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The Effects of Vouchers on School Results: Evidence from Chile's Targeted Voucher Program

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The Effects of Vouchers on School Results: Evidence from Chile's Targeted Voucher Program*

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Abstract

We use data from Chile's targeted voucher program to test the effects of vouchers on school results. Targeted vouchers have delivered extra resources to low-income, vulnerable students since 2008. Moreover, under this scheme, additional resources are contingent on the completion of specific education reforms. Using a difference-in-differences approach and a market-level empirical analysis, we find a positive and significant effect of vouchers on standardized test scores. Additionally, our results highlight the importance of conditioning the delivery of resources to some specific academic goals in markets with institutional characteristics that prevent public schools from behaving as profit-maximizing firms.

Keywords: targeted vouchers, school choice, academic achievement
JEL Classification: H4; I2

I. Introduction

A central question in education economics is how to increase the quality of schools that low-income students attend. Since Friedman wrote his 1955 essay on the role of government in education (Friedman, 1955), many have considered the use of vouchers to be a promising way to increase the education quality supplied by schools. However, at the empirical level, the literature is far from reaching a consensus. This paper contributes to the literature by providing additional empirical evidence on the effects of vouchers on school results. We use data from a targeted voucher program introduced in Chile in 2008. A special characteristic of that program is that resources are conditional upon

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compliance with certain scholastic goals by schools. We find a positive and significant effect of vouchers on school results. Additionally, our findings highlight the importance of conditioning the delivery of resources to the accomplishment of specific educational reforms in markets where institutional characteristics prevent public schools from behaving as profit-maximizing firms.

At a theoretical level, educational vouchers can improve the academic results of low-income students through two main channels. First, vouchers allow low-income students to migrate from public to private schools. If private schools are better than public schools, educational vouchers should increase students' academic achievement just by allowing them to migrate from bad to good schools. Second, school choice can affect the overall system. Educational vouchers foster competition among schools, which can generate quality improvements in both public and private schools. However, empirical evidence from research on these two channels is not conclusive. Our paper focuses the analysis on the second channel.

Regarding the first channel, estimates of the achievement gains associated with private schooling often vary considerably even across studies that employ the same data sources. However, one result is robust across studies: Catholic schooling enhances educational attainment, especially for minority students in urban areas (Hill, Foster, and Gendler 1990; Evans and Schwab 1995; Figlio and Stone 1997; Neal 1998, 2002; among others).

Regarding the effects of vouchers on the overall system, the results are also far from reaching a consensus. For instance, Rouse (1998), Brighouse (2000), and Hoxby (2001, 2003) argue that educational vouchers generate competitive forces that produce quality improvements in both public and private school systems. On the other hand, some studies, such as Hsieh and Urquiola (2006), find evidence of no improvements in average test scores of public schools after educational vouchers are introduced in the market.

In Chile, the empirical literature so far has exclusively used evidence on the universal voucher program implemented in 1981. These studies deliver mixed results that could be explained by differences in both data sources used and time period studied.

Regarding the first channel through which vouchers may increase the academic results of low-income students, early studies on private schooling use school-level data and find that, after properly controlling for students' socioeconomic backgrounds, public and voucher private schools perform similarly on achievement tests (Carnoy and McEwan 2000; Mizala and Romaguera 2000; Tokman 2002; Elacqua and Fabrega 2004). The availability of individual-level data since 1997 has induced a new generation of studies that include controls for students' resources and attempt to account for selection. Most studies using individual-level data find that students attending voucher private schools have higher educational outcomes than those from public schools (McEwan 2001; Mizala and Romaguera 2001; Sapelli and Vial 2002, 2005; Lara, Mizala, and Repetto 2011; among others).

Regarding the effect of Chile's universal voucher program on the overall system, as

in other countries, the evidence is not conclusive. For instance, using community-level data, Hsieh and Urquiola (2006) find that average standard test scores did not rise faster in communities that were exposed to more competition. However, other studies (Gallego 2006, 2012) find positive effects of competition on the overall system.[1]

In 2008 the Chilean government implemented a new voucher program targeted to low-income students, which generated new data to study the effect of vouchers on school results. At first glance, this voucher program could be considered to be merely a more intense version of the 1981 universal voucher program. However, several differences exist between this reform and the one implemented in 1981.

The targeted voucher program is focused on low-income students, named *priority students*. Moreover, schools must sign the Equality of Opportunity and Educational Excellence Agreement to receive the extra resources delivered by the program. That agreement forces schools to present an Educational Improvement Plan to the Ministry of Education, which details educational reforms that the school will undertake to improve results on the SIMCE, a national standardized test.[2] Noncompliance with those reforms can result in the cancellation of the official recognition given by the Ministry of Education. Additionally, schools must detail how the extra funds delivered by the program fund will be spent to improve the academic performance of priority students and establish academic performance goals for their students, especially for those priority students. Schools that sign the agreement must also exempt all priority students from paying any co-payment or tuition. Finally, schools must open their first- to sixth-grade admissions to any prospective student without taking into account past academic performance, current academic ability, or socioeconomic status. Therefore, schools that receive the extra funds from the program cannot select among priority students.

We use data from this voucher program implemented in Chile in 2008 to estimate the effect of educational vouchers on schools' results. We use two different empirical methodologies. First, we use a difference-in-differences approach. We build a panel of schools in which we can identify those that signed the Equality of Opportunity and Educational Excellence Agreement and received funds from the program from 2009 to 2011 (i.e., the treatment group) and those that decided not to participate in this program during this period (i.e., the control group). The pre-treatment period is defined as the time before the reform was implemented (i.e., from 2006 to 2008), and the post-treatment period as the time in which the reform was in effect (i.e., from 2009 to 2011). Second, we carry out a market-level analysis. We define each municipality as an individual market. Then, we compare the changes in test scores after the implementation of the reform in a market where a different number of schools signed the agreement.

[1] In general, the scarcity of the literature on this second channel is due to the complexity of having both a voucher program covering a significant number of schools and the counterfactual markets.

[2] The SIMCE (Sistema de Medición de la Calidad de la Enseñanza) is a mandatory national standardized test designed to evaluate the quality of the content taught in primary and secondary education in math, language, geography, and science. It is administered annually to fourth, eighth, and tenth graders through a system in which grades are chosen to be evaluated by turns.

Under both methodologies, we find a positive and statistically significant effect of vouchers on school results. After three years of exposure to the reform, the difference-in-differences approach shows that schools that participate in the program increase their math test scores by 0.4 standard deviations (with respect to the counterfactual school), which is equivalent to moving from the 50th percentile to the 65th percentile of the distribution. For language test scores, the total gain is 0.3 standard deviations, which moves a school from the 50th percentile to the 62th percentile of the distribution. The market-level analysis shows that for each 1% of schools joining the program in a municipality, the average test score increases by 0.18 points in math and 0.11 points in language in that market. That means that in a market where 80% of schools participate in the reform, the average gain is 14.4 points in math test scores and 8.8 points in language test scores after the third year, compared with a market where no reform was implemented. Those effects are equivalent to test score gains of 0.53 and 0.37 standard deviations in math and language, respectively.

In environments where public schools receive funds regardless of the number of students they attract, these schools may not react under increasing competition of an unconditional voucher system. Therefore, our results highlight the importance of conditioning the delivery of resources to some specific academic goals in markets with institutional characteristics that prevent public schools from behaving as profit-maximizing firms.

We discuss some potential channels through which the reform encouraged schools to improve quality. However, an important avenue for future research involves further empirical analysis to disentangle the mechanism through which the targeted voucher program changed the educational market.

The rest of the paper is organized as follows. Section 2 reviews the existing literature on educational vouchers. Section 3 describes the institutional details of the targeted voucher reform implemented in Chile. Section 4 describes the data used. Section 5 discusses the empirical strategy used to test the effect of targeted vouchers on school results. Section 6 presents and discusses the results. Finally, section 7 concludes.

II. Related Literature

Research on educational choice and educational vouchers typically focuses on two complementary research questions. First, how do educational vouchers affect the outcomes of students who use the vouchers? Second, what is the effect of school choice on the overall system?

The first strand of the literature evaluates whether students who receive vouchers benefit from having the freedom to choose the school that they will attend. If private schools are better than public schools, educational vouchers should increase students' academic achievement just by allowing them to migrate from bad public schools to good private schools. Therefore, this strand of the literature is inevitably linked to the literature on the effects of private schooling.

The starting point was the 1981 report by James Coleman (Coleman, Kilgore, and Hoffer 1981) that concluded that Catholic and other private schools are, as a rule, more effective institutions of learning than public schools. Neal (1998) attempts to assess what we have learned since Coleman's report. He concludes that although many questions remain unanswered, one result seems clear. Black and Hispanic students in large cities often have the most to gain from private schooling-in particular, Catholic schooling. The poor quality of many inner-city schools appears to drive this result. In a subsequent work (Neal 2002), he concludes that while it is difficult to predict the outcome of any large-scale voucher experiment, voucher systems targeted toward large cities with a history of public school failure may have the greatest potential for yielding large benefits.[3]

Another set of studies focuses on a more general comparison between public and both Catholic and non-Catholic private schools. In general, the evidence comes from small-scale voucher programs that are mostly designed for low-income students. Some programs are publicly funded, like the Milwaukee Parental Choice Program. Rouse (1998) uses data from the Milwaukee voucher program to measure the effect of vouchers on students who use the voucher. She provides evidence that access to private education increased the math scores of program participants, although she finds no evidence of positive effects on reading achievement. Using data from the same program in Milwaukee, Greene, Peterson, and Du (1998) perform a randomized experiment and confirm efficiency gains that can result from privatization in education. Another publicly funded voucher program is the D.C. Opportunity Scholarship Program. This program has been evaluated using a random assignment program design (Wolf et al. 2008). The evidence suggests at most small improvements in the academic results of students who move to private schools. Other voucher programs are privately funded-for instance, the New York City school voucher experiment. Using a randomized design, Mayer et al. (2002) and Krueger and Zhu (2004) report small but not statistically significant effects when all students are included, and significant positive effects when only African American students are considered.[4] [5]

[3]Additional studies supporting the idea that minorities in urban areas benefit from Catholic schooling are Hill et al. (1990), Evans and Schwab (1995), and Figlio and Stone (1997). Evans and Schwab (1995) use the 1986 follow-up survey to the "High School and Beyond Study" to study the effects of private schooling. They find that Catholic schooling increases graduation rates. Additionally, they show that gains from Catholic schooling are larger for students in urban areas. Hill et al. (1990) support the claim that minority youth in large cities benefit from Catholic schooling. Figlio and Stone (1997) conducted an analysis using data from the 1988 National Educational Longitudinal Study. Correcting estimates for selection bias, they find that private schools with a religious affiliation do not enhance achievement in the population as a whole or within most subgroups. However, the authors do report large achievement gains for blacks and Hispanics who live in large, central cities.

[4]A complete review of the literature on the impact of private-school vouchers can be found in Belfield and Levin (2002), Belfield and Levin (2003), Hoxby (2003), McEwan (2003), McEwan et al. (2004), Barrera-Osorio and Patrinos (2009), and Rouse and Barrow (2009).

[5]In the United States, a related literature studies the performance of charter schools. Hanushek et al. (2007) analyze the Texas charter experiment based on a panel of individual students who move across different schools, including charter schools. After controlling for student fixed effects to account for selection bias, Hanushek et al. (2007) find that after an initial start-up period, the performance of charter schools is statistically similar to that of public schools.

Outside the United States, some studies have taken advantage of a randomized design. Angrist et al. (2002) present evidence on the impact of the Programa de Ampliacion de Cobertura de la Educacion Secundaria (PACES), a targeted and conditional voucher program in Colombia.[6] Their results suggest that PACES participants completed more years of school and had lower grade repetition, higher test scores, and a lower probability of working than did students not enrolled in PACES. Angrist, Bettinger, and Kremer (2006) examine the longer-run effects of Colombia's PACES program. Their results show a substantial gain in both high-school graduation rates and achievement as a result of the voucher program.

Angrist et al. (2006) discuss the issue of how to reconcile the consistently positive voucher effects that they found for Colombia with the more mixed results for the United States. They suggest three possible explanations. First, PACES could be a better experiment than those programs evaluated in the United States. Second, there is larger gap in the quality of public and private schools in Colombia than in the United States. Finally, PACES included features not necessarily shared by other voucher programs, such as the incentives for academic advancement that introduce the conditionality of the program.

Although the studies of Angrist et al. (2002) and Angrist et al. (2006) suggest strong evidence of the overall effect of educational vouchers, they do not shed light on the underlying mechanisms through which the voucher effects emerged. Bettinger, Kremer, and Saavedra (2010) identified several plausible channels by which the Colombia voucher program has affected students' educational outcomes. These channels include income effects, changes in peers, changes in incentives, and changes in school resources. That study notes that the effects of school choice on those who exercise choice need not be solely about the productivity of different schooling options. Understanding the channels through which vouchers enhance student achievement is important for formulating policy recommendations. Without knowing the mechanism, it is difficult to know whether the results will generalize to other voucher programs, as noted by Neal (2002).

In Chile, evaluations of the voucher program implemented in 1981 lack randomized designs. Therefore, studies mainly compare the achievement of students who attend public and private schools with controls for their observed and, more tentatively, unobserved characteristics. Achievement and socioeconomic data were available at the school level but not at the individual level until 1997; thus, early studies used the school as the unit of analysis.[7] Using school-level data, Carnoy and McEwan (2000) concluded that nonreligious private subsidized schools produce lower academic achievement than public schools, while Catholic private subsidized schools produce higher achievement outcomes than nonreligious private subsidized schools. Mizala and Romaguera (2000) argued that when sufficient control variables are taken into account, there are no consistent differences in achievement between public and private subsidized schools. Tokman (2002) finds that public schools are not consistently better or worse than private voucher schools, although

[6] Vouchers are renewed only for students who maintain satisfactory academic performance.

[7] An empirical problem with these set of studies is that school-level data does not allow us to control for selection bias.

public schools are more effective for students from disadvantaged family backgrounds. Elacqua and Fabrega (2004) find that students attending voucher private schools do not necessarily outperform public school students and that competition has not necessarily improved the test results of both types of schools.

Student-level analysis became possible when the Ministry of Education began to administer a questionnaire to all parents of students who participated in SIMCE, a standardized test in Chile. The availability of individual-level data since 1997 has generated new studies that control for students' resources and that attempt to account for selection. Most studies using individual-level data found that students attending voucher schools have higher educational outcomes than those from public schools. McEwan (2001) finds that there is no consistent difference between student achievement in public and nonreligious private voucher schools, although fee-paying private schools and Catholic private voucher schools have higher achievement levels than public schools. Mizala and Romaguera (2001) and Sapelli and Vial (2002, 2005) find that students attending private voucher schools have higher educational outcomes than those from public schools. More recently, Anand, Mizala, and Repetto (2009) find that students in fee-charging private voucher schools score higher than students in public schools. However, they find no difference in the academic achievement of students in fee-charging private voucher schools relative to their counterparts in free private voucher schools. Their results suggest that low-income students who typically attend public schools can benefit from attending private voucher schools. Bravo, Mukhopadhyay, and Todd (2010) use the 2002 and 2004 Social Protection Surveys (Encuesta de Protección Social) to estimate a dynamic model of schooling and working decisions. They conclude that the school voucher program induced individuals affected by the program to attend private voucher schools at a higher rate, to achieve higher educational attainment, to participate more in the labor force, and to earn higher wages. Finally, Lara et al. (2011) use a number of propensity-score-based econometric techniques and changes-in-changes estimation methods and find that private voucher education leads to small differences in academic performance.

Despite the favorable evidence presented in most of the Chilean studies that use individual-level data, it is difficult to determine the causes of the positive effects of private schooling. Some candidates could be better peers, superior teachers, more involved parents, and more effective management (in general, more productive schools). Overall, the evidence based on Chile's universal voucher program is less conclusive than the research on the Colombian voucher program, and conclusions depend heavily on the type of data used.[8]

[8]There are three other potential reasons why research on the Chilean voucher program could have been less conclusive than the research on the Colombian voucher program. First, Chilean private schools can use selective admissions in accepting voucher students. As a result, Chilean voucher schools could have admitted students with better academic qualifications. Second, given that the program has existed for over 30 years and that a significant number of new private schools have entered the program, it is quite difficult to identify counterfactual outcomes of students who are attending schools that did not exist prior to the reform. Third, given the large magnitude of the program, the Chilean voucher program could have impacted the overall quality of the system, and the control group in any regression specification may have also been influenced by the vouchers.

In sum, the literature on the effects of private schooling delivers results that appear quite fragile. Estimates of the achievement gains associated with private schooling often vary considerably even across studies that employ the same data sources. However, there is one result that remains very solid across a number of studies: Catholic schooling enhances educational attainment, especially for minority students in urban areas.

The second line of research has attempted to identify the effect of school competition on the overall system. This strand of the literature focuses on the improvement of outcomes for all students in the system as a result of the increased opportunities for attendance. For instance, Brighouse (2000), Rouse (1998), and Hoxby (2001, 2003) argue that a voucher program fosters competition among schools, which generates quality improvements in both public and private school systems and promotes equality of educational opportunity.

In the United States, Hoxby (2003) analyzes the impact that different programs had on school productivity: specifically, the effect of vouchers on achievement in Milwaukee public schools and the effect of charter schools on achievement in Michigan and Arizona public schools. Hoxby (2003) concludes that the regular public schools boosted their productivity when exposed to competition and that they responded to competitive threats that were surprisingly small.

Unlike the programs analyzed in the United States, the universality of Chile's voucher program makes it especially suitable to analyze the effect of competition on school results. Hsieh and Urquiola (2006) use an identification strategy that compares communities that experienced a greater increase in private school enrollment to those that experienced less of an increase. Using community-level data, they find that average standard test scores did not rise faster in communities where the private sector enrollment expanded more. Gallego (2006) uses the number of priests as an instrument for the penetration of the voucher program in a specific market. His findings suggest positive effects of the voucher program on the academic outcomes of students throughout municipalities where the voucher program had more penetration. His results may be indicative of competitive effects. More recently, Gallego (2012) study the effects of interschool competition on the academic outcomes of Chilean students who attend publicly subsidized schools. He finds that, using instrumental variables, a one-standard-deviation increase in the ratio of voucher schools to public schools in a market increases tests scores by about 0.10 standard deviations.

Considering the differences in the time period studied is important to understand the differences in the results of the literature on Chile's universal voucher program. Gallego (2002) argues that the system operating in the 1980s differs in an important way from the system that has operated in recent decades. First, public school budgets were not affected by the voucher reform, in part because the decentralization of public schools was not completed until the late 1980s. Second, employment of public school agents was quite rigid until the mid-1990s. Third, test scores were not public until the late 1990s. Fourth, local governments were not elected democratically until 1992. Finally, the real value of the voucher decreased steadily during the 1980s and recovered only in the early 1990s.

There is also evidence of the competitive effects of vouchers in other countries of the world. The evidence from Sweden focuses on whether the program has improved outcomes throughout the entire educational system or has exacerbated inequalities by increasing the amount of stratification between schools. As Bunar (2010) summarizes, even the positive estimates of the voucher program suggest that the voucher program may have had only a small impact on the overall educational quality in Sweden. On the other hand, Bohlmark and Lindahl (2007) find that a 10 percentage point increase in the private school share increases average pupil achievement by almost one percentile rank point. Additionally, Bergstrom and Sandstrom (2005) and Bjorklund et al. (2004) both conclude that public schools improved as a result of competition from privately operated schools in Sweden.

For Canada, Card, Dooley, and Payne (2010) study the Ontario public education system to assess whether there is evidence of a willingness to switch schools and, if so, whether student performance is better in areas where the willingness to switch schools is greater. They test the prediction that test score gains between the third and sixth grades are larger for students in more competitive markets. The study finds that market characteristics associated with greater potential competition have statistically significant impacts on the growth rate of student achievement. The study's estimates suggest that expanding choice to all Ontario students would have a modest effect on sixth-grade test scores, raising achievement by 6%-8% of a standard deviation.

To summarize, in regard to the effects of vouchers on the overall system, the results are also far from conclusive. Although many studies have suggested positive effects in both Sweden and Chile, these studies employ identification schemes that are not perfect.

III. The Targeted Voucher Program

A. The Chilean School System

In 1980, Chile implemented several educational reforms seeking to improve education quality and the efficient use of resources by fostering competition between schools. Before these reforms, Chile had a centralized education system whereby the vast majority of schools were publicly financed and the Ministry of Education was directly responsible for designing and overseeing the implementation of all education policies, both substantive and administrative. Additionally, there were subsidized private schools that were free for students and partially funded by the government, but that received a lump-sum subsidy that was substantially smaller than the per-student spending in the public sector.[9]

Three main changes were particularly transformative. First, administrative responsibility over public schools was transferred from the Ministry of Education to each municipal government, resulting in a more decentralized configuration. Second, a new scholastic subsidy system was introduced as the principal financing mechanism. Subsidized private

[9] At the beginning of 1980, more than 90% of all Chilean students were enrolled in institutions directly dependent on the Ministry of Education, and the remaining 10% were enrolled in completely private institutions.

schools began to receive exactly the same per-student payment as the public (municipal) schools. To distinguish these institutions from the subsidized private schools that existed before the reforms (mainly religious), we will call them voucher private schools. The subsidy was calculated as a function of total student enrollment and average student attendance. Third, the government moved to actively encourage the participation of private entities in the financing and administration of educational institutions. By making public funding directly contingent on student enrollment and retention, schools should compete for a larger share of the student body by offering a better education.

In 1993, voucher private schools were allowed to charge students an additional tuition fee to complement the state subsidy.[10] However, some fraction of those voucher private schools continued to not charge any co-payment to parents.

Therefore, since 1993, the Chilean primary and secondary education system has been composed of four types of schools: (i) public schools financed by government subsidies based on students' attendance and by additional funds from local governments (municipalities); (ii) free voucher private schools, (iii) fee-charging voucher private schools (that receive co-payments from parents); and (iii) private schools financed exclusively by parents (private schools). Non-voucher private schools are generally for-profit, whereas private subsidized schools can be either for-profit or nonprofit. Non-voucher private schools include both religious (mainly Catholic) and nonreligious schools.

There are 3.5 million students enrolled in the 12,500 schools that compose the Chilean school system. Of these, 5,670 are voucher private schools, 38.2% of which are fee-charging voucher private schools (that charge co-payments to parents), whereas 61.8% are free private voucher schools. Additionally, 60% of fee-charging private voucher schools are for-profit schools. Overall, public schools, voucher private schools, and private schools represented 40.7%, 50.7%, and 8.6%, respectively, of the total enrollment in primary and secondary education in 2010.

After the 1981 reform, more than 3,000 private voucher schools have been created. As a result, a massive migration from the public sector occurred. Total enrollment in public schools decreased from 75% in 1982 to 40.7% in 2010. However, as shown by Hsieh and Urquiola (2006), despite extensive private entry and sustained declines in public enrollments, the aggregate number of municipal schools has barely fallen.

Currently, the K-12 Chilean school system is divided into primary education (from kindergarten to eighth grade) and secondary education (from ninth to twelfth grades). Primary and secondary level education is mandatory. Almost all private non-voucher schools offer primary and secondary education. However, 88% of public schools and 61% of private voucher schools offer primary education only.

It is also important to note that there are important differences between public and voucher private schools. First, private and voucher private schools employed competitive admission processes to admit only the most promising applicants. In contrast, public

[10]Subsidy law limited the family contribution to no more than US$153 per month (in 2012 values). The average co-payment is US$30 per month.

schools with vacancies were legally obliged to admit all applicants regardless of their academic potential or socioeconomic backgrounds. Second, teachers' job contracts in public schools are regulated by a special legislation, the Teaching Statute, which involves a centralized collective bargaining process with wages based on uniform pay scales and bonuses for training and experience. In contrast, private voucher schools hire and fire teachers according to the more flexible Labor Code. As a result, private voucher schools can more freely select, hire, and dismiss teachers, while municipal authorities find it a lot more difficult to fire teachers due to the Teaching Statute. Finally, public schools can receive municipal subsidies if the voucher is not enough to cover the entire budget. Because of the existence of those non-voucher transfers, authors such as Sapelli and Vial (2002) claim that some public schools face a soft budget constraint.

B. The Targeted Vouchers Program

Created in 2008, the targeted voucher program (SEP[11]) aims to improve the quality of education of the most vulnerable students by giving an additional per-student subsidy to schools that voluntarily enter the program. By providing additional resources to less advantaged students, named *priority students*, the additional subsidy aims to both improve the quality of education received by priority students and decrease socioeconomic inequality in the academic performance of students from different socioeconomic backgrounds, through a combination of individually allocated additional funds and an incentive-based school reform program. Moreover, for the first time, under this scheme additional resources are contingent on the completion of specific scholastic reforms and improvements in school academic performance on a national standardized test (SIMCE).

B..1 Who Are Priority Students?

The fundamental basis of the program is the targeted support of a specific group of underprivileged and vulnerable students through additional subsidies. To automatically qualify as priority, a student must meet one of the following criteria in order, proceeding to further criteria if and only if the preceding one is not applicable: (i) participation in the Chile Solidario program (a social welfare program protecting those in extreme poverty), (ii) being in the most vulnerable third of the population according to the latest measurement instrument, or (iii) belonging to the most vulnerable group in the National Health Fund (FONASA). If none of the preceding criteria are met, the student's position can also be temporarily established according to their family socioeconomic background.

[11]SEP stands for *Subvención Escolar Preferencial*, the official name in Chile for the targeted voucher program.

B..2 The Equality of Opportunity and Educational Excellence Agreement

To join the SEP program, schools must sign the Equality of Opportunity and Educational Excellence Agreement (Convenio de Igualdad de Oportunidades y Excelencia Educativa) with the Ministry of Education. This agreement is valid for four years and may be renewable for an equal period of time. During this period, schools agree to report the use of all resources received under the program and the status of specific projects. They must also present an Educational Improvement Plan to the Ministry of Education, which details educational reforms that the school will undertake to improve academic results. Additionally, schools must detail how the extra funds delivered by the program will be spent to improve the academic performance of priority students and establish academic performance goals for their students, especially for priority students.

Schools that sign the agreement must exempt all priority students from paying any co-payment or tuition that could condition their application, entry, or stay in the schools;[12] must open their first- to sixth-grade admissions to any prospective student without taking into account past academic performance, current academic ability, or socioeconomic status; and must retain all students, even those with poor academic performance.[13] These requirements for participation in the program are designed primarily to ensure that high-performing schools are accessible to all low-income students and that schools are not allowed to give preference to highly qualified priority students.

The Educational Improvement Plan contains specific actions and measures that schools will undertake in the following areas, emphasizing those that schools identify as needing the greatest improvements:

- Curriculum management: Schools should carry out measures to strengthen the school education project , improve pedagogic practices, support students with special needs, and improve students' evaluation systems.
- School leadership: Schools should, for example, prepare and train school management teams, strengthen the value and civic formation of students, and involve the school in the community.
- Student life: Schools must take measures to provide psychological support and social assistance to students and their families and improve the relationships between students, their parents, and teachers.
- Resource management: Schools should take actions to define a policy to improve teacher performance; strengthen those areas of the curriculum in which students

[12]Despite the fact that schools that participate in the program are prohibited from charging any tuition or co-payment to priority students, they can charge non-priority students. This is especially relevant for voucher schools that do not lose the co-payment of non-priority students after they decide to participate in the program.

[13]If the demand surpasses the number of available spots, students will be admitted through a public and transparent application process that will not consider the student's socioeconomic status or their past or potential academic performance.

obtain unsuccessful results; design and implement evaluation systems for teachers; implement performance incentives for management teams, teachers, and administrative personnel (which must be linked to the goals established in the Educational Improvement Plan); and foster instruments to support educational activities, such as a library, computers, and Internet access.

The actions included in the Educational Improvement Plan could be extraordinarily modified if the conditions that were used to define the plan changed over time. Additionally, the SEP law establishes that in order to accomplish the actions in the areas previously mentioned, schools can hire teachers, educational assistants, and the necessary staff to improve their technical and pedagogical performance and to elaborate and develop the Educational Improvement Plan.

The Ministry of Education classifies schools into three categories according to their academic performance on a national standardized test (SIMCE) and the socioeconomic characteristics of their students. Depending on their performance on the SIMCE, schools could be classified as *autonomous* (if their performance is at or above the median for their SIMCE group), *emergent* (if their performance is below the median for their SIMCE group), or *in recuperation* (applied to emergent institutions that fail, after four years, to meet the quantitative goals required by the program). Although the amount of resources distributed to each priority student is the same for all schools and varies only by educational level, the autonomy of schools to decide how to use those resources and under what level of supervision will depend on the school's classification.[14]

The sanctions that schools could receive as a result of noncompliance with their Educational Improvement Plan depend on their classification. Autonomous and emergent schools could be demoted to a lower category (emergent and in-recuperation, respectively) if they do not accomplish the initiatives included in their improvement plan. If in-recuperation schools fail to achieve the academic results of emergent schools or do not accomplish the measures established in their improvement plan, the National Education Quality Agency[15] will offer to students' families the possibility of switching to a different

[14]For instance, emergent schools receive half of their funding as a subsidy and the other half as a contribution of additional resources to design and execute their Educational Improvement Plan, and schools that are in recuperation receive all of their funding as a contribution of additional resources to their plan. Additionally, emergent and in-recuperation schools must assume additional commitments. Emergent schools must include in their Educational Improvement Plan a diagnostic of the school's initial situation, in terms of its technical, human, and material resources, and a set of goals for educational results for the lifetime of the plan. Emergent schools must coordinate their actions with social institutions to detect and treat psychological and social problems and address the specific educational needs of priority students. Those schools must also establish complementary teaching and learning activities for priority students to improve their academic performance. On the other hand, the Educational Improvement Plan for in-recuperation schools must contain specific initiatives in administrative and management areas and those concerning students' learning process and must be elaborated before the beginning of the school year that follows the year when schools sign the Equality of Opportunity and Educational Excellence Agreement. To elaborate their improvement plan, in-recuperation schools could be assisted by the Ministry of Education and agencies certified by the Ministry of Education.

[15]The National Education Quality Agency is in charge of evaluating and guiding the education system

school, and schools may lose the official recognition given by the Ministry of Education.

B..3 Funds

SEP funding is allotted per priority student and is delivered directly to the school instead of to any municipal funding system. It is calculated based on the average attendance rate of priority students over the previous three months, the grade level of the priority student (younger students receive more resources), and the concentration of priority students in the school. Table 1 shows the monthly subsidy delivered per priority student in 2012.

In addition to the regular funds received from the program, schools qualify for a subsidy if priority students make up more than 15% of the student body. Table 2 presents the concentration subsidy amount.

In relation to the flat voucher delivered by the 1981 reform, the program increases the resources given to schools for priority students by 70%. Table 3 presents the amount of additional resources given by the targeted voucher program.

IV. Data

Our sample is composed of public and voucher private schools that do and do not sign the Equality of Opportunity and Educational Excellence Agreement. The database contains information about students' socioeconomic backgrounds, including variables such as gross family income and the education level of the students' parents. We link this information with school academic performance. In particular, we include the yearly average score that a school obtained on the SIMCE during the period 2006-2011. Considering that the reform was progressively implemented in preschool and primary education (and only since 2012 in secondary education), we use schools' average scores obtained by fourth graders in math and language, which are the only measures of school performance available for the levels under the program.

Using this information, we build a panel for public and voucher private schools that allow a pre-treatment and a post-treatment period. We define the pre-treatment period as the three years before the implementation of the SEP reform (2006-2008). The post-treatment period corresponds to the three years in which schools could receive the extra funds by signing the Equality of Opportunity and Educational Excellence Agreement (2009-2011). By signing the agreement, schools agreed to carry out specific measures designed to improve the quality of the education provided and perform specific actions to encourage the school's retention and academic performance of priority students.

From a total of 12,117 schools in 2009, we select all of those schools with primary education that appear on SIMCE records from 2006 to 2011. From this sample, we select schools with 20 or more students taking the SIMCE, considering that the evaluation and

so that it leads to the improvement of the quality and equity of educational opportunities.

test scores are not representative for schools with fewer than 20 students. Additionally, for treated schools, we select those that participated in the program from 2009 to 2011.

We use school-level data because data availability makes it impossible to perform an individual-level analysis. SIMCE evaluates students from the fourth, eighth, and tenth grades by turns. Although test scores are available at the student and school levels, we use schools as observational units due to the impossibility of following the same cohort of students during the pre- and post-treatment periods. Additionally, if the same cohort of students were evaluated each year, it would not be possible to identify priority students and their transfers across schools. However, since 2006, the SIMCE has evaluated fourth graders each year, which allows us to use school-average SIMCE scores for schools that have and have not participated in the reform, and to compare their academic performance using the methodology described in the next section.

V. Empirical Strategy

The Chilean targeted vouchers program is not a randomized experiment, which makes the policy evaluation of the program difficult. In this section, we discuss two alternative empirical approaches to estimate the causal effect of the reform on the academic achievement of schools.

We first use a difference-in-differences approach. According to this methodology, there are two groups observed in two time periods, where one is exposed to a treatment in the second period but not in the first (treatment group). The other group is not exposed to a treatment during either period (i.e., the control group). If the same units of the treatment and control groups are both in the first and second periods, the effect of the treatment could be obtained by subtracting the average gain of the control group from the average gain of the treatment group. This approach allows us to remove the biases that result from the comparison of both groups in the second period and that can be explained by permanent differences between them and differences across time due to group-specific trends.

We use a panel of schools in which we can identify those that signed the Equality of Opportunity and Educational Excellence Agreement and received funds from the program[16] from 2009 to 2011 (i.e., the treatment group) and those that decided not to participate in this program during this period (i.e., the control group). In our model, the pre-treatment period is defined as the time before the reform was implemented (i.e., from 2006 to 2008), and the post-treatment period as the time in which the reform was in effect (i.e., from 2009 to 2011).

[16]It is important to note that schools enrolled in the program receive SEP funds for each enrolled priority student (to whom schools cannot charge co-payments). However, those schools are free to enroll non-priority students, for whom schools do not receive funds from the program and to whom they can charge co-payments.

$$Y_{it} = \beta_1 \lambda_t + \beta_2 w_{it} + c_i + u_{it} \quad (1)$$

where Y_{it} corresponds to the average score that school i obtained on the SIMCE (in math and language, depending on the econometric specification) in the period t, λ_t is a time trend, and w_{it} is a binary program indicator that equals one if the school i participates in the program at time t and equals zero otherwise. Finally, we include a fixed school effect c_i. u_{it} represents an idiosyncratic error term. We estimate equation (1) by OLS, clustering by municipality to estimate standard errors.

How compelling the methodology described by equation (1) is will depend on the specific characteristics of the educational market. Consider first a frictional education market with a low enrollment elasticity for low-income students.[17] In that type of education market, the demand for schools is fixed and does not respond to changes in quality. Therefore, competitive forces do not operate. However, the conditionality imposed by the Equality of Opportunity and Educational Excellence Agreement could raise the academic results of the treatment group even in this frictional educational environment. Schools that sign the agreement are required to implement education reforms, and noncompliance with those reforms can result in the cancellation of the official recognition given by the Ministry of Education (see discussion in section 3).

In that case, the key identifying assumption of a difference-in-differences approach is that the trend in test scores would be the same in both treatment and control schools in the absence of treatment. In that case, we interpret the policy effect estimator associated with w_{it} as the average effect of the reform on a school's academic results. That effect would be the result of conditioning the delivery of extra resources on the implementation of specific scholastic reforms. Figure 1 shows test scores in the treatment and control groups. We observe that the trends followed by those school groups are fairly similar until 2008, satisfying the main identifying assumption of a difference-in-differences methodology.

A problem with the difference-in-differences methodology emerges when there is competition for market shares in the education market. The education market could be thought of as, first, a "residual" public school, where the children who attend are those who either cannot afford a private school or are denied admission to a private school. The remainder of the market may be minimally modeled as two schools, making appropriate quality choices. If there is heterogeneity in the willingness to pay, these remaining schools will vertically differentiate, with the one choosing a lower quality also charging a lower price. When the reform is introduced, the lower-priced school has less to give up relative to the voucher amount and will therefore opt in. Competition for the resources delivered by the program will lead to higher quality for all children in the market.

In that type of education market, the difference-in-differences methodology raises some econometric challenges. First, all schools will react to the program. Since schools are

[17] For instance, Chumacero, Gómez, and Paredes (2011) and Gallego and Hernando (2009) suggest that the enrollment elasticity in Chile is not so high, especially for poor children. The reason is that parents consider not only the quality of the school but also its location.

now competing for market share, if the schools that receive funds from the program are able to do better for all types of children with the additional resources, other schools will be forced to react to maintain market share, either by decreasing prices or by increasing quality or both. Similarly, public schools will also react. For this reason, the control group (schools that do not receive funds from the program) may not be valid because that group of schools does not offer a valid counterfactual of what would have happened in the schools that signed the agreement had they not chosen to join the program. In the presence of competition for share, a difference-in-differences methodology should produce a downward bias of the true causal effect of the reform on schools' academic results. The magnitude of this bias crucially depends on how fast schools that do not participate in the reform react to competition.

Additionally, children and households will also react to this system. Children will actively sort into different types of schools, and therefore comparisons across schools will be compromised due to changes in the student body. The new sorting of children across schools will fundamentally complicate averaged school-level test scores, which reflect both school quality and student composition. The assumption of "parallel trends in covariates" implied by the difference-in-differences assumption would be violated.[18] The bias generated by the sorting of students depends on the type of sorting induced by the program. Specific characteristics of the reform are essential to understand the sign of the sorting (if any sorting exists).

Schools that receive funds from the program must exempt all priority students from paying any co-payment and cannot select among those priority students. If the demand surpasses the number of available spots, students will be admitted through a public and transparent application process that will not consider their socioeconomic status or their past or potential academic performance. However, an important change in the observable composition of students in the treatment group and the control group would be produced if schools that initially enrolled middle- and high-income students (higher co-payment schools) join the program and begin to enroll priority students. We should note that it is unlikely that those schools have large incentives to join the program since one of the main costs for schools derived from the Equality of Opportunity and Educational Excellence Agreement is the impossibility of charging private co-payments to priority students. If this type of sorting existed, the socioeconomic composition of treatment schools should worsen and a difference-in-differences methodology would produce a downward bias when our result variable of interest is school results conditional on the human capital level of the student body. Therefore, overall, in the presence of sorting, a difference-in-differences methodology would produce an underestimation of the causal effect of the reform on schools' academic results.[19]

[18] Controlling for the family income and other socioeconomic variables (at school-level averages) may exacerbate the problem if changes in those covariates are caused by the treatment. However, we also show results where those types of covariates are included.

[19] Another econometric issue is the potential existence of selection bias if there are structural school characteristics that are correlated with choice and also explain the results. However, the school-level fixed effects might capture all the characteristics that remain constant over time and, thus, control for

A simple way of evaluating the sign of the sorting (if any) is by observing the trends followed by socioeconomic variables in the treatment and control groups. Figure 2 graphs the evolution of some socioeconomic variables for both groups during the pre- and the post-treatment periods. We observe that trends regarding parents' education are roughly the same in the treatment and control groups. Therefore, we see no apparent sorting when we look at those socioeconomic variables. Additionally, we observe that the trend followed by the average gross family income is the same in the treatment and control groups during the pre-treatment. However, after the reform, the average gross family income of the control group improves relative to that of the treatment group. That evidence is consistent with the type of sorting discussed above. If anything, the program should give more incentives to fee-charging schools to accept low-income students whose family income is lower than the average family income of the students previously enrolled in those schools. Then, it would be expected that the relative family income of schools that join the program would decrease, although the effect exhibited in Figure 2 does not seem to be excessively important.

If the education market is characterized by competition for shares, the ideal methodology to estimate the causal effect of the program on the academic achievement of schools is to use data at the market level. That is, we can base identification on "closed" markets, and then shock one or more schools with the program and look at market-level impacts on different types of children. We can identify specific locations where one or more schools joined the program and compare them to other locations where schools were eligible but did not opt in. The outcome variable would then be the aggregate scores across all schools in the market. To follow such a strategy requires the identification of the control group, which is not straightforward.

We decided to pursue an alternative methodology. We define each municipality as an individual market. Then, we compare the changes in test scores after the implementation of the reform in markets where a different number of schools signed the agreement. Even though the channels described in the case of frictions could still operate, this methodology allow us to better capture the competitive forces that encourage both treatment and control groups to supply a higher level of quality. Specifically, we estimate the following empirical model:

$$\Delta Y_i = c + \alpha_1 S_i + \alpha_2 X_i + u_{it} \tag{2}$$

where ΔY_i corresponds to the change in the average test score in municipality i since the treatment, S_i is the fraction of schools that join the program in municipality i, and X_i are covariates that include the change in the average test score and the average socioeconomic variables of municipality i during the pre-treatment period. u_{it} represents an idiosyncratic error term, and c is a constant.

The next section presents the results of our two empirical approaches: difference-in-

self-selection if it is explained by characteristics that are invariant over time.

differences estimates and a market-level analysis.

VI. Results

Table 4 presents the results of equation (1). Columns (1) to (8) show a positive and statistically significant effect of the reform on math and language test scores. According to the basic specification (1), where no socioeconomic variables are included, schools that join the program in 2008 experienced an average gain of 4.8 points in math test scores and 2.8 points in language test scores. Those effects are equivalent to test score gains of 0.18 and 0.12 standard deviations in math and language, respectively.[20] Despite the fact that the point estimate associated with math is higher than that for language, the trend coefficient associated with language is higher than that for math. This could be explained by reforms carried out to increase the quality of the language education content overall. As a result, test scores for language showed an increasing tendency attributable to curriculum reforms that were not implemented in math. Columns (2) to (4) and (6) to (8) show the estimated coefficients for math and language when family background is controlled for. The conclusions are similar to those reported in the baseline specification.

An additional question is whether or not the program has a cumulative effect on school academic results, considering that, in our sample, all schools signed the agreement in 2009 and remained in the program until 2011. It is possible that the program has an additional effect for each additional year. A lag in the effect may exist for mainly two reasons. First, it is possible that some adjustment costs exist. Vouchers may increase incentives to enhance education quality. However, because of some adjustment costs (for instance, the construction of new infrastructure), the increase in education quality would not materialize until some future period. Second, it is possible that students must be exposed to more than one period of investment in order to experience improvements in academic achievement.

Table 5 presents the results of equation (1), including the interaction of the policy indicator and a trend variable $\lambda_t^{'}$ that takes the value of zero during the pre-treatment period and the values of one, two, and three during the post-treatment period for both treatment and control groups. By doing this, we capture the average effect of an additional year of the reform on test scores. Table 5 indicates that an additional year increases test scores by 4.1 points in math and 1.6 points in language, values that are statistically significant at the 1% level. Therefore, a school that has received funds from the program for three consecutive years improves its test scores by 12.3 points in math and 4.8 points in language, relative to their counterfactuals. These effects are equivalent to test score gains of 0.5 and 0.2 standard deviations in math and language, respectively. After including school socioeconomic background variables (family income and parents' schooling), results

[20] To obtain the equivalence of estimated effects in terms of standard deviations, we use the distribution of test scores for the whole sample of schools and calculate its standard deviation. Then, using simple proportion rules we find the equivalence of the estimated effects of the reform on test scores in terms of standard deviations for the different regressions presented in Tables 4 to 7.

remain positive and significant.

To have a better idea of the impact of the reform, we can consider a school in the 50th percentile of the test score distribution. An increase of 12.3 points would place the school in the 66nd percentile in the math score distribution, while an increase of 4.8 points would locate the school in the 58nd percentile in the language score distribution.

Additionally, we estimate a more flexible model replacing the linear trend by a vector of year indicators. We also replace the policy indicator w_{it} by three dummy variables (for the years 2009, 2010, and 2011) that take the value of one if the school i participates in the program. These dummy variables ($w_{1=2009}$, $w_{1=2010}$, and $w_{1=2011}$) give us information about the test score gains that result from each additional year of exposure to the program. We observe in Table 6 that the rise in test scores is increasing. In math, there are no statistically significant gains in test scores after the first year. The second year of the program produced an additional gain of 4.1 points, whereas, after the third year, test scores increase another 7.2 points. Overall, after three years, schools that participate in the program increase their math test scores by 11.2 points, which is equivalent to move a school from the 50th percentile to the 65th percentile of the distribution. For language test scores, we observe no significant improvement after the first year, a rise of 4 points during the second year, and an additional gain of 3.9 points after the third year. The total gain in language test scores is 7.9 points, equivalent to moving a school from the 50th percentile to the 62th percentile of the distribution. Those effects are equivalent to test score gains of 0.4 and 0.3 standard deviations in math and language, respectively.[21]

As discussed in section 5, we also perform a market-level analysis. To do so, we define each municipality as an individual market and compare the changes in test scores after the implementation of the reform in a market where some schools signed the agreement and others did not. This empirical approach allows us to better capture competitive forces. Regarding competition for shares, the improvement in the academic results of the treatment group encourages the control group to react and compete and, thus, to potentially improve education quality. In that type of education market, a market-level analysis is a more compelling approach to estimate the effects of the reform on academic results than a difference-in-differences approach.

As we can see in Table 7, from the coefficient of S_i, we can infer that 1% of schools joining the program produce a gain of 0.18 points in math and 0.11 points in language test scores in the average market. Since in our sample around 80% of the schools joined the program, we may observe average gains of 14.4 points in math and 8.8 points in language test scores after three years of exposure to the reform, relative to a market where the reform is not implemented. Those effects are equivalent to test score gains of 0.53 and 0.37 standard deviations in math and language, respectively. Therefore, this market-level

[21] In additional regressions, we included dummy variables one and two years before the introduction of the reform that take the value of one for the treatment group. In this way, we tested whether our results can be simply explained by program participant schools, which changed their behavior before signing the Equality of Opportunity and Educational Excellence Agreement. The conclusions do not change using this specification.

analysis confirms the positive and statistically significant effects of targeted vouchers on school results.

A. Discussion

Based on the empirical results presented in this paper, along with some institutional characteristics that might appear in a mixed funding school system, we can speculate about the more likely characterization of the school market and the channels through which a reform of the SEP characteristics may affect the incentives of schools. However, a formal empirical analysis to disentangle the specific channels through which conditional vouchers encourage schools to offer a higher quality of education constitutes an important avenue for future research.

The Chilean school system is a mixed funding system, where we can find four types of schools: (i) "residual" public schools, where the children who attend are those who either cannot afford fee-charging voucher private schools or are denied admission to private schools;[22] (ii) free private voucher schools, which offer a lower quality and compete for low-income students who cannot afford private co-payments; (iii) fee-charging voucher private schools, which supply a higher education quality; and (iv) elite private schools, which do not receive public funds.

A voucher system should encourage schools that enroll low-income students to compete for these resources. However, competition would not operate if schools face a fixed demand that does not respond to changes in quality. That happens when the enrollment elasticity for poor students is relatively low, as argued by Chumacero et al. (2011) and Gallego and Hernando (2009). However, the massive migration of students from public to voucher private schools observed after the implementation of the 1981 universal voucher program does not fully support a low-enrollment elasticity. Figure 3 shows a strong migration of students from public schools to private schools. Total enrollment in public schools has decreased from 75% in 1982 to 40.7% in 2010.

In an environment with some mobility of students across schools, voucher private schools behave very much like profit-maximizing firms. Competition for the voucher resources may give incentives to voucher private schools to attract low-income students and, thus, to offer a higher level of quality. In principle, public schools should react by also increasing their quality. However, some institutional characteristics of public schools prevent a fully profit-maximizing behavior among public schools.

The Teaching Statute constrains public schools from freely competing in the education market. Public schools cannot easily dismiss teachers or modify the structure of

[22]In this regard, the SEP reform is different from the universal voucher introduced in 1981. Whereas private schools can employ competitive admission processes to admit only the most promising applicants among those who receive funds from the universal voucher program, they cannot select among priority students who receive SEP funds. Public schools with vacancies are legally obliged to admit all applicants regardless of their academic potential, socioeconomic backgrounds, or the type of voucher or financing that they have.

monetary incentives for their teachers. They have more flexibility to implement reforms in other dimensions, such as infrastructure, curriculum management, or student life. However, there is a second element that could slow the progress of public schools even in those areas. Several public schools receive non-voucher transfers from municipalities. These are the so-called soft budget constraints (Sapelli and Vial 2002; Hsieh and Urquiola 2006). These non-voucher transfers introduce perverse incentives, since schools that experience a decrease in their enrollment do not experience a worsening in their budgets. Therefore, public schools that face strong competition from voucher private schools do not react by increasing quality, even though they lose students. Non-voucher transfers from municipalities allow them to continue operating and prevent a closure of these schools.[23] Figure 4 shows the average annual non-voucher transfers per student in different municipalities.[24] We observe that non-voucher transfers are present in practically all municipalities, although a lot of heterogeneity is observed.

All these elements decrease the degree to which unconditional vouchers encourage public schools in Chile to behave as profit-maximizing firms. Therefore, it is not straightforward that unconditional vouchers should have led public schools to improve their quality. However, since the SEP program does consider conditionality in the allocation of vouchers, this conditionality might be important to understand why the SEP reform produced academic improvements in public schools.

The Equality of Opportunity and Educational Excellence Agreement requires schools to implement education reforms, and noncompliance with those reforms can result in the cancellation of the official recognition given by the Ministry of Education. The required reforms by the Equality of Opportunity and Educational Excellence Agreement force schools to progress in some specific areas, undermining in this way the negative incentives derived from the non-voucher transfers. Even though public schools are constrained by the Teaching Statute, there are several other areas in which schools can experience improvements. Additionally, the SEP law establishes some flexibility, although small, to hire teachers, educational assistants, and the necessary staff to improve the technical and pedagogical performance of the schools.

Our results are consistent with a story where the SEP reform delivered extra resources to the market, targeted to low-income students. Competition for those resources encouraged private voucher schools to offer a higher quality to attract more priority students. Public schools should react by increasing their quality as long as the enrollment elasticity is not so low. However, the Teaching Statute and the presence of soft budget constraints in public schools prevent profit-maximizing behavior. At the same time, these specific institutional characteristics of public schools introduce an important role for the conditionality embodied in the Equality of Opportunity and Educational Excellence Agreement. That agreement forces schools to progress in reforms aim at improving the

[23]For instance, Hsieh and Urquiola (2006) show that despite extensive private entry and sustained declines in public enrollments, the aggregate number of municipal schools has barely fallen.

[24]Nine municipalities were excluded from the graph for expositional reasons. Those municipalities present an average non-voucher transfer between US$2,000 and US$15,000.

academic achievement of their students. Therefore, public schools that signed the agreement experience an improvement in their quality, although perhaps smaller than that of the private voucher schools. Public schools that did not join the program should not have experienced significant improvements in their academic results since there is no conditionality that undermines the rigidity imposed by the Teaching Statute or the bad incentives derived from the non-voucher transfers that these schools receive (they represent only 10% of total public schools).

VII. Conclusions

This paper provides empirical evidence of the effect of targeted vouchers on school results. We use data from the targeted voucher program implemented in Chile in 2008. This program is different in several dimensions from the universal voucher program implemented in 1981.

First, this voucher program is focused on low-income students. Second, the program requires that schools sign the Equality of Opportunity and Educational Excellence Agreement to receive the extra resources delivered by the program. That agreement forces schools to present an Educational Improvement Plan to the Ministry of Education, which details specific educational reforms that the school must undertake to improve results on the SIMCE, a national standardized test. Third, schools must also exempt all priority students from paying any co-payment or tuition. Finally, schools joining the program cannot select among priority students.

Using a difference-in-differences approach and a market-level analysis, we find positive and statistically significant effects of vouchers on math and language test scores. After three years of exposure to the reform, the difference-in-differences approach shows that participating schools increased their math test scores by 0.4 standard deviations, which is equivalent to move a school from the 50th percentile to the 65th percentile of the distribution. The total gain in language test scores was 0.3 standard deviations, equivalent to move a school from the 50th percentile to the 62th percentile of the distribution. The market-level analysis shows that for each 1% of schools joining the program, the average market experiences test score gains of 0.18 points in math and 0.11 points in language. This means that, after three years, a market in which 80% of schools participate in the reform experiences average gains of 14.4 points in math and 8.8 points in language, relative to a market where the reform is not implemented. Those effects are equivalent to test score gains of 0.53 and 0.37 standard deviations in math and language, respectively.

Our results highlight the importance of conditioning the delivery of resources to some specific academic goals in markets with institutional characteristics that prevent public schools from behaving as profit-maximizing firms. Further analysis to disentangle the mechanisms through which targeted vouchers changed the educational market constitutes an interesting and important avenue for future research.

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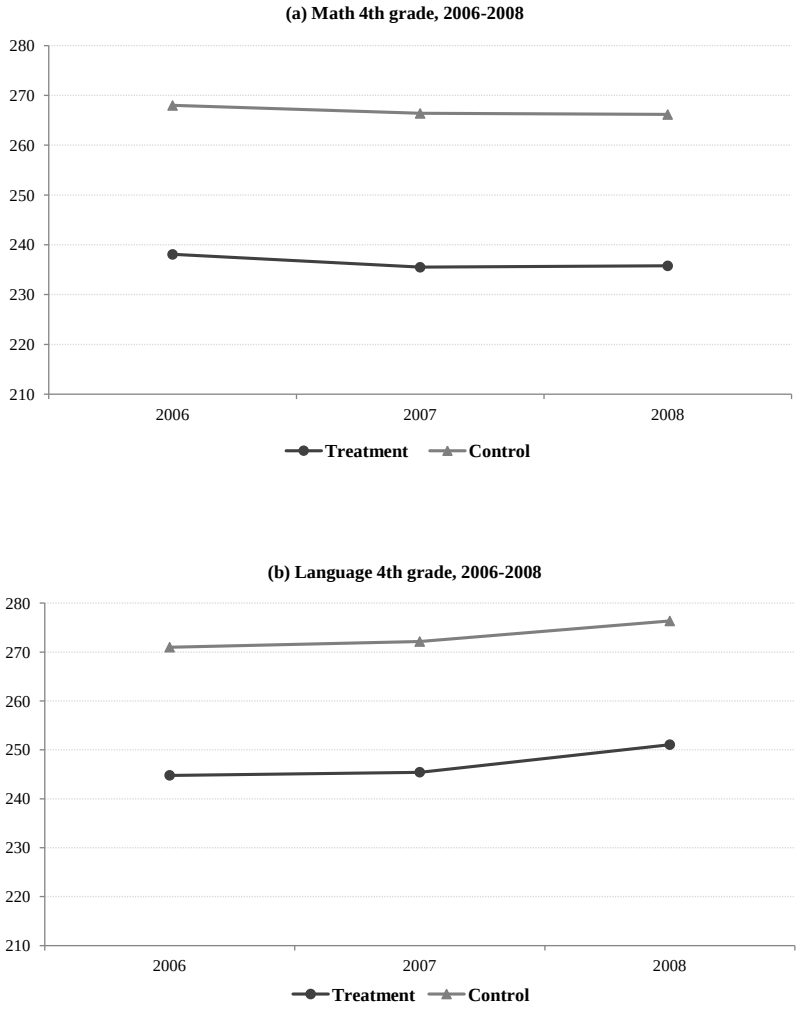
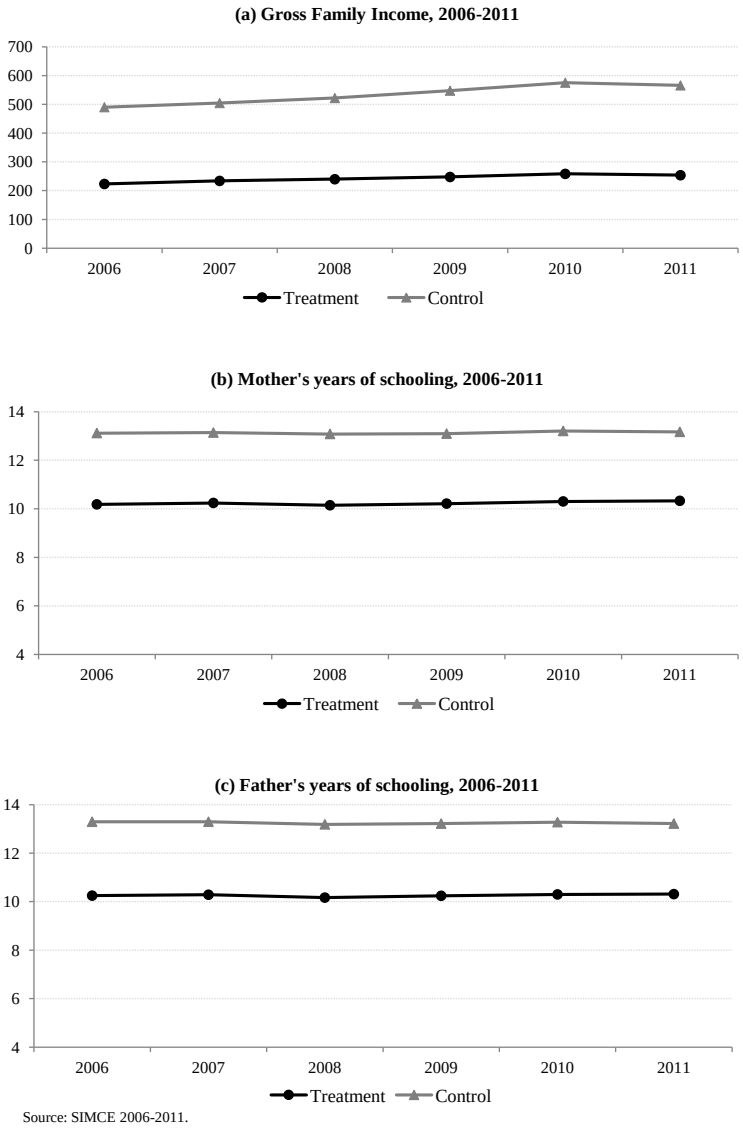
Figures and Tables

Figure 1: Test Scores in the Treatment and Control Groups



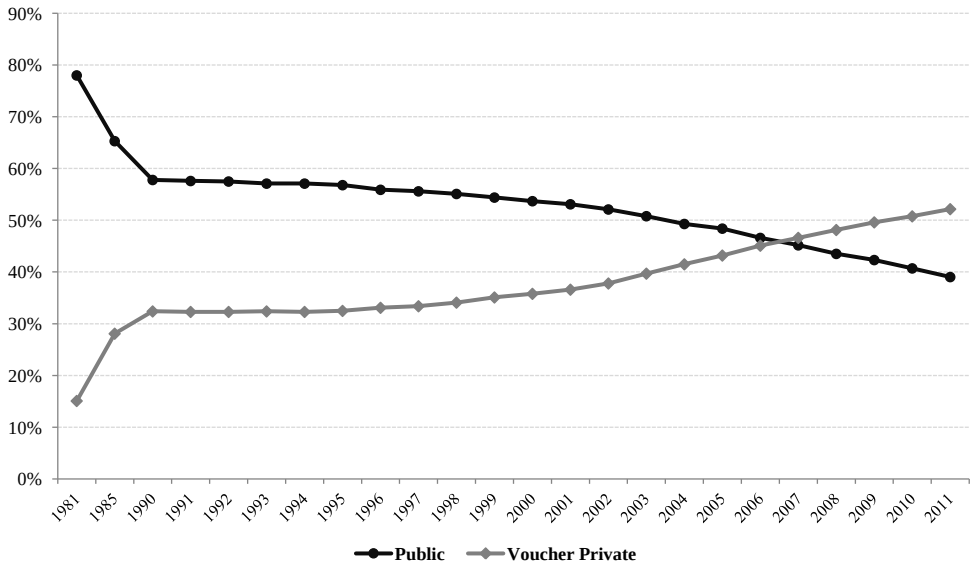
Source: SIMCE 2006-2008.

Figure 2: Socioeconomic Variables in the Treatment and Control Groups



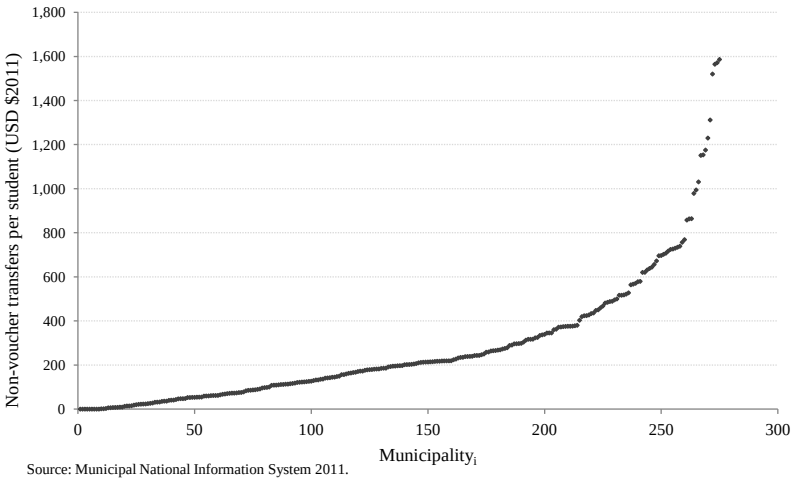
Source: SIMCE 2006-2011.

Figure 3: Enrollment Share by Type of School



Source: Ministry of Education.

Figure 4: Non-Voucher Transfers at the Municipal Level



Source: Municipal National Information System 2011.

Table 1: Monthly Subsidy per Priority Student (US$)

	Pre-Kindergarten to 4th Grade	5th and 6th Grades	7th to 12th Grades
Monthly per-student subsidy	86.6	57.6	29.1

Source: Ministry of Education (Chile). Notes: Values are for 2012 and are adjusted by purchasing power parity.

Table 2: Monthly Concentration Subsidy per Priority Student (US$)

Concentration of Priority Students	Pre-Kindergarten to 4th Grade	5th and 6th Grades	7th to 12th Grades
15%-30%	6	4	2
30%-45%	10.3	6.9	3.4
45%-60%	13.8	9.2	4.6
$\geq$60%	15.4	10.3	5.2

Source: Ministry of Education (Chile). Notes: Values are for 2012 and are adjusted by purchasing power parity.

Table 3: Flat Voucher and SEP for Pre-Kindergarten and Fourth Graders (US$)

Category	Subsidy
Flat voucher	143
SEP	86.6
Concentration subsidy	13.8
Total	243.4

Source: Ministry of Education (Chile). Notes: Values are for 2012 and are adjusted by purchasing power parity.

Table 4: Effects of the SEP Reform on School Academic Achievement

Variable	SIMCE 4^{th}-Grade Math				SIMCE 4^{th}-Grade Language			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
λ_t	0.8632***	0.7382***	0.8274***	0.9130***	2.4463***	2.2876***	2.4144***	2.4160***
	(0.133)	(0.145)	(0.127)	(0.143)	(0.111)	(0.111)	(0.107)	(0.108)
w_{it}	4.7634***	4.9283***	4.4684***	4.3418***	2.8204***	3.0297***	2.5897***	2.5872***
	(0.432)	(0.433)	(0.419)	(0.421)	(0.433)	(0.430)	(0.429)	(0.426)
Gross family income		0.0100***		-0.0069**		0.0128***		-0.0001
		(0.003)		(0.003)		(0.003)		(0.003)
Mother's years of schooling			3.2819***	3.3743***			2.7572***	2.7589***
			(0.289)	(0.295)			(0.259)	(0.263)
Father's years of schooling			2.0068***	2.1285***			1.4507***	1.4530***
			(0.256)	(0.261)			(0.249)	(0.253)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,203	18,203	18,203	18,203	18,203	18,203	18,203	18,203

Source: SIMCE 2006-2011 and Ministry of Education (Chile). Notes: (a) Gross family income corresponds to the average family income that students report at the moment of taking SIMCE. It is expressed in thousands of Chilean pesos (CLP) for each one of the years considered in the sample (1 US$ = 520 CLP). (b) Standard errors were estimated using clustering by municipality. Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1.

Table 5: Cumulative Effects of the SEP Reform on School Academic Achievement

Variable	SIMCE 4^{th}-Grade Math				SIMCE 4^{th}-Grade Language			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
λ_t	-0.1639	-0.4129***	-0.1362	-0.1437	2.2270***	2.0051***	2.2470***	2.2200***
	(0.117)	(0.124)	(0.114)	(0.126)	(0.113)	(0.114)	(0.111)	(0.113)
$\lambda_t^{'} * w_{it}$	4.0698***	4.2698***	3.8264***	3.8331***	1.6065***	1.7848***	1.4076***	1.4317***
	(0.216)	(0.211)	(0.212)	(0.208)	(0.206)	(0.205)	(0.208)	(0.208)
Gross family income		0.0166***		0.0005		0.0148***		0.0018
		(0.003)		(0.003)		(0.003)		(0.003)
Mother's years of schooling			3.1524***	3.1457***			2.7151***	2.6908***
			(0.291)	(0.298)			(0.259)	(0.263)
Father's years of schooling			1.8815***	1.8727***			1.4235***	1.3918***
			(0.254)	(0.258)			(0.248)	(0.252)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,203	18,203	18,203	18,203	18,203	18,203	18,203	18,203

Source: SIMCE 2006-2011 and Ministry of Education (Chile). Notes: (a) Gross family income corresponds to the average family income that students report at the moment of taking SIMCE. It is expressed in thousands of Chilean pesos (CLP) for each one of the years considered in the sample (1 US$ = 520 CLP). (b) Standard errors were estimated using clustering by municipality. Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1.

Table 6: Year Effects of the SEP Reform on School Academic Achievement

Variable	SIMCE 4^{th}-Grade Math				SIMCE 4^{th}-Grade Language			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$w_{1=2009}$	0.958	1.4077**	0.7281	0.7388	1.1422*	1.4474**	0.9546	0.8912
	(0.646)	(0.633)	(0.644)	(0.634)	(0.585)	(0.576)	(0.590)	(0.588)
$w_{1=2010}$	4.0697***	4.8041***	3.9140***	3.9310***	3.9841***	4.4826***	3.8589***	3.7581***
	(0.679)	(0.672)	(0.646)	(0.652)	(0.655)	(0.660)	(0.639)	(0.648)
$w_{1=2011}$	11.2471***	11.9001***	10.7555***	10.7714***	7.9296***	8.3729***	7.5304***	7.4358***
	(0.732)	(0.725)	(0.717)	(0.712)	(0.726)	(0.723)	(0.718)	(0.717)
Gross family income		0.0167***		0.0004		0.0114***		-0.0022
		(0.003)		(0.003)		(0.003)		(0.003)
Mother's years of schooling			3.2126***	3.2075***			2.7196***	2.7499***
			(0.288)	(0.295)			(0.257)	(0.261)
Father's years of schooling			1.9060***	1.8993***			1.4689***	1.5087***
			(0.252)	(0.256)			(0.255)	(0.258)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,203	18,203	18,203	18,203	18,203	18,203	18,203	18,203

Source: SIMCE 2006-2011 and Ministry of Education (Chile). Notes: (a) Gross family income corresponds to the average family income that students report at the moment of taking SIMCE. It is expressed in thousands of Chilean pesos (CLP) for each one of the years considered in the sample (1 US$ = 520 CLP). (b) Standard errors were estimated using clustering by municipality. Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1.

Table 7: Effects of the SEP Reform on School Academic Achievement: Market-Level Analysis

Variable	SIMCE 4^{th}-Grade Math					SIMCE 4^{th}-Grade Language				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
s_i	17.0557***	17.1119***	18.0110***	16.9264***	18.2149***	10.4087***	10.4490***	10.8473***	10.2728***	10.6930***
	(4.061)	(4.132)	(4.057)	(4.086)	(4.126)	(3.067)	(3.067)	(3.059)	(3.101)	(3.153)
Δ SIMCE (2006-2008)		0.0564	0.0438	0.0496	0.0473		0.0168	0.0116	0.0161	0.0161
		(0.072)	(0.072)	(0.075)	(0.075)		(0.059)	(0.059)	(0.061)	(0.061)
Δ Gross family income (2006-2008)			0.0428*		0.0417			0.0193		0.0136
			(0.025)		(0.030)			(0.021)		(0.024)
Δ Mother's years of scholing (2006-2008)				3.058	1.8498				2.1857	1.7915
				(2.510)	(2.610)				(2.013)	(2.147)
Δ Father's years of schooling (2006-2008)				-1.7721	-2.1429				-1.1152	-1.2378
				(2.323)	(2.353)				(1.687)	(1.739)
Constant	-6.6268**	-6.5631*	-8.2412**	-6.4938*	-8.4564**	-2.4551	-2.5805	-3.2916	-2.4771	-3.1143
	(3.275)	(3.347)	(3.361)	(3.314)	(3.538)	(2.438)	(2.451)	(2.503)	(2.501)	(2.715)
Observations	309	309	309	309	309	309	309	309	309	309

Source: SIMCE 2006-2011 and Ministry of Education (Chile). Notes: (a) Gross family income corresponds to the average family income that students report at the moment of taking SIMCE. It is expressed in thousands of Chilean pesos (CLP) for each one of the years considered in the sample (1 US$ = 520 CLP). (b) Standard errors were estimated using clustering by municipalitys. Standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1.