# SCHOOL SEGREGATION IN CHILE: THE IMPACT OF A TARGETED VOUCHER FOR DISADVANTAGED STUDENTS ON THE SOCIOECONOMIC COMPOSITION OF SCHOOLS[1]

Patricio Domínguez Rivera[2]

*Goldman School of Public Policy, UC Berkeley*

**ABSTRACT**

Chilean school system is among the most segregated in the world. In 2008 a new law, SEP, was passed with an unprecedented support from different political coalitions. SEP has changed the school funding system from a universal flat voucher to a new one that targeted more resources to vulnerable students (60 % more). In spite of its recent implementation, some studies have shown a reduction on the student socioeconomic achievement gap on standardized tests scores that can be attributed to SEP. However, little is still known about the effect of SEP on segregation. This article suggests that although SEP might provide some incentives to reduce segregation is still far from being sufficient to significantly reduce the highly segregated pattern of the Chilean school system. I provide several analyses to support that claim. First, by analyzing the evolution of the school´ socioeconomic composition for students from different socioeconomic background I show that the segregation pattern has remained pretty stable after SEP took place. Then, based on a school fixed-effects model, I show that SEP has had just a modest impact on school composition, and that impact has not been sufficient to modify the previous pattern of high socioeconomic segregation. Finally, I estimate other models to test heterogeneity on school´s responses according to their previous socioeconomic composition, as well as I run an event-study model in order to look in more detail the dynamics effects of SEP over time. In that sense this article finds evidence about the limited possibilities of a school finance reform as SEP on modifying the socioeconomic school segregation pattern in a context of a consolidated universal voucher system such as the Chilean school system.

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[2] Patricio Domínguez is a graduate student at the Goldman School of Public Policy at the University of California, Berkeley. He holds a M.A in Sociology and a B.S in Industrial and Transportation Engineering both from the Catholic University of Chile (PUC). Author´s email: pdominguez@berkeley.edu, pdomingr@uc.cl.

# 1. Introduction

The main purpose of this project is to analyze the extent to which a specific school financial reform that targets more resources to students from low-income families can reduce socioeconomic segregation in a particular context of school choice as the Chilean school system. SEP reform (Preferential School Subsidy[3]) started in 2008 and is changing the school finance system from a universal flat voucher to a new one that allocates more resources to vulnerable students. The main rationale is based on the idea that students from low-socioeconomic background are more expensive to be educated, so giving more resources to them would reduce the achievement gap but also make those vulnerable students more attractive to high-performance schools. Recent studies have shown that SEP has been promising in terms of a significant and positive effect on reducing the student socioeconomic achievement gap. In this project I confirm those results for the case of schools in Santiago. However, for the sake of this project I have mainly focused on the effect of SEP on school socioeconomic composition. Given that the Chilean school system is one of the most segregated systems in the world this is a key issue that needs to be deeply analyzed. My main conclusion is that in spite of a positive and significant effect in terms of standardized test scores, SEP reform has provided just modest incentives for further integration of vulnerable students that are still far from being sufficient to change the highly segregated pattern of the school system.

This article is organized as it follows. First, I describe the Chilean education system in terms of the main important reforms that have taken place in the last 30 years after the school choice system was implemented universally. I also briefly review the literature that has focused on the relation between school choice and segregation in Chile. Then, in the second section I describe the administrative data and the research questions of this project. In the third section I present the research methods and its main findings. I describe the segregation pattern over time and I implement a school fixed-effects model to test the effect of SEP on school composition. Also, in order to look in more detail the impact of SEP, I test for both heterogeneous school responses and the dynamics of the effect over time. Finally, in the final five I review the main findings of this project, and I present some policy recommendations that should be explored in order to address the high segregation pattern of the Chilean school system in a more effective way.

## a. Description of the Chilean School System

There are three main institutions that currently provide education in Chile: public schools (39% enrollment rate and managed by municipalities), private-voucher schools (53.5%; managed by either for-profit or non-profit organizations) and private schools (7.5% which do not receive public funds)[4].

[3] In Spanish, SEP, Subvención Preferencial Escolar.

[4] In the case of 4th grader students that attend schools in Región Metropolitana where Santiago is located, those numbers in 2012 were: public schools (29%), private-voucher schools (60%), private schools (11%).

Also, the school system can be broadly described by the three main reforms which have taken place in the last 30 years.

(i) Universal Voucher System (1981). The Government implemented a system that allocates funds indistinctly to either public or private schools according to the number of students that each one enrolled (flat voucher). Basically, this school finance system establishes that "money follows students on a per student basis to the schools they attend".

(ii) Shared Financing System (FC copayment system, 1993). School finance reform that allows private-voucher schools to "charge 'add-on' fees to parents to supplement the government voucher under a withdrawal schedule that reduces the subsidy (voucher value) as parental fees increase" (Mizala & Torche, 2012).

(iii) Preferential School Subsidy (SEP, 2008). It replaced the flat voucher with a means-tested one. SEP establishes an extra per-student subsidy for economically disadvantaged students (approximately bottom 40%: priority students), and for schools that agree to participate. Schools can voluntarily agree to receive the extra voucher as long as they do not charge copayment (FC) to priority students[5]. SEP increases in 60% the per-pupil voucher for vulnerable students that attend SEP schools. It is based on the idea that students from low-socioeconomic backgrounds have on average lower educational performance and are usually more demanding in terms of resources (Ducombe & Yinger, 2000; Rechovsky & Iamzeki, 2001). The goal of SEP is to increase academic performance reducing the achievement gap between students from low-income and high-income families, but also to decrease the segregation of vulnerable students.

### b. School choice and segregation

There is a growing literature that has analyzed the performance of the voucher system in Chile. Mainly, that research has been focused on the relative effectiveness of private-voucher over public schools, and the effect of school competition on student outcomes (Mizala & Torche, 2012). In terms of the relative effectiveness comparison, although private-voucher schools, on average standardized test scores, achieve better results than public schools, there is no strong evidence which probes that they offer a higher quality education to their students. Indeed, there is a considerable amount of evidence that shows that the gap in standardized tests that favors private-voucher over public schools can be mainly explained by socioeconomic differences of their students[6]. Moreover, public schools have proved to have advantages in educating students from disadvantaged family backgrounds (Tokman, 2002). Likewise, Hsieh & Urquiola (2006) argue that private-voucher schools seem to respond to the

[5] Additionally, the law prohibits the use of parental interviews and admission tests to select students among participating schools.

[6] See Mizala & Romaguera (2000). A recent research on that debate found that private-voucher schools lead to small and sometimes not statistically significant differences in academic performance (Lara et al. 2009). Lara et al (2009) use a very rich data set from SIMCE that contains information on previous academic achievement for a specific cohort of students. They particularly focuses on the effect of private-voucher schools on students that are forced to enroll at a different school to attend secondary school once graduated from primary schooling (structural switches).

competitive pressures choosing better students rather than raising productivity and, as a result, the net aggregate effect of competition on student performance is negligible. In a similar way, using interesting identification strategies to deal with the endogenous entry of private-voucher schools, Gallego (2006) and Auguste & Valenzuela (2003) argue that greater competition significantly raises students´ test scores but the size of the effect is moderate. In any case, both Auguste & Valenzuela (2003) and Gallego (2006) concluded that while competition may lead to a low increase on student achievement it has been associated to a higher socioeconomic and academic segregation.

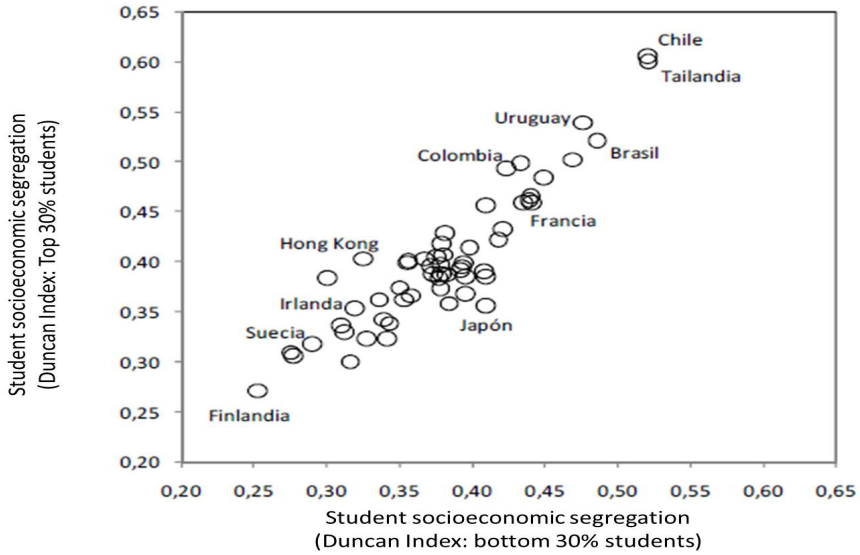
Specifically, in terms school segregation, the literature is considerably less extensive. Hsieh and Urquiola (2006) argue that the voucher reform of 1981 spurred an exodus of middle-class students from public to private-voucher schools. Perhaps, the two most relevant works on this topic have been developed by Valenzuela et al (2013) and Elacqua (2012). Valenzuela et al (2013) analyze the magnitude of school segregation in Chile, before SEP was implemented, and show that the magnitude of socioeconomic segregation measured according to Duncan index is very high (ranged from 0.5 to 0.6 in 2008). They also argue that there is a strong link between socioeconomic school segregation and some market-oriented mechanisms in education. Similarly, though using a different data source[7], Elacqua (2012) analyzes the relationship between school choice and segregation and shows that "public schools are more likely to serve disadvantaged student populations (low socioeconomic status and indigenous) than private voucher schools" (Elacqua, 2012, p.451). Besides, he also finds that disadvantaged students are less segregated in the public sector than in the private sector. According to him, this fact may not be surprising since "public schools are mandated by law to accept all students who apply, regardless of ability to pay, while private schools are permitted to use parental interviews to select and expel students as they see fit" (Elacqua, 2012, p.451).

### c. Socioeconomic School segregation in Chile

The Chilean educational system is one of the most segregated in the world. Valenzuela et al (2008) using data from PISA from 57 countries shows that Chile has the highest level of school socioeconomic segregation in terms of isolation of the top 30% and bottom 30% of students.

[7] Elacqua (2012) uses JUNAEB parent´s survey which provides information about student´ socioeconomic background.

**Figure 1.** School segregation: International comparison.




Source: Bellei (2010) based on Valenzuela (2008)

There is no clear consensus in terms of the specific causes and the effects of the high school segregation in Chile. Some scholars emphasize more *demand-side* factors as parent´s self-selection (for example: parent´s decisions as in Gallego & Hernando, 2006) while others emphasize more aspects from the supply-side of the system (different school´s funding sources, incentives and school´ selection rules (screening) as in Contreras et al, 2010). In any case, it is important to take into account the recent evidence of Elacqua & Santos (2013) who have shown that socioeconomic school segregation is even higher than residential segregation[8]. This fact raises the issue that at least the interaction between family choices and school entry barriers promote a higher socioeconomic segregation[9].

[8] Based on georeferenced information of students and their schools they compare the observed school segregation with a counterfactual scenario where students attend the closest schools to their homes. They show that this finding is robust to different segregation measures.

[9] Previously, based on a different methodology, Valenzuela et al (2012) had shown that residential segregation can explain only a part of the observed school segregation and the rest is due to specific characteristics of the school system.

## 3. Data and Research Questions

In this section I will describe the data and the research questions of this project. The data that I use comes from different sources. Basically, I use administrative data provided by the Ministry of Education (student unique registry system, RECH; SEP administrative records) and SIMCE (Education Quality Government Agency which is the responsible to administrate the national standardized tests).

### a. Data

I have merged different database from different series for this project. In this section I will describe the information that I found on each on:

**i. Enrollment Series (2004-2013).**

For each year I obtained information at the micro-level for all students in the school system. Some basic variables that are included in this database for each year are: Student ID1, gender, city, age, school level, school ID, school type (public, private).

Table 1 shows the number of observation that each database has –which represents the number of students enrolled in any institution for each year:

**Table 1.** Evolution of the total number of students enrolled in the school system

| Year | # Students |
|---|---|
| 2004 | 3,640,575 |
| 2005 | 3,751,909 |
| 2006 | 3,748,234 |
| 2007 | 3,707,706 |
| 2008 | 3,683,273 |
| 2009 | 3,698,577 |
| 2010 | 3,647,607 |
| 2011 | 3,603,002 |
| 2012 | 3,549,148 |
| 2013 | 3,537,087 |

Source: Own elaboration. Enrollment Series. MINEDUC, Chile.

**ii. Priority Student Series (2008-2013)**

The implementation of SEP began in 2008 and it has been progressively expanding over time as each cohort has been growing. I have micro-data at the student level that identifies the students that are eligible (priority student) for SEP since 2008, and those who are actually attending a SEP school (beneficiary student). Priority students are those who are eligible to receive the extra voucher while the beneficiary students are those who, besides being a priority student eligible for the extra voucher, are actually attending a SEP school for each year since 2008. Thus, for each year I have information about

student ID, school ID, dummy priority student =1, dummy beneficiary student =1, among other variables.

**iii. Standardized Test Score Series (SIMCE, 1999, 2002, 2005-2012)**

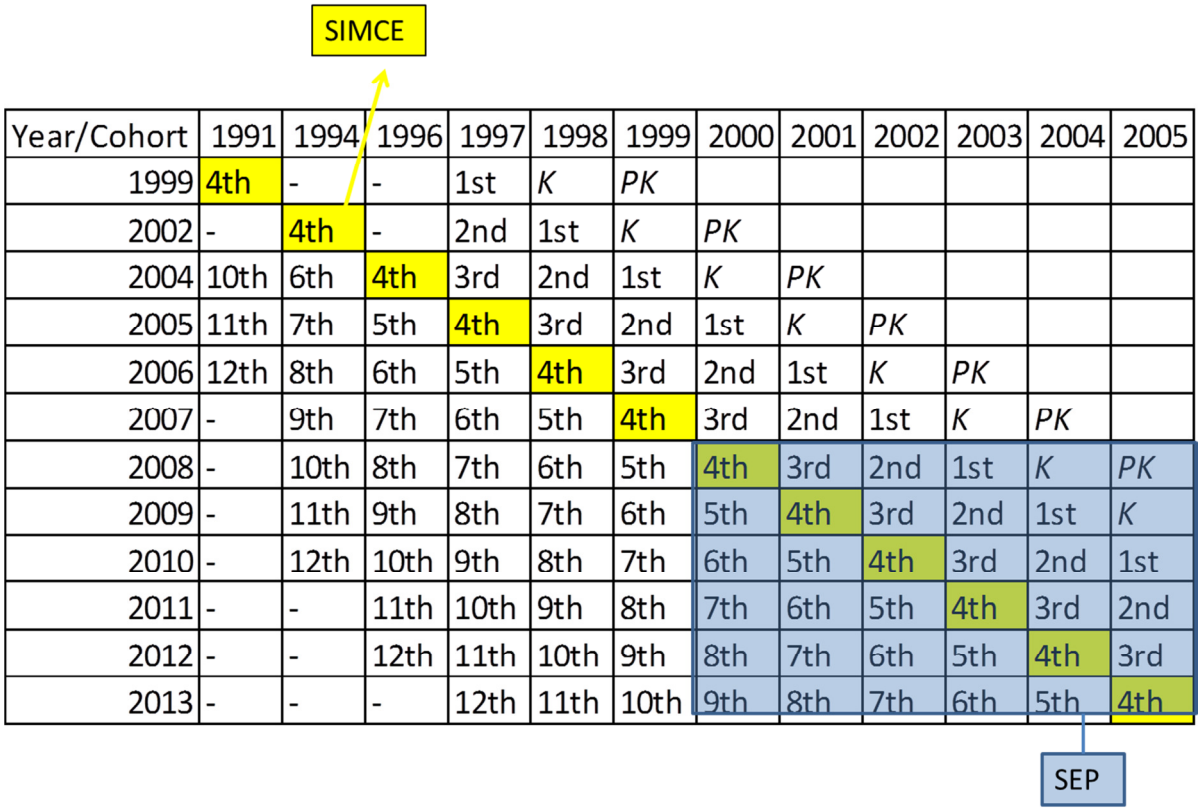
SIMCE collects information of standardized test scores for all 4th graders students for almost every year since 2002. I have student information at micro-data level of 10 cohorts (years): 1999, 2002, 2005-2012.

For each year I obtained 3 different databases that contains the following information: (a) student ID1, Student ID2, school ID, test scores in math and language; (b) parents survey: student ID2, parent´s education level (degree obtained), family income level (ranges), and many questions regarding parent´ school perceptions; (c) school attributes: school ID, school county, region, school type (public, private). Each of those three databases was merged for each year.

## b. Databases merged: Students and Schools

The following figure can summarizes the microdata that I used for this project:

**Figure 2.** Data available: Enrollment series, Test Scores (yellow), and SEP eligible students (blue).




| Year/Cohort | 1991 | 1994 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1999 | 4th | - | - | 1st | *K* | *PK* | | | | | | |
| 2002 | - | 4th | - | 2nd | 1st | *K* | *PK* | | | | | |
| 2004 | 10th | 6th | 4th | 3rd | 2nd | 1st | *K* | *PK* | | | | |
| 2005 | 11th | 7th | 5th | 4th | 3rd | 2nd | 1st | *K* | *PK* | | | |
| 2006 | 12th | 8th | 6th | 5th | 4th | 3rd | 2nd | 1st | *K* | *PK* | | |
| 2007 | - | 9th | 7th | 6th | 5th | 4th | 3rd | 2nd | 1st | *K* | *PK* | |
| 2008 | - | 10th | 8th | 7th | 6th | 5th | 4th | 3rd | 2nd | 1st | *K* | *PK* |
| 2009 | - | 11th | 9th | 8th | 7th | 6th | 5th | 4th | 3rd | 2nd | 1st | *K* |
| 2010 | - | 12th | 10th | 9th | 8th | 7th | 6th | 5th | 4th | 3rd | 2nd | 1st |
| 2011 | - | - | 11th | 10th | 9th | 8th | 7th | 6th | 5th | 4th | 3rd | 2nd |
| 2012 | - | - | 12th | 11th | 10th | 9th | 8th | 7th | 6th | 5th | 4th | 3rd |
| 2013 | - | - | - | 12th | 11th | 10th | 9th | 8th | 7th | 6th | 5th | 4th |

**Source:** Own elaboration. Enrollment Series. SIMCE, MINEDUC administrative data, Chile.

In order to analyze the evolution of the segregation pattern I created two different data sets; one that collect information at the student level for different cohorts in 4th grade(pooled cross section data at

the student level), and another one that collects data at the school level for different years (panel data at the school level). Table 2 shows the information that each database collects.

**Table 2.** Description of the databases created.

| Data description | Pooled Cross-section | Panel |
|---|---|---|
| **Unit of analysis** | Student´s database | Schools´ database |
| **Each observation identifies** | Indiv i<br>School j<br>Year t | School j<br>Year t |
| **Characteristics** | **Student characteristics** | **School composition** |
| | Family Income | Average Income |
| | Parent´s education level | Average Parent´s education |
| | Test Scores | Average Test scores |
| | Priority Student (D) | Proportion of poor kids |
| | Prob.being a priority stud | School participate on SEP (D) |

## c. Research questions

The main objective of this project is to analyze the evolution of the school composition. In particular, the idea is to analyze whether SEP is providing enough incentives to change the high school segregation pattern in Chile. In that sense, I am going to focus on analyzing the extent to which vulnerable students are more integrated with students with higher socioeconomic characteristics after the implementation of SEP. In order to do that I aim to explore two basic approaches:

(i) Analyzing the evolution of some school attributes over time for students from different socioeconomic background. Using the student´s pooled cross section data and based on a comparable measure of student, I analyze the extent to which SEP can be associated to a decrease or an increase on socioeconomic school segregation. With the available data, I can analyze the evolution of the school socioeconomic composition for student from different SE quintiles. This analysis may broadly inform the extent to which SEP reform has promoted a greater integration of vulnerable students within the education system.

(ii) Analyzing the impact of SEP school participation on school composition. The mere description of the evolution of school composition cannot directly inform about the effect of SEP on the school system. Using specific identification strategies to determine the effect of SEP reform on school composition, I aim to show the extent to which school SEP participation has led to changes on school socioeconomic composition. Particularly, I proposed a school fixed-effects model using the school panel data. I test for the mean effect of SEP and I have included different model specifications to analyze heterogeneous school´s responses and its dynamics over time.

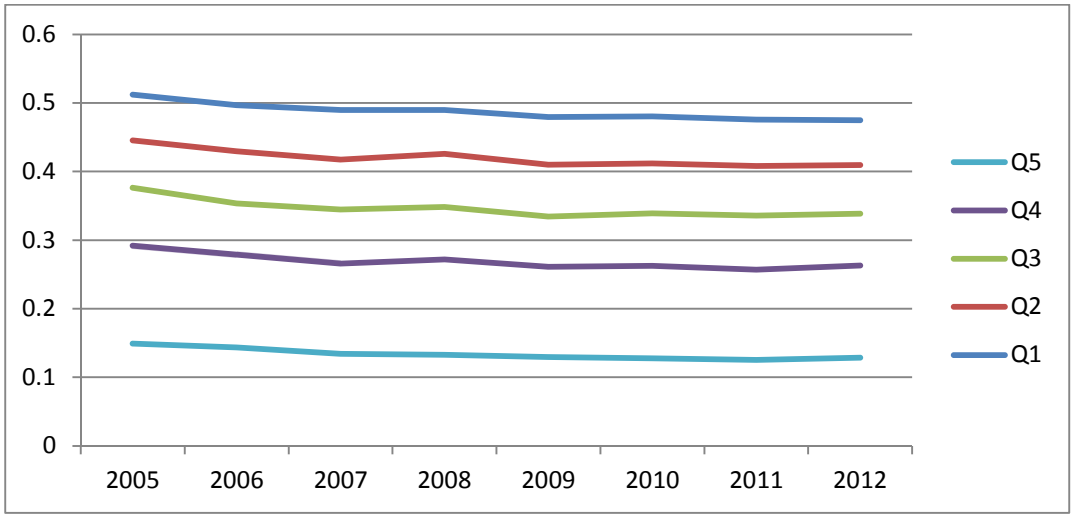
## 4. Research Methods and Results

A first attempt to assess how SEP has affected the allocation of priority students within the school system may be analyzing the evolution of the school socioeconomic composition for students from different backgrounds. Comparing the level of integration of priority student before and after the reform may be an interesting starting point to analyze whether SEP can be associated with a change in some observable trends.

Considering the available data, it is not possible to clearly identify the students that would have been characterized as priority students before SEP reform took place in 2008. Nevertheless, a reasonable strategy to deal with the issue of comparability is analyzing the level of integration of students from low socioeconomic background based on the same measure for both periods. I run a Probit model that calculates, for the years that SEP has been in place (2008-2012), the probability of being a priority student based on a set of observable characteristics that are available in the data before and after SEP took place. Based on those observable student characteristics I estimated for each student him or her predicted probability of being a priority student[10].

Then, for every year I created quintiles of socioeconomic backgrounds based on the student probability of being a priority student. Therefore, for every student-year observation I identify the quintile to which he or she belongs to. Based on that information I will present a set of graphs that aim to compare the extent to which SEP has led to a greater socioeconomic integration across the school system.

**Figure 3.** Evolution of the school´s average of the "probability of being a priority student" by student quintiles



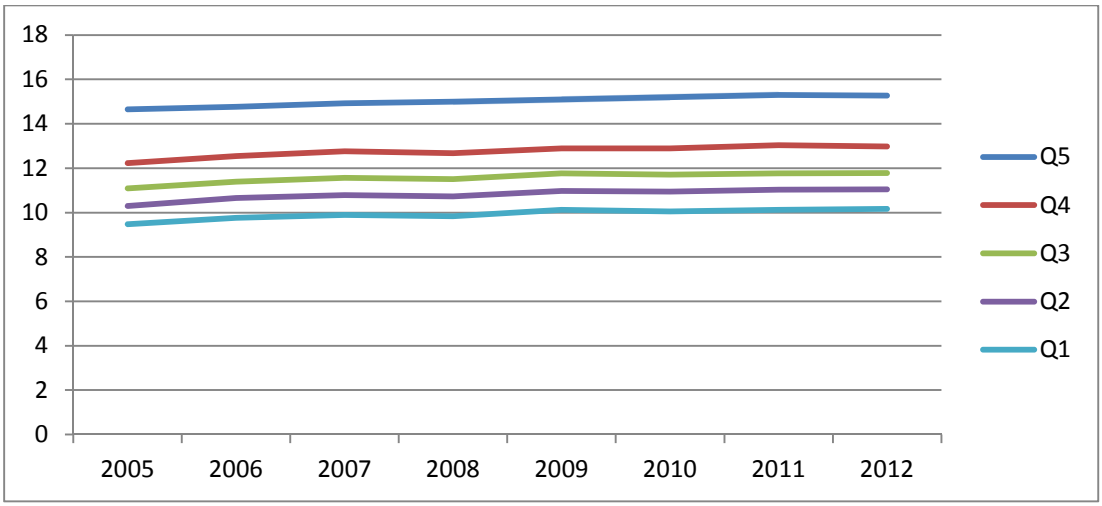

Source: Own Elaboration based on data from MINEDUC, Agencia de Calidad (SIMCE) &SEP.

[10] More details of the Probit model can be found in the Appendix Sections 7.2 and 7.3.

Figure 3 represents a way to characterize the socioeconomic segregation of the Chilean school system. In a broad sense, it shows that students attend schools with other students that have similar socioeconomic backgrounds, and that that tendency has been stable over time[11]. Each trajectory represents the socioeconomic composition of the schools which students from different quintiles attend to. A way to interpret each trajectory is saying that, over time, students from the first quintile attend to a school where students have, on average, a probability of being a priority student of 0.5. Similarly, the classmates of students from the "richest" quintile have, on average, a probability of being a priority student around 0.15. Therefore, based on Figure 3 and the observed gap between different quintile trajectories, you can argue that the segregation in terms of the school composition of student from different socioeconomic backgrounds has remained pretty stable over this period.

A similar conclusion can be extracted[12] from the Figure 4.

**Figure 4**. Evolution of the school ´s average of "student´s mother education (years of education)" by student quintiles




Source: Own Elaboration based on data from MINEDUC, Agencia de Calidad &SEP.

Figure 4 represents another comparable measure of the evolution of class composition[13]. In this case, we can see even clearer that over time the school composition of student from different socioeconomic backgrounds has remained pretty stable. This result is consistent with Valenzuela (2012) who based on the evolution of the Duncan Index over time argues that SEP has been not sufficient to reduce school

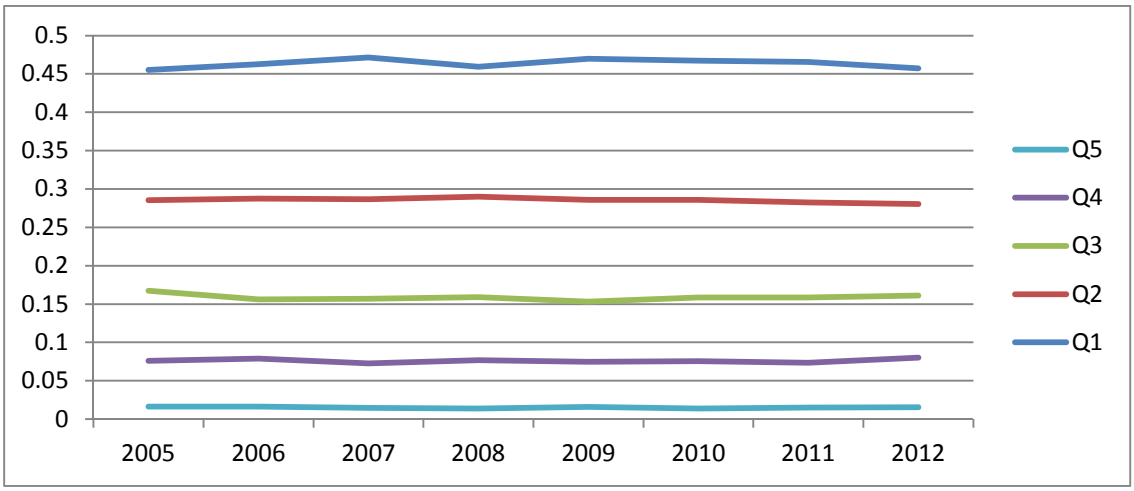
[11] The decreasing trajectory can be explained for the way that the probability of being a priority student has been estimated. As you can see in the appendix 7.2 one of the main explanatory variables are father and mother´ schooling which increases over time. By construction, the school´s average of being a priority student is a variable that slightly decreases over time in the sample. Therefore, as I will show ahead, a better comparable measure of school composition over time is the school proportion of "priority students" -measured as the bottom 20 or 40% of student in terms of the probability of being a priority student.

[12] In the appendix 7.4 you can see the same evolution using school average student´s father education.

[13] A similar figure considering as "priority" students that belong to the bottom 40% in the distribution of the probability of being a priority student can be seen in the appendix 7.5.

segregation. In other words, it seems that the segregation pattern of the school system has remained high and stable over time.

**Figure 5**. Evolution of the school proportion of "priority students" (bottom 20%) by student quintiles.



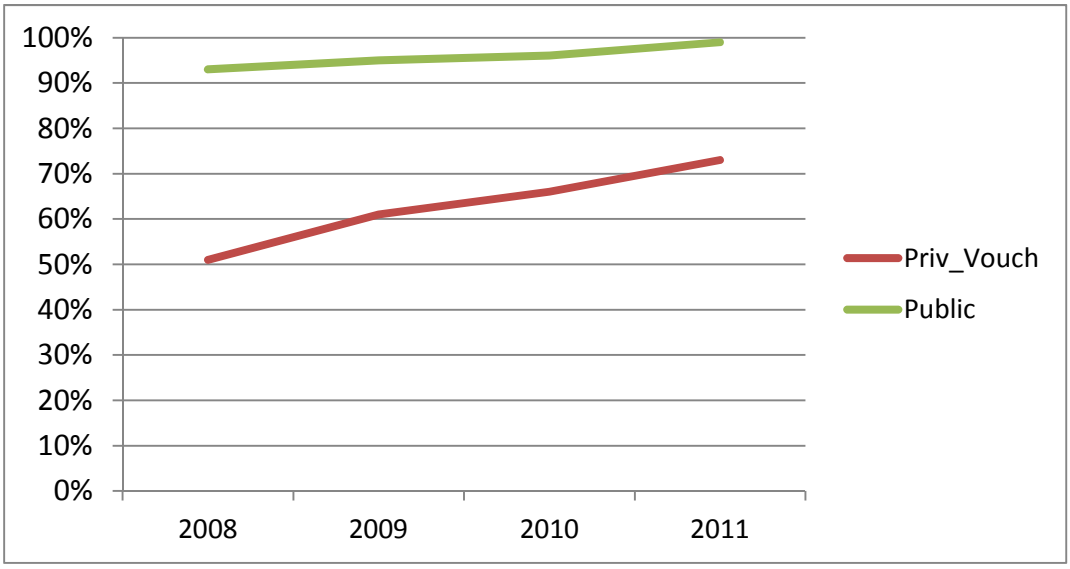

Source: Own Elaboration based on data from MINEDUC, Agencia de Calidad &SEP.

Tentatively, based on Figure 5, it can be argued that SEP reform has not affected the student class composition. However that observed stable gap between different quintile trajectories should not necessarily imply that SEP has had no effect on school composition. The key issue is about the counterfactual that we are using to compare the effect of SEP. We know that just analyzing the differences before and after the reform does not necessarily offer enough evidence about the effect of a socioeconomic differentiated voucher on the school system. Perhaps, if the reform would not have taken place in 2008 the gap between different quintile trajectories would have widened or narrowed.

The main problem about the effect of SEP is that we cannot clearly observe what would have happened with the evolution of the school´s socioeconomic composition in the Chilean education system in the case that SEP reform would not have taken place. A precise identification strategy would require the comparison to another "same Chilean school system" except for the SEP implementation, but that possibility is clearly not feasible. However, we can define a strategy that may allow us to analyze the effect of SEP on school composition. The challenge is to find comparable groups that have or not participated on SEP over time. In other words, we can find a question that is related to the main issue of this article but is testable using the available observational data. In that sense we may ask about the extent to which SEP has increased (or reduced) the proportion of priority student to those schools that are been affiliating to SEP over time. The majority of public schools decided to participate on SEP in the first year, so it would be hard to find a comparable group for them. However, only 50% of private-voucher schools decided to participate in the program in the first year which may offer a natural comparison group that approximates to the scenario of not having affiliated to SEP for the same period of analysis.

Figure 6 describes the evolution of school SEP affiliation for different school types.

**Figure 6**. Evolution of school participation on SEP by school type.




Looking at the private-voucher school´s evolution, I suggest a school fixed-effect model to analyze the effect of school SEP participation on its socioeconomic. The main description of the model is the following:

$$Prop.Prio.St_{jt} = \alpha + \beta\overrightarrow{X_{jt}} + \gamma SEP_{jt-k} + School_j + year_t + \varepsilon_{jt}$$

In this model the dependent variable is the proportion of "priority student" of a school j in the year t. Using different model specifications[14] we can test the effect of being affiliated to SEP on our dependent variable for the same year and the year before (t-1). The model also specifies a fixed-effect for each school based on the idea that there are some non-observable factors that may affect the school´s SE composition. For our estimation purposes, we will assume that those factors do not change over time and the main effect is being captured by SEP. Besides, there is a dummy variable that identifies whether the observation belongs to the year t or not (year effect) which may allow us to control for any national trend that may have affected school composition. Finally, the model is open to different specification of $X_{jt}$ which is a vector of observed characteristics for a school j in the year t, and a non-observable zero mean error term for each year t and school j.

[14] Based on a similar strategy, Mizala & Torche (2013) estimated the effect of SEP reform on test scores. As a part of this project I replicated that model finding very similar results on test scores for urban schools in Santiago. Those results indicate that SEP seems to have a positive significant effect on student Spanish and Math test scores. However, they do not specify the mechanisms through which test scores has increased since SEP may have led to better results based on at least two different ways: (i) more economic resources for schools may increase their performance on student learning but also (ii) throughout changing the student composition of those schools. This is an interesting issue to be analyzed further since if SEP may have led to a higher concentration of vulnerable students on SEP schools it can be argued that the findings of Mizala & Torche (2013) might even underestimate the effect of SEP on test scores.

Table 3 shows the results for different model specifications using as dependent variable the school proportion of vulnerable students measured as the student bottom 20% on the distribution of the probability of being a priority student. I also used another measure of school socioeconomic composition based on the proportion of students from bottom 20% on the mother´s education distribution[15] and the results can be interpreted in the same way. In addition, similar results can be found in the appendix 7.6 using the proportion of student from the bottom 40% as dependent variable.

**Table 3.** Effect of school SEP participation on school socioeconomic composition (student proportion from the bottom 20%)

| Model | Prob.Being.Priorit | Prob.Being.Priorit | Motheduc | Motheduc |
|---|---|---|---|---|
| SEP (t) (D) | 0.012 | | 0.015 | |
| | (3.02)** | | (3.48)** | |
| SEP (t-1) (D) | | 0.011 | | 0.013 |
| | | (2.59)** | | (2.85)** |
| 2006.Year | 0 | 0 | -0.009 | -0.009 |
| | (0.03) | (0.11) | (2.19)* | (2.10)* |
| 2007.Year | 0.011 | 0.011 | -0.015 | -0.015 |
| | (1.89) | (1.92) | (2.53)* | (2.52)* |
| 2008.Year | 0.007 | 0.012 | -0.019 | -0.013 |
| | (1.89) | (3.15)** | (4.42)** | (3.07)** |
| 2009.Year | 0.022 | 0.023 | 0.018 | 0.02 |
| | (5.69)** | (5.86)** | (4.03)** | (4.56)** |
| 2010.Year | 0.018 | 0.019 | 0.012 | 0.014 |
| | (4.64)** | (4.68)** | (2.83)** | (3.18)** |
| 2011.Year | 0.024 | 0.025 | 0.013 | 0.015 |
| | (5.80)** | (6.30)** | (2.83)** | (3.28)** |
| 2012.Year | 0.023 | 0.025 | 0.014 | 0.017 |
| | (5.54)** | (5.83)** | (3.10)** | (3.62)** |
| Constant | 0.16 | 0.16 | 0.177 | 0.177 |
| | (59.11)** | (59.23)** | (60.88)** | (61.01)** |
| Observations | 7386 | 7253 | 7389 | 7256 |
| Number of Schools | 1088 | 1069 | 1088 | 1069 |
| R-squared | 0.03 | 0.03 | 0.04 | 0.04 |

Robust t statistics in parentheses

* significant at 5%; ** significant at 1%

[15] Creating a comparable measure over time based on mother´s education was not as simple as it sounds. The problem is that, over time, different cohorts in 4th grade have been increasing mother´s education level. In order to deal with this "inflation" trend, and the large proportion of students on some specific school level, I decided to compare a proxy of the bottom 20% as it follows. For the cohorts in 4th grade prior to the reform I consider as "vulnerable student" those whose mother´s primary education level was incomplete (aka less than 8th grade) which considers around 19% and 21% of students. Then for cohorts after 2008 I characterized as "vulnerable student" those whose mother reach less than 9th grade which varies between 18% to 22% for those cohorts.

Table 3 shows that School SEP participation has increased the likelihood of receiving a priority student. However, in terms of the size of the effect it can be argued that SEP reform has led to a very modest effect on school composition. Table 1 shows that approximately the effect of participating on SEP has increased from 1 to 1.5 percentage points the proportion of vulnerable students for those schools – which, on average, is 23% for students that belong to the bottom 20% of the student distribution, and around 44% for students that belong to the bottom 40% in the student distribution.

An interesting variation of the previous model can be to analyze whether the effect of SEP is different for different previous school´s socioeconomic composition. I test for heterogeneous school responses based on the following school fixed-effect model specification:

$$Y_{jt} = \alpha + \gamma\overrightarrow{X_{jt}} + \theta i * SEP_{jt-k} + \sum_{i=1}^{5} \delta * Q_i \quad + \sum_{i=1}^{5} \beta i(SEP_{jt-k} * Qi) \quad + School_j + year_t + \varepsilon_{jt}$$

where $Y_{jt}$ represents the proportion of vulnerable students (either from the bottom 20% or 40%) of the school j in the year t. The results for this model are described in the Table 4.

**Table 4.** School heterogeneous effect of SEP participation on school socioeconomic composition (student proportion from the bottom 20% and 40%)

| | scho_prop_bot20 | scho_prop_bot40 |
|---|---|---|
| 2006.Year | 0 | 0.013 |
| | (0.02) | (2.84)** |
| 2007.Year | 0.011 | 0.044 |
| | (2.02)* | (6.61)** |
| 2008.Year | 0.007 | 0.029 |
| | (2.03)* | (5.94)** |
| 2009.Year | 0.022 | 0.048 |
| | (6.14)** | (9.35)** |
| 2010.Year | 0.018 | 0.04 |
| | (4.95)** | (7.91)** |
| 2011.Year | 0.024 | 0.056 |
| | (6.24)** | (10.65)** |
| 2012.Year | 0.023 | 0.053 |
| | (6.00)** | (9.84)** |
| Q1*SEP (t) | 0.007 | 0.006 |
| | (0.6) | -0.47 |
| Q2*SEP (t) | 0.003 | 0.015 |
| | (0.7) | -1.93 |
| Q3*SEP (t) | 0.013 | 0.028 |
| | (2.79)** | (3.75)** |
| Q4*SEP (t) | 0.033 | 0.034 |
| | (4.94)** | (3.77)** |
| Q5*SEP (t) | -0.001 | -0.022 |
| | (0.11) | (3.14)** |
| Constant | 0.16 | 0.35 |
| | (64.48)** | (102.56)** |
| Observations | 7386 | 7386 |
| Number of schools | 1088 | 1088 |
| R-squared | 0.03 | 0.06 |

Robust t statistics in parentheses

* significant at 5%; ** significant at 1%

Table 4 shows that school´s responses to SEP participation are different according the previous school´s SE composition[16]. For this model specification I created schools quintiles according to their average proportion of vulnerable students in the years prior to SEP. The interactive coefficient terms in the model shows that SEP impact on school´s composition has been positive for an important group of

[16] Another model specification (incorporating to SEP in the previous year) can be found in the appendix 7.7, though the results can be interpreted in a similar way.

schools. The largest and most significant effect has been for schools that belong to the quintiles 3 and 4. The effect of SEP for these schools is also larger in magnitude compared to what we found in the first model. For these schools, SEP is increasing the proportion of vulnerable students between 1 and 3 percentage points. On the other hand, for the schools that prior to SEP had the smallest proportion of vulnerable students (quintiles 1 and 2) SEP has had a positive but not significant impact. This result raises the fact that SEP has had a little impact on school´s composition since it seems to have no effect in the most selective schools. Finally, it is interesting to notice that schools with the highest concentration of vulnerable students (quintile 5) have had a negative and sometimes significant effect of SEP (considering the model that uses the proportion of students from the bottom 40% as the dependent variable). This heterogeneous effect can be interpreted as evidence of a small "composition effect" associated to SEP since while it provides little incentives to include more vulnerable students in the most selective schools, at the same time, is providing less incentives to increase the concentration of vulnerable students to the least selective schools. Overall, the results of this model suggest that at least in terms of the direction of the effect, SEP has provided some (though still very little) incentives in a way that might increase the level of integration of vulnerable students within the school system.

The results of the previous models show a slightly but sometimes significant impact on the proportion of vulnerable students associated to school SEP participation. In this case we have been comparing. A more detailed look at the dynamics of the effects on school socioeconomic composition associated to SEP can be provided using an event-study model. Following Kline (2012) and McCrary (2007) I estimate the following econometric model:

$$Prop.Prio.St_{jy} = \sum_{t} \beta_t \, D^{t}_{y,\ School} + School_j + year_y + \varepsilon_{jy}$$

where the dependent variable is the school proportion of vulnerable students in the school j in calendar year y, $School_j$ is a school-effect, $Year_y$ is a year-effect and $\varepsilon_{jy}$ is an error term. The $D^{t}_{y,\ School}$ variables are a series of "event time" dummies that equal one when the school j participation to SEP is t periods away in a school and it can formally be defined by:

$$D^{t}_{SEP,\ j} \equiv I\left[y - SEP_j = t\right]$$

where I is an indicator function for the expression bracket being true and $SEP_j$ is the year that the school j started to participate to SEP. As the βs are perfectly correlated I decided to normalize $\beta_{-1} = 0$ which could allow us the see the effect of the program in the first year of implementation (t=0).

A slightly different application of this research strategy which considers "school test scores" in lieu of school socioeconomic composition may allow us to also confirm the results of Mizala & Torche (2013). Mizala & Torche (2013) also estimate a specific school-fixed effects model but different in terms of years specification and using the national school sample. They find that over time SEP has had an increasing positive effect over time on test scores. The Figure 7 shows for the case of schools in Santiago that SEP has had also a positive and increasing significant effect on test scores.

**Figure 7.** Event-Study Model of SEP effect on test scores (Math-SIMCE)

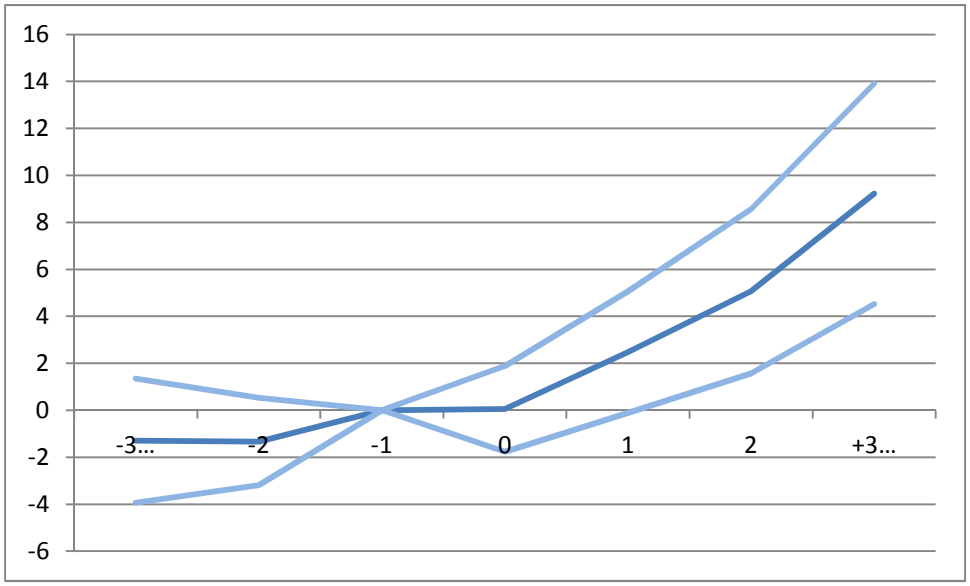
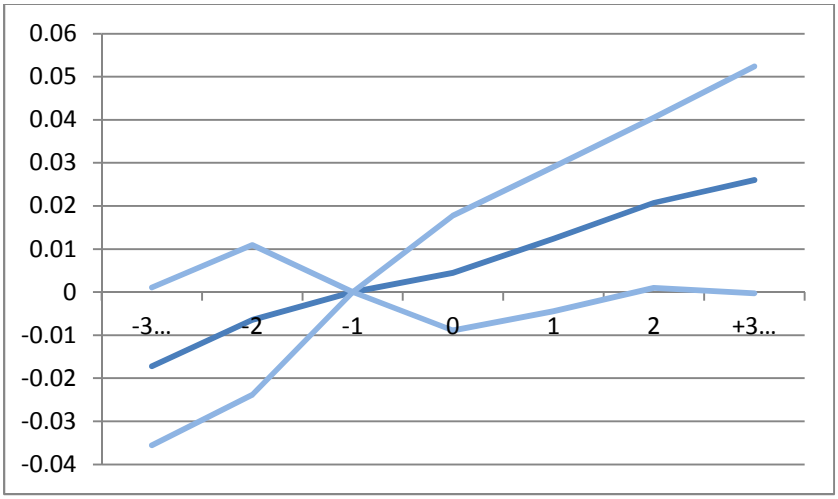



Figure 7 shows the average values (blue line) of the coefficients of βs for the event-study model, and the light-blue line represents the confidence interval for each estimated β. As you can see in Figure 7, SEP has had, on average, an increase positive effect on test scores. A similar pattern can be seen in terms of Spanish test scores in appendix 7.8.

In the case of the school composition the results of this model are presented in Figure 8.

**Figure 8.** Event-Study Model of SEP effect on school composition




Although in this case there is a growing trend of increasing the proportion of vulnerable students (bottom 20%) for the schools that decided to participate on SEP -and also that this effect seems to be growing over time (statistically different to zero after the second year of SEP participation), the results in

Figure 8 do not allow us to prove that SEP have had a strong effect on school composition[17]. As you can see, there is not completely clear that the same trend could have already existed before SEP since βs seem to become more significant different to zero as you move away before the implementation of the reform (t=-3 and before). A possible explanation for that result is related to a selection in the trend that the event-study model shows in terms of the βs prior to SEP (t=0). In an event-study model, the condition for not preceded trend states that $\beta_t = 0$ to every $t < 0$, which would mean that the policy is not, on average, preceded by trends on school specific student compositions. That condition does not hold in this case. Perhaps, schools that have decided to participate on SEP (and even those that participate earlier) are the ones that for some specific reason where willing to accept more vulnerable students even in the scenario where SEP would not have taken place[18].

In the next section I will try to put all these findings in a common perspective as well as providing some policy recommendations that might be explored of being implemented and considered for future research.

[17] In the appendix 7.10 you can see the results. For the case of using proportion of vulnerable students (bottom 40%) as dependent variable the trend is pretty stable around zero.

[18] Indeed, Acevedo & Valenzuela (2013), based on a probit model of school decision to participate on SEP, find a lot of heterogeneity on school participation. Among the main factors that explain that pattern are admission rules and copayment prices that schools set. That result can be interpreted as school facing a trade-off decision between receiving the benefits of SEP and keeping their own rules of admission and copayment to their students.

## 5. Final Discussion

The main finding of this project is that SEP reform seems to have had a significant and positive effect on reducing the student socioeconomic achievement gap, however, at the same time, it has not provided enough incentives to reduce high socioeconomically segregated pattern of the Chilean school system. I have provided several analyses to support that claim. First, based on a large student´s database (pooled cross-section data) I showed that the socioeconomic pattern of school segregation has remained high and pretty stable after SEP was implemented. Moreover, based on a school fixed-effects model to test the degree to which SEP has provided incentives to schools to incorporate more vulnerable students, I found that, on average, SEP has increased the proportion of vulnerable students in only 1 percentage points. I also test for heterogeneous school´s responses based on their previous composition which seems to indicate that SEP has provided some incentives that might reduce school segregation, but in just a modest amount. In particular, I found no significant effect in the most selective schools (quintiles 1 and 2), a small significant and positive effect in less selective schools (quintiles 3 and 4), and a negative and (sometimes) no significant effect in those schools that previously had the highest concentration of vulnerable students (quintile 5). However, there is no clear evidence that this modest effect of SEP on school composition were not a part of a previous trend that schools were experiencing before SEP. I run an event-study model to look in more detail the dynamics effects of SEP over time, and I found that it is not possible to reject the fact that schools could have experienced a process of incorporating more vulnerable students prior to SEP participation. Finally, in terms of the academic gap reduction, and probably due to its recent implementation, it remains unclear what exactly would explain such a rapid reduction. What is really driving the change on student socioeconomic achievement gap? Is it just a consequence of giving more resources to vulnerable schools?[19] The question about the mechanisms that are driving these changes should be a challenge for future research.

In a sense, these findings are consistent with what Ladd & Fiske (2009) concluded for the Dutch case. With regard to a similar school finance mechanism as the weighted student funding (WSF), they argue that it "promotes, but does not assure, equal quality of education in all schools"[20]. In particular, they show that after 30 years of implementation of the WSF they found no evidence of impact on segregation suggesting that "even a funding system with high weights is not likely to reduce school segregation" (Ladd & Fiske, 2010, p.2).

In terms of policy recommendations an interesting path that the Chilean system may implement is indeed presented by Ladd & Fiske (2011). They argue that financial resources may not be sufficient to meet the needs of disadvantaged students. According to them, the Dutch do not expect schools "by themselves to be able to close achievement gaps or to meet other needs of disadvantaged children" (Ladd & Fiske, 2009, p.5). In fact, the Dutch have claimed a *multi-pronged approach* to address this issue. In Chile, there is a lot of room to think on other than school finance reforms to increase student

[19] Mizala & Torche (2013) includes a variable that specifies the fulfillment of a so called "improvement educative plan" (PME, "Plan de Mejoramiento Educativo" in Spanish) which is mandatory to SEP schools, however there is still unclear what specific factor may explain the improvement on performance.
[20] Ladd & Fiske (2010, p.9).

socioeconomic integration and even without affecting the general performance of the system. A possible policy innovation which is also gaining political support is the elimination of the copayment system. A phase-out of the copayment system could eliminate, at least nominally, an important economic barrier that is associated to the social segmentation of the system (Valenzuela et al, 2013). Similarly, a more rigorous control of the selection admission practices is needed. Some scholars have shown that in spite of the fact that after the implementation of SEP it is established a sort of "double prohibition" of selection practices, many schools are still using different mechanisms in the admission process as parental interviews or student tests (Carrasco, 2014)[21]. In that sense it is necessary to explore the design of new admission mechanisms that may ensure non-discrimination of the less advantageous students[22].

In addition, another policy recommendation that can be considered is the expansion of SEP to all schools which also means to eliminate an important economic barrier for vulnerable students to attend the most selective schools –expanding it at least those schools that receive public funds. Although SEP has provided little incentives for vulnerable students to attend more selective schools, it is expected that this effect may increase if the most selective schools, which are still not participating to SEP, were automatically enrolled on it. The gradual elimination of the copayment system along with the mandatory expansion of SEP to all schools may provide more incentives to integrate vulnerable students in most selective schools, and as a result, the high segregation pattern might be reduced. In any case, such a measure should address a crucial underlying process of the Chilean school system evolution which has to do with a massive migration of students from public to private-voucher schools. This is an issue that it has not been deeply discussed here, but it should certainly be taken into account. In terms of school composition, public schools have shown to be more socioeconomically diverse (Valenzuela et al, 2013) and the ones that are less likely to adopt any mechanism to select students (Carrasco, 2014; Contreras et al, 2010). As I highlighted before there is strong evidence that public schools, on average and after controlling for student socioeconomic characteristics, do not necessarily offer a lower quality education than private-voucher schools, but nonetheless they have experienced a large process of enrollment rate reduction since the voucher system started in the early 1980s. In that sense, another important research for policy innovation must analyze how to strengthen public education and how to make it more attractive to parent´s decisions.

Finally, it is important to recognize that the process that started with SEP is continued being implemented, and schools are still in the middle of a learning process on how to response to the new duties and incentives that SEP requires and promotes, respectively. Similarly, families might be still

[21] In particular, Carrasco (2014) shows that indeed it exists an ambiguity in the General Education Law (LGE) that may affect law enforcement; while article 12 prohibits any source of discrimination in the selection process, the article 13 states that any selection procedure should be transparent and communicate in advance to parents.

[22] As in other countries it can be explored the implementation of independent local agencies responsible of the selection admission process that, based in more fair and transparent criteria, allocate students to schools according to their parent´s preferences. Another possibility is to implement random selection process for the cases where the demand surpasses the local supply. A good report that reviews the implementation of some student assignment mechanisms in US cities can be found in Abdulkadiroglu, A., & Sonmez, T. (2003) and Abdulkadiroglu, A., Pathak, P., Roth, A. E., & Sonmez, T. (2006).

looking to adopt their strategies in order to take the most advantages of this new finance incentive, so perhaps we are still not able to see the whole effects of the reform, and indeed, we need more time to see whether SEP is providing enough incentives to change the high socioeconomic pattern of the Chilean school system. At least until now this report has shown that while SEP is reducing the student socioeconomic academic gap, more efforts are needed to have a more integrated school system.

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# 7. Appendix

### 7.1. Descriptive Statistics by School Type over time

| School Type/ Charact. | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|
| **Public** | | | | | | | | |
| Mother´s Educ | 9.490225 | 9.72252 | 9.897416 | 9.750384 | 9.962309 | 9.93372 | 10.00055 | 9.990258 |
| Family Income | 169926 | 192196 | 214197 | 214295 | 230204 | 244399 | 241284 | 252501 |
| Prop. Priority Stud | | | | 0.39 | 0.62 | 0.58 | 0.56 | 0.57 |
| Prop. SEP Stud | | | | 0.38 | 0.61 | 0.57 | 0.56 | 0.57 |
| **Private** | | | | | | | | |
| Mother´s Educ | 15.88119 | 16.0727 | 16.07746 | 16.16561 | 16.19726 | 16.16424 | 16.27765 | 16.37598 |
| Family Income | 1375638 | 1454001 | 1455388 | 1527628 | 1723498 | 1732573 | 1788478 | 1871231 |
| Prop. Priority Stud | | | | 0.00 | 0.03 | 0.04 | 0.03 | 0.03 |
| Prop. SEP Stud | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Private Voucher** | | | | | | | | |
| Mother´s Educ | 11.68113 | 11.946 | 12.09583 | 11.9457 | 12.02259 | 12.02637 | 11.9895 | 12.04964 |
| Family Income | 322731 | 356882 | 375778 | 381700 | 400129 | 425210 | 417269 | 444945 |
| Prop. Priority Stud | | | | 0.17 | 0.40 | 0.38 | 0.39 | 0.40 |
| Prop. SEP Stu | | | | 0.10 | 0.23 | 0.24 | 0.27 | 0.30 |

**7.2. Probit Model: Probability of being a priority Student.**

| | Prioritary Stud | Prioritary Stud | Prioritary Stud | Prioritary Stud |
|---|---|---|---|---|
| Father Schooling (years) | -0.069 | -0.08 | -0.075 | -0.063 |
| | (31.01)** | (33.36)** | (49.41)** | (46.92)** |
| Mother Schooling (years) | -0.092 | -0.099 | -0.092 | -0.082 |
| | (38.13)** | (39.27)** | (59.38)** | (58.16)** |
| Mother completed High School (D) | 0.138 | 0.16 | | |
| | (11.64)** | (12.88)** | | |
| Mother completed College (D) | 0.113 | 0.097 | | |
| | (5.35)** | (4.49)** | | |
| Father completed High School (D) | 0.106 | 0.145 | | |
| | (8.74)** | (11.03)** | | |
| Father completed College (D) | 0.063 | 0.074 | | |
| | (3.10)** | (3.45)** | | |
| c1 (D) | -0.035 | | | -0.003 |
| | (0.05) | | | (0) |
| c2 (D) | -0.026 | | | 0.016 |
| | (0.04) | | | (0.02) |
| c3 (D) | 0.374 | | | 0.427 |
| | (0.52) | | | (0.57) |
| c4 (D) | 0.036 | | | 0.087 |
| | (0.05) | | | (0.12) |
| c5 (D) | 0.244 | | | 0.293 |
| | (0.34) | | | (0.39) |
| c6 (D) | 0.076 | | | 0.121 |
| | (0.1) | | | (0.16) |
| c7 (D) | -0.126 | | | -0.091 |
| | (0.17) | | | (0.12) |
| c8 (D) | 0.021 | | | 0.065 |
| | (0.03) | | | (0.09) |
| c9 (D) | 0.081 | | | 0.12 |
| | (0.11) | | | (0.16) |
| c10 (D) | -0.08 | | | 0.043 |
| | (0.11) | | | (0.06) |
| c11 (D) | 0.362 | | | 0.413 |
| | (0.5) | | | (0.55) |
| c12 (D) | 0.306 | | | 0.354 |
| | (0.42) | | | (0.47) |
| c13 (D) | -0.482 | | | -0.465 |
| | (0.66) | | | (0.62) |
| c14 (D) | -0.749 | | | -0.752 |

| | | |
|---|---|---|
| | (1.03) | (1) |
| c15 (D) | -0.534 | -0.524 |
| | (0.73) | (0.69) |
| c16 (D) | 0.336 | 0.388 |
| | (0.46) | (0.52) |
| c17 (D) | 0.172 | 0.223 |
| | (0.24) | (0.3) |
| c18 (D) | 0.141 | 0.178 |
| | (0.19) | (0.24) |
| c19 (D) | -0.27 | -0.225 |
| | (0.37) | (0.3) |
| c20 (D) | -0.256 | -0.247 |
| | (0.35) | (0.33) |
| c21 (D) | 0.213 | 0.264 |
| | (0.29) | (0.35) |
| c22 (D) | 0.137 | 0.172 |
| | (0.19) | (0.23) |
| c23 (D) | -0.512 | -0.519 |
| | (0.7) | (0.69) |
| c24 (D) | 0.071 | 0.12 |
| | (0.1) | (0.16) |
| c25 (D) | -0.04 | 0.006 |
| | (0.05) | (0.01) |
| c26 (D) | 0.44 | 0.488 |
| | (0.61) | (0.65) |
| c27 (D) | 0.107 | 0.155 |
| | (0.15) | (0.21) |
| c28 (D) | 0.259 | 0.309 |
| | (0.36) | (0.41) |
| c29 (D) | 0.416 | 0.465 |
| | (0.57) | (0.62) |
| c30 (D) | 0.083 | 0.111 |
| | (0.11) | (0.15) |
| c31 (D) | 0.359 | 0.409 |
| | (0.5) | (0.55) |
| c32 (D) | -0.898 | -0.92 |
| | (1.23) | (1.21) |
| c33 (D) | -0.046 | 0.002 |
| | (0.06) | (0) |
| c34 (D) | -0.186 | -0.152 |
| | (0.26) | (0.2) |
| c35 (D) | 0.023 | 0.064 |
| | (0.03) | (0.08) |

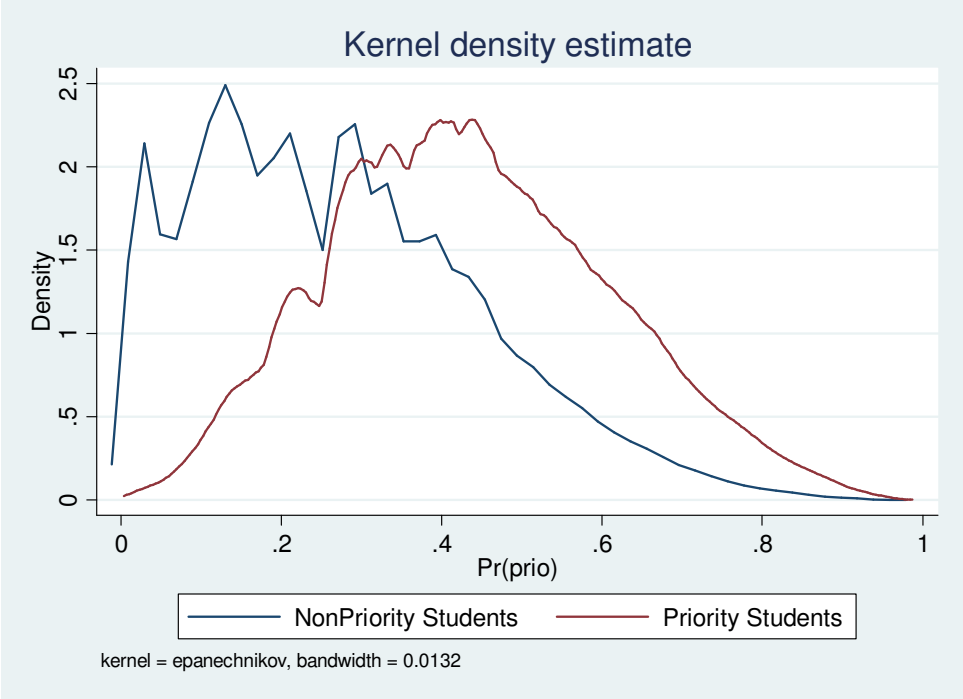
| | | | | |
|---|---|---|---|---|
| c36 (D) | 0.193 | | | 0.217 |
| | (0.27) | | | (0.29) |
| c37 (D) | 0.088 | | | 0.124 |
| | (0.12) | | | (0.16) |
| c38 (D) | 0.46 | | | 0.499 |
| | (0.63) | | | (0.66) |
| c39 (D) | 0.242 | | | 0.286 |
| | (0.33) | | | (0.38) |
| c40 (D) | -0.006 | | | 0.028 |
| | (0.01) | | | (0.04) |
| c41 (D) | -0.305 | | | -0.279 |
| | (0.42) | | | (0.37) |
| c42 (D) | 0.353 | | | 0.386 |
| | (0.49) | | | (0.51) |
| c43 (D) | 0.174 | | | 0.209 |
| | (0.24) | | | (0.28) |
| c44 (D) | 0.271 | | | 0.3 |
| | (0.37) | | | (0.4) |
| c45 (D) | 0.236 | | | 0.275 |
| | (0.33) | | | (0.37) |
| c46 (D) | 1.116 | | | 1.146 |
| | (1.53) | | | (1.52) |
| c47 (D) | 0.968 | | | 0.994 |
| | (1.32) | | | (1.31) |
| c48 (D) | 0.082 | | | 0.122 |
| | (0.11) | | | (0.16 |
| c49 (D) | 0.094 | | | 0.133 |
| | (0.13) | | | (0.18) |
| c50 (D) | -0.044 | | | -0.005 |
| | (0.06) | | | (0.01) |
| c51 (D) | 0.024 | | | 0.072 |
| | (0.03) | | | (0.1) |
| c52 (D) | -0.002 | | | 0.046 |
| | (0) | | | (0.06) |
| Constant | 1.215 | 1.447 | 1.515 | 1.178 |
| | -1.68 | (54.35)** | (54.74)** | -1.57 |
| Observations | 367,941 | 367,941 | 367,941 | 367,941 |
| Pseudo R-squared | 0.14 | 0.12 | 0.12 | 0.14 |

Robust z statistics in parentheses

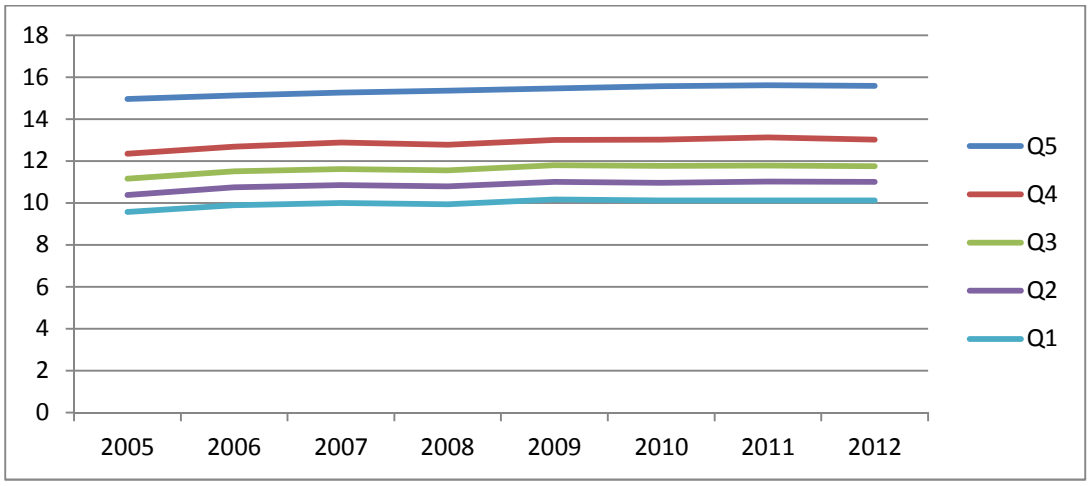
* significant at 5%; ** significant at 1%

Variables c1-c53 are municipality (D) and are jointly significant

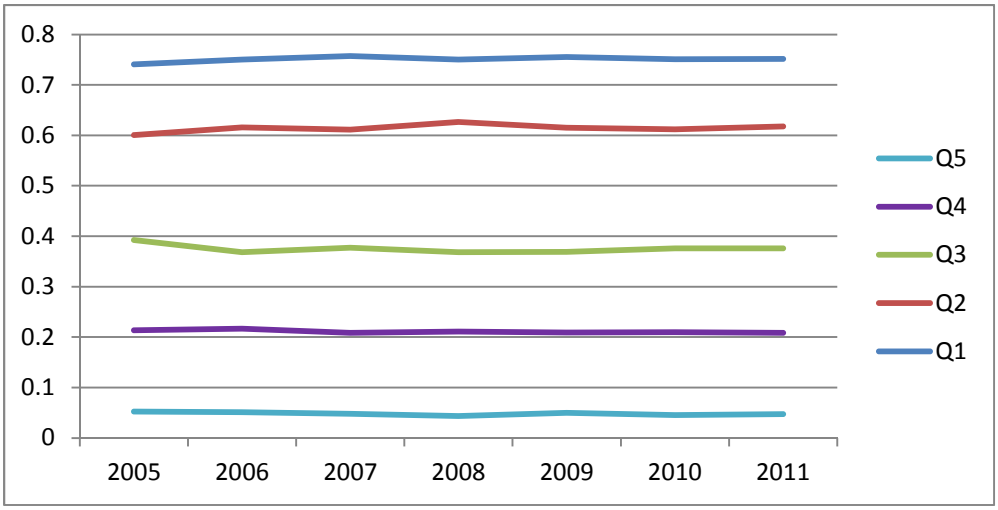
**7.3.** Kernel Distribution of the probability of being a priority student (years 2008-2012)




**7.4** Evolution of the school average of "student´s father education (years of education)" by student year-quintiles



**7.5.** Evolution of the school proportion of "priority students" (bottom 40%) by student-year quintiles.




**7.6**. Effect of school SEP participation on student class composition

| Model | scho_Prop_bot40 | scho_Prop_bot40 |
|---|---|---|
| SEP (t) (D) | 0.011 | |
| | (2.25)* | |
| SEP (t-1) (D) | | 0.005 |
| | | (1) |
| 2006.Year | 0.013 | 0.013 |
| | (2.61)** | (2.76)** |
| 2007.Year | 0.044 | 0.044 |
| | (6.17)** | (6.17)** |
| 2008.Year | 0.028 | 0.033 |
| | (5.31)** | (6.49)** |
| 2009.Year | 0.048 | 0.051 |
| | (8.58)** | (9.40)** |
| 2010.Year | 0.04 | 0.043 |
| | (7.25)** | (7.89)** |
| 2011.Year | 0.056 | 0.059 |
| | (9.80)** | (10.51)** |
| 2012.Year | 0.053 | 0.057 |
| | (9.09)** | (9.95)** |
| Constant | 0.35 | 0.35 |
| | (94.01)** | (94.21)** |
| Observations | 7386 | 7253 |
| Number of Schools | 1088 | 1069 |
| R-squared | 0.05 | 0.05 |

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

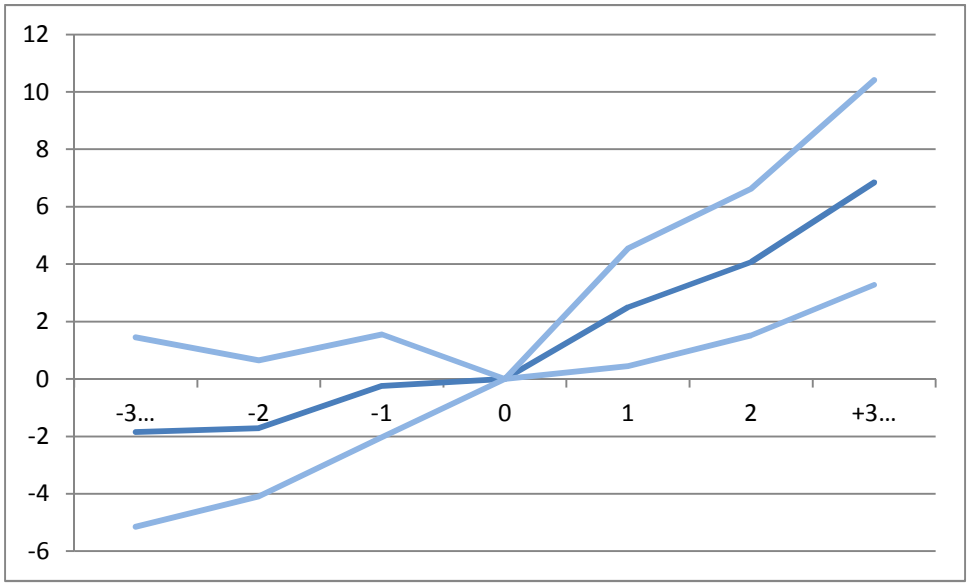
**Table 7.7.** School heterogeneous effect of SEP participation on school socioeconomic composition (student proportion from the bottom 20% and 40%)

| Model | scho_prop_bot20 | scho_prop_bot40 |
|---|---|---|
| 2006.Year | 0 | 0.013 |
| | (0.11) | (2.99)** |
| 2007.Year | 0.011 | 0.044 |
| | (2.06)* | (6.63)** |
| 2008.Year | 0.012 | 0.033 |
| | (3.41)** | (7.07)** |
| 2009.Year | 0.023 | 0.051 |
| | (6.27)** | (10.18)** |
| 2010.Year | 0.019 | 0.043 |
| | (5.02)** | (8.51)** |
| 2011.Year | 0.025 | 0.059 |
| | (6.77)** | (11.38)** |
| 2012.Year | 0.025 | 0.057 |
| | (6.31)** | (10.76)** |
| Q1*SEP (t-1) | 0.004 | -0.001 |
| | (0.48) | (0.14) |
| Q2*SEP (t-1) | 0 | 0.012 |
| | (0.04) | (1.49) |
| Q3*SEP (t-1) | 0.012 | 0.026 |
| | (2.71)** | (3.12)** |
| Q4*SEP (t-1) | 0.028 | 0.023 |
| | (3.70)** | (2.30)* |
| Q5*SEP (t-1) | 0.002 | -0.026 |
| | (0.27) | (3.87)** |
| Constant | 0.16 | 0.35 |
| | (64.76)** | (102.72)** |
| Observations | 7253 | 7253 |
| Number of Schools | 1069 | 1069 |
| R-squared | 0.03 | 0.06 |

Robust t statistics in parentheses

* significant at 5%; ** significant at 1%

**7.8.** Event-Study Model of SEP effect on test scores (Spanish-SIMCE)



**7.9** Event-Study Model of SEP effect on test scores (Spanish and Math-SIMCE)

| Model | Spanish | Math |
|---|---|---|
| t_3 and before | -1.61 | -1.291 |
| | (1.23) | (0.96) |
| t_2 | -1.479 | -1.329 |
| | (1.65) | (1.4) |
| t_0 | 0.238 | 0.061 |
| | (0.26) | (0.07) |
| t_1 | 2.735 | 2.479 |
| | (2.21)* | (1.88) |
| t_2 | 4.306 | 5.065 |
| | (2.70)** | (2.84)** |
| t_3 and after | 7.084 | 9.22 |
| | (3.23)** | (3.86)** |
| _IYear_2006 | -5.047 | -0.045 |
| | (5.34)** | (0.05) |
| _IYear_2007 | -3.859 | -2.933 |
| | (3.26)** | (2.45)* |
| _IYear_2008 | 1.049 | -3.033 |
| | (0.72) | (2.05)* |
| _IYear_2009 | -0.389 | -0.457 |
| | (0.21) | (0.24) |
| _IYear_2010 | 8.356 | -2.574 |
| | (3.80)** | (1.11) |
| _IYear_2011 | 0.896 | -1.104 |
| | (0.34) | (0.4) |
| _IYear_2012 | 0.923 | 1.416 |
| | (0.32) | (0.47) |
| Constant | 253.809 | 244.612 |
| | (174.69)** | (165.46)** |
| Observations | 4775 | 4776 |
| Number of schools | 647 | 647 |
| R-squared | 0.17 | 0.09 |

Robust t statistics in parentheses

* significant at 5%; ** significant at 1%

**7.10.** Event-Study Model of SEP effect on school composition (Prop. Student Bottom 40% and 20%)

| Model | scho_prop_bot40 | scho_prop_bot20 |
|---|---|---|
| Neg | -0.007 | -0.017 |
| | (0.56) | (1.99)* |
| t_2 | -0.004 | -0.006 |
| | (0.47) | (0.78) |
| t_1 | - | - |
| | - | - |
| t_0 | 0.002 | 0.004 |
| | (0.23) | (0.71) |
| t1 | -0.003 | 0.012 |
| | (0.33) | (1.56) |
| t2 | 0 | 0.021 |
| | (0.01) | (2.22)* |
| Pos | -0.011 | 0.026 |
| | (0.63) | (2.10)* |
| _IYear_2006 | 0.01 | -0.006 |
| | (1.28) | (0.88) |
| _IYear_2007 | 0.041 | 0.009 |
| | (3.44)** | (1.05) |
| _IYear_2008 | 0.031 | 0 |
| | (2.55)* | (0.01) |
| _IYear_2009 | 0.057 | 0.014 |
| | (3.89)** | (1.41) |
| _IYear_2010 | 0.045 | 0 |
| | (2.48)* | (0.03) |
| _IYear_2011 | 0.069 | 0.002 |
| | (3.15)** | (0.12) |
| _IYear_2012 | 0.067 | 0 |
| | (2.86)** | (0.03) |
| Constant | 0.452 | 0.23 |
| | (34.78)** | (25.28)** |
| Observations | 4617 | 4617 |
| Number of schools | 646 | 646 |
| R-squared | 0.06 | 0.03 |

Robust t statistics in parentheses

* significant at 5%; ** significant at 1%