size of Household							-0,56 [1.9]	-1,09 [4.7]	-0,56 [2.1]	-0,87 [4.2]
Head of household=1							6,69 [1.6]	4,13 [0.9]	-3,49 [0.8]	-10,01 [2.2]
Work=1							-15,53 [12.7]	-15,67 [13.9]	-13,82 [12.1]	-13,39 [12.7]
Partner=1							-0,99 [0.2]	1,15 [0.4]	-9,01 [2.0]	-13,36 [4.9]
Avg. Grades									0,38 [86.4]	0,36 [91.2]
Constant	783,5 [38.6]	686,61 [54.2]	795,68 [36.3]	695,32 [52.8]	553,7 [27.0]	514,09 [37.6]	546,36 [26.7]	515,84 [38.0]	327,21 [16.9]	312,44 [22.4]
Observations	56395	63055	56395	63055	56395	63055	56187	62839	56187	62839
R-squared	0,21	0,23	0,24	0,28	0,31	0,32	0,31	0,32	0,45	0,47
Chow Test										
H0: Male=Female										
F-test	2,43		3,74		10,67		9,19		9,75	
P-value	0,00		0,00		0,00		0,00		0,00	

Robust t-statistics in brackets

Table 7
PAA by gender: Different Specifications
PAA Verbal, 1998

	ORDINARY LEAST SQUARES									
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Age	-14,93	-16,21	-16,46	-17,13	-7,79	-10,66	-7,01	-10,23	-2,18	-5,69
	[10.7]	[16.5]	[11.4]	[16.7]	[5.1]	[10.5]	[4.6]	[10.1]	[1.3]	[5.4]
Age square	0,14	0,16	0,16	0,18	0,06	0,11	0,05	0,1	-0,01	0,04
	[6.5]	[10.2]	[7.3]	[10.4]	[2.8]	[7.1]	[2.5]	[6.9]	[0.3]	[2.4]
Maturity	20,7	20,64	21,81	21,61	17,88	18,49	17,95	18,67	16,43	18,1
	[20.8]	[33.0]	[20.8]	[33.2]	[18.0]	[28.5]	[17.7]	[28.1]	[17.8]	[28.5]
Father sec. Education=1	19,77	22,99	17,43	20,3	12,51	17,54	11,93	17,09	15,73	19,6
	[14.3]	[19.7]	[12.7]	[17.5]	[9.3]	[15.3]	[8.8]	[14.9]	[12.4]	[18.4]
Father sup. Education=1	64,84	68,89	52,17	53,99	40,46	46,55	40,02	46,3	39,74	43,72
	[40.0]	[48.6]	[31.8]	[37.8]	[25.4]	[33.0]	[25.1]	[32.9]	[26.8]	[33.9]
Mother sec. Education=1	21,48	24,76	17,91	20,85	13,04	16,71	12,44	15,78	15,05	17,8
	[16.2]	[21.7]	[13.5]	[18.4]	[10.1]	[14.9]	[9.6]	[14.1]	[12.3]	[17.1]
Mother sup. Education=1	68,74	73,7	55,01	58,01	44,05	49,87	43,14	48,35	39,92	42,61
	[41.4]	[50.1]	[32.8]	[39.2]	[27.0]	[34.1]	[26.4]	[33.0]	[26.3]	[31.9]
Private=1			53,89	63,32	53,78	67,49	53,49	67,2	43,5	55,33
			[40.7]	[48.9]	[42.4]	[53.5]	[42.0]	[53.2]	[37.1]	[48.8]
Subsidized private=1			9,8	15,51	16,92	20,56	16,57	20,07	14,93	19,75
			[9.4]	[16.9]	[16.6]	[22.6]	[16.3]	[22.1]	[15.7]	[23.7]
Male school=1					43,87	0	43,83	0	39,94	0
					[39.8]	[.]	[39.8]	[.]	[39.1]	[.]
Female school=1					0	23,55	0	23,34	0	17,34
					[.]	[26.1]	[.]	[25.9]	[.]	[21.5]
Humanistic=1					42,52	32,76	41,9	31,92	33,36	23,38
					[39.3]	[31.9]	[38.7]	[31.1]	[32.6]	[24.0]
Daily schedule=1					50,6	44,22	49,58	43,28	17,06	5,28
					[21.2]	[20.6]	[20.3]	[19.8]	[7.4]	[2.3]
Size of Household							-2,86	-3,98	-2,84	-3,75
							[9.0]	[14.6]	[9.6]	[14.9]
Head of household=1							0,45	-2,91	-8,43	-17,38
							[0.1]	[0.5]	[1.8]	[3.2]
Work=1							-9,02	-10,91	-6,86	-8,28
							[6.6]	[8.0]	[5.2]	[6.4]
Partner=1							-3,52	3,95	-10,31	-10,85
							[0.7]	[1.1]	[2.1]	[3.2]
Avg.Grades									0,35	0,37
									[77.1]	[86.4]
Constant	671,2	664,9	688,09	671,73	485,87	508,34	491,66	525,8	289,37	313,55
	[35.3]	[51.9]	[34.7]	[50.2]	[21.5]	[34.1]	[21.8]	[35.2]	[12.1]	[20.0]
Observations	56493	63128	56395	63055	56395	63055	56187	62839	56187	62839
R-squared	0,21	0,23	0,23	0,26	0,29	0,29	0,29	0,29	0,39	0,42
Chow Test										
H0: Male=Female										
F-test	3,73		6,59		16,98		13,82		15,67	
P-value	0,00		0,00		0,00		0,00		0,00	

Robust t-statistics in brackets

Table 7A
PAA by gender: Different Specifications, (controlling by regional effects)
PAA Verbal, 1998

	ORDINARY LEAST SQUARES									
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Age	-15,32	-16,45	-16,44	-17,33	-7,66	-10,8	-6,7	-10,27	-1,67	-5,72
	[11.0]	[16.3]	[11.3]	[16.7]	[4.9]	[10.4]	[4.3]	[10.0]	[0.9]	[5.3]
Age square	0,14	0,17	0,16	0,18	0,06	0,11	0,05	0,1	-0,02	0,04
	[7.0]	[10.0]	[7.1]	[10.3]	[2.6]	[7.0]	[2.2]	[6.8]	[0.5]	[2.3]
Maturity	21,26	21,07	22,05	21,78	18,06	18,7	18,16	18,92	16,73	18,45
	[20.6]	[33.0]	[20.7]	[33.3]	[17.9]	[28.6]	[17.6]	[28.3]	[17.8]	[28.6]
Father sec. Education=1	18,91	22,21	17,05	20,15	11,99	17,11	11,35	16,61	15,29	19,15
	[13.7]	[18.9]	[12.4]	[17.3]	[8.9]	[14.9]	[8.4]	[14.5]	[12.1]	[17.9]
Father sup. Education=1	63,56	67,6	51,88	54,02	39,85	45,98	39,29	45,64	38,94	42,9
	[39.3]	[47.7]	[31.7]	[37.9]	[25.1]	[32.6]	[24.7]	[32.4]	[26.4]	[33.3]
Mother sec. Education=1	20,57	24,32	17,56	20,9	12,73	16,68	12,09	15,75	14,77	17,88
	[15.5]	[21.3]	[13.3]	[18.4]	[9.9]	[14.9]	[9.3]	[14.1]	[12.2]	[17.2]
Mother sup. Education=1	67,47	72,87	54,9	58,15	43,75	49,73	42,79	48,2	39,4	42,38
	[40.9]	[49.8]	[32.9]	[39.5]	[26.9]	[34.1]	[26.3]	[33.0]	[26.2]	[31.9]
Private=1			50,16	60,05	51,02	63,6	50,6	63,27	39,65	50,82
			[37.3]	[45.7]	[39.7]	[49.6]	[39.2]	[49.3]	[33.5]	[44.2]
Subsidized private=1			6,94	12,76	14,69	17,59	14,26	17,04	11,81	16,21
			[6.5]	[13.5]	[14.2]	[18.9]	[13.8]	[18.3]	[12.3]	[19.2]
Male school=1					41,33	0	41,19	0	36,37	0
					[37.1]	[.]	[36.9]	[.]	[35.5]	[.]
Female school=1					0	20,69	0	20,49	0	14,26
					[.]	[22.6]	[.]	[22.4]	[.]	[17.5]
Humanistic=1					43,31	35,12	42,64	34,28	33,91	26,03
					[39.9]	[33.7]	[39.2]	[32.9]	[33.1]	[26.5]
Daily schedule=1					52,3	46,29	51,07	45,13	18,02	6,87
					[21.8]	[21.6]	[20.9]	[20.8]	[7.7]	[3.0]
Size of Household							-2,77	-3,91	-2,77	-3,68
							[8.8]	[14.3]	[9.5]	[14.7]
Head of household=1							-0,32	-3,44	-9,84	-18,25
							[0.1]	[0.6]	[2.1]	[3.3]
Work=1							-10,57	-12,27	-8,98	-9,88
							[7.8]	[9.0]	[6.9]	[7.7]
Partner=1							-4,93	2,84	-12,42	-12,36
							[0.9]	[0.8]	[2.5]	[3.7]
Avg.Grades									0,36	0,38
									[78.5]	[87.2]
Constant	690,37	680,65	701,03	684,24	494,27	518,83	497,83	535,02	293,11	321,97
	[36.1]	[51.8]	[34.9]	[50.6]	[21.6]	[34.4]	[21.8]	[35.4]	[11.9]	[20.2]
Observations	56395	63055	56395	63055	56395	63055	56187	62839	56187	62839
R-squared	0,22	0,24	0,24	0,27	0,29	0,3	0,29	0,3	0,4	0,42
Chow Test										
H0: Male=Female										
F-test	3,14		4,11		7,94		7,39		8,04	
P-value	0,00		0,00		0,00		0,00		0,00	

Robust t-statistics in brackets

Table 8
First Stage IV estimation

School Choice

Private School		
Male=1	0,188 [10.4]	0,192 [10.6]
Age	0,043 [1.8]	0,351 [8.0]
Age square	0 [1.0]	-0,005 [5.4]
Avg. grades	0,002 [18.8]	0,002 [21.8]
Maturity		-0,22 [19.3]
Father sec. Education=1	0,614 [16.9]	0,66 [17.7]
Father sup. Education=1	1,799 [48.3]	1,857 [48.5]
Mother sec. Education=1	0,897 [26.0]	0,942 [26.6]
Mother sup. Education=1	1,922 [52.1]	1,97 [52.0]
Dummy Private available	20,341 [62.9]	20,357 [36.7]
Dummy Voucher available	-0,341 [2.5]	-0,316 [2.3]
Constant	-24,319	-28,773
Voucher School		
Male=1	-0,028 [2.0]	-0,029 [2.1]
Age	-0,144 [9.7]	-0,236 [13.3]
Age square	0,002 [5.8]	0,003 [7.2]
Avg. grades	0 [1.7]	0 [0.2]
Maturity		0,085 [12.2]
Father sec. Education=1	0,055 [2.9]	0,049 [2.6]
Father sup. Education=1	0,177 [7.7]	0,17 [7.4]
Mother sec. Education=1	0,18 [9.9]	0,173 [9.5]
Mother sup. Education=1	0,311 [12.8]	0,304 [12.6]
Dummy Private available	0,078 [4.3]	0,065 [3.6]
Dummy Voucher available	19,396 [105.5]	19,39 [86.4]
Constant	-17,757	-16,306
Observations	119450	119450
Chi2-test	10.364.473,00	12.003.895,53
Prob>chi2	0,00	0,00

Robust z-statistics in brackets

Table 9
PAA by gender: Different Specifications
PAA Math., 1998

	OLS		TSLS (*)		TSLS (**)		TSLS (***)	
	Male	Female	Male	Female	Male	Female	Male	Female
Age	-5,63 [4.4]	-6,13 [6.5]	-5,74 [3.9]	-7,77 [7.7]	-5,588 [2.0]	-8,076 [2.3]	-7,451 [4.3]	-10,226 [10.9]
Age square	0,03 [1.3]	0,05 [3.2]	0,03 [1.2]	0,07 [4.3]	0,006 [0.1]	0,005 [0.1]	0,051 [2.2]	0,095 [6.7]
Maturity	14,25 [17.9]	12,6 [24.2]	14,86 [15.9]	14,04 [22.9]	14,825 [7.4]	16,584 [9.1]	16,095 [14.0]	15,993 [31.4]
Father sec. Education=1	12,54 [11.5]	13,37 [16.0]	7,57 [6.7]	9,15 [10.6]	12,773 [8.0]	11,685 [10.5]	5,899 [4.0]	6,325 [5.4]
Father sup. Education=1	38,49 [29.0]	35,25 [32.8]	21,19 [11.4]	19,70 [13.1]	23,676 [10.3]	17,868 [9.6]	24,643 [9.4]	18,113 [8.6]
Mother sec. Education=1	9,1 [8.6]	11,95 [14.5]	1,38 [1.2]	6,01 [7.0]	3,928 [2.5]	9,116 [8.2]	0,04 [0.0]	3,031 [2.6]
Mother sup. Education=1	31,48 [22.8]	32,67 [28.7]	12,22 [6.5]	15,58 [9.9]	8,174 [3.5]	12,291 [6.4]	14,771 [5.4]	13,07 [5.9]
Private=1	48,76 [43.3]	61,7 [59.3]	130,25 [28.1]	137,73 [32.2]	148,31 [26.5]	151,713 [28.0]	114,88 [15.8]	146,382 [22.5]
Subsidized private=1	13,67 [16.0]	15,83 [23.1]	88,96 [21.6]	67,40 [23.2]	104,793 [19.3]	74,875 [20.1]	90,218 [10.6]	70,097 [11.2]
Size of Household	-0,54 [2.1]	-0,88 [4.2]	-0,46 [1.7]	-0,98 [4.6]	0,066 [0.2]	-0,139 [0.5]	-0,327 [1.0]	-0,531 [1.9]
Head of household=1	-3,03 [0.7]	-10,01 [2.3]	-4,22 [1.0]	-10,76 [2.4]	-10,546 [1.5]	-18,53 [2.2]	-2,068 [0.4]	-17,188 [3.2]
Work=1	-13,05 [11.4]	-13,07 [12.4]	-14,26 [12.4]	-13,53 [12.7]	-16,292 [9.5]	-16,78 [11.8]	-15,544 [10.7]	-14,67 [10.8]
Partner=1	-7,83 [1.8]	-12,85 [4.8]	-9,10 [2.0]	-15,14 [5.5]	-17,285 [2.3]	-26,418 [5.0]	-7,978 [1.6]	-15,094 [4.4]
Avg.Grades	0,37 [85.9]	0,36 [91.0]	0,37 [78.5]	0,35 [85.6]	0,506 [70.2]	0,483 [78.4]	0,375 [60.3]	0,34 [64.4]
Male school=1	42,55 [43.2]	0,0 [.]	40,35 [40.8]	0,0 [.]	48,25 [40.2]	0,0 [.]	48,19 [40.1]	0,0 [.]
Female school=1	0,0 [.]	19,48 [27.7]	0,0 [.]	12,17 [16.6]	0,0 [.]	15,68 [18.5]	0,0 [.]	15,32 [16.7]
Humanistic=1	29,52 [32.8]	26,13 [34.5]	34,03 [38.3]	31,14 [41.0]			37,293 [31.6]	36,201 [37.3]
Daily schedule=1	23,95 [11.6]	11,32 [6.0]	15,09 [7.2]	-0,32 [0.2]			9,595 [3.6]	-10,287 [4.6]
Constant	324,83 [17.1]	309,13 [22.5]	307,53 [13.4]	326,02 [21.1]	276,05 [6.3]	301,111 [6.8]	332,748 [11.7]	371,558 [24.2]
Observations	56187	62839	56.187	62.839	36248	45330	34583	37893
R-squared	0,44	0,46	0,43	0,44	0,455	0,472	0,445	0,451

Robust t-statistics in brackets

(*) Whole sample.

(**) Sample composed by humanistic=1 and daily schedule=1

(***) Sample composed only by regions 2, 3, 5 y 13

Table 10
PAA by gender: Different Specifications
PAA Verbal, 1998

	OLS		TSLS (*)		TSLS (**)		TSLS (***)	
	Male	Female	Male	Female	Male	Female	Male	Female
Age	-2,18 [1.3]	-5,69 [5.4]	-0,87 [0.5]	-5,64 [4.9]	1,19 [0.3]	-6,899 [1.8]	-3,428 [1.6]	-8,407 [8.5]
Age square	-0,01 [0.3]	0,04 [2.4]	-0,02 [0.8]	0,04 [2.2]	-0,068 [1.1]	-0,014 [0.2]	0,016 [0.5]	0,068 [5.1]
Maturity	16,43 [17.8]	18,1 [28.5]	16,48 [15.5]	18,90 [25.8]	15,609 [7.4]	21,823 [10.4]	18,163 [13.6]	21,666 [34.6]
Father sec. Education=1	15,73 [12.4]	19,6 [18.4]	10,26 [7.9]	14,28 [13.1]	15,327 [8.7]	17,348 [12.9]	7,463 [4.3]	10,421 [7.0]
Father sup. Education=1	39,74 [26.8]	43,72 [33.9]	22,77 [11.0]	26,73 [15.1]	26,711 [10.7]	24,538 [11.4]	22,693 [7.8]	23,217 [9.4]
Mother sec. Education=1	15,05 [12.3]	17,8 [17.1]	6,37 [5.0]	10,15 [9.3]	9,617 [5.5]	13,545 [10.1]	2,135 [1.2]	7,329 [4.9]
Mother sup. Education=1	39,92 [26.3]	42,61 [31.9]	20,53 [9.9]	23,52 [12.8]	19,15 [7.5]	20,457 [9.2]	19,256 [6.3]	19,588 [7.6]
Private=1	43,50 [37.1]	55,33 [48.8]	131,13 [25.1]	145,78 [29.5]	140,82 [22.9]	158,99 [25.4]	126,88 [14.8]	161,13 [20.8]
Subsidized private=1	14,93 [15.7]	19,75 [23.7]	115,07 [22.7]	104,21 [27.4]	130,71 [20.6]	109,25 [23.7]	124,48 [11.0]	120,63 [14.1]
Size of Household	-2,84 [9.6]	-3,75 [14.9]	-2,74 [9.2]	-3,81 [15.0]	-2,236 [6.1]	-3,04 [10.1]	-2,52 [6.7]	-3,709 [11.1]
Head of household=1	-8,43 [1.8]	-17,38 [3.2]	-9,76 [2.1]	-18,08 [3.3]	-12,869 [1.8]	-12,032 [1.4]	-10,23 [1.9]	-29,588 [4.3]
Work=1	-6,86 [5.2]	-8,28 [6.4]	-7,94 [6.1]	-8,71 [6.7]	-9,434 [5.1]	-10,544 [6.4]	-8,527 [5.2]	-9,851 [6.0]
Partner=1	-10,31 [2.1]	-10,85 [3.2]	-11,68 [2.3]	-13,20 [3.9]	-26,749 [3.6]	-29,221 [4.9]	-8,655 [1.5]	-16,243 [3.8]
Avg.Grades	0,35 [77.1]	0,37 [86.4]	0,34 [70.3]	0,37 [81.4]	0,45 [62.3]	0,472 [72.5]	0,344 [53.3]	0,356 [61.1]
Male school=1	39,94 [39.1]	0,00 [.]	37,42 [36.5]	0,00 [.]	47,21 [39.4]	0,00 [.]	45,36 [37.2]	0,00 [.]
Female school=1	0,00 [.]	17,34 [21.5]	0,00 [.]	9,64 [11.7]	0,00 [.]	12,27 [13.2]	0,00 [.]	13,84 [13.5]
Humanistic=1	33,36 [32.6]	23,38 [24.0]	37,12 [36.9]	27,56 [28.5]			42,548 [32.1]	36,165 [29.2]
Daily schedule=1	17,06 [7.4]	5,28 [2.3]	9,67 [4.2]	-4,03 [1.7]			4,283 [1.4]	-16,7 [6.2]
Constant	289,37 [12.1]	313,55 [20.0]	240,50 [8.6]	291,73 [16.4]	195,119 [3.8]	289,972 [5.7]	277,67 [8.0]	340,66 [19.5]
Observations	56187	62839	56.187	62.839	36248	45330	34583	37893
R-squared	0,39	0,42	0,39	0,41	0,411	0,443	0,4	0,418

Robust t-statistics in brackets

(*) Whole sample.

(**) Sample composed by Only humanistic=1 and daily schedule=1

(***) Sample composed only by regions 2, 3, 5 y 13

Figure 1: PAA Distribution, by type of test and gender

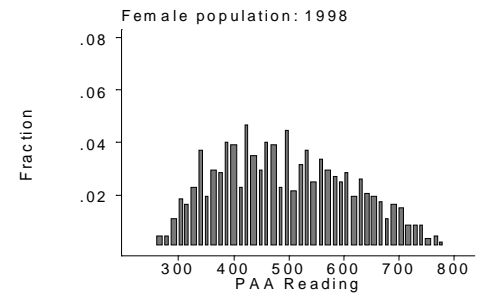
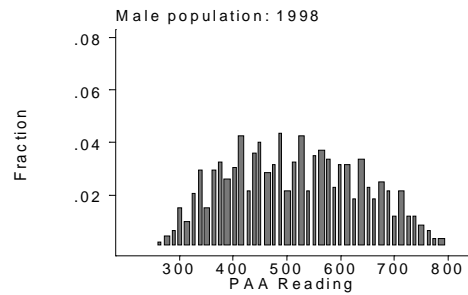
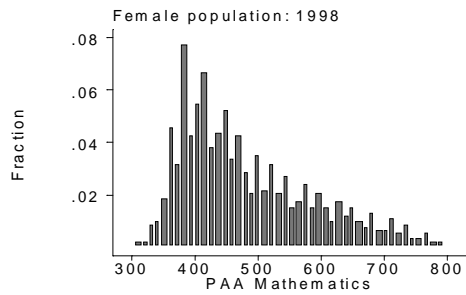
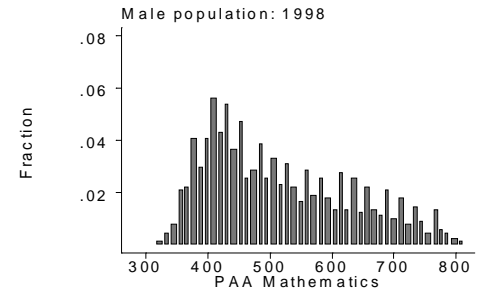
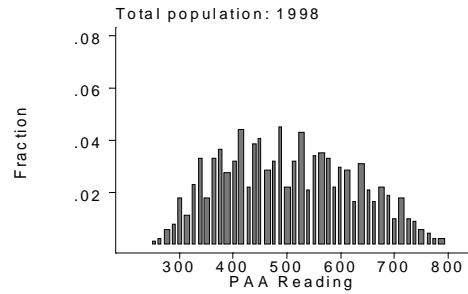
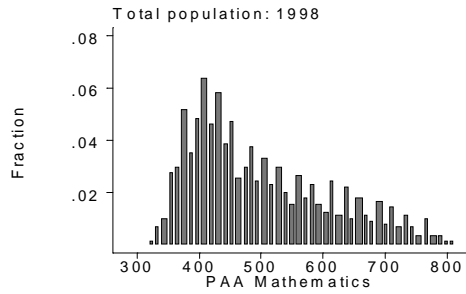


Figure 2: PAA Distribution, by type of test and school

