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The Effect of School Voucher Spending on Initial Earnings

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ABSTRACT

The Effect of School Voucher Spending On Initial Earnings*

We quantify the effect of school voucher spending on initial earnings. We use administrative data on the monetary resources received by schools from a targeted voucher program implemented in Chile. We merge this dataset with education and labor market administrative records for the universe of students enrolled in the Chilean education system. We find that an increase of US$100 in the yearly expenditure of voucher resources per student raises initial earnings by 2.3%. However, we find that the positive effect of voucher spending only holds for private voucher schools that operate in local education markets with low enrollment concentration.

JEL Classification: H52, I22, I26, I28
Keywords: school vouchers, education spending, earnings

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1 Introduction

A vast literature quantifies the effect of school vouchers on educational outcomes. Empirical evidence on the effect of vouchers on labor market earnings is much scarcer. In addition, existing studies mostly evaluate the difference in outcomes between voucher recipients and non-recipients, or the effect of a voucher reform on the overall quality of the education system. Nevertheless, the impact of the intensity of a voucher program has been less explored.[1] This paper exploits heterogeneity in the resources received by schools, from a targeted voucher program implemented in Chile since 2008, to quantify the impact of voucher spending on initial labor market earnings.

We deviate from previous studies in four dimensions. First, our focus is on labor market outcomes and not on educational outcomes. Second, our analysis assesses the impact of the amount of resources allocated by a voucher program, beyond the dichotomic effect that comes from the presence/absence of vouchers. Third, we provide evidence on how the effect of vouchers might depend on the institutional context and market concentration under which schools operate. Fourth, our data contain information on the educational items on which schools spend voucher resources; then, we evaluate not only the overall effect of voucher spending on earnings but also the impact of the schools' allocation of voucher resources across different education inputs.

We find that an increase of US$100 in the yearly expenditure of voucher resources per student (US$80,000 per school, on average) raises the initial labor market earnings of 12th graders by 2.3%. However, we find that the latter effect only persists in private voucher schools that operate in lowly concentrated local education markets. As we further discuss later, different regulatory frameworks between public schools and private schools, and the level of competition among schools may affect the efficiency of resource spending. Furthermore, we show that the positive effect of voucher spending on initial earnings is mainly explained by the allocation of resources used to hire new full-time staff.[2]

We combine administrative data collected from four sources. The first dataset contains

[1] See Epple et al. (2017) for a review.

[2] Information disclosed by school principals suggests that voucher resources allow schools to hire staff to support the psycho-pedagogical and socio-emotional dimensions of secondary students, which might foster the development of some skills that are relevant for the tertiary education stage.

yearly information on the public subsidies received by the universe of public schools and private voucher schools during the period 2005-2016.[3] Specifically, this dataset includes information from two sources: first, resources received by schools that joined the targeted voucher program implemented in Chile in 2008, hereafter, SEP program;[4] second, the universal flat subsidy received by schools which originated from an education reform implemented in Chile in 1981. The second dataset includes yearly information on the top-up fees charged by private voucher schools during the period 2004-2016. The third dataset contains administrative information for the universe of students enrolled in the Chilean education system during the period 2002-2017. We identify, for instance, the school and student grade level, schools' location, students' socioeconomic characteristics, their school grades, their performance on standardized tests, among other student and school administrative information. The fourth dataset contains the monthly earnings for the universe of workers affiliated to the Chilean unemployment insurance system during the period 2002-2019.

The SEP program allocates resources to participating schools, hereafter SEP schools, based on the number of *priority* students that attend the school.[5] Then, differences in the enrollment of priority students across schools generate heterogeneity in the resources received by schools.[6] We exploit the latter heterogeneity to estimate the effect of school spending of SEP resources on the students' initial labor market earnings. We rely on panel data models that take schools as the relevant observational units. We use schools as the observation unit because SEP funding is allotted per priority student but distributed directly to the school. Our outcome is the average initial monthly earnings of 12th graders at each school. We focus on students in their last year of high school in order to maximize the number of observations considered in our empirical analysis. However, we only observe a short labor life for the last cohorts of our data, which explains our focus on initial earnings as the relevant outcome.[7] We

[3]We refer to private schools that were receptors of vouchers as private voucher schools.

[4]SEP stands for *Subvención Escolar Preferencial*, the official name of the Chilean targeted voucher program.

[5]In Section 3, we define the criteria established by the program for a student to qualify as priority. Section 3 also describes in detail all the relevant characteristics of the program.

[6]For instance, suppose that a school, enrolling m priority students and n non-priority students, receives a SEP subsidy per priority student equal to w. In that school, the SEP resources per student are $wm/(m+n) \leq w$. Hence, a higher enrollment of priority students implies more SEP resources per student, despite the flat nature of the SEP subsidy. Besides the across-school heterogeneity of SEP resources, our data also exhibit within-school heterogeneity over time. Indeed, 99.2% of SEP schools exhibit variation in the proportion of priority students during the period of analysis.

[7]Hyslop (2001) and Huggett et al. (2006) show that income levels are positively correlated over time. This evidence suggests that initial earnings may be a relevant indicator of future earnings.

include fixed effects and control for other sources of school resources, socioeconomic covariates, and sorting covariates, which the literature has identified as significant confounders to estimate the effect of vouchers. Using this specification, we find that an increase of US$100 in the yearly expenditure of voucher resources per student raises the initial labor market earnings of 12th graders by 2.3%. A US$100 increase in the SEP resources per student is equivalent to increasing the program resources by 75%.

In addition, we document regulatory differences between public schools and private schools in Chile, which may impact the incentive for schools to spend the SEP resources efficiently (Hanushek, 1997). We also show that enrollment concentration is heterogeneous across local education markets. Local market power may also impact the efficiency with which schools spend their resources (Manski, 1992). Motivated by these facts, we perform separate regressions for public schools and private voucher schools, and for schools located in education markets with low and high enrollment concentrations. We find that an increase of US$100 in the yearly expenditure of SEP resources per student increases, by about 2.5%, the initial earnings of students enrolled in private voucher schools that operate in lowly concentrated education markets. However, the effect of SEP expenditure on the initial earnings of students from public schools and schools located in highly concentrated markets is not statistically significant. This finding suggests that the institutional setting and market concentration indeed matter for the effectiveness of monetary transfers.

Our data also contain information on the education items in which schools allocate the SEP resources. We use that information to estimate the impact of the schools' allocation of voucher resources on initial earnings. To do so, we estimate our baseline regression by including the disaggregated expenditure of SEP resources in different items and sub-items. We find that an increase of US$100 in the yearly expenditure on personnel per student increases initial earnings by about 3.1%. Furthermore, our results show that the positive effect of personnel expenditure on earnings is mostly driven by the hiring of new full-time staff.[8]

[8]To contextualize these results, we interviewed the head of education affairs at the Social Development Corporation of the Providencia municipality and the school principals that depend on that corporation. This corporation is the body in charge of allocating education and health resources in the Providencia municipality, which is one of the largest in Chile. They provided us with information regarding the criteria used by schools to spend SEP resources on different inputs as well as the programs that they believe are most effective for improving the outcomes of 12th graders. This information shows that schools frequently use SEP resources to hire new staff that provide psycho-pedagogical and socio-emotional support to secondary students that exhibit serious need in these dimensions. This type of expense is embodied in the item "hiring of new full-time staff."

We conclude our paper by presenting four additional results. First, we estimate the effect of the SEP program on intermediate outcomes. We find that the SEP program increases the fraction of students that complete tertiary education, specially, at highly selective universities. Second, we show that the effect of SEP resources on the initial earnings of 12th graders is larger in schools with a higher primary-secondary school performance gap on the SIMCE test.[9] A potential explanation of this result is that schools allocate resources more heavily to their secondary students when those students exhibit lower performance relative to primary students. Third, we extend the analysis carried out for 12th graders to other grades. We find that there is a positive effect of SEP spending on earnings for all levels with the exception of the 5th grade, the effect being larger for upper secondary levels. Fourth, we show that SEP resources also raise earnings growth in early stages of the labor market. This result is relevant because early career earnings growth compounds an important part of earnings growth over the life cycle, as shown by Murphy and Welch (1990).

The contribution of this paper can be framed in the context of two strands of the literature: first, the literature that quantifies the effects of school spending on education and labor market outcomes; and second, the literature on school vouchers. Specifically, the SEP program allocates, through vouchers, a significant amount of resources to schools that enroll socioeconomically disadvantaged students. Furthermore, vouchers are targeted to priority students, which generates heterogeneity in the amount of resources received by schools. Hence, the SEP reform provides a quasi-experiment to analyze the impact of vouchers on labor market outcomes at an extensive margin as well as an intensive margin.

Recent works use school finance reforms to evaluate the effects of spending on educational outcomes in the U.S. (e.g., Jackson, et al. 2016; Lafortune et al. 2018). These studies report positive effects on academic achievement. In addition, Jackson et al. (2016) show that an increase of 10% in spending per student during each year of primary and secondary education raises wages by 7%. Different from these studies, our paper provides evidence on the relationship between school spending and labor market earnings for a middle-income country, which may help design education policies in developing countries. In addition, the Chilean school

[9]The SIMCE is a mandatory national standardized test in Chile designed to evaluate the level of student achievement in primary and secondary education for math, language, history and geography, and science. It is administered to 2nd, 4th, 6th, 8th, and 10th graders. The test is administered annually only to 4th, 8th and 10th graders.

system provides an opportunity to assess the effectiveness of monetary transfers under different institutional environments and levels of market concentration. As previously discussed, public schools and private schools in Chile face different regulatory frameworks and schools are located in local education markets that exhibit different levels of concentration. We exploit the latter heterogeneity to assess how regulation and market concentration impact the incentives of schools to spend public resources efficiently.

The literature on school vouchers has focused on (i) the school performance of voucher recipients (Rouse, 1998; Angrist et al., 2006; Bettinger et al., 2010; Wolf et al., 2010; Correa et al., 2014; Aguirre, 2020; among others), (ii) the migration of students from public to private schools (Hsieh and Urquiola, 2003, 2006; Mizala et al., 2007; McEwan et al., 2008; Bohlmark et al., 2015; among others), (iii) the efficiency of public schools (Hoxby, 2003; Sandstrom and Bergstrom, 2005; Chakrabarti, 2008; Figlio and Hart, 2014; among others), and (iv) aggregate educational outcomes (Hsieh and Urquiola, 2003; Gallego, 2006; Hsieh and Urquiola, 2006; Bohlmark and Lindahl, 2008; Card et al., 2010; among others).[10] Most of this literature finds positive effects on school outcomes, although some studies have the opposite view (Feigenberg et al., 2019; Aguirre, 2020). An important point here is that test scores are imperfect measures of learning and may be weakly linked to labor market outcomes (e.g., Chetty et al., 2011; Heckman et al., 2013; Jackson et al., 2016).

Notwithstanding the substantial analysis of the effect of vouchers on school performance, evidence of the effect of school vouchers on labor market outcomes has been less explored. Bravo et al. (2010) develop a dynamic behavioral model of schooling to study the effect of the universal voucher reform in Chile. They retrieve 2002 and 2004 school attendance and labor market data from a survey of about 17 thousand individuals. Simulating individuals' behavior with and without vouchers, they find that vouchers do not increase mean earnings as the education premium gains driven by the universal voucher reform is partially offset by a decrease in the return of secondary schooling.[11] An advantage of our approach is that we use both education and labor market administrative data to estimate the effect of vouchers

[10] Epple et al. (2017) provide an exhaustive discussion of the empirical evidence on these issues.

[11] More recently, Dobbie and Fryer (2020) analyze the effect of Texas charter schools on labor market outcomes. Using information of about 400 thousand individuals, they find that charter schools have a negative impact on earnings and no impact on test scores. Epple et al. (2017) suggest not considering charter schools as voucher schools since they are very heterogeneous in their characteristics.

on earnings, instead of using survey data to simulate it. Our dataset exhibits a match rate of education-earnings of about 85%.

In addition, some studies have assessed the mechanisms through which the positive effects of the SEP program might be triggered. Three non-exclusive mechanisms could be argued: (i) the program provides more resources, (ii) the program improves the regulation under which schools allocate public resources, and (iii) the program encourages competition among schools (Neilson, 2020). We add to this literature by providing evidence showing that resources matter but only under some institutional settings and levels of market concentration.

Overall, our dataset allows us to observe the exact amount of resources that SEP schools spend on their students, as well as the specific items to which those resources are allocated. Therefore, this paper provides evidence on (i) the effect of the intensity of vouchers on initial earnings, (ii) how the institutional context in which schools operate shapes the effect of voucher spending on earnings, and (iii) how the allocation of voucher expenditures on different educational items impacts initial earnings.

The rest of this paper is organized as follows. Section 2 explains the institutional context of the Chilean education system. Section 3 describes the SEP program. Section 4 describes our data and outlines the construction of the variables used in the empirical approach. Section 5 presents the empirical analysis and discusses the results. Section 6 concludes.

2 Institutional Context

In this section, we discuss the institutional context in which the SEP program was implemented. We describe the Chilean school system, emphasizing the idiosyncratic elements that might impact the efficiency of schools to spend SEP resources. Later, in Section 3, we describe in detail the main elements of the SEP program.

2.1 The Chilean School System

Chile exhibited a heavily centralized education system by the end of the 1970s; more than 90% of all Chilean students were enrolled in institutions directly dependent on the Ministry

of Education. A first major reform was implemented in 1980, which was structured on three pillars: first, the administrative responsibility of public schools was transferred from the Ministry of Education to each local government (municipality[12]), as an attempt to decentralize the system at higher levels; second, a universal school voucher system was introduced as the main education public funding system; and third, the government moved to actively encourage the participation of private entities in the financing and administration of educational institutions. Then, a second reform was implemented in 1993, which allowed private voucher schools[13] to charge parents top-up fees in order to complement the resources distributed by school vouchers. However, a fraction of private voucher schools continued not charging parents a top-up fee.[14]

The reforms described above resulted in an education system composed of four types of schools: (i) public schools financed by school vouchers and by additional funds from municipalities, (ii) free private voucher schools, which do not charge families a top-up fee, (iii) fee-charging private voucher schools, which receive top-up fees from parents, and (iv) private schools financed exclusively by student families.[15]

From kindergarten through 12th grade, the Chilean school system is divided into primary education (from kindergarten to 8th grade) and secondary education (from 9th to 12th grade). Primary and secondary education are mandatory. Almost all public and private non-voucher schools offer primary and secondary education, whereas around 60% of private voucher schools offer primary education only.

Currently, there are 3.6 million students enrolled in the Chilean school system. Among them, 35.8% are enrolled in public schools, 54.6% attend private voucher schools, 8.3% are enrolled in private schools, and 1.3% attend schools managed by non-profit educational foundations. Moreover, there are 11,749 schools, and of these, 5,196 are public schools, 5,866 are private voucher schools, 617 are private schools, and 70 are managed by non-profit educational foundations.

[12]A municipality is the smallest administrative subdivision in Chile. It may contain cities, towns, villages, hamlets as well as rural areas. Each municipality is governed by a directly elected body, for a period of four years, known as a municipal council, consisting of a mayor and a group of councilors. Until 2018, there were 345 municipalities grouped into 56 provinces, which were themselves grouped into 16 regions.

[13]These are private schools that were receptors of vouchers.

[14]Private voucher schools could be managed as for-profit or non-profit institutions. However, in 2016, Law 20.845 eliminated top-up fees and lucre in educational establishments that were receiving public funds.

[15]Nowadays, as a consequence of Law 20.845, private voucher schools are exclusively non-profit and free of top-up fees.

2.2 Incentives and Enrollment Concentration

Teacher contracts at public schools have been regulated by a teaching statute since 1991. The statute is characterized by a centralized collective bargaining process and a wage structure strongly tied to experience.[16] In addition, the teaching statute considers two main situations for the contract dismissal of teachers in public schools. First, schools can dismiss teachers with poor performance on the National Teacher Evaluation.[17] Second, teachers who have violated their legal duties can be dismissed under an administrative indictment, which involves a long five-stage process: a period to investigate the charges that originated the indictment, the formulation of charges, a period of presentation of evidence, the verdict, and the formulation of resources to challenge the verdict.[18] In contrast to public schools, private voucher schools are ruled by Chile's labor code, with very general and flexible rules for hiring, dismissing and setting salaries, in the same way that the code regulates interactions between employers and employees in other private activities of the economy.

A second idiosyncratic characteristic of public schools relates to the non-voucher transfers that they receive from municipalities. These transfers aim to balance the budget of these schools when resources from vouchers are not enough. These are the so-called soft budget constraints (Sapelli and Vial, 2002; Hsieh and Urquiola, 2006). Figure 1, extracted from Correa et al. (2014), shows the average annual non-voucher transfers per student in different municipalities. We observe that non-voucher transfers are present in practically all municipalities, in spite of the high heterogeneity observed.

[16]The statute sets up a basic remuneration system called the Basic National Minimum Salary (BNMS), which is supplemented by several bonuses, many of them indexed to the BNMS. For instance, in addition to their BNMS, teachers receive a bonus based on their teaching experience, which is equivalent to 6.76% of the BNMS for the first two years in the labor market and 6.66% of the BNMS for every two additional years. Furthermore, depending on their participation in training courses, teachers can receive additional compensation equivalent to 40% of their BNMS (as maximum). The statute also establishes special bonuses related to the type of degree obtained by teachers (professional degrees and majors), the celebration of national holidays, and the number of children between 4 and 24 years old attending school. See Correa et al. (2015) for further aspects of the wage structure implied by the teaching statute.

[17]This evaluation considers four levels of performance: outstanding, competent, basic, and unsatisfactory. Teachers who exhibit an unsatisfactory performance for two consecutive years, a basic performance for three consecutive years, or an unsatisfactory/basic performance in alternation for three years must leave the system. The statute also allows school directors to dismiss up to 5% of teachers who perform at the basic or unsatisfactory levels in a given year. Official records from the Ministry of Education show that only 0.9% of teachers evaluated annually are in the unsatisfactory category, and nearly 19.5% are in the basic category.

[18]In 2016, Law 20.903 introduced some changes to the teaching statute. The main modifications include: an increase in non-teaching time, a new remuneration scale based on levels of professional development, and access for teachers to continue support and training opportunities during the first years of their professional career.

The fact that revenue losses are mediated by municipal education budgets makes it possible for public schools to lose students without direct consequences on their resources. For instance, since the 1981 reform, we observe a massive entry of private voucher schools in the education system, together with a sharp decline in public enrollment, from 75% in 1982 to 35.8% in 2017. However, as shown by Hsieh and Urquiola (2006), despite the extensive private entry and sustained declines in public enrollment, the aggregate number of public schools has barely fallen.[19]

We now discuss enrollment concentration in the Chilean school system.[20] Evidence on the demand for school attributes suggests a possible way to define a local education market. Gallego and Hernando (2009) show that distance to school is one of the main attributes that Chilean households value. Hence, schools seem to operate in geographically segregated markets. Indeed, some empirical studies have used municipalities as proxies for different education markets (Urquiola and Hsieh, 2006; Correa et al., 2014). However, as noted by Neilson (2020), in large urban zones, families located near the border of a municipality might choose a school located across this border.

Therefore, in our analysis, we rely on three approaches to define a local education market. In the first one, we use the administrative division of each municipality as a proxy for a local education market (Market I), as in Urquiola and Hsieh (2006) and Correa et al. (2014). Our second and third approaches intend to address, in a simple way, the issue highlighted by Neilson (2020). In the second approach, we group the municipalities of the three most densely populated and urbanized provinces as individual markets: Valparaíso, Concepción, and Santiago (Market II). In those provinces, the mobility cost of students should be small; thus, we consider each of those provinces as individual markets. The third approach defines a local market as the set of schools located inside an exogenous geodesic radius (Market III). Chumacero et al. (2011) show that the average distance that a Chilean secondary student travels to a school is about five

[19]There is a third difference between public and private voucher schools. Public schools with vacancies were compelled to enroll all applicants, whereas private schools employed selective admission processes. However, in 2015, Law 20.845 eliminated the selection of students by schools that receive public subsidies.

[20]Ideally, an indicator of profitability should be constructed to measure competition among schools. However, full information on schools' financial statements is not available in our dataset and, in addition, a large number of schools are non-profit. Therefore, our analysis focuses on concentration. Nevertheless, we cannot discard cases in which highly contestable local markets exhibit, in turn, few schools that concentrate a high proportion of students, which is a limitation of our analysis. Allende (2019) and Neilson (2020) make an important contribution to the literature by providing models with a rich structure on the supply side and demand side, which can be used to analyze school competition and its interaction with education policy.

kilometers. Our dataset contains the exact coordinates where each school is located, although we do not know the location of the students' homes. Thus, based on the available information, we define a ten-kilometer geodesic radius from a school as the limit for its local market.

We measure enrollment concentration in a local education market by computing $\sum_{j \in J} s_{jt}^2$, where s_{jt} is the number of students enrolled in school j at time t divided by the sum of all students enrolled in schools located in local market J at time t. Figure 2 plots the enrollment concentration using municipalities (panel a) and the geodesic radius (panel b) to define a local market. Indeed, we observe heterogeneity in the enrollment concentration of local education markets using either measure of concentration. However, the heterogeneity seems to be slightly larger when using the geodesic radius to define a local market. We also observe that most of the local markets exhibit a concentration level less than 0.2.

In sum, the regulatory framework is different for public schools and private schools, revenue losses in public schools seem to be mediated by municipal educational budgets, and competitive threats exhibit heterogeneity across education markets. Some studies suggest that the regulatory environment could indeed affect the school performance (Hanushek, 1997; Correa et al., 2015). Other studies conclude that local market power may also impact the efficiency with which schools spend their resources (Manski, 1992). Then, the facts documented in this subsection lead us to conjecture that the incentives for efficiency in the use of resources could differ across school types and local education markets, which motivates our analysis in the following sections.

3 The SEP Program

Law 20.248 created a targeted voucher program in 2008, the SEP program. Since then, this reform has delivered an additional subsidy per student to schools that enroll students from the most disadvantaged families or *priority students*. A student qualifies as priority if s/he meets 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 safety net program for those in extreme poverty), (ii) being among the most disadvantaged third of the population according to the latest measurement instrument, and (iii) belonging to the most disadvantaged

group in the public health insurance system (FONASA). If none of the preceding criteria are met, the student's position is temporarily established, in successive order: (i) by family income, (ii) the mother's schooling, (iii) the parent's or caregiver's schooling, (iii) the rural condition of the household, and (iv) the level of poverty of the municipality where the student resides. Subsidies are allocated according to the number of priority students enrolled in schools that joined the SEP program.

Schools must sign the Equal Opportunity and Excellence Agreement (EOEA) to join the SEP program. The EOEA is valid for four years and may be renewed for an equal period of time.[21] During this period, schools must comply with an Educational Improvement Plan presented to the Ministry of Education, which includes specific actions in the areas of curriculum management, school leadership, student life, and resource management; prioritizing areas where there is more space for improvement. Law 20.248 establishes that schools can employ teachers, and necessary staff to provide technical and pedagogical support for their students, and to elaborate and develop the Educational Improvement Plan. In any case, all these hires and increase in working hours must be linked to specific actions and goals of the Educational Improvement Plan. Appendix A describes additional characteristics of the EOAE.

In addition to the requirements needed to sign or renew the EOEA, schools must satisfy other requisites and obligations to receive SEP resources. One of these requisites is that schools must exempt all priority students from paying a top-up fee or tuition that could place conditions on their application, entry, or attendance in the school. However, school can continue charging non-priority students top-up fees or tuition.[22]

3.1 Evaluation of Participating Schools

The Ministry of Education classifies schools into three categories according to their academic performance on the SIMCE test and the socioeconomic characteristics of their students: *autonomous* (high performance), *emergent* (medium or low performance), or *in-recuperation* (poor

[21]The EOEA can be renewed if the following requirements are copulatively met: a timely report to the Superintendence of Education regarding the use of all resources received under the program, and a verification that at least 70% of resources were spent in accordance to the Educational Improvement Plan elaborated by the school.

[22]As discussed in footnote 14, at present, all private voucher schools are not allowed to charge top-up fees.

performance). Although the amount of resources distributed to each priority student is the same for all schools and varies only by educational level, the freedom for schools to decide how to use those resources (and the level of supervision) depends on the school's classification. 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, whereas schools that are in-recuperation receive all of their funding as a contribution of additional resources to their plan.

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 will offer student families the possibility of moving to a different school, and schools may lose their official recognition given by the Ministry of Education.[23]

3.2 SEP Resources

SEP resources are allotted per priority student and are distributed directly to the school. This is calculated based on the average attendance rate of priority students over the previous three months, the grade level of the priority student, and the concentration of priority students in the school.

Table 1 shows the monthly subsidy per priority student distributed by the SEP program in 2018.[24] On top of the regular funds, schools qualify for an additional subsidy–a concentration subsidy–when priority students represent at least 15% of the student body. Therefore, as shown in Table 1, a priority student in the 4th grade who attends an SEP school with at least 60% of priority students, brings a monthly subsidy of US$79.34 to the school, where US$67.34 corresponds to the regular SEP subsidy and US$12 to the SEP concentration subsidy.

[23]The National Education Quality Agency is in charge of evaluating and guiding the education system so that it leads to improvement in the quality and equity of educational opportunities.

[24]We use 640 (CLP/USD) as the parity of reference.

As a matter of comparison, in the case of a student attending the 4th grade in a subsidized school with all students classified as priority students, the resources per student allocated by the universal voucher program, created by the 1981 reform, reaches US$119.16; thus the US$79.34 provided by the SEP program represents an increase of about 67% in the resources brought to the school by priority students.

4 Data and Sample Construction

We combine administrative data from four sources. The first dataset contains yearly information on all the public subsidies received by the universe of public schools and private voucher schools during the period 2005-2016. These subsidies come from two sources: first, the SEP resources received by schools that signed the EOEA; and second, the universal voucher received by schools from the reform implemented in 1981. The second dataset includes yearly information on the top-up fees that private voucher schools charged during the period 2004-2016. The third dataset includes administrative information for the universe of students enrolled in the Chilean education system during the period 2002-2017. From this database we retrieve yearly individual information for students, such as school, grade, family income, parents' educational attainment, SIMCE score, and PSU[25] score; and yearly information for schools, such as type of school, location, and number of students. The fourth dataset contains information on monthly earnings for the universe of workers affiliated to the unemployment insurance system during the period 2002-2019.[26]

A universe of 6,996,302 students were enrolled in 11,003 schools during the period 2002-2017. From them, 6,498,235 attended one of the 10,335 public or private voucher schools that operated during that period. In addition, from the latter group, we identify those students who graduated from the 12th grade, which amounts to 2,720,345 students in 2,692 schools.[27] We observe initial earnings information for 2,251,790 of those students in 2,687 schools, resulting in an 85% education-earnings match, approximately. If we consider those students who graduated

[25]PSU stands for *Prueba de Selección Universitaria*. The PSU is a standardized test taken by students for admission to college.

[26]Workers must be at least 18 years old to be affiliated to the unemployment insurance system.

[27]As explained in Section 2, almost all public and private non-voucher schools offer primary and secondary education, whereas around 60% of private voucher schools offer primary education only.

from the 12th grade but were not, concurrently, studying in a tertiary education program, we observe an 90% education-earnings match. Our final baseline sample contains 2,687 schools with information for 2,251,790 students.

Table 2 shows the path followed by different cohorts of year 2008 along the period 2008-2019. Each column identifies individuals who were enrolled in the corresponding grade in 2008, whereas each row describes the fraction of them who were exposed to 0, 1, 2, 3, 4 or more years of SEP, completed 12th grade, took the PSU test, were enrolled in tertiary education, completed tertiary education, and exhibited earnings in the labor market. This characterization is carried out for the total sample of the students attending subsidized schools, and also, for SEP and non-SEP students, separately. We observe that nearly 20% of the 12th graders were enrolled in schools that signed the EOEA in 2008. We also observe that 91% of that cohort exhibited earnings in the labor market at some point of the period 2009-2019. Furthermore, Table 2 shows that, across all cohorts, SEP students are less likely to complete 12th grade, to take the PSU test, and to enroll in a tertiary education institution. However, they are observed in the labor market in a higher proportion than non-SEP students. As we discuss later, this (non-causal) evidence is, in part, consistent with the fact that SEP students are more socioeconomically disadvantaged than non-SEP students. The rest of the information of Table 2 can be analyzed analogously.

Our relevant unit of analysis is the school because SEP funding is allotted per priority student but distributed directly to the school, which uses those resources to implement the Educational Improvement Plan, as described in Section 3. We focus on students in their last year of high school in order to maximize the number of observations that come from individuals that pursue a tertiary education before entering the labor market. In addition, our choice of initial earnings as the outcome is explained by the fact that we only observe a short labor life for the last cohorts of our data. Furthermore, initial earnings might be a relevant indicator of future income due to the high correlation that earnings levels exhibit over time (Hyslop, 2001; Huggett et al., 2006). We now explain how we construct the main variables used in our empirical analysis and present descriptive statistics of our baseline data.[28]

Table 3 shows the average yearly expenditure of SEP resources per student for different

[28] All the variables expressed in Chilean pesos were deflated using 2017 as the base year and expressed in U.S. dollars using 640 (CLP/USD) as the parity of reference.

items.[29] To build the information exhibited in Table 3, we first computed the yearly expenditure of SEP resources per student within each school, and we then computed the simple average across schools. Notice that the amounts exhibited in Table 3 are smaller than the annualized subsidy that the SEP law states (see Table 1). The reason behind this apparent discrepancy lies in the fact that, even though SEP funding is allotted per priority student, SEP schools are allowed to enroll both priority and non-priority students. Moreover, the reform was implemented progressively, including new cohorts every year. Hence, the average expenditure per student could be substantially smaller than the amount per priority student considered in the SEP law. We observe heterogeneity in the allocation of resources across the items considered in Table 3. For instance, on average, SEP private voucher schools spend, yearly, almost US$30 per student on hiring new staff, whereas the expenses for teacher training for these type of schools is close to zero.

On top of the SEP resources, public schools and private voucher schools receive additional subsidies from the universal voucher program implemented in Chile in 1981. On top of that subsidy, private voucher schools that did not join the SEP program were allowed to charge parents a top-up fee in the period of analysis. Table 4 shows the yearly additional expenditure per student of other (non-SEP) public subsidies. We observe that the mean of the expenditure per student from other public sources for SEP private voucher schools is about US$1,300. In addition, we report in Table 4 the average top-up fee (per student) charged by private voucher schools.[30] We can observe from Table 4 that SEP schools charged a lower top-up fee than non-SEP schools before the reform. The latter could be explained by the fact that the SEP law impedes schools from charging priority students a top-up fee, which might generate more incentives for schools with low levels of top-up fees to join the program.

Our set of covariates includes the students' socioeconomic background variables and proxies for sorting. Both variables have been identified by the literature as significant confounders to estimate the effect of vouchers (Epple et al., 2017). We measure the socioeconomic background of a student by using the average educational attainment (in years of education) of her mother

[29] We have included only the sub-items that are relevant for our empirical analysis. Descriptive statistics of other sub-items are available upon request.

[30] As discussed in Section 3, the SEP law establishes that participating schools must exempt all priority students from paying a top-up fee or tuition. However, schools can continue charging non-priority students a co-payment. Public schools cannot charge parents a co-payment.

(father). We also include family income as a control for socioeconomic status. In addition, we proxy for sorting by constructing rates of inflow and outflow, and also ratios of standardized test scores between incoming/outgoing students and incumbent students. Specifically, for each school, we build the school inflow rate at time t as the number of new students arriving at time t from a different school divided by the number of students enrolled at time $t-1$. Analogously, for each school, we construct the school outflow rate at time t as the number of students leaving the school after completing the year t (and moving to a new school) divided by the number of students enrolled at time t.[31] However, school inflow and outflow rates might not capture differences in the endowments between incoming/outgoing students and incumbent students. This issue is potentially important because changes in the composition of the student body may trigger peer effects, and thus, undermine the fixed effects approach that we perform in the empirical analysis. To address this issue, we construct an inflow performance ratio at time t as the average of the math and language SIMCE score of students arriving at time t divided by the score of students enrolled at time $t-1$. Analogously, we build an outflow performance ratio at time t as the average of the math and language SIMCE score of students leaving the school after completing the year t divided by the score of students enrolled at time t.

Table 5 presents the mean values of the set of covariates described previously for public schools and both participating and non-participating private voucher schools. We observe that, on average, students attending public schools come from more socioeconomically disadvantaged families than those attending private voucher schools. In addition, we observe that, in private voucher schools, the inflow rates are slightly smaller after the SEP program was implemented, whereas it is relatively stable in public schools. We also observe that the outflow rates do not seem to be significantly different before and after the SEP program.[32] Regarding the performance ratios, they are roughly the same before and after the SEP program. Overall, the evidence in Table 5 suggests that the SEP program did not trigger a massive flow of students between SEP and non-SEP schools. This conclusion is consistent with the evidence provided by Aguirre (2020), who concludes that being eligible for a SEP voucher had no impact on parents' school choices.

[31] Inflow and outflow rates at the school level capture more systematic movements of students across schools than those rates for specific cohorts of students.

[32] Notice that the relevant information to be extracted from Table 5 is not about the level of the inflow/outflow rate but whether these rates are or not significantly different before and after the SEP program.

Lastly, we describe the outcome used in the regression analysis: initial earnings. We define the representative earnings of school j at time t as the average of the first earnings record (in the unemployment insurance system) of 12th graders in school j at time t, which is observed after completing the 12th grade.[33] Figure 3 shows the distribution of the schools' initial earnings. Indeed, we can notice that most of the distribution lies between the range of US$200 and US$600 per month.

5 Empirical Analysis

We now present and discuss our results. Even though our main focus is on the effect of each dollar of SEP resources on earnings, we begin our analysis presenting evidence on the SEP participation effect. We then estimate the effect of SEP voucher spending on initial earnings. In Subsection 5.2, we estimate separate regressions for public schools and private voucher schools, and for schools that operate in lowly and highly concentrated local education markets. As discussed in Subsection 2.2, the latter analysis is motivated by the regulatory differences observed between public and private schools, and the significant heterogeneity in enrollment concentration across local education markets. We then explore the effect of the allocation of SEP resources across different education items. After that, we discuss potential explanations for our results.

5.1 SEP Resources and Initial Earnings

We estimate the participation effect in the SEP program by using a difference-in-difference approach. The pre-treatment period is delimited by the three years that precede the SEP reform (2005-2007), which is the largest window of pre-treatment information available in our data. The post-treatment period corresponds to the period 2008-2011, which is the first four years of the reform. The four-year window for the post-treatment period was chosen to match the duration of the EOEA which, as described in Section 3, schools must sign to join the SEP program. We use schools as observational units since, as described in Section 3, SEP resources are distributed and spent at the school level. The treatment group is composed of schools that

[33] In the case of grade retention, we consider the year of graduation.

joined the program in 2008 and participated in it during the period 2008-2011, whereas the control group includes public schools and private voucher schools that did not participate in the program during the post-treatment period. We estimate the following difference-in-difference model:

$$\ln y_{jt}^{I} = \gamma w_{jt}^{s} + X_{jt}'\psi + \chi_j + \phi_t + v_{jt}, \tag{1}$$

where y_{jt}^{I} is the average initial monthly earnings of 12th graders in school j at time t, w_{jt}^{s} is a policy indicator that equals one if school j participates in the program at time t and equals zero otherwise, X_{jt} is a vector of covariates, χ_j are school-fixed effects, ϕ_t are time-fixed effects, and v_{jt} is an i.i.d. error term.

Regression (1) estimates the average yearly effect of the SEP program on initial earnings. We complement the evidence derived from regression (1) by estimating a second difference-in-difference model:

$$\ln y_{jt}^{I} = \sum_{t=2008}^{2011} \delta_t w_j^t + X_{jt}'\mu + \chi_j + \phi_t + \epsilon_{jt}, \tag{2}$$

where w_j^t are yearly SEP policy indicators that equal one if school j participates in the program at time t and equal zero otherwise, and ϵ_{jt} is an i.i.d. error term.

Regression (2) estimates the cumulative effect of exposure to the SEP program on initial earnings. This second specification also allows us to assess the additional effect of the program after each year of exposure, which might give us a better notion of how the dosage of SEP impacts earnings. In both specifications, (1) and (2), the vector of covariates X includes other sources of public resources, socioeconomic characteristics of the students, and proxies for sorting. We next motivate the inclusion of these covariates.

As described in Section 2, both public schools and private voucher schools receive other public resources which are mostly triggered from the universal voucher program implemented in 1981. On top of these additional resources, private voucher schools were allowed to charge parents top-up fees until 2017 (see Table 4). A correlation between the amount of non-SEP resources and both student performance and the participation choice of schools would bias our estimates. Card and Krueger (1992) suggest that raising the education expenditure in public schools indeed drives an increase in student performance.[34] In addition, the participation choice

[34]Hanushek (1997) challenges these results stating that, after controlling for family inputs, there is not a

in the program could also be correlated with the non-SEP resources received by schools. For instance, the SEP law prohibits SEP schools from charging parents a co-payment. Hence, low top-up fee schools might exhibit more incentives to join the program than high top-up fee schools. Therefore, our first set of covariates includes the yearly non-SEP public subsidies per student received by schools and the top-up fees charged by private voucher schools.

A correlation between the students' socioeconomic characteristics with both the participation choice in the program and student performance is another potential source of bias. As discussed in Section 3, SEP schools are composed, on average, of more disadvantaged students in terms of socioeconomic indicators. Specifically, Table 5 shows that students at SEP schools, on average, belong to families with lower levels of parental education and family income, compared to students enrolled in non-SEP schools. Hence, the socioeconomic background of the school's student body may determine the participation choice in the program, for instance, due to the fact that SEP resources are allotted per priority student, as we explained in Section 3. In addition, Dickson et al. (2016) find that parental education has a positive and continuous effect on children's school performance, while Dahl and Lochner (2012) argue that higher family income raises math and reading test scores, the effect being larger for students from disadvantaged families. Therefore, we control for socioeconomic characteristics of schools by including the average educational attainment (in years of education) of mothers and fathers of all students at the school, the average educational attainment (in years of education) of mothers and fathers of 12th graders, and the analogous variables using family income.

Hsieh and Urquiola (2006) find that the universal voucher program implemented in Chile in 1981 "led to increased sorting", as students of the best public schools moved to private voucher schools. Therefore, the SEP program may have encouraged the best students from the non-SEP schools to move to SEP schools, impacting performance at both SEP and non-SEP schools. However, Table 5 suggests that both the inflow and outflow rates did not experience a significant change after the implementation of the SEP program. Consistent with these descriptive statistics, Aguirre (2020) concludes that being eligible for a SEP voucher had no impact on school choice. Furthermore, Table 5 also shows that the performance of incoming/outgoing students is not different from that of incumbent students. Nevertheless, given that sorting may produce a bias in our estimations, we include the inflow and outflow rates as well as the inflow

consistent relation between student performance and school resources.

and outflow performance ratios in the set of covariates.[35]

Table 6 shows the results of regressions (1) and (2) for a specification that includes the full set of covariates. Column (1) shows the estimated coefficient γ of regression (1). We observe a positive and statistically significant effect of the SEP program on initial earnings. Specifically, students at schools that joined the program in 2008 exhibited average initial earnings that are 4.2% higher than the earnings of those at the non-participating schools, per each year of exposure to the program. Column (2) of Table 6 present the results of regression (2). We observe that every year of SEP exposure exerted a positive and statistically significant effect on initial earnings. In the case of the first year of the SEP program, 2008, our estimates indicate an increase of initial earnings by 2.3%. For the second, the third and the fourth year, our results show an increase of 2.6%, 3.6% and 9.1%, respectively. Therefore, our results suggest an increasing cumulative effect of the SEP program on initial earnings.

We also estimate regressions (1) and (2) considering only schools with inflow rates weakly lower than 15% (columns 1 and 3 of Table 7) and 20% (columns 2 and 4 of Table 7) in every year of the post-treatment period. Even though, we control for proxies of sorting, this additional empirical exercise allows us to focus on schools that indeed exhibited minor changes in the composition of their student body. We observe an average effect of the program on earnings between 6.1% and 6.7%. Moreover, we observe, in general, a weakly increasing effect of each additional year of exposure to the SEP program. Hence, our main conclusions hold for the subsample of schools that exhibit a low student turnover.[36]

A potential concern with the difference-in-difference methodology is that the outcome of regressions (1) and (2) might be driven by pre-treatment trends. To discard this possibility, we perform a falsification test. We explore two options to falsify the treatment: (i) the false treatment is applied in 2007, and thus, the pre-treatment period is 2005-2006, and (ii) the false treatment is applied in 2006-2007, and thus, the pre-treatment period is the year 2005. Table 8 shows the result of the falsification test. Columns (1) and (2) show the outcome of regression (1) considering 2007 and 2006-2007, respectively, as the treatment period; and column (3) includes

[35]See Section 4 for a discussion on the construction of these covariates.

[36]In addition, notice that movements of students from school A to school B within the control group or within the treatment group do not introduce any bias in our estimations because the average result of the group (treatment or control) should not be affected.

the outcome of regression (2) with 2006-2007 as the treatment period.[37] We note from Table 8 that all coefficients are not statistically significant at any conventional level of significance, thus supporting our difference-in-difference assumption that results are not driven by pre-treatment trends.

We next perform a market-level analysis, as in Correa et al. (2014). This analysis is especially compelling in the presence of spillover or general equilibrium effects. To see the latter, suppose that competitive forces lead schools in the control group to react to the actions implemented by the schools that joined the SEP program. If this is the case, the control group does not represent a proper counterfactual for the trend that treatment schools would have followed in the absence of the treatment. In that case, the ideal methodology is to use data at the market level.

To implement the market-level analysis, we exploit heterogeneity in the proportion of schools that joined the SEP program across local education markets. We consider the three definitions of local education markets that we discussed in Subsection 2.2. Then, we compare the changes in average earnings across local markets where a different number of schools signed the EOEA. To do so, we estimate the following regression:

$$\ln \overline{y}_{m,2011} - \ln \overline{y}_{m,2007} = \theta S_m + \mu(\ln \overline{y}_{m,2007} - \ln \overline{y}_{m,2005}) + X'_{m,2007/2005}\zeta + \nu_m, \tag{3}$$

where $\overline{y}_{m,t}$ is the average earnings of 12th graders in market m at time t, S_m is the proportion of schools that join the program in market m,[38] $X_{m,2007/2005}$ is a vector that contains the change in the covariates during the pre-treatment period, and ν_m is an i.i.d. error term.

Table 9 shows the results of regression (3) for the three definitions of a local market (see Subsection 2.2). We observe that, across all the definitions, the proportion of schools joining the SEP program in a market exerts a positive and significant impact on the average earnings of 12th graders attending schools in that market. For instance, consider the third definition, which relies on the geodesic radius (Market III). We observe that an increase of 10% in the

[37] Note that in the case of regression (2), the 2007 false treatment would drive the same results of column (1).

[38] Specifically, the number of schools in market m that signed the EOEA for the period 2008-2011 divided by the number of schools in market m that either signed the EOEA for the period 2008-2011 or that did not join the program at any time during that period.

share of schools joining the program increases average initial earnings by 1.7% in the local market. The effect is also positive and significant when considering the other two definitions of a local market. Therefore, this market-level analysis confirms the positive and statistically significant effects of the SEP program on initial earnings.

We now turn to analyze the effect of the intensity of SEP voucher spending on initial earnings. That is, the effect on earnings for each dollar of SEP spending per student. Hereafter, the period of estimation is 2008-2011. The sample includes both SEP and non-SEP schools, and thus, spending is null at non-participant schools. Then, we estimate the following model:

$$\ln y_{jt}^{I} = \alpha w_{jt} + X_{jt}'\rho + \chi_j + \phi_t + u_{jt}, \tag{4}$$

where w_{jt} is the SEP expenditure per student in school j at time t, measured in US$100 units, X_{jt} is the vector of covariates, χ_j are school-fixed effects, ϕ_t are time-fixed effects, and u_{it} is an i.i.d. error term.

Results of regression (4) are displayed in Table 10 for different specifications, which sequentially introduce subsets of covariates. We observe that the effect of SEP voucher spending is positive and statistically significant in all the specifications that include school-fixed effects, at any conventional level of significance. We also observe that ignoring other sources of income spawns a small upward bias, overstating the effect of SEP expenditure on initial earnings (see the comparison of column 4 with column 3). In addition, excluding the socioeconomic covariates would understate the effect of SEP expenditure on initial earnings (see the comparison of column 5 with column 3), and excluding sorting covariates drives a small downward bias (see the comparison of column 6 with column 3). Column (7) of Table 10 displays our preferred specification. We observe that an increase of US$100 in the expenditure of SEP resources per student raises initial earnings by 2.3%.[39] Notice that US$100 is about 75% of the average yearly SEP expenditure per student during the period 2008-2016 (see Table 3). Overall, our findings suggest that each extra dollar of SEP resources allocated to participating schools exerts a positive and significant effect on initial earnings.

[39]The average enrollment in schools that offer secondary education is about 800 students. Then, US$100 per student represents, on average, US$80,000 per school.

5.2 Incentives and Enrollment Concentration

Public schools and private voucher schools may face different incentives for an efficient allocation of resources. As described in Subsection 2.2, public schools are ruled by a teaching statute that imposes a rigid structure of performance incentives. In addition, revenue losses in public schools seem to be mediated by municipal education budgets. These idiosyncratic characteristics of public schools could trigger differences in the efficiency with which public schools and private schools allocate school resources. For instance, Hanushek (1997) explicitly claims that "state policies influence school performance." Moreover, he argues that centralized policies are unlikely appropriate in the context of large schools and teacher heterogeneity, and an increase in the amount of resources in a system lacking a suitable incentives scheme may not drive positive results in school performance. In the same line, Correa et al. (2015) suggest that the more rigid incentive scheme faced by public schools in Chile may impact the quality of the teachers they hire, which in turn, harms school performance.

The previous elements motivate our next empirical analysis. We estimate the effect of SEP expenditure in public schools and private voucher schools, separately. To do so, we use regression (4), considering the specification with the full set of covariates. Table 11 shows the results. We observe a positive and significant effect of SEP expenditure on initial earnings at private voucher schools. Concretely, an increase of US$100 in the SEP expenditure per student increases, by 2.2%, the labor earnings of students that were enrolled in private voucher schools. However, we also observe in Table 11 that the effect is not statistically significant for public schools.

In addition, some evidence suggests that the level of concentration of local school markets may impact incentives for schools to spend their resources efficiently. Neilson (2020) finds that more disadvantaged families are sensitive to school distance. He argues that schools in less affluent areas tend to have local market power and, therefore, present lower levels of quality than schools located in more affluent sectors.

Our data allow us to define local markets using either administrative divisions, such as municipalities and provinces, or geographic information, such as geodesic distances between schools. First, we follow Urquiola and Hsieh (2006), and Correa et al. (2014), and use the administrative division of each municipality as a proxy for a local education market. However,

as discussed in Subsection 2.2, and highlighted by Neilson (2020), students in large urban zones may attend schools across the border of the municipality where they live. Therefore, we also build two alternative definitions; first, we group the municipalities of the three most densely populated and urbanized provinces as individual markets (Santiago, Valparaíso and Concepción), and second, we use the ten-kilometer geodesic radius from a school to delimit its local market. We construct the enrollment concentration indicator for these three definitions of a local market (see Subsection 2.2) and then define a lowly concentrated market as the one with a concentration weakly lower than 0.1.

Table 12 exhibits the results of regression (4) for private voucher schools in markets with low and high concentrations. We observe a positive and statistically significant effect of SEP expenditure on the initial earnings of students in schools that operate in lowly concentrated markets. Indeed, in those schools, an increase of US$100 in the expenditure of SEP resources per student leads to an increase between 2.3% and 2.5% in initial earnings across the local market definitions. In contrast, the effect is not significant for students in schools located in highly concentrated markets.

Overall, the findings of this subsection suggest that the institutional context in which the schools spend the voucher resources matters. Specifically, we have shown that the effect of SEP expenditure on the initial earnings of students from private voucher schools that operate in markets with low concentration is positive and significant, whereas the effect is not significant in public schools and schools located in highly concentrated markets. To complement the empirical analysis of this subsection, we develop a stylized model in Appendix B that illustrates how idiosyncratic characteristics of schools may impact the incentives to spend educational resources on human capital-enhancing inputs.

5.3 School Inputs

We now study the effect of the allocation of SEP resources on initial earnings. This analysis is motivated by the literature that suggests a relation between school inputs and school performance. For instance, the quality of teachers is a school input frequently analyzed in the literature. In this regard, Rivkin et al. (2005) state that less experienced teachers underperform compared to more experienced teachers. Beyond school performance, Chetty et al. (2014) find

that children exposed to better teachers not only exhibit better academic results but also earn higher salaries in the labor market. The effectiveness of school infrastructure and pedagogical material has also been extensively analyzed in the literature. For instance, Glewwe et al. (2011) posit that desks, tables, and chairs exhibit a positive effect on student performance.

Our data include the expenditure of SEP resources on different school inputs. Then, we assess the expenditure items that exhibit the most significant impact on the students' initial labor earnings. We focus our analysis on private voucher schools located in markets with low levels of enrollment concentration, in which the SEP program exhibits a significant effect. We estimate the following regression:

$$\ln y_{jt}^{I} = \beta_1 w_{jt}^{O} + \beta_2 w_{jt}^{T} + \beta_3 w_{jt}^{E} + \beta_4 w_{jt}^{U} + \beta_5 w_{jt}^{P} + \beta_6 w_{jt}^{C} + \beta_7 w_{jt}^{R} + X_{jt}'\eta + \chi_j + \phi_t + \nu_{jt}, \qquad (5)$$

where w_{jt}^{O} is operating expenses of school j at time t, w_{jt}^{T} is teaching resources, w_{jt}^{E} denotes equipment expenditures, w_{jt}^{U} refers to unexpected expenses, w_{jt}^{P} denotes personnel expenses, w_{jt}^{C} is consulting and job training expenditures, w_{jt}^{R} denotes the remainder of expenses, and ν_{it} is an i.i.d. error term.[40] All expenditure items are measured in US$100 units.

Table 13 displays the results of regression (5). We observe that personnel, and consulting and job training expenditures exhibit a positive and statistically significant effect on initial earnings. An increase of US$100 in the expenditure per student on personnel increases initial earnings between 3.1% and 3.6%, while an increase of US$10 on consulting and job training expenses per student raises initial earnings by 0.7%. As a reference, in private SEP schools, the average expenditure per student on personnel is about US$70 and nearly US$12 on consulting and job training (see Table 3).

We also perform regression (5) by including all sub-items. Table 14 shows the coefficients for the sub-items included in the personnel expenditure item.[41] We observe that only the expenditure for hiring new full-time staff exhibits a positive and statistically significant effect on initial earnings. Concretely, an increase of US$100 in the expenditure per student on new full-time staff increases initial earnings between 5.1% and 6%. As a reference, in private SEP

[40] Operating expenses include equipment rental, equipment inputs, and full and toll expenditures; but it does not include any type of personnel expenses. All types of personnel expenses are included in the personnel expenses item.

[41] This regression includes 41 sub-items. Results for other sub-items are available upon request.

schools, the average expenditure per student on new full-time staff is about US$30 (see Table 3).[42]

Overall, the analysis of this subsection shows that the positive effect of SEP expenditure on earnings is related to the schools' spending of SEP resources on personnel. Furthermore, the latter effect is mostly driven by the schools' expense in hiring new full-time staff.

5.4 Additional Results

We now present four additional results. First, we estimate the effect of the SEP program on intermediate outcomes, which shed light on some channels through which the program might impact initial earnings. Second, we analyze the allocation of SEP resources to the primary and secondary education levels. This evidence helps understand heterogenous effects of the SEP program across schools. Third, we assess whether the positive effects that we found for 12th graders also exist for other grades. Lastly, we evaluate the effect of SEP spending on earnings growth during the first three years of working life. This last piece of evidence is also relevant in the context of the literature that highlights the importance of early career earnings growth for the overall dynamics of earnings over the life cycle (e.g., Murphy and Welch, 1990).

5.4.1 Intermediate outcomes

In this subsection, we analyze the effect of the SEP program on intermediate outcomes. We focus on outcomes observed between secondary education and entry into the labor market. Therefore, before presenting the results, we provide some background information on the tertiary education system in Chile.

Two types of institutions operate in the tertiary education market. First, there are *institutos profesionales* and *centros de formación técnica* which provide vocational education. Second, there are *universities* that offer academic degrees. Among the latter institutions, there is a group of highly selective universities or *traditional universities* which enroll, in general,

[42]Schools' expenditure decisions on a specific (sub)item might be tied to other (sub)items. Then, both item and sub-item regressions might suffer from multicollinearity. However, we observe in Tables 13 and 14 that all the variance inflation factors are lower than 2, which discards the presence of a strong correlation among the expenditure (sub)items, and thus, corrective measures are not needed.

students with the highest performance scores on the PSU test. In addition, those universities exhibit better employability indicators than the rest of the tertiary education institutions.

Public data show that initial earnings are, on average, higher (i) for individuals that complete tertiary education than for those who only complete secondary education, (ii) for individuals who graduate from universities than for those who graduate from a vocational program, and (iii) for individuals who graduate from traditional universities than for those who complete tertiary education at another institution.[43] Therefore, motivated by facts (i) to (iii), we define six intermediate outcomes: PSU math score (measured in standard deviations), PSU language score (measured in standard deviations), the fraction of 12th graders enrolled in a tertiary education program, and the fraction of 12th graders that completed a tertiary education program, a university program, and a university program in a highly selective university. Table 15 displays the results of regression (4) for these six intermediate outcomes.

We observe no impact of the SEP program on the PSU math score and tertiary education enrollment, and a weak effect on the PSU language score. In contrast, we observe positive and significant effects on completion of a tertiary education program, a university program, and a program in a traditional university. Specifically, an increase of US$100 in the expenditure per student increases the fraction of students completing tertiary education and university programs by about 4 percentage points, and the fraction of students completing programs at traditional universities by about 2 percentage points. These effects are significant compared with the average completion rates of tertiary education exhibited by students attending subsidized schools.[44] Therefore, the evidence of this subsection suggests that the effect of the SEP program on initial earnings might be operating through higher rates of completion in the tertiary education stage, specially at high-rank institutions.

5.4.2 SEP expenditure allocation across levels

In order to understand how SEP resources are allocated within schools in practice, we interviewed the head of education affairs at the Social Development Corporation of the Providencia

[43] See Mi Futuro (2021), and Bordón (2014).

[44] The average fractions of subsidized school students who complete tertiary studies, university programs and traditional university programs are 29%, 13% and 6%, respectively.

municipality and the principals of schools that depend on that corporation.[45] We highlight two conclusions from these interviews, which help to understand our results.

First, the principals stated that a fraction of SEP resources are used to hire new staff to provide psycho-pedagogical and socio-emotional support for secondary students with serious need in these areas. Principals also stated that expenses for this type of program are reported to the Ministry of Education under the item "hiring new full-time staff." Importantly, psycho-pedagogical and socio-emotional support is available for all types of students. The principals explained that the latter is due to the fact that, even though there are priority students with significant socio-emotional needs, other students who do not belong to the most economically vulnerable families still need psycho-pedagogical and socio-emotional support. They also claimed that the main impact of the psycho-pedagogical and socio-emotional support for 12th graders–provided through SEP resources–is that it allows students with socio-emotional needs to develop skills that make it more likely they will complete a tertiary education program, which is in line with our results.

Second, the principals stated that they concentrate SEP resources on the educational stage in which students exhibit more evident weaknesses. Concretely, principals stated that if the SIMCE results in secondary levels are weaker than in primary levels, they allocate SEP resources more heavily on activities involving secondary students.

Then, an hypothesis that can be drawn from interviews with the school principals relates to the fact that SEP resources are more heavily allocated to secondary students when the SIMCE results at that stage are weaker than at the primary level. We test this hypothesis by estimating the effect of SEP resources on initial earnings at schools with different primary-secondary performance gaps on the SIMCE test. Specifically, we estimate the following model:

$$\ln y_{jt}^{I} = \delta_1 w_{jt} + \delta_2 (w_{jt} \times g_{jt}) + \delta_3 g_{jt} + X_{jt}'\lambda + \chi_j + \phi_t + \upsilon_{jt}, \tag{6}$$

where g_{jt} is the primary-secondary school performance gap, constructed as the 4th grade SIMCE result of school j at time t minus the 10th grade SIMCE result of school j at time t, and υ_{jt} is

[45]The Social Development Corporation is in charge of allocating education and health resources in the Providencia municipality.

an i.i.d. term.[46]

The marginal effect of SEP voucher spending on initial earnings is given by $\delta_1 + \delta_2 g_{jt}$. Then, a positive value of δ_2 implies that the positive effect of SEP resources on initial earnings is larger in schools with a higher primary-secondary school performance gap. The latter is consistent with a larger allocation of resources for secondary level related activities in schools with a higher primary-secondary school performance gap, as reported in the interviews. Table 16 shows the results of regression (6). We observe that both δ_1 and δ_2 coefficients are positive and significant. Therefore, the effect of SEP resources on initial earnings is larger in schools with a higher primary-secondary gap on the SIMCE test. Since our outcome considers the earnings of 12th graders (secondary students), the latter result is consistent with the hypothesis that school performance at different levels impacts the way SEP resources are allocated.

5.4.3 Other cohorts

A significant amount of research highlights the importance of early childhood interventions to improve school performance and labor outcomes (Deming, 2009; Chetty et al., 2011; Heckman et al., 2013). Therefore, we extend the analysis carried out for 12th graders to other grades. In the case of students in the 4th grade cohort of 2008, they would have completed high school in 2016 which gives us three years of earnings data or two years of higher education plus one year of earnings data. Therefore, we extend our analysis to estimate the effect of SEP on earnings for grades 4th to 11th. We construct the outcome analogously to how we did it for 12th graders, and estimate the analogous regression to (4).

Table 17 shows the results of this regression. We first note that there is a positive effect of SEP on earnings for all levels with the exception of the 5th grade. We also observe that from 6th grade the positive effect increases its magnitude for higher levels until 10th grade, reaching there its highest effect.[47]

[46] As explained in footnote 9, the SIMCE is only administered to 10th graders in the case of secondary students.

[47] The number of observations is higher for lower grades because some schools in the Chilean education system offer primary education only.

5.4.4 Earnings growth

We next evaluate the effect of SEP spending on earnings growth. This is motivated by some articles that have emphasized the effects of education on earnings growth patterns (Brunello and Comi, 2004). We construct four measures of earnings growth: the average of the difference between the logarithm of the initial earnings record in the unemployment insurance system and the logarithm of the 12th, 18th, 24th, and 36th earnings record.[48]

Table 18 shows the results of regression (4), but using our earnings growth measures as dependent variables. We observe that a US$100 increase in the expenditure of SEP resources per student increases the growth rate of earnings by 3.1, 4.1, 4.2, and 1.9 percentage points for periods of 12, 18, 24, and 36 months, respectively. This evidence suggests that the spending of SEP resources not only raises initial earnings but also the earnings growth rate during the first years in the labor market.

6 Conclusions

We exploited heterogeneity in the resources received by schools from a targeted voucher reform implemented in Chile in 2008 (the SEP program) to quantify the effects of voucher spending on initial labor market earnings. We found that an increase of US$100 in the expenditure of voucher resources per student raises initial earnings by 2.3%. However, our results showed that the latter effect is only significant for private voucher schools located in lowly concentrated markets. We conjecture that differences in the regulatory frameworks under which public and private schools operate in Chile, and the market power exerted by schools in highly concentrated local education markets are potential factors that explain this result. Furthermore, we found that the positive effect of voucher spending on initial earnings is mainly explained by the allocation of resources to hire new full-time staff; schools frequently use SEP resources to hire new staff that provide psycho-pedagogical and socio-emotional support to secondary students that exhibit serious need in these dimensions. We also showed that the use of SEP resources increases the probability that 12th graders will complete a higher education program, specially

[48] Although our data allow us to analyze only the first three years of the agents in the labor market, Murphy and Welch (1990) find that a relevant proportion of earnings growth during the life cycle is explained by earnings growth during the first years in the labor market.

at high-rank institutions, which might be one of the drivers of our results.

A vast literature quantifies the effect of school vouchers on educational outcomes. More precisely, existing studies have focused on the effects of vouchers on the school performance of voucher recipients, the migration of students from (low quality) public to (high quality) private schools, the efficiency of public schools, and the aggregate educational outcomes. This paper contributes to the literature by focusing on labor market outcomes instead of educational outcomes, by providing evidence on how the effect of vouchers might depend on the institutional context under which schools operate, and by studying how the allocation of voucher resources across educational inputs impacts earnings.

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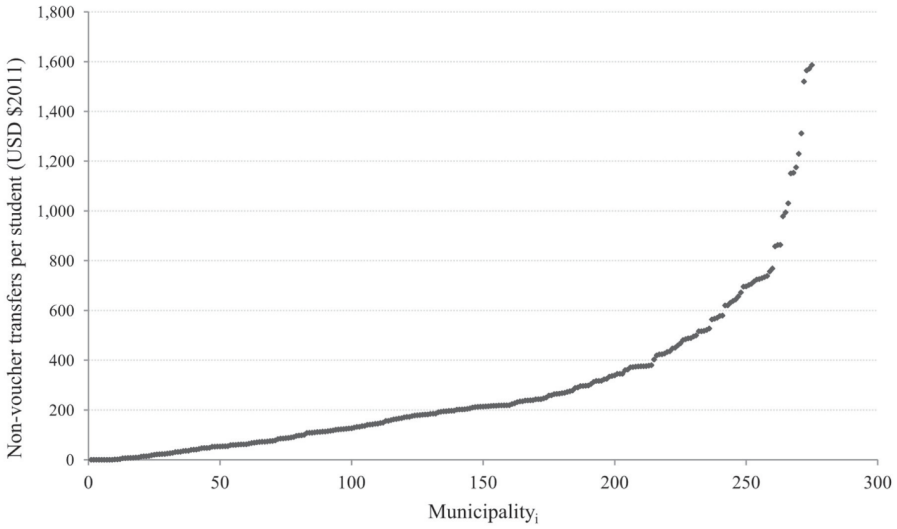
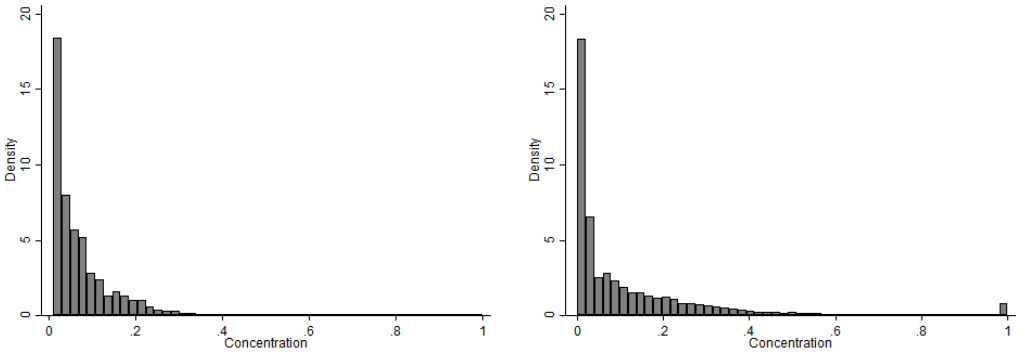
Figures

Figure 1: Non-voucher Transfers at the Municipal Level



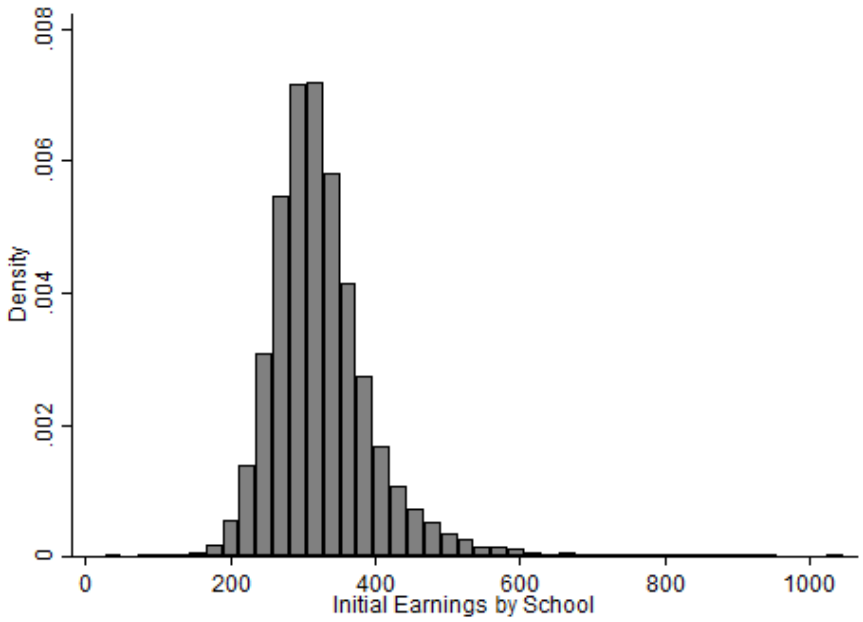
Source: Correa et al. (2014).

Figure 2: Enrollment Concentration



(a) Municipalities (Market I) (b) Geodesic Radius (Market III)

Figure 3: School Earnings Distribution



Tables

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

	Kindergarten–4th Grade	5th–6th Grade	7th–12th Grade
Regular SEP	67.34	44.73	22.61
15%–30% Concentration	4.69	3.10	1.59
30%–45% Concentration	8.03	5.33	2.66
45%–60% Concentration	10.69	7.12	3.58
≥ 60% Concentration	12.00	8.03	4.01

Source: Law 20.248 and the Ministry of Education of Chile.

Table 2: Path Followed by Cohorts of Year 2008 along Period 2008-2019

%	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade	9th Grade	10th Grade	11th Grade	12th Grade
0 years of SEP	0.09	0.11	0.12	0.14	0.19	0.68	0.75	0.79	0.83
1 year of SEP	0.03	0.03	0.04	0.08	0.42	0.10	0.06	0.05	0.17
2 years of SEP	0.03	0.04	0.06	0.22	0.13	0.06	0.05	0.15	–
3 years of SEP	0.03	0.06	0.16	0.24	0.08	0.05	0.12	0.01	–
4 or more years of SEP	0.82	0.76	0.62	0.32	0.18	0.11	0.02	–	–
12th grade	0.71	0.71	0.71	0.71	0.73	0.71	0.81	0.90	1.00
PSU	0.52	0.63	0.64	0.63	0.63	0.61	0.68	0.74	0.76
Tertiary ed. enrollment	0.34	0.52	0.59	0.62	0.64	0.63	0.69	0.74	0.76
Tertiary ed. completion	–	–	–	0.04	0.08	0.13	0.21	0.30	0.38
Earnings	0.59	0.68	0.75	0.80	0.84	0.88	0.90	0.91	0.91
SEP students									
12th grade	0.69	0.69	0.69	0.69	0.71	0.73	0.80	0.90	1.00
PSU	0.50	0.59	0.61	0.59	0.59	0.64	0.71	0.78	0.81
Tertiary ed. enrollment	0.32	0.49	0.55	0.58	0.60	0.64	0.69	0.74	0.75
Tertiary ed. completion	–	–	–	0.04	0.08	0.13	0.21	0.31	0.37
Earnings	0.61	0.71	0.77	0.82	0.86	0.88	0.90	0.91	0.91
Non-SEP students									
12th grade	0.89	0.88	0.86	0.82	0.81	0.71	0.81	0.90	1.00
PSU	0.79	0.91	0.90	0.87	0.83	0.59	0.68	0.73	0.75
Tertiary ed. enrollment	0.52	0.82	0.86	0.86	0.83	0.63	0.70	0.73	0.77
Tertiary ed. completion	–	–	–	0.03	0.08	0.13	0.21	0.30	0.38
Earnings	0.38	0.48	0.58	0.67	0.77	0.88	0.90	0.91	0.91

Table 3: Mean Yearly SEP Expenditure Per Student by Item (US$), 2008-2016

Variable	Public Schools	SEP Private Voucher Schools
Operating expenses	20.06	24.43
Teaching resources	13.18	21.67
Equipment	10.10	14.55
Unexpected expenses	1.02	1.17
Personnel	55.53	68.75
Travel and per diem	0.04	0.30
Performance incentives	0.13	1.15
Teacher training	0.33	1.50
Fee contract staff	16.23	9.09
New full-time staff	19.70	28.10
Overtime pay	12.71	22.45
Consulting and job training	9.27	11.54
Others	13.06	4.24

Table 4: Additional Yearly Resources Per Student (US$), 2005-2016

Variable	Public Schools	Private Voucher Schools	
		Non-SEP	SEP
Other subsidies	1,476.27	1,176.50	1,260.30
Top-up Fee (before SEP)	–	657.19	321.59

Table 5: Covariates Descriptive Statistics

Variable	Public Schools	Private Voucher Schools	
		Non-SEP	SEP
Family income (monthly)	463.97	1,106.70	666.65
Mother's education	9.79	13.18	11.45
Father's education	9.95	13.52	11.56
Inflow % rate (before SEP)	27.36	22.54	22.12
Inflow % rate (after SEP)	26.95	18.71	18.72
Outflow % rate (before SEP)	8.95	12.82	12.65
Outflow % rate (after SEP)	9.26	11.62	11.65
Inflow performance ratio (before SEP)	0.99	0.99	0.99
Inflow performance ratio (after SEP)	1.00	0.99	0.99
Outflow performance ratio (before SEP)	1.01	0.98	0.99
Outflow performance ratio (after SEP)	1.01	0.98	0.99

Table 6: Effect of SEP Treatment on Initial Earnings

	(1)	(2)
SEP treatment	0.0422***	–
	(0.0090)	
SEP 1st year	–	0.0231**
		(0.0106)
SEP 2nd year	–	0.0262**
		(0.0126)
SEP 3rd year	–	0.0362***
		(0.0113)
SEP 4th year	–	0.0907***
		(0.0128)
Observations	8,083	8,083

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Table 7: Schools with Low Inflow Rates

	Equation (1)		Equation (2)	
	(1)	(2)	(3)	(4)
SEP treatment	0.0609***	0.0662***	–	–
	(0.0163)	(0.0142)		
SEP 1st year	–	–	0.0515**	0.0466**
			(0.0211)	(0.0183)
SEP 2nd year	–	–	0.0332	0.0351*
			(0.0222)	(0.0189)
SEP 3rd year	–	–	0.0618***	0.0658***
			(0.0211)	(0.0180)
SEP 4th year	–	–	0.0914***	0.1125***
			(0.0223)	(0.0187)
Observations	2,117	3,133	2,117	3,133

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Table 8: Falsification Test

	(1)	(2)	(3)
False SEP treatment	0.0279	0.0121	–
	(0.0221)	(0.0154)	
False SEP 1st year	–	–	0.0077
			(0.0164)
False SEP 2nd year	–	–	0.0322
			(0.0235)
Observations	2,393	2,393	2,393

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Table 9: Market-Level Analysis

	Market I	Market II	Market III
Share of SEP schools	0.1119***	0.1397***	0.1695***
	(0.0389)	(0.0489)	(0.0100)
Observations	216	130	6,063

Note: (a) All specifications include the change in earnings and the covariates during the pre-treatment period. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level. (d) Market I uses the administrative division of each municipality as a proxy for a local education market; Market II groups the municipalities of the three most densely populated and urbanized provinces as individual markets: Valparaíso, Concepción, and Santiago; Market III defines the local market of a school as the set of schools located inside a ten-kilometer geodesic radius from that school.

Table 10: Effect of SEP Expenditure on Initial Earnings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SEP Expenditure	-0.0288***	-0.0361***	0.0164***	0.0154***	0.0243***	0.0167***	0.0233***
	(0.0036)	(0.0038)	(0.0045)	(0.0045)	(0.0048)	(0.0045)	(0.0048)
Year fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
School fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Additional resource covariates	No	No	No	Yes	No	No	Yes
Socioeconomic covariates	No	No	No	No	Yes	No	Yes
Sorting covariates	No	No	No	No	No	Yes	Yes
Observations	8,283	8,283	8,283	8,283	6,661	8,198	6,613

Note: (a) Clustered standard errors in parentheses. (b) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Table 11: Effect of SEP Expenditure on Initial Earnings, by Type of School

	Public Schools	Private Voucher Schools
SEP expenditure	0.0107	0.0221***
	(0.0069)	(0.0065)
Observations	1,898	4,715

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Table 12: Effect of SEP Expenditure on Initial Earnings, by Concentration Exposure (Private Voucher Schools)

	Market I		Market II		Market III	
	Low Concentration	High Concentration	Low Concentration	High Concentration	Low Concentration	High Concentration
SEP expenditure	0.0232***	0.0056	0.0226***	0.0053	0.0254***	-0.0040
	(0.0071)	(0.0191)	(0.0070)	(0.0197)	(0.0075)	(0.0152)
Observations	4,384	331	4,424	291	4,316	399

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level. (d) Market I uses the administrative division of each municipality as a proxy for a local education market; Market II groups the municipalities of the three most densely populated and urbanized provinces as individual markets: Valparaíso, Concepción, and Santiago; Market III defines the local market of a school as the set of schools located inside a ten-kilometer geodesic radius from that school.

Table 13: Effect of SEP Expenditure on Initial Earnings, by Items (Private Voucher Schools in Lowly Concentrated Markets)

Item	Market I	Market II	Market III
Operating expenses	0.0166	0.0125	0.0204
	(0.0297)	(0.0289)	(0.0326)
	[1.67]	[1.67]	[1.61]
Teaching resources	-0.0048	-0.0041	0.0243
	(0.0332)	(0.0331)	(0.0330)
	[1.69]	[1.69]	[1.67]
Equipment	-0.0133	-0.0122	-0.0106
	(0.0319)	(0.0319)	(0.0321)
	[1.38]	[1.37]	[1.35]
Unexpected expenses	0.0210	0.0038	-0.0533
	(0.1490)	(0.1485)	(0.1538)
	[1.11]	[1.11]	[1.09]
Personnel	0.0355***	0.0354***	0.0305**
	(0.0126)	(0.0126)	(0.0137)
	[1.86]	[1.87]	[1.89]
Consulting and job training	0.0655**	0.0656**	0.0702**
	(0.0259)	(0.0258)	(0.0284)
	[1.17]	[1.17]	[1.18]
Others	-0.0003	0.0002	-0.0206
	(0.0433)	(0.0434)	(0.0551)
	[1.07]	[1.07]	[1.07]
Observations	4,384	4,424	4,316

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) Variance inflation factors in brackets. (d) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level. (e) Market I uses the administrative division of each municipality as a proxy for a local education market; Market II groups the municipalities of the three most densely populated and urbanized provinces as individual markets: Valparaíso, Concepción, and Santiago; Market III defines the local market of a school as the set of schools located inside a ten-kilometer geodesic radius from that school.

Table 14: Effect of SEP Expenditure on Initial Earnings, by Sub-item (Private Voucher Schools in Lowly Concentrated Markets)

Sub-item	Market I	Market II	Market III
Travel and per diem	-0.5258	-0.5122	-0.5471
	(0.4299)	(0.4327)	(0.4774)
	[1.27]	[1.27]	[1.29]
Performance incentives	0.1894	0.1875	0.1817
	(0.1854)	(0.1849)	(0.1931)
	[1.02]	[1.02]	[1.02]
Teacher training	0.2731	0.2695	0.1871
	(0.2730)	(0.2723)	(0.3002)
	[1.15]	[1.15]	[1.11]
Fee contract staff	0.0709	0.0526	0.0368
	(0.0467)	(0.0463)	(0.0455)
	[1.44]	[1.42]	[1.39]
New full-time staff	0.0555**	0.0592***	0.0511**
	(0.0230)	(0.0227)	(0.0231)
	[1.51]	[1.51]	[1.50]
Overtime pay	-0.0285	-0.0272	-0.0338
	(0.0286)	(0.0286)	(0.0309)
	[1.51]	[1.51]	[1.49]
Observations	4,384	4,424	4,316

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) Variance inflation factors in brackets. (d) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level. (e) Market I uses the administrative division of each municipality as a proxy for a local education market; Market II groups the municipalities of the three most densely populated and urbanized provinces as individual markets: Valparaíso, Concepción, and Santiago; Market III defines the local market of a school as the set of schools located inside a ten-kilometer geodesic radius from that school.

Table 15: Effect of SEP Expenditure on Intermediate Outcomes

	PSU Math	PSU Language	Tertiary Education Enrollment	Tertiary Education Completion	University Completion	Traditional Universities Completion
SEP expenditure	0.0093	0.0116*	-0.0004	0.0373***	0.0369***	0.0192***
	(0.0061)	(0.0063)	(0.0027)	(0.0033)	(0.0025)	(0.0015)
Observations	6,606	6,606	6,614	6,614	6,614	6,614

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Table 16: Effect of SEP Expenditure on Initial Earnings with Primary-secondary School Gap Interaction

Variable	Effect
SEP expenditure	0.0252***
	(0.0058)
Interaction	0.0004**
	(0.0002)
Primary-secondary school gap	0.0002
	(0.0002)
Observations	4,815

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Table 17: Effect of SEP Expenditure on Initial Earnings, Other Grades

	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade	9th Grade	10th Grade	11th Grade
SEP expenditure	0.0117***	0.0044	0.0057**	0.0072***	0.0097***	0.0286***	0.0359***	0.0255***
	(0.0046)	(0.0031)	(0.0026)	(0.0020)	(0.0019)	(0.0044)	(0.0047)	(0.0049)
Observations	22,134	24,062	24,189	21,386	21,134	7,458	7,270	6,829

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Table 18: Effect of SEP Expenditure on Earnings Growth

	12 Months	18 Months	24 Months	36 Months
SEP Expenditure	0.0307***	0.0410***	0.0422***	0.0190*
	(0.0067)	(0.0074)	(0.0084)	(0.0101)
Observations	6,598	6,597	6,595	6,569

Note: (a) All specifications include school and year fixed effects, socioeconomic covariates, additional resource covariates, and sorting covariates. (b) Clustered standard errors in parentheses. (c) $***$ significant at 1% level, $**$ significant at 5% level, $*$ significant at 10% level.

Appendices

Appendix A: The Equal Opportunity and Excellence Agreement

Schools that sign the EOEA must agree to the following conditions. First, schools must report (annually), to the Superintendence of Education, the use of all resources received under the program. Second, schools must demonstrate the effective operation of a school board, a council of teachers, and a parent's board. Third, schools must also document the teaching hours allocated to fulfill the technical-pedagogical function in the establishment, and ensure effective compliance with non-school curricular hours. Fourth, schools must comply with an Educational Improvement Plan presented to the Ministry of Education, which includes specific actions in the areas of curriculum management, school leadership, student life, and resource management; prioritizing areas where there is more space for improvement. Fifth, schools must set academic performance goals for their students, with emphasis on priority students. Sixth, schools must indicate, in the agreement, the amount of other public resources received. Seventh, schools must inform parents regarding the existence of this agreement, with special emphasis on its academic performance goals. Eighth, schools must ensure that teachers deliver an annual educational plan for the curriculum to school directors. Lastly, schools must ensure that artistic/cultural activities and sports are available for students in order to promote an integral formative process.

Appendix B: School Spending Incentive Model

In this appendix, we develop a model to study the incentives for schools to spend their educational resources on human capital-enhancing inputs. The model highlights the role of two elements: (i) regulation, and (ii) competition. To be clear, we do not intend to capture all the potential factors that determine the decisions of schools and parents. Our exclusive goal is to put the main aspects of the institutional context of the Chilean school system into a formal framework, so as to motivate the empirical analysis developed in Subection 5.2.

Consider an education market composed by a public school, p, and a private voucher school, s. We assume a linear demand for education in the form $q_i = a + b \times e_i$, where q_i is the number of students that school $i \in \{p, s\}$ enrolls when the school spends $e_i \in \mathbb{R}_+$ resources per

student. Then, in this setting, e is the only school attribute that students value. Hereafter, we say that e is the expenditure (per student) on *human-capital enhancing purposes.* Pushing the interpretation of variable e to the fullest, we also state that a larger expenditure per student directly maps into higher labor market earnings, which is the underlying reason why students in this model value attribute e. Furthermore, a is school enrollment when no resources are spent on purposes valued by students. Hereafter, we say that a is the *residual demand*, and we fix the demand parameters a and b. A subsidy per student $v > a/b$ is allocated to each school.[49] For the next analysis, we define a school's surplus as the difference between resources collected from enrollment and total expenditure.

The public school differs from the private school in several aspects. First, the public school is not allowed to charge tuition. Second, as in Manski (1992), we assume that the public school is a local monopolist and so it is not pressured by competition to spend all of its revenues in ways valued by students. Thus, the public school chooses expenditures per student that maximize the surplus available for advancing costly objectives not valued by students; for instance, some socially desired goals. We assume that the latter objectives demand an amount $K > 0$ of resources, and we will refer to them as *non-student purposes.* Third, the public school receives non-voucher transfers $M \geq 0$, which are endogenously determined to mediate any budgetary losses. These transfers capture the existence of the "soft-budget constraints" in public schools that we have discussed in Subsection 2.2. Fifth, the public school faces an iceberg-type cost, θ, for each unit of resources spent. We motivate the existence of θ by rigidities that the regulation imposes on public schools to spend their resources. Hereafter we refer to θ as *expense frictions.* These expense frictions imply that $\theta > 1$ units of resources must be spent in order for one unit of expenditure to reach its desired use. All these elements together, which are idiosyncratic to the public school, intend to capture the main aspects of the institutional context described in Section 2.

The private school operates in two exclusive education markets, non-competitive or competitive, and it is allowed to charge an exogenous tuition $\tau \in \mathbb{R}_+$. We model a private school operating in a non-competitive market by a local monopolist that behaves similar to a public school; then, a local monopolist private school maximizes surplus, which we assume is used to

[49] A subsidy strictly larger than a/b ensures that the private school spends a positive amount of resources on human-capital enhancing purposes, as we will see later.

pay rents to anonymous school owners. In addition, we model a private school operating in a competitive market by imposing a zero-surplus condition that the school must meet. The latter implies that a competitive private school uses all of its collected revenues for human capital enhancing purposes.

The Maximization Problem of Schools

The public school chooses the expenditure per student so as to solve:

$$\pi_p(e; v; \theta, M, K) = \max_e \left(v - \theta \times e\right)\left(a + b \times e\right) + M - K. \tag{B1}$$

Let $e_p(v;\theta)$ be the solution to problem (B1):

$$e_p(v;\theta) = \begin{cases} 0 & \text{if } v \leq \frac{a\theta}{b}, \\ \frac{vb-\theta a}{2\theta b} & \text{if } v > \frac{a\theta}{b}, \end{cases} \tag{B2}$$

Then, for a fixed K and v, non-voucher transfers must solve:

$$\arg\min_M \pi_p(e_p; v; \theta, M, K) \geq 0. \tag{B3}$$

Note that problems (B1) and (B3) explicitly show the elements that are idiosyncratic to the public education sector in Chile: we observe the presence of expense frictions (θ), expenditure on non-student purposes (K), and non-voucher transfers (M).

A private school that is a local monopolist solves a problem analogous to (B1):

$$\pi_s(e; v, \tau) = \max_e \left(v + \tau - e\right)\left(a + b \times e\right). \tag{B4}$$

A competitive private school spends all resources in ways valued by students. Hence, a zero-surplus condition must hold:

$$\pi_s(e; v, \tau) = 0. \tag{B5}$$

We denote by $e_s^n(v,\tau)$ and $e_s^c(v,\tau)$ the solutions to problems (B4) and (B5), respectively:

$$e_s^n(v,\tau) = \frac{(v+\tau)b - a}{2b}, \tag{B6}$$

$$e_s^c(v,\tau) = v + \tau. \tag{B7}$$

Analysis

Consider program P that delivers an additional subsidy per student w to participating schools. Denote by $v' = v + w$ the total subsidy per student. To join this program, schools must exempt all students from any tuition. Then, w must be equal or higher than τ in order to encourage the private school to join the program.[50] The policy experiment illustrated by program P resembles the SEP program that we have described in Section 3.

Assumption B1. $w > \tau$.

We focus the analysis on the case where expense frictions make it very costly for a public school to invest resources on human-capital enhancing purposes. Then, the public school invests no resources ($e_p(r;\theta) = 0$), enrolls the residual demand ($q_p = a$), and losses are mediated by non-voucher transfers such that $M = K - ra$, for $r = \{v, v'\}$.

Assumption B2. $\theta \geq v'b/a$.

Consider the effects of program P on the expenditure choice of participating schools. Let Δe be the change in the expenditure per student in participating schools. That is, $\Delta e_p = e_p(v';\theta) - e_p(v;\theta)$, $\Delta e_s^n = e_s^n(v',0) - e_s^n(v,\tau)$, and $\Delta e_s^c = e_s^c(v',0) - e_s^c(v,\tau)$. Then, it follows directly from the analysis carried out above that:

$$\Delta e_p = 0 \tag{B8}$$

$$\Delta e_s^n = \frac{(w-\tau)}{2}. \tag{B9}$$

$$\Delta e_s^c = w - \tau. \tag{B10}$$

[50] For instance, Table 4 shows that the top-up fees of SEP schools, before the SEP, were smaller than those in non-SEP schools.

Then, program P rises spending per student in the private school by a strictly larger amount than in the public school. The existence of significant expense frictions in the local monopolist public school rationalizes this result. Furthermore, the effect of program P on the expenditure per student is higher when the private school behaves competitively than when it behaves non-competitively. Competitive forces evaporate any positive surplus, which leads the private school to spend all the collected resources on uses that are valued by students.

Hence, this stylized model illustrated how idiosyncratic characteristics of schools may impact the incentives to spend educational resources on human capital-enhancing inputs. The latter motivates the empirical analysis of Subsection 5.2, where we explore whether the impact of the SEP program depends on the type of school (public versus private) or the level of concentration of the education market.