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Government fragmentation and educational outcomes: Evidence on the creation of municipalities in Chile[1]

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Abstract

We explore how government fragmentation affects public education provision by examining the case of Chile, which created 11 municipalities between 1994 and 2004. Using territories that sought, but failed to, achieve independence as controls, we find that schools in newly created municipalities, on average, experienced a standard deviation decline of 0.2 in elementary school mathematics performance. In addition, fragmentation led to a high turnover and increased job insecurity of classroom teachers and school management teams in newly created municipalities. In contrast, reducing the size of the original municipalities' school networks does not impact student outcomes or school personnel. Overall, our findings point to specific unintended educational effects of policies that seek to enhance horizontal decentralization.

JEL classifications: I21, I28, H83.

Keywords: Municipalities, Decentralization, Education, Chile.

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1. Introduction

In recent decades, several Latin American countries have pushed reforms to decentralize public education, devolving responsibility for public functions and the provision of education from national to authorities at the sub-national or local levels, while at the same time increasing the number of subnational/local educational administration units. In this process, a distinction is made between "vertical" decentralization, i.e., the distribution of powers and functions throughout the different levels of a given system (national, subnational, local), and "horizontal" decentralization, which is related to the number of subnational administrative units in a country.

Thus, "horizontal decentralization" or "government fragmentation" refers to a jurisdictional reorganization that does not affect the legal framework for the distribution of functions or the "vertical decentralization" of a given system (Grossman and Lewis 2014). While there is a large body of research on vertical decentralization, scant literature exists on the effects of horizontal decentralization on the quality of public service provision, despite the critical trend towards the proliferation of administrative units experienced by developing countries in the last few decades. The available research warns that the expansion of subnational administrative units has positive albeit diminishing effects when an extreme fragmentation limit is crossed, which may weaken bargaining power at the central level (Grossman and Lewis, 2014) or have serious repercussions on efficiency (Grossman et al. 2017). A vital issue at the core of many of the studies on government fragmentation is that the analysis is limited to the global effect on all the affected territories, which makes it impossible to observe heterogeneities within the fragmented units (Grossman and Lewis 2014, and Billing 2018).

In this paper, we analyze the consequences of government fragmentation (horizontal decentralization) on the educational outcomes of schools in 11 Chilean municipalities created between 1994 and 2004. This policy resulted from enacting a set of laws that allowed territories to emancipate themselves politically and administratively from the municipalities on which they depended, thus creating new municipalities. In other words, the policy engenders new municipal governments (hereinafter, "New"), originating from existing municipalities whose territories have been reduced ("Mothers"). We therefore specifically study two direct effects of government fragmentation on student' educational outcomes in the territories affected by the policy:

(A) New management effect: Schools transferred to the newly created municipality become subject to the social and administrative control of the local community, the capacities, culture, and political trends that prevail in the territory, and which may differ from the municipality of origin. On the one hand, the emergence of new administrative units can positively affect educational outcomes as a result of increased

accountability, as the local government is closer to the people (Schumacher 1973, and Oates 1972). This improvement may be attributed to a lower information asymmetry and greater accountability of the authorities to the public (Tommasi and Weinschelbaum 2007, and Gottlieb et al. 2019). On the other hand, creating new administrative units could negatively impact the educational outcomes of transferred schools. Literature cautions that these new, smaller, and more homogeneous units have the potential to be captured by local elites, which is likely to both affect management capacity and facilitate corruption or cronyism (Lewis 2017a; 2017b, Bardhan and Mookherjee 2003, 2006, Aspinall 2012, Pierskalla 2016, and Billing 2018). Likewise, new units may not have the local skills needed to fill key positions in the new administration (Sujarwoto 2017, and Hanushek et al. 2013). In addition, there could be a steep learning curve for the new administration.

(B) Size effect: In countries where municipalization administratively covers the entire territory, creating a municipality necessarily implies separating from another. For Mother municipalities from which the new municipalities derive, it involves reducing the size of the school network it administers. Literature cautions that downsizing—especially in highly fragmented contexts—could harm educational outcomes by reducing the ability to achieve economies of scale (Boyne 1998, Andrews et al. 2002, and Duncombe and Yinger 2007). In the case of Chile, a smaller school network may lead to a scaled back budget for the municipal administration, given that central offices are financed through a portion of a variable income that depends on the number of students enrolled and their attendance. This may translate into fewer opportunities to provide support to schools, fewer staff positions open at the municipal central offices, and overall, fewer options than in municipalities with a greater number of students and thus more significant income. On the other hand, the decrease in the number of schools could positively affect educational processes by easing the administrative burden of the central office management teams. Fewer schools translate into fewer purchase orders, fewer replacements for teachers on leave, i.e., less bureaucracy and fewer transaction costs (Williamson 1967). In addition, fewer schools may make it easier for the central office staff to monitor and provide pedagogical support to schools in their territory.

To analyze these effects, we compared trends in New and Mother municipalities against those in other municipalities that sought to split but were not yet authorized by the competent technical body, the Sub-Secretariat for Regional and Administrative Development - SUBDERE. We thus identified two control groups: 1) Potential New municipalities and 2) Potential Mothers, both within the confines of an existing municipality that never split. We used a difference-in-differences (DID) strategy to estimate the effect of the new management (effect A) in New municipalities (Treated and potential) and the size effect (effect B) in Mother municipalities (Treated and potential).

We find that the policy on average had a detrimental effect on mathematics learning outcomes (primary school grade 4) in schools transferred to the New municipality and exposed to a new administration (effect A). This effect is robust, relevant in magnitude (0.2 of a standard deviation), and persistent over time (6 years). On the other hand, we find no evidence that a size reduction (effect B) affects educational outcomes (Language, Math, or internal efficiency outcomes) in schools in Mother municipalities.

What mechanisms could be driving this adverse effect? Based on the cohort of schools treated in 2004 for which administrative data on educational staff is available, we note that schools that came to be managed by a new municipality experienced a deterioration in teaching working conditions along with a temporary shock in teacher turnover, which was particularly high in the case of school management teams.

This study primarily contributes to two areas of interest. First, we contribute to available literature of empirical studies on the effects of public service decentralization in developing countries. We also address a commonly neglected aspect of decentralization related to changes in the territorial organization of nations rather than changes in the political structure or the delegation of authority (Grossman and Lewis 2014). Second, our study seeks to provide an analytical and methodological framework to address the various consequences of political-government fragmentation policies. This is an essential question as several countries in the developing world seem to be following a trend towards increasing the number of administrative units, in sharp contrast with developed countries, which have instead been pushing for policies to consolidate local governments and school districts (Berry and West 2008, and Leach et al. 2010).

Finally, our study contributes to the body of literature on educational governance by highlighting the importance of intermediate governance layers on student academic improvement (McKinsey 2010). A significant body of literature stresses the benefits of reforming education systems towards forms of local government that promote community participation and control of schools (Jiménez and Sawada 2014, 1999, King and Ozler 2005, Gunnarsson et al. 2009, Elacqua et al. 2019, Faguet 2004, and Faguet and Sanchez 2008). However, our results are in line with several studies suggesting that decentralization reforms may not always result improve student achievement (Billing 2018, Blimpo et al. 2015, Hanushek et al. 2013, Galiani et al. 2008, and Madeira 2012).

Section 2 of this paper describes the governance of education in Chile and the process for creating new municipalities. Sections 3, 4, and 5 describe the data as well as our criteria to define our control group and provide descriptive statistics of our sample. Section 6 describes the identification strategy, and Sections 7 and 8 present our key results and robustness analyses. Finally, Section 9 discusses our findings.

2. Background

The governance of the Chilean education system stems from a series of reforms that started in the 1980's. In 1981, the management of public schools was transferred from the central to municipal governments. Municipalities became the new managers (*sostenedores* or "holders") of state-owned kindergartens, primary and secondary schools, while the role of the Ministry of Education (MINEDUC) was to establish regulations, determine policies, and oversee educational institutions.[2]

Compared to other countries, the Chilean system shows a high degree of both vertical and horizontal decentralization. Regarding vertical decentralization, more than 80% of the administrative, financial, and staffing decisions surveyed by the Organization for Economic Cooperation and Development (OECD) are made at the local or the school level, a higher percentage than the OECD average (Figure A1). Municipal governments oversee the administration of public schools within their territory; personnel management (hiring, sanctioning, and dismissing teachers and other personnel); planning improvement efforts; implementing the funds transferred by the central government; executing ministerial programs; infrastructure maintenance; making decisions on the opening of new schools and the closing of existing ones; among others (Table A1). Regarding horizontal decentralization, Chilean municipalities operate on a relatively small geographical scale. Over 75 percent of municipalities manage less than 20 schools, and 60 percent thereof have less than 2,500 students.

Municipal schools are financed through national funds allocated on a per-pupil basis (considering both enrollment and student attendance). No funds are earmarked to finance the operation of the municipal offices in charge of managing schools. In general, municipal education offices are financed using municipal funds and a portion of the per-pupil income. This results in fewer resources available to their schools and students as well as large inequalities between municipalities with a greater number of students (and thus a more considerable income and the possibility of making economies of scale) and smaller municipalities; as well as between better-off municipalities that can supplement funds from their revenue and municipalities that cannot (Bellei et al. 2018).[3]

The creation of new municipalities in Chile is regulated by Act 18,695 from 1988. Once a motion for municipal independence is moved, all proposals must be submitted to the SUBDERE technical body for evaluation. This evaluation has three main criteria: geographic, demographic, and sociocultural and

[2] In 1980, there were 8,846 general education institutions (primary and secondary) in Chile, of which 6,370 (72%) were public schools, 1,674 (18.9%) were subsidized (voucher) schools managed by private entities, and 802 (9.1%) were fully private schools.

[3] This governance structure was reformed in 2017, with the passing of the Act 21,040, which transferred municipal schools to a new layer of decentralized public services.

organizational. The first two criteria consider the level of isolation, connectivity, and population growth, while the third includes qualitative aspects about the identity of the potential new municipality. The evaluation is presented first to the President and then to Congress, and new municipalities are created by law. From 1994 to 2004, municipalities in Chile grew by 3 percent, from 334 to 345[4] despite the fact that over 20 requests were put forward by territories to become an independent local government that were rejected or deferred. No new municipalities were created after 2004.

3. Data

We collected historical information at the student, school, and municipal levels from various data sources from 1992 to 2014. We describe the different sources of information below:

Average school academic performance data: Our primary source of information was the Chilean System for Measuring Educational Quality (SIMCE), which contains primary school grade 4[5] census information on the school's academic performance and socioeconomic level, among others. Our main results were based on school averages, since before 1998, only data at this level of aggregation were available. SIMCE's data collection and processing methodology have changed over time. First, the SIMCE changed its methods and scale from 1999 onwards, thus restricting inter-temporal comparisons (Eyzaguirre and Fontaine 1999). Our analysis, therefore, focuses on the inter-temporal relationship of intra-temporal differences, i.e., differences between groups each year (Gallego 2002). This means that we did not examine whether schools have improved over time, but instead if their rank among other schools changed with each passing year. To this end, we standardized academic performance scores using the standard and mean deviation of the universe of schools in the Chilean school system for each year, only including schools with observations throughout the panel, as shown in Table A3. Second, SIMCE provided a sample school coverage for applying the test until 1999, when it became a census. This slightly reduces the number of schools with available information throughout the panel. Hence, our results are presented as balanced panels.[6]

Individual academic performance and student enrollment data: Our results include a subsample using student-level microdata available only for the cohort of municipalities created in 2004. Since school averages are subject to possible selection bias, we cross-checked the SIMCE results with MINEDUC's

[4] Nine municipalities were officially created in 1980 whose administrations took office in 1991. Strictly speaking, these municipalities were not created under the same scheme as the one in our sample, so we do not include them in our analyses.

[5] The SIMCE is conducted on Grades 4, 8, and 10. However, we have decided to present results for the 4th grade, mainly because of the educational supply structure in the municipalities under analysis. Many of them are small and only have primary schools.

[6] The schools included in our balanced panel represent 77% of all schools in the analyzed territories. It should be noted that when schools with one, two, or even three incomplete SIMCE values are incorporated into the model, the results do not change.

enrollment records to evaluate only students affected by the policy in 2004. Enrollment records have information on each student's school, the average attendance, whether the student graduated, and the grade point average achieved that year. We also use the SIMCE parent surveys to obtain socioeconomic information (parents'' income and education) for each student, among other variables. With this information, we also developed secondary analyses to study student migration in schools in 2004.

Teacher data: We used data from the 2003-2012 Teacher Census (MINEDUC) to make a panel of each teacher working in the public or private subsidized system, to observe their professional characteristics (gender, age, type of professional degree, among others), the school where they work, type of contract (tenured or fixed-term) and role at school (classroom teacher or management), among others.

Population and housing census: We used the population and housing censuses conducted in 1992, 2002, and 2017 to identify new potential municipalities and their Mothers (control group) by basing the projections on census districts (territorial units that administratively comprise the municipalities). Second, we used territorial-level census data to characterize the territories in our sample.

4. Treatment and control groups

In our research, we use the 11 New municipalities created since 1994 with their respective Mothers (that is, the municipalities from which the new municipalities emancipated) as the treatment group. Seven were created from 1994 to 1996 (with their majors taking office in December 1996), with the remaining municipalities being created in 2004 (with their majors taking office in December of that year). Heterogeneity among the new municipalities exists regarding demographic, socioeconomic, geographic, and other characteristics. Certain municipalities, such as San Rafael, Alto Biobío, and Cholchol, are very small, rural, or semi-rural, while others (Chiguayante, San Pedro de la Paz, and Hualpén) were created in urban and more densely populated areas. See Table 1 for a description of the New and Mother pairs of municipalities.

On average, before the creation of the new municipalities, the Mother municipalities managed about 40 schools. However, once the new municipalities achieved independence, the New municipalities took over 10 schools on average (with the smallest and the largest running as few as 3 and as many as 17, respectively), while their Mothers administered 30 (with a range of 6 to 53 schools).

Table 1: New municipalities created since 1990 and their Mother municipalities

New Municipality						Mother Municipality	
Name	Year of enactment of the law	Urban/Rural	2012 Census Population (thousands)	Macro-region	No. of Schools (T+1)[7]	Name	No. of Schools (T+1)
Hualpén	2004	Urban	88.4	South	17	Talcahuano	33
Alto Hospicio[8]	2004	Urban	65.3	North	3	Iquique	26
Alto Biobío	2004	Rural	8.5	South	5	Santa Bárbara	14
Cholchol	2004	Rural	10.5	South	13	Nueva Imperial	30
Chiguayante	1996	Urban	85.9	South	12	Concepcion	43
San Pedro de la Paz	1996	Urban	80.5	South	15	Concepcion	43
Concón	1996	Urban	32.3	Center	8	Viña del Mar	53
Chillán Viejo	1996	Urban	27.4	South	6	Chillán	45
Padre Hurtado	1994	Semi-urban	38.8	Center	5	Peñaflor	12
Padre de las Casas	1995	Urban	75.0	South	15	Temuco	47
San Rafael	1995	Semi-urban	9.1	Center	6	Pelarco	6
Total			522		105		352

Note: Prepared by the authors based on data from the 2002 Census and MINEDUC records for the number of schools in 1997 and 2005 (T+1). The municipalities created in 1994 and 1995 officially came into effect in December 1996.

For the control group, we used territories that have formally applied to become an independent local government but have not yet been authorized as Potential New municipalities. In addition, we used municipalities with territories within their boundaries that have applied for political-administrative independence as Potential Mothers.

We identified 22 territories[9] that applied to become a new local government from 1992 to 2006 (See Table A2 in Appendix A). Five of the 22 Potential New municipalities had already had their borders defined in a SUBDERE assessment. As for the remaining 17 territories, since they a SUBDERE evaluation, we estimated their borders by identifying the census district of the head town seeking emancipation and generated conservative proposals based on natural and urban boundaries. In some cases, we also used the territorial proposals made by the communities themselves[10]. The black dotted line in Figure 1 shows an

[7] This includes all educational institutions run by municipalities, including kindergartens, adult education centers, special and secondary schools.

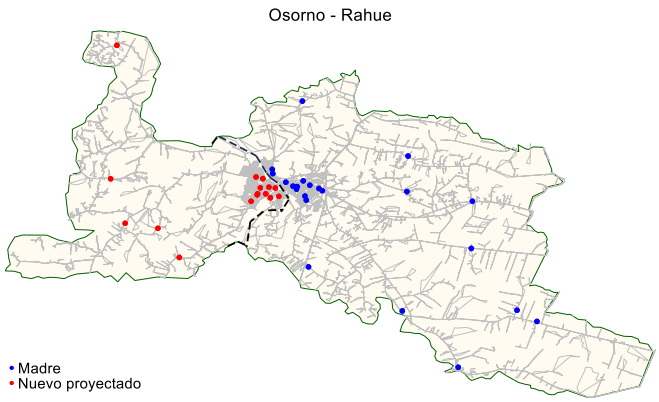
[8] This municipality is characterized as an outlier due to its highly privatized educational offering. In our overall results, we excluded this municipality since its schools do not have pre-trends. Our results were not significantly changed by including it. In Section 8, we include this municipality in the student-level analyses.

[9] SUBDERE recognizes 75 requests of municipal independence, only 22 of them fulfilled the conditions to by evaluated: i) territories with primary schools, ii) available educational performance data, and ii) an emancipation request raised before 2006. We also excluded if a potential New municipality requested emancipation of a Mother municipalities that was already in the sample as treated Mother municipalities (3 municipalities met this criteria).

[10] We used multiple sources of information to project the boundaries in the potential territories, including SUBDERE reports, media, and publications by neighborhood councils in these territories. A general criterion to outline the boundaries of most potential territories was to use the boundaries drawn in the census district for each territory by the corresponding administrative division, plus corrections per school using their georeferenced coordinates. In addition,

example of territorial boundaries projected by the SUBDERE in Rahue, one of the Potential New municipalities that are still pending congressional approval.

Figure 1: Example of territorial delimitation between the potential Mother municipality (Osorno) and the Potential New municipality (Rahue)



Note: Map of the Municipality of Osorno based on the geolocation of schools and community maps of the National Institute of Statistics (INE). The schools belonging to the potential territory of Rahue are shown in red. The schools that we projected would remain in what is now the municipality of Osorno are shown in blue.

Our treatment and control groups have similar observable characteristics (see section 5 below). However, they may differ in unobservable characteristics, which would invalidate our results. First, our controls would not be valid if time-varying unobservable characteristics correlated with the decision to create a new municipality and the evolution of educational outcomes. For example, if the decision to create a municipality were based on the educational outcomes of schools in the territory, the policy evaluation would be endogenous to its allocation criteria. We believe that this is unlikely. The technical criteria considered by SUBDERE in their evaluations include the existence of a sufficient demographic base, local support for the initiative, access to public services, and geographic isolation, among others. Following the technical evaluation, the process involves a political negotiation between municipal and regional representatives and the central government.[11] In addition, the bill must secure definitive backing from both chambers of Congress. In fact, our sample includes Potential New municipalities that, having received a favorable technical evaluation to emancipate, have not yet managed to do so.[12]

geographic boundaries, i.e., natural borders between territories, such as rivers or lakes, were also considered. Details for each territory are available upon request.

[11] Mayors of Treated Mother municipalities do not differ significantly in their political alignment with mayors of Potential Mother municipalities. A classification of mayors before the cutoff period by party shows that 60% of the mayors in Potential Mothers were aligned with the central government, whereas for those in Treated Mothers that number stands at 40%.

[12] In some cases, the emancipation request was met with strong opposition from the Potential Mother municipality, which organized referendums to halt the emancipation process.

Another potential threat to the validity of our control group concerns the timing of achieving independence by controls. To address this threat, we assigned a "treatment" year to the controls, i.e., we assumed in which year they would have been granted independence. For territories that applied for independence from 1992 to 1995, we assumed that their treatment year would have been following the 1996 municipal election. For potential municipalities that applied between 1997 and 2003, we assumed that their treatment year would have been after the 2004 municipal election. This assumption is plausible given the nature of the public policy we are analyzing. Considering that treatment is based on legislation that was applied at only two points in time within the period analyzed, we can attribute the fact that all territories failed to be granted emancipation to the proximity of their petition to the time at which the policy was made effective (1996 and 2004, election years). Assigning this temporality allows us to isolate specific temporal circumstances that gave rise to the request.

Table 2 in section 5 shows the coefficient of a simple regression using each variable as an outcome to evaluate the significance of the differences between Treated New and Mother municipalities and their respective controls (Potential New municipalities and Potential Mothers). There are no relevant differences in our outcomes of interest before treatment, nor did we identify any differences in characterization variables and socioeconomic level between Treated New and Mother municipalities and their respective controls. However, there are relevant differences in variables linked to the characteristics of the educational market in each territory. For instance, Treated New municipalities include three times more private subsidized (voucher) schools than Potential New municipalities and slightly more than twice the enrollment rate. This occurs in three municipalities, Alto Hospicio, Padre de las Casas and Cholchol, where subsidized private enrollment reaches a percentage that exceeds the national average. The robustness section describes several tests that suggest that these pretreatment differences do not explain our effects. There is also a small imbalance between treatment and control groups in the population with access to higher education, which is higher in Treated Mothers.

5. Descriptive statistics

Table *2* shows descriptive statistics based on school and municipality-level information two years before treatment (1994 and 2002 for those municipalities that began to function as independent territories in 1996 and 2004, respectively) for New and Mother territories. A third column (*Diff Coeff*) shows the coefficient of a simple regression using each variable as an outcome to evaluate the significance of the differences between treated New and Mother municipalities and their respective controls (Potential New municipalities and Potential Mothers)

Table 2: Descriptive statistics

	New Municipalities			Mother Municipalities		
	mean	*s.d.*	*Diff. Coef.*	*mean*	*s.d.*	*Diff. Coef.*
School level						
Math 4th grade test score (Z)	-0.31	0.86	0.06	-0.26	0.75	0.06
Language 4th grade test score (Z)	-0.39	0.84	-0.07	-0.29	0.77	-0.03
Graduation Rate (%)	0.89	0.07	-0.03	0.91	0.06	0.00
Low SES[13]	0.55	0.50	-0.21	0.42	0.50	-0.11
Medium-Low SES	0.23	0.43	-0.11	0.33	0.47	0.02
Medium SES	0.19	0.40	0.27*	0.24	0.43	0.08
Mean Parental Education	2.32	0.59	-0.23	2.59	0.62	0.02
Enrollment 4th grade	58.49	36.77	19.66	61.70	37.91	-4.09
Enrollment School	261.12	157.89	78.45	281.19	170.36	11.49
Rural (Urban)	0.30	0.46	-0.25	0.12	0.32	-0.15
Km. to Mother's municipality [a]	11.13	12.04	1.17	4.03	5.79	-0.46
Municipal level						
Voucher Schools Math 4th grade test score (Z)	0.01	0.69	-0.01	0.22	0.40	0.12
Voucher Schools Spanish 4th grade test score (Z)	0.00	0.65	0.06	0.30	0.38	0.14
Total number of schools	17.11	7.92	6.53	61.58	28.00	5.77
Number of Voucher Schools	8.62	4.93	5.77**	21.16	9.08	-1.01
Voucher School Enrollment (%)	0.40	0.18	0.14*	0.33	0.08	-0.06
Private School Enrollment (%)	0.07	0.07	0.02	0.12	0.08	0.05
Municipal level Census 2002						
Low Income (%)	0.48	0.27	-0.11	0.38	0.24	-0.06
Population with college or above (%)	0.17	0.11	0.04	0.22	0.13	0.04*
Population (Log)	9.35	0.87	0.25	9.34	0.75	-0.04
Indigenous population (%)	0.07	0.12	0.07	0.04	0.04	0.00
Unemployment	0.06	0.01	0.00	0.06	0.01	0.00

Note: Columns 2,3, 5, and 6 show descriptive statistics for New and Mother municipalities. Columns 4 and 7 show the significance level (*** <0.01, ** <0.05, *<0.1) of the difference between treated group averages and their respective Potential New and Potential Mother controls using a simple regression using the covariates as the dependent variable and clusters at the borough/territory level. The descriptive statistics correspond to 1994 for municipalities treated in 1996 and to 2002 for municipalities treated in 2004. This includes only primary schools with complete information for the entire analysis period and with at least five students. Period: 1992–2011. [a] Euclidean distance between a school and the building of its Mother municipality, as a proxy for its distance to the administration.

As shown in the table above, New municipalities (both treated and Potential) tend to have a lower socioeconomic status than their Mothers and to be situated in rural locations. Indeed, New municipalities created after 1990 are on average poorer regarding income and education and rely on the Municipal

[13] The SIMCE provides a school SES scale based on surveys to parents. We include the scale with 4 categories: "Low", "Medium Low", "Medium" and "High". No schools in the sample fall in the "High" SES group.

Common Fund (a fund that redistributes national revenue across municipalities) to a higher extent. Except for three municipalities, half of the funding of the new municipalities came from this source (SUBDERE, 2011). In addition, New municipalities in both the treated and control groups have fewer schools compared to Mother municipalities (17 vs. 61 on average), which means comparatively smaller education budgets as a result of the per capita national funding and a lower capacity of the municipal government to compensate with local funds. New municipalities tend to record a lower academic performance in Mathematics and Language, as well as a reduced graduation rate.

Figures A2 and A3 show the trends over time in contextual and main variables in both the treatment and the control groups. As time elapses there are no changes in trends in variables such as socioeconomic level, demographics, and population belonging to indigenous peoples (Figure A2). Figure A3 displays an average performance in Mathematics, teacher turnover, socioeconomic level, percentage of private subsidized enrollment, and total enrollment over time (1992-2013). Academic performance in Mathematics suggests a negative impact of the post-reform policy. On the other hand, teacher turnover averages (only for the cohort of schools affected by the policy in 2004) increase considerably in the treated New municipalities against those of Potential New municipalities immediately after implementing the reform.

6. Identification strategy

We use a DID methodology to identify two direct effects of fragmentation: (A) the new management effect, comparing schools in Treated New municipalities with schools in Potential New municipalities, and (B) the size effect, comparing schools in Treated Mother municipalities with schools in Potential Mother municipalities.

The policy was implemented at two points in time (1996 and 2004). Time is thus based on the year of establishment of the new municipality (T=0), which matches the year in which the municipal election took place (October, while actual changeover was in December). For each cohort, data are available for four time periods, two pre- and two post-treatment periods (see Table A3). Thus, for example, T+3 corresponds to 1999 and 2007 for municipalities created in 1996 and 2004, respectively. As discussed in section 4, we assigned a temporality to controls, taking the year in which, the request was formalized as a reference, and assigning the year of treatment according to the proximity of the request to 1996 or 2004. This means that we can calculate the pooled estimator of the fragmentation policy, say, two years after implementation.

In econometric terms, we evaluated the policy from equation (1), where i is an individual school from the set of schools (I) under study. Y_{it} is our outcome, the standardized SIMCE fourth grade (Mathematics or Language) score of school i in year t. In this equation, T_i is a binary variable that equals 1 if the school i belongs to a treated municipality (either a Treated New or Treated Mother) and 0 if it belongs to a Potential

municipality (either a Potential New or potential Mother). N_i is a binary variable that equals 1 if the school i belongs to a New municipality (Treated or Potential) and 0 if it belongs to a Mother territory (Treated or Potential). $post_t$ is a binary time variable that shows whether the time t is before (0) or after (1) the year of treatment. x'_{it} is a vector of characteristics of the observation it,[14] μ_t is a time effect, v_i is a fixed effect at school level, and ε_{it} is the error term.

(1)

$$Y_{it} = \gamma_1 N_i + \gamma_2 T_i + \gamma_3 post_t + \gamma_4 N_i post_t + \gamma_5 N_i T_i + \gamma_6 T_i post_t + \gamma_7 N_i T_i post_t + x'_{it}\beta + \mu_t + v_i + \varepsilon_{it}$$

In the above equation, when a school i belongs to a Treated New municipality, variables N_i, T_i, and their interaction have a value of 1. When the school i belongs to a Treated Mother municipality, only variable T_i has a value of 1. When the school i belongs to a Potential New municipality, only variable N_i has a value of 1. When the school i belongs to a Potential Mother municipality, variables N_i and T_i receive a value of 0.

In this model, the new management effect (A) on the schools in Treated New municipalities compared to schools in Potential New territories amounts to the sum of $\gamma_6 + \gamma_7$; the size effect (B) on schools in Treated Mother municipalities compared to schools in Potential Mother territories is shown by γ_6.[15]

Equation (1) imposes a constant average effect over the treatment years. In other words, γ_6 would be an average of the size effect of the policy over the entire period under analysis (6 years after treatment). However, the treatment effect may vary over time. For example, new management reforms are expected to exert only temporary local effects due to an adaptation period (Beuchert et al. 2018). Long-term effects could also take place if these temporary shocks alter the conditions in which teaching is carried out (e.g., if there is a drop in the quality of teachers and school managers). We, therefore, use a variation of equation (1) that is used to evaluate the treatment effect over time, as shown in equation 2 below:

[14] Comprised of three control variable dimensions: socioeconomic variables (SES, a four-valued index constructed from the average parental income and education), educational market variables (number of voucher schools in the municipality and percentage of subsidized private enrollment in the municipality), and geographic variables (total enrollment of the school on a logarithmic scale, Euclidean distance in km from the school to the municipal building of its Mother municipality, and whether the school is rural).

[15] Our identification strategy is used to gauge the effect of the policy on the achievement gap between schools in Treated New and Treated Mother municipalities, compared to the effect on the gap between schools in Potential New and Potential Mother municipalities, represented by γ_7. Nevertheless, since we aim to understand the impact of the policy on schools in Mother and New municipalities—instead of the specific parameter γ_7—, we are interested in the sum of $\gamma_6 + \gamma_7$ to determine the new management effect (B) in schools belonging to Treated New municipalities.

(2)

$$Y_{it} = \gamma_1 N_{it} + \gamma_2 T_{it} + \sum_{s=-5}^{6} \gamma_3^s post_{it}^s + \sum_{s=-5}^{6} \gamma_4^s N_{it} post_{it}^s + \gamma_5 N_{it} T_{it} + \sum_{s=-5}^{6} \gamma_6^s T_{it} post_{it}^s + \sum_{s=-5}^{6} \gamma_7^s N_{it} T_{it} post_{it}^s + x_{it}'\beta + \mu_t + v_i + \varepsilon_{it}$$

The main difference with equation (1) is that equation (2) breaks down the binary variable $post_{it}$ into pre- and post-treatment items. In light of our data availability, we included four cut-off points for t, two values for pre-treatment years (2 and 4 or 5 years[16]) and two values for post-treatment years (3 and 6).

$$t = \begin{cases} -4\ or\ -5 \\ -2 \\ 3 \\ 6 \end{cases}$$

First, we used the specification in equation (2) to determine the new management effect (A). The effect (A) for s years post-treatment is given by $\gamma_6^s + \gamma_7^s$. Second, we used the same specification to determine the size effect (B) for s years post-treatment, which is given by γ_6^s. So, for example, after three years effect (A) is given by $\gamma_6^3 + \gamma_7^3$ and effect (B) is given by γ_6^3.

7. Results

As detailed in the previous section, Table 3 displays the average effect on primary school grade 4 Mathematics and Language scores from equation 1 six years after policy implementation. Results are structured using schools as the minimum unit of analysis. The models include fixed effects at the school and year level, and we use clustering for standard errors at the territory/municipality level. Models 1 and 2 in Table 3 suggest that schools transferred to the new municipality (new management effect A) experience a decrease in educational outcomes of around 0.2 SD in Mathematics. This effect is robust to the inclusion of regional or macro-regional fixed effects. Using a more extended cut-off (9 years), the effect visibly maintains its significance and magnitude, suggesting the long-term stability of the effects of government fragmentation in the New municipalities.[17] Likewise, our findings are unchanged when controlling for the contemporary average academic performance in Mathematics and Language of voucher schools at the

[16] For the pre-trend convergence, we merged the year 1992 (4 years before the creation of municipalities in 1996) with 1999 (5 years before the creation of municipalities in 2004) into one category.
[17] Results not reported but available upon request.

municipal level.[18] As for Language outcomes, we observe a non-significant negative effect on standardized tests across different specifications. As for the effect of size (B) in models 3 and 4, there is a negative albeit not significant effect in Mathematics and Language.

Table 3: Average effect of the policy after 6 years

	(1) Math 4th grade Test Score (Z)	(2) Math 4th Grade Test Score (Z)	(3) Language 4th Grade Test Score (Z)	(4) Language 4th grade Test Score (Z)
New Management Effect (A)	-0.237*	-0.228**	-0.127	-0.097
	(0.124)	(0.108)	(0.158)	(0.136)
Size Effect (B)	-0.140	-0.124	-0.060	-0.033
	(0.126)	(0.078)	(0.126)	(0.082)
Covariates	No	Yes	No	Yes
School FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes
Number of obs.	2180	2180	2180	1440
Number of schools	563	563	563	563
Number of Clusters	60	60	60	60

Note: The above table reports the coefficients of the effect of the creation of new municipalities on the average SIMCE at the primary school grade 4 level from Equation 1. Effect A= $\gamma_6 + \gamma_7$ and Effect B= γ_6. Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01. Balanced panels using -5/-4 years up to 6 years after policy implementation. Confidence intervals were constructed using standard errors with clusters at the municipality/territory level. The full sample includes all 60 municipalities/territories. The academic performance scores are taken from the SIMCE test and standardized using all public schools' mean and standard deviation each year. All models include fixed effects per school and year. Control variables include the school's SES, enrollment (log), the enrollment rate in voucher schools, number of voucher schools, distance (km) to the headquarters of their Mother municipality, and regional fixed-effects. Period of models predicting academic performance: 1992 to 2011.

In an effort to examine temporal dynamics of the policy on educational outcomes, we tested effects (A) and (B) that allow the coefficients to vary by year (equation 2 above). Figure 2 provides a graphical representation of the model disaggregated by pre- and post-treatment year following model specifications 2 and 4 (with controls) in Table 3. Panel A includes the effect of the policy on schools in New municipalities (new management effect (A)), while panel B includes the effect on the Mother municipalities (size effect (B)).

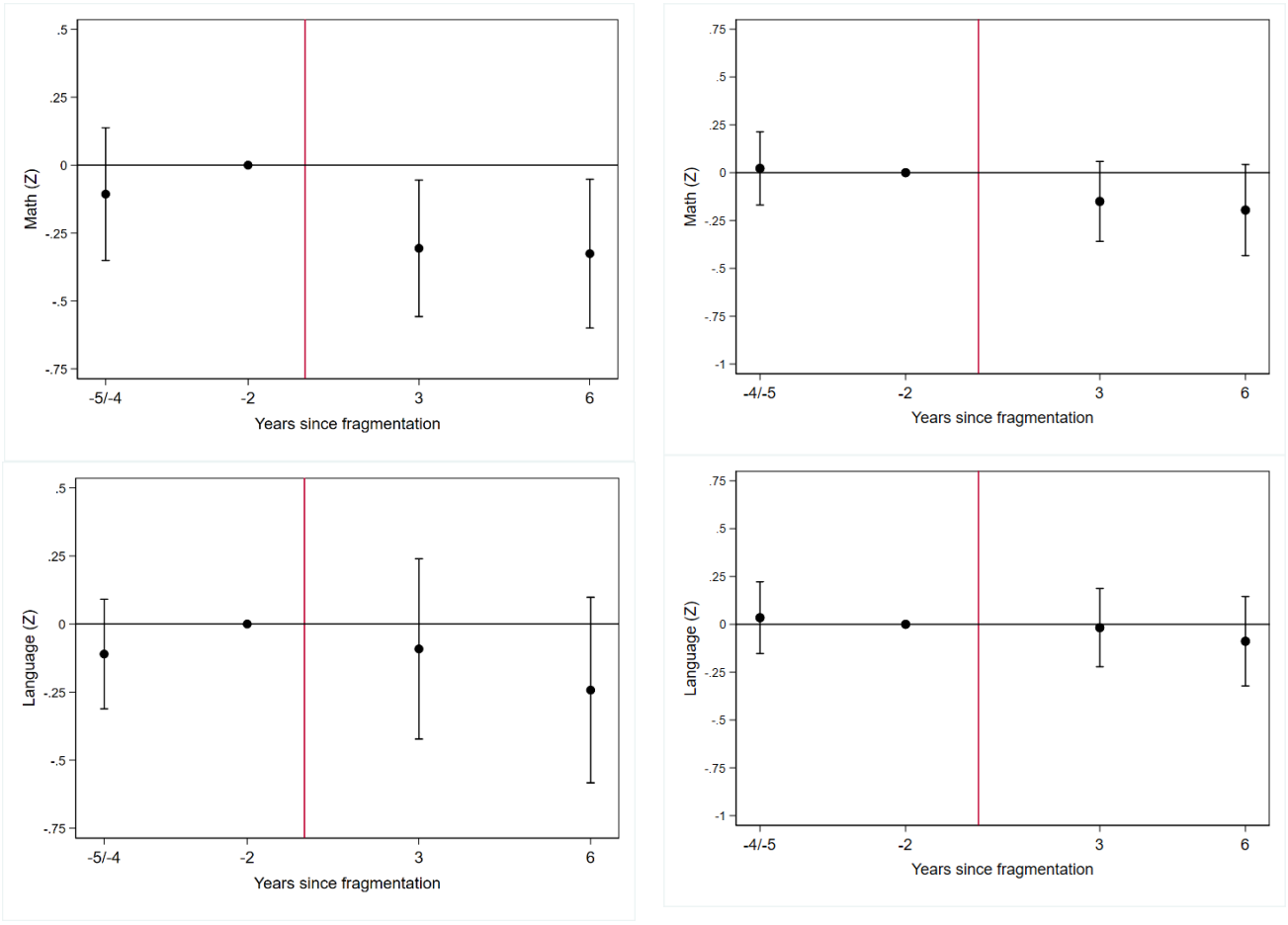
Panel A shows that the trends in the years prior to the policy run in parallel.[19] We note a short-term negative trend (year 3), which is significant and of a sizeable magnitude.[20] Conversely, in line with the average

[18] Results not reported and available upon request.
[19] F test for Panel A: p value=0.75
[20] Given that we use school-level averages, the short-term effect is believed to be cleaner than the effect in later years, which may be altered by potential selection biases such as parental school choice dynamics, among others.

results observed in Table 3, Panel B shows that the policy had no significant effect on schools in Mother municipalities.

Figure 2: Policy evaluation on educational outcomes (Mathematics). Comparison of Mother municipalities (versus Potential Mother) and New municipalities (versus Potential New)

Panel A: New Management Effect (A) Panel B: Size Effect (B)



Note: Panels A and B present the policy effect by policy year on average school academic performance in Mathematics (top) and Language (bottom) from a balanced panel with fixed effects at the school and year level with clustered standard errors at the municipality/territory level. The reference year is two years prior to policy implementation. Panel A shows the coefficients relative to Effect A ($\gamma_6^S + \gamma_7^S$) of equation 2, for S={-4/5,-2,3,6}. Panel B shows the coefficients relative to Effect B (γ_6^S)) of equation 2, for S={-4/5,-2,3,6}. The models include the same controls as models 2 and 4 in Table 3. The academic performance scores are taken from the SIMCE test and standardized using all public schools' mean and standard deviation each year. The number of schools is 563 per year in 60 territories/municipalities. Panel periods: 1992 to 2011.

Policy effect on working conditions and teacher turnover

One of the significant challenges for literature reviewing the effects of vertical and horizontal decentralization reforms is to identify the mechanisms whereby institutional reforms affect the quality of teaching and learning. While several mechanisms are available through which changes at the institutional level may influence what happens inside the classroom, a growing body of literature focuses on the

detrimental effect of teacher turnover shocks on educational processes (Ronfeldt et al. 2013, Akhtari et al. 2022; Hanushek et al. 2016; Dolton and van der Klaauw 1999).

As mentioned earlier, Chilean municipalities oversee the management of principals, teachers, and non-teaching staff. We thus analyzed how this horizontal decentralization policy may affect teacher and principal turnover in treated schools. Using the teacher census (2003-2009), we performed a longitudinal analysis of the work history of teachers and principals in the four municipalities created in 2004[21] Table 4 shows results in line with equation 3 in Appendix B. All models predict the probability that the teacher will not be in the same school at T+1, and different constraints are applied based on the teachers' characteristics.

Table 4: Probability of teaching staff departure by post and contract type. 5-year average.

	General	Role		Contract		Full-time	
		Classroom Teacher	Principal´s Team	Tenure	Annual Hire	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Departure	Departure	Departure	Departure	Departure	Departure	Departure
New Management Effect (A)	0.10**	0.08*	0.23***	0.08**	0.12	0.15***	0.09*
	(0.04)	(0.05)	(0.04)	(0.04)	(0.09)	(0.04)	(0.05)
Size Effect (B)	0.04**	0.04***	-0.04	0.02	0.05	-0.04	0.06***
	(0.02)	(0.02)	(0.03)	(0.01)	(0.04)	(0.02)	(0.02)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	148,404	125,647	15,478	104,485	41,221	42,902	105,502
Number of schools	558	558	558	558	558	558	558

Note: The table shows the effect of the policy on the probability of school staff departure at T+1 for municipalities created in 2004 using a panel of school management teams and classroom teachers. Coefficients are reported from Equation (iii) where: Effect A= $\gamma_6 + \gamma_7$ and Effect B= γ_6. Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01. Paired restricted sample. All models include fixed effects per school. The covariates include at the individual level: age and squared age, the # of hours in the teacher's contract, novice teacher, professional degree in education, type of contract, educational level of specialization (pre-primary, primary, secondary, among others), years of experience. At the school and territorial level: Enrollment (N and log), SEL of the census district, rural (urban), % of enrollment in voucher schools. Period: 2003–2009.

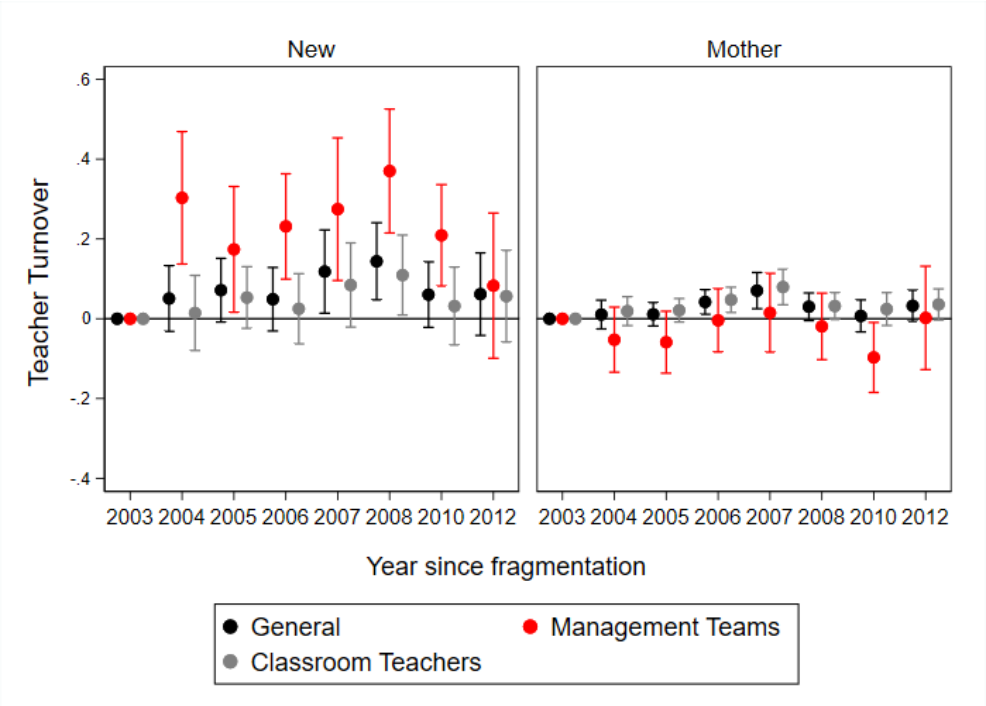
Model 1 in Table 4 suggests that the policy significantly increases the probability of a teacher leaving the school of origin in New and Mother municipalities. However, the size of the effect is smaller for the latter (size effect B). Table A4 in the Appendix includes results by the type of teacher departure (change of school, transfer to a school in a different municipality, transfer to a private school, departure from the educational system, temporary departure from the educational system). In most cases, teachers who leave a school after policy implementation leave the public system temporarily, in addition to some teachers who move to public schools in other municipalities. There are no significant flows of teachers to private or voucher schools.

[21] We were unable to use the set of municipalities created between 1994 and 1996 because data is not available on teacher turnover for those years.

Models 2 to 7 analyze turnover by the teacher's post, the type of contract between the teacher and the municipality, and finally, whether the teacher works full time (40 hours under Chilean legislation). Policy implementation is associated with a temporary bout of high teacher turnover for managerial positions (such as technical leads, inspectors, cycle coordinators, and principals, among others). This increased turnover of school management teams is only visible in New municipalities. The exodus of teachers is significant among tenured teachers (model 4) and those with full-time contracts (model 6).

In addition, as shown in columns 1 and 2 of Table A5, work experience is lower in schools in New municipalities, which suggests that the school management teams hired during this period in New municipalities had less work experience than those who left. Following equation iv (in Appendix B), we sought to provide a temporal representation of the effects on teacher turnover. As shown in Figure 3 for 2004 (which reflects teacher and school management team departures for 2005), there was a significant increase in teacher turnover in the New municipalities. While our estimates are imprecise given the low number of cases, we can observe an upward trend in teacher turnover that is especially marked for school management teams, which declines after eight years. Conversely, schools in Mother municipalities show signs of classroom teacher departures in 2007, but the general trend remains close to 0.

Figure 3: Probability of educational staff departure from their school by type of teaching post and year



Note: The above Figure shows the probability of a teacher leaving the school at T+1. Two types of teaching staff roles are identified: classroom teachers and school management teams (who perform administrative and pedagogical management tasks outside the classroom). Unbalanced panel of teachers with school cluster with the fixed-effect model at school level and per year. Panel A shows the coefficients pertaining to Effect A ($\gamma_6^s + \gamma_7^s$) of equation (iv), for S={-1,0,1,2,3,4,6,8}. Panel B shows the coefficients

pertaining to Effect B (γ_6^s) of equation (ii) in Appendix C, for S={-1,0,1,2,3,4,6,8}. The teacher turnover rate between 2002 and 2003 is used as a reference (1 year prior to policy implementation). School sample N=601, Observations per year=148,404. Same covariates as in Table 4. Period: 2003–2013.

These results suggest that changes in the composition of school management teams in schools transferred to New municipalities (less experienced, with a more significant proportion of temporary contracts, with a lower number of contract hours) may be one of the mechanisms through which this decentralization policy affects academic outcomes.

8. Robustness analyses

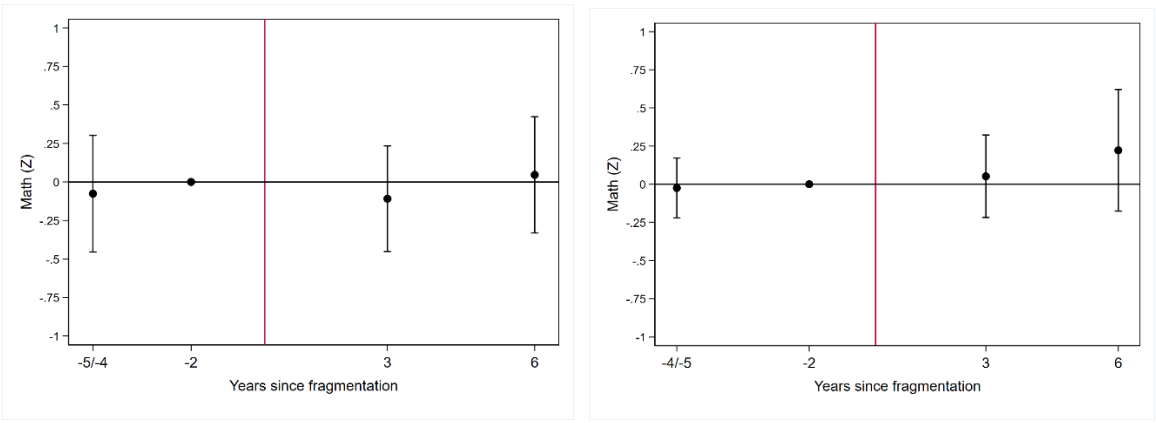
This section analyzes the robustness of our results, focusing on four threats to their validity: (i) whether the effect may precede treatment; (ii) whether a contemporaneous effect occurs in schools not managed by municipalities but in the same territory as treated schools; (iii) whether pre-trend imbalances between treatment and control groups may introduce bias in our results; and (iv) whether selective student migration issues occur.

(i) Pre-trends check: A standard way of examining the internal validity of difference-in-differences models is to use pre-trends to test whether the treatment effect precedes the treatment itself. To do so, we artificially imposed treatment at T-2 as our *placebo* test (1994 for the 1996 cohort and 2002 for the 2004 cohort). Having an effect statistically different from zero would imply severe bias, as the effect precedes the treatment. Table A6 replicates the models, specifications, and restrictions shown in Table 3. An analysis of our parameters of interest, both for New and Mother territories, confirmed insignificant placebo effects.

(ii) Effect on non-municipal schools: In theory, the policy only modifies the administrative structure of public municipal schools and does not affect other types of schools, such as private or voucher schools, in the same territory. While the policy may spill over into non-municipal schools, the effect of government fragmentation should primarily be concentrated in public schools directly affected by changes in management. Figure 4 below replicates Figure 2 using equation 2 of Section 6 but using the SIMCE grade 4 Mathematics average for voucher schools in the territory as a placebo test.

Figure 4: Policy evaluation on educational outcomes of voucher schools (mathematics). Comparison of Mother (versus Potential Mother) and New (versus Potential New) municipalities

Panel A: New Management Effect (A) Panel B: Size Effect (B)



Note: Policy effect on average Mathematics performance in voucher (non-municipal) schools. Balanced panel with fixed effects per school and year, with standard errors clusters by municipality/territory. The reference year is two years prior to policy implementation. Panel A shows the coefficients corresponding to Effect A ($\gamma_6^S + \gamma_7^S$) of equation 2, for S={-4/5,-2,3,6}. Panel B shows the coefficients corresponding to Effect B (γ_6^S) of equation 2, for S={-4/5,-2,3,6}. The models include the same control variables as models 2 and 4 in Table 3. The number of schools is 563 per year in 55 territories/municipalities. Panel period: 1992–2011.

Figure 4 suggests that policy implementation had no effects on learning outcomes in voucher schools in New municipalities or Mother municipalities.[22] Furthermore, there was no increased teacher turnover in voucher schools in Treated municipalities during the evaluated period (we only have data for municipalities in the 2004 cohort) (see Table A7). Finally, Table A8 shows no significant effect on learning outcomes occurs three years after treatment for students enrolled in voucher schools in the same territories as Treated schools.[23]

(iii) Results using an alternative sample: Our sample of schools presents unbalanced variables between the treatment and control groups, particularly regarding the percentage of students in voucher schools or the number of voucher schools in the same territory. We tested whether this imbalance leads to bias in our results by performing a matched DID (Heckman et al., 1997) to ensure comparability between treatment and control. We base our matching on four key dimensions: participation of the private subsidized sector, school size, location (measured as the Euclidean distance between each school and the municipality central office), and socioeconomic characteristics of the school. As shown in Table A9, we offer four models that

[22] We do not report the figure that predicts SIMCE academic performance in Language, which tends to be 0 for both Effects (A) and (B). Results available upon request.

[23] Student-level data only for those students enrolled in voucher schools in 2004 (second cohort of municipality creation).

use almost 70% of the overall sample, including only schools that are similar in these characteristics. Overall, the direction and significance of our main findings in mathematics are maintained. However, Effect (A) is bigger, at around 0.3 SD.

(iv) Selection: One challenge of using school-level averages for student achievement is proving that the effects are not driven by changes in student-level sample composition over time. For example, if the policy caused advantaged families to migrate from treated schools, the drop in outcomes could be explained by student attrition from the upper part of the distribution of learning outcomes. On the other hand, if new municipalities increase access or implement student retention policies, the drop in Math scores could be driven by a greater concentration of students from the lower end of the distribution. To address this, we replicated equation 1 in Section 6 using student level data available for the subsample of municipalities created in 2004 to estimate the policy effect in the short-term net of potential selection biases. Since individual student enrollment data is available since 2002, we evaluated the effect of the policy only for those students who were in treated and control schools in 2004 (the year in which the municipal vote was held). For example, we evaluated a student's performance in 2007 only if in 2004 he/she was enrolled in a school in one of the municipalities in our sample, regardless of the type of school he/she was enrolled in 2007. The models estimate the average effect for 2005, 2006 and 2007, using 2002 as the reference category, since the SIMCE grade 4 was not conducted in 2004. Table 5 shows the average effect three years after the policy was implemented (2002-2007). Our results at the student level are consistent with the aggregate results at the school level. For New management effect (A), students belonging to the four New municipalities created in 2004 experienced a significant decrease in grade 4 Mathematics of around 0.2 SD. Adverse, yet insignificant, coefficients in Language also occur. Additionally, we do not find an effect of the policy in Mother municipalities using individual data (Size effect (B)).

To further analyze student-level attrition, we analyzed the effect of the policy on four variables of student departure from schools[24]: student dropout, students transferring to other schools, exit of students under the 25th GPA (Grade Point Average) percentile, and exit of students above the 75th GPA percentile (see Table A10 in Appendix). We show the overall estimates for schools (all levels) in models 1 to 4 and for primary schools only in models 5 to 8. We found no evidence that the policy affects dropout rates in the treated schools in either effect A or B. Nor do we find support for the claim that there is a general or selective migration of students to other schools at the lower (p25) or higher (p75) ends of the grade distribution. Nevertheless, it is worth mentioning that our data only allows us to test this for the New municipalities

[24] # of students not enrolled in the same school in period t+1 (and not having graduated from the school system in the previous period). We then add the percentage of students migrating or dropping out of school at T+1 divided by the total number of students at T.

2004 cohort; therefore, we cannot include these variables in the general models nor conclusively rule out this explanation for our results. Neither can we test whether the policy changes the nature of school choice for parents whose children have not yet joined the education system.

Table 5: 3-year average policy effect – student level

	(1) Math 4th grade Test Score (Z)	(2) Math 4th Grade Test Score (Z)	(3) Language 4th grade Test Score (Z)	(4) Language 4th Grade Test Score (Z)	(3) Student Attendance	(4) Student Graduation
New Management Effect (A)	-0.166*** (0.028)	-0.202*** (0.034)	-0.047 (0.059)	-0.080 (0.068)	-0.003 (0.004)	-0.009 (0.007)
Size Effect (B)	-0.011 (0.025)	-0.031 (0.030)	0.010 (0.021)	-0.008 (0.026)	0.004 (0.004)	-0.002 (0.004)
Covariates	No	Yes	No	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	86012	86012	86012	86012	96397	96397
Number of Clusters	50	50	50	50	50	50

Note: The above table reports the 3-year policy effect using individual student-level data on four outcomes: primary school grade 4 performance in Mathematics and language, average student attendance, and whether the student passed or failed that year. Each coefficient is estimated from equation 1, where Effect A= $\gamma_6 + \gamma_7$ and Effect B= γ_6. Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01. Base Year: 2002. We include fixed effects at the municipality/territory level. Confidence intervals were constructed using standard errors with clusters at the municipality/territory level. The complete sample includes all 50 municipalities/territories. Control variables include the income and education of each student's parents, school size trend, and a fixed effect by macro-region of the country. Period: 2002–2007.

9. Discussion

This paper seeks to contribute to existing research on the effects of decentralization on the quality of public service provision by analyzing how creating new local administrative units affects educational outcomes. We examined the creation of eleven municipalities in Chile between 1994 and 2004, whose communities secured government autonomy to manage different municipal services, including education. We analyze two different effects: the new management effect (Effect A), which refers to the effect of the establishment of a new administrative body in the new municipalities, and Size effect (B), which refers to the effect of the decrease in size in those municipalities that lose part of their original territory.

We found strong evidence that schools in newly created municipalities (Effect A) experience a significant drop in primary school grade 4 Mathematics achievement. The observed effects are significant in magnitude (0.2 of a standard deviation) and appear stable over time, for at least six years. Estimates using school-level averages are consistent with individual-level policy effects for municipalities created in 2004: there is a drop in individual student achievement in those schools that are transferred to the management of the new municipality.

The fact that voucher schools in the same territory do not experience a similar drop in student achievement suggests that there is something about the new municipal administration that may be related to the decline in results. As mentioned earlier, there are several mechanisms through which the new management could affect what happens inside the classroom. One such mechanism is the school personnel management. Indeed, after the policy was implemented, there was a high turnover of school personnel, especially school management teams. School principals and management teams, particularly those in tenured and full-time positions, were more likely to leave schools transferred to the new municipalities. Departing teachers either changed to a school in a different municipality or left the education system temporarily.

The high teacher turnover in the new municipalities would explain the drop in achievement, at least in part. Increased job insecurity can detrimentally affect the 'school's educational outcomes (Elacqua & Marotta 2020). However, what led to this high teacher turnover? With the available data, we can only hypothesize why teachers and principals left public schools in the new municipalities but did not in the voucher schools in the same territory. First, a plausible explanation is that, since the municipality hires school management teams and classroom teachers, local politics may have played a role in staff turnover. Elected authorities in the new municipalities could be making discretionary decisions about school staff, perhaps in an attempt to tighten their political grip over the territory (Akhtari et al. 2022, Colonnelli et al. 2020). These measures could become disruptive to the learning processes in schools, with long-lasting consequences (Lewis 2017a, Akhtari et al. 2022). This explanation, while plausible, does not seem to fully apply to the case under analysis. Out of the 11 New municipalities, only four (36 per cent) had new administrations from a coalition different from the one ruling the Mother municipality. This turnover rate is lower than the average political turnover country-wide (40 per cent).

A second plausible explanation is the tension between creating a new central office for education at the municipal government and financing schools. As mentioned earlier, the school financing system in Chile relies on national transfers on a per-pupil basis, plus additional funds each municipality can add from their own revenue. Together, these funds support both the central office and the schools, and the municipal government determines the proportion intended for each. Compared to their Mothers, New municipalities have relatively fewer schools. On average, New municipalities manage ten schools, while Mothers manage about 40 after the split. The median enrolment in New municipalities' schools is 171 students, while in Mothers', it is 252. Moreover, the smallest schools (P25) in New municipalities are considerably smaller than those in Mother municipalities (58 vs. 115 students). That is, New municipalities have proportionally greater fixed costs and less income than their Mothers: they still need to support all necessary roles at the newly created municipal education central office, while at the same time financing a full set of teachers at each school. The administrators in New municipalities may address this difficulty by hiring "cheaper"

personnel: using annual hires instead of tenure, part-time positions instead of full-time, and hiring less-experienced personnel. In addition, this hypothesis could explain why we do not see a similar rise in school personnel turnover in Mother municipalities. These municipalities lose those schools that have a greater imbalance between costs and the income they generate to the New municipalities.

Our results suggest that governments should proceed with caution when deciding on increasing horizontal decentralization. The effect of such reforms may vary greatly depending on the characteristics of other elements of the institutional architecture of the education system in a given country, such as the financing mechanism. Such reforms should consider these challenges and provide mitigation measures so that the increase in local control does not detract from the quality of public services.

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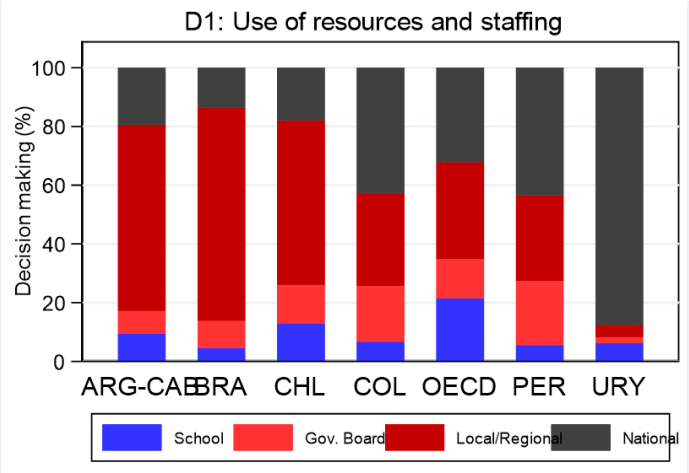
Appendix A: Tables and figures

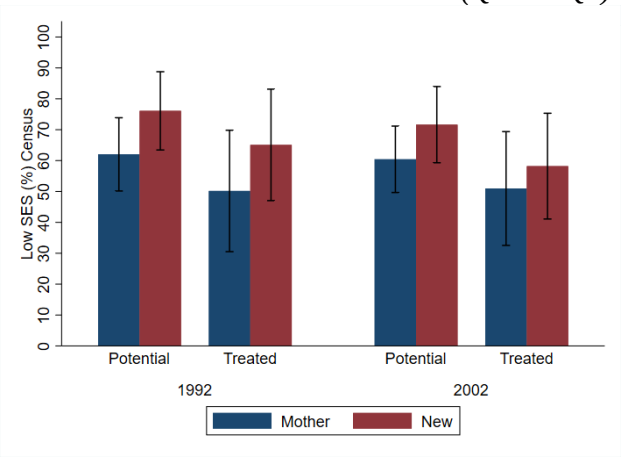
Figure A1: Decision-making in the Chilean education system - PISA (2018)



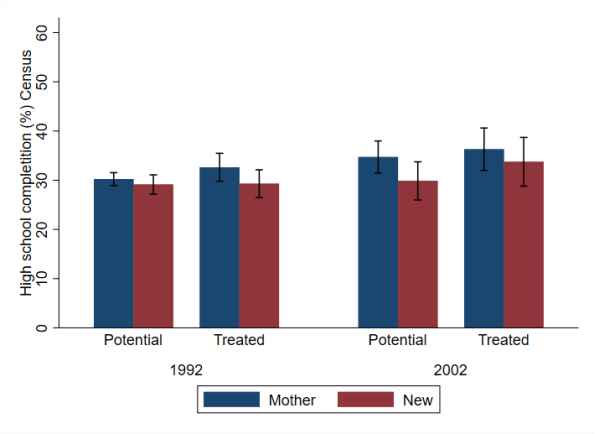
Note: The above figure describes the level of governance at which different decisions are made concerning resource use and the management of teaching and non-teaching staff restricted to public schools in the selected countries. The distribution is drawn from the Pisa Test (2018) school 'principals' survey applied by the OECD in Latin America and the world. For comparison purposes, only countries in the region plus the average decision-making distribution of all countries participating in the OECD survey are shown. The first bar from left to right corresponds to Argentina (City of Buenos Aires), followed by Brazil, Chile, Colombia, Peru, and Uruguay. The black color in the upper part of the figure corresponds to the decision-making declared by school principals that is assumed at the highest administrative level: state level in Brazil, provincial level in Argentina, and Ministries of National Education in the rest of the countries. The next level relates to decision-making at the regional or local level, which corresponds to the municipal level for the public sector in Chile. Then, in third place, the Governing Board layer, which is part of the survey but does not apply to the case of Chile and other countries, given that the local level and the Governing Board overlap. Finally, the lowest link is the school's *de facto* or *de jure* decision-making, which in comparative governance may take multiple forms (school councils, principals with delegated powers, among others).

Figure A2: Balance in the evolution of compositional variables by type of territory/municipality using census data

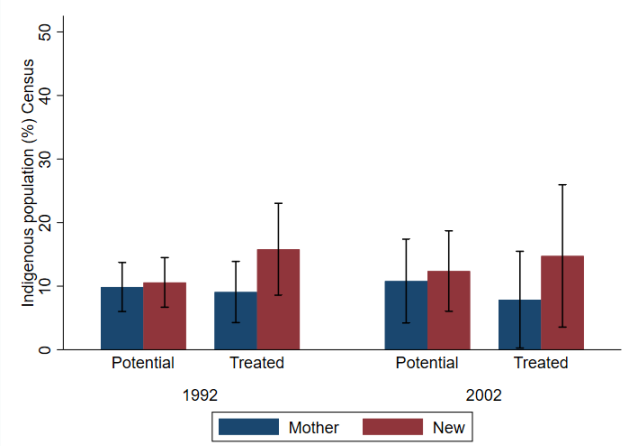
Panel A: Socioeconomic Level (Q1 and Q2)



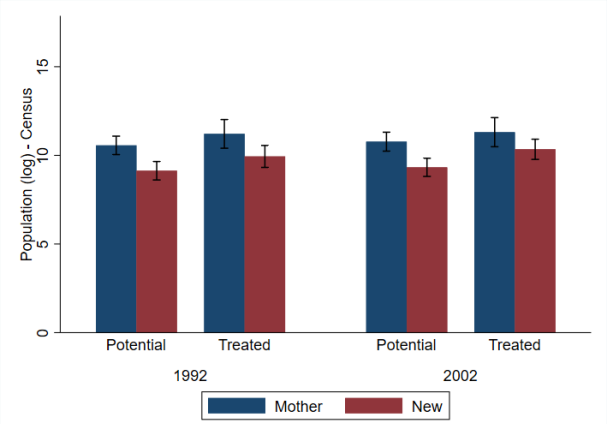
Panel B: School graduation rate



Panel C: Indigenous Population (%)



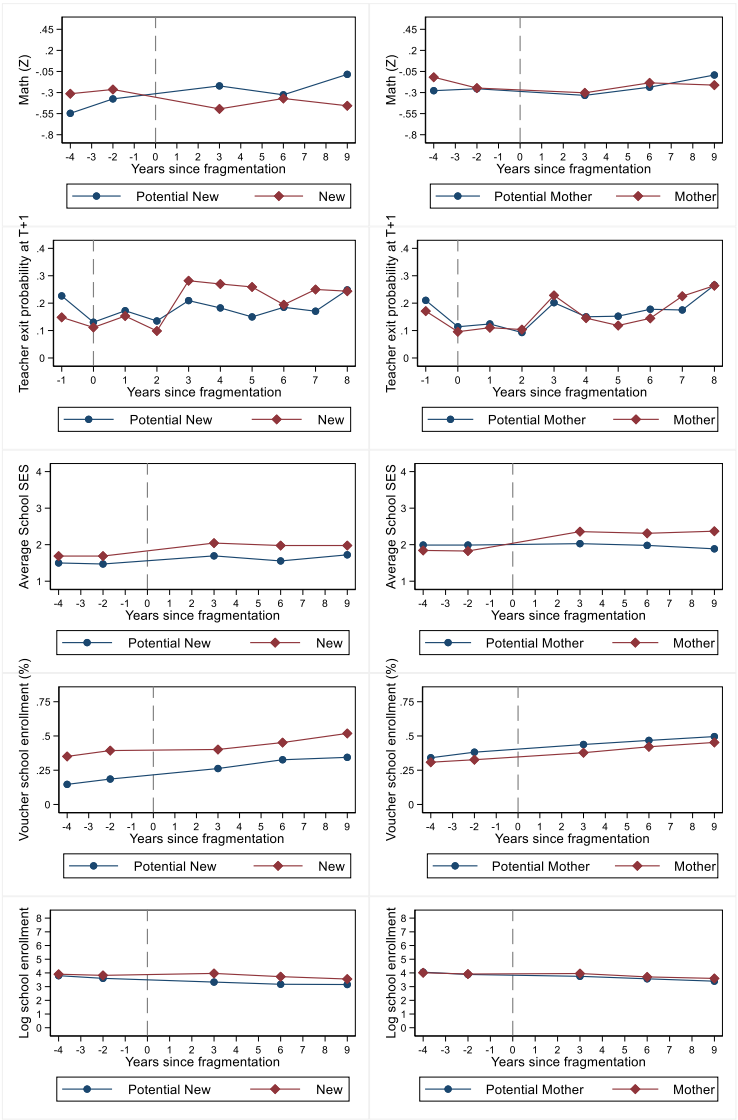
Panel D: Total Population (Log)



Note: Prepared by the authors based on the 1992 and 2002 censuses. Four variables are analyzed: Socioeconomic quintile 1 and 2, high school graduation rate, percentage of indigenous population, and log total population. The panel includes all treatment and control territories across the available censuses for each variable, independent of treatment years. N=63 territories/municipalities.

Figure A3: Average by year of dependent and independent variables, according to type of municipality/territory.

Panel A: Potential New and Treated New Panel B: Potential Mothers and Treated Mothers



Note: The figure compares simple averages by year of schools in New and Potential New municipalities (left column) and Mother and Potential Mother municipalities (right column) on five variables: average academic performance in Mathematics (Z), teacher mobility, average socioeconomic level, percentage of students in voucher schools in the territory, and school size (log). Teacher mobility is only available for the cohort of municipalities created in 2004.

Table A1: Education governance in Chile

Dimension	Ministry of Education (MINEDUC) *Ministerial authorities nominated by the executive[25]	Municipalities *Elected local authorities, Education authorities selected by the elected local authorities.
Administrative management	Establishes a regulatory framework and holds system operators accountable.	System operators with broad powers over planning and resource allocation according to their priorities tasked with preparing the Annual Municipal Education Development Plan (PADEM).
Pedagogical management	Through its provincial departments, the MINEDUC supervises municipal schools and provides technical support for ministerial programs.	School management decisions fall heavily on the schools and their principals. The municipalities can engage consultancy and pedagogical support for their schools.
Personnel management	The MINEDUC is in charge of determining norms regulating the teaching profession, the most important of which is the Teacher's Statute. A Teaching Assessment is also conducted.	Municipalities are in charge of hiring and dismissing teaching and non-teaching staff, within statute's constraints . They can decide on the number and types of contracts to offer, the salaries (within national regulations), and other benefits.
Financing	Centralized funding. Each municipality receives a monthly subsidy to support education in their territory. This subsidy is calculated based on student enrollment and attendance.	About 70% of the subsidies municipalities receive from the national level are unrestricted (that is, they can be used in any school and for any type of activities), and the rest (mainly the preferential school subsidy) must finance specific actions in specific schools (that is, they may not be transferred from one school to another). In addition, municipal governments can use their own revenue to supplement the national subsidy.
Curriculum and assessment	The MINEDUC sets curricula and minimum teaching hours. This is evaluated at a central level through the SIMCE (Quality Agency).	Municipalities can make limited modifications to the curriculum, which must be approved by the MINEDUC. They can also generate their own evaluation processes.

[25] In addition to the MINEDUC, there are other three institutions with governing roles in education at the national level: the Quality of Education Agency, the Superintendency of Education, and the National Education Council (CNED). Together with the MINEDUC, these institutions comprise the Quality Assurance System (SAC).

Table A2: List of Potential New and Mother Municipalities

	Potential New Municipality		Potential Mother Municipality	Macro-Region
	Name	Year	Name	
1	Placilla	2000	Valparaíso	Center
2	Playa Ancha	2003	Valparaíso	Center
3	Puerta Norte	2005	Arica	North
4	Azapa	2003	Arica	North
5	Tongoy	1990	Coquimbo	Center North
6	Capitán Pastene	2006	Lumaco	Center South
7	Rahue	2001	Osorno	South
8	Mamina	1999	Pozo Almonte	North
9	Conaripe	2000	Panguipulli	South
10	Lontué	2000	Molina	Center South
11	Alerce	2004	Puerto Montt	South
12	Lican Ray	2000	Villarrica	South
13	Putú	2003	Constitución	Center South
14	Monteáguila	2003	Cabrero	Center South
15	Paillihue	2005	Los Ángeles	Center South
16	Ensenada	2003	Puerto Varas	South
17	Antofagasta Sur	2006	Antofagasta	North
18	Rosario	2003	Rengo	Center South
19	Puramávida	2000	Colbún	Center South
20	Las Vizcachas	2000	Puente Alto	Center
21	Batuco	2000	Lampa	Center
22	Pomaire	2006	Melipilla	Center

Source: SUBDERE list of aspiring new municipalities 2019 and SUBDERE Territorial Delimitation of aspiring municipalities.

Table A3: Panel structure over the time corresponding to policy implementation

	T-5 / T-4		T-2	T	T+3	T+6
1st wave: 1996.	1991	1992	1994	1996	1999	2002
		x	x		x	x
2nd wave: 2004.	1999	2000	2002	2004	2007	2010
	x		x		x	x

Note: This table shows the data structure used in the general models to evaluate the average aggregate effect on academic outcomes for the two cohorts of municipalities created in 1996 and 2004. The structure is related to the availability of information from primary school Grade 4 SIMCE tests to cover pre- and post-policy implementation years at both points in time. It should be noted that we truncated the years 1992 and 1999 as one point of -4 or less. No information is available on primary school grade 4 academic performance for the treatment year (T) of any of the waves.

Table A4: Probability of teaching staff departure from municipal schools by type of destination.

	General	Type of Departures				
	(1)	(2)	(3)	(4)	(5)	(6)
	Leave School	Changed School	Changed to School in different municipality	Changed to private school	Out of panel	Took time off
New Management Effect (A)	0.09**	0.03	0.03***	0.00	0.02**	0.04***
	(0.04)	(0.03)	(0.01)	(0.02)	(0.01)	(0.02)
Size Effect (B)	0.03*	0.01	0.00	-0.00	-0.00	0.02***
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	93516	93516	93516	93516	93516	93516
Number of schools	623	623	623	623	623	623

Note: Following Equation (i), this table reports the probability of departure of classroom teachers and school managers of municipal schools in the territory by destination type. Model 1 includes all types of teacher destinations. In contrast, models 2 to 6 predict types of teacher departure: change of school (2), change to a school in another municipality (3), change to a non-public school (4), attrition from the public system (5), and temporary attrition from the system (6). An unbalanced panel of teachers was with fixed effects at school level and year. The models include clusters at the municipality/territory level. The control variables include age and squared age, # of hours in the teacher's contract, novice teacher, professional degree in education, type of contract, educational level of specialization (pre-primary, primary, secondary, among others), years of experience at the individual level. They include enrollment (N and log), rural (urban), % of enrollment in voucher schools at the school and territorial level: Period: 2003–2009. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Policy effect on average age average experience (%) full-time teachers and principals, and teacher assessment

	Principals and management teams			Classroom Teachers			
	(1)	(2)	(3)	(4)	(6)	(7)	(8)
	Age	Teaching Experience	Full Time	Age	Teaching Experience	Full Time	Teacher Quality
New Management Effect (A)	-1.06 (0.74)	-2.15*** (0.54)	-0.13*** (0.03)	0.03 (0.74)	0.64 (0.94)	-0.15*** (0.04)	0.00 (0.01)
Size Effect (B)	0.07 (0.35)	-0.04 (0.39)	-0.03* (0.02)	-0.74 (1.13)	-0.60 (1.28)	-0.10*** (0.02)	0.01 (0.01)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	3252	3252	3252	3252	3252	3252	3252
Number of schools	542	542	542	542	542	542	542

Note: Following Equation (i), the above table reports the coefficients to estimate the policy effect on the average characteristics of municipal schools in the territory. Columns 1 to 4 correspond to the averages for school management teams, while columns 5 to 8 correspond to the averages for classroom teachers. Outcomes correspond to averages in the following characteristics: age, years of experience, contract of 40 hours or higher (%), and teacher quality measured as the average result of the portfolio (instrument of the Chilean Teacher Assessment) of all teachers evaluated. A balanced panel of schools was structured with a fixed-effect model at school level and year. The averages include both new and returning teachers. Models include clusters at the municipality/territorial level. The control variables include each school's average: Total enrolment, district socioeconomic level (2002 census), rural school trend, and percentage of students in voucher schools. Period: 2003-2009. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: Falsification test using pretrends

	(1) Math 4th grade Test Score (Z)	(2) Math 4th Grade Test Score (Z)	(3) Language 4th Grade Test Score (Z)	(4) Language 4th Grade Test Score (Z)
New Management Placebo Effect (A)	0.064	0.116	0.061	0.147
	(0.109)	(0.110)	(0.106)	(0.111)
Size Placebo Effect (B)	-0.039	0.059	-0.041	0.093
	(0.076)	(0.082)	(0.092)	(0.080)
Covariates	No	Yes	No	Yes
School FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Number of obs.	1178	1178	1178	1178
Number of schools	589	589	589	589

Note: This table reports the falsification test on average primary school grade 4 Mathematics and Language scores using two time periods before policy implementation. We created a balanced panel of municipal schools using two time periods (-4 or -5 depending on the cohort and -2 years) before policy implementation. Confidence intervals were constructed using standard errors with clusters at the territory/municipality level. All models include fixed effects per school. The control variables include the 'school's SEL, enrollment (log), enrollment rate in voucher schools, number of voucher schools. In addition, the models control for trends in rural schools, distance (km) from each school to the municipality of origin and fixed effects by region. N of schools 589, N of observations 1178. Panel periods: 1992 to 1994 (cohort 1996) and 1999 to 2002 (cohort 2004). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: Probability of teaching staff departure from voucher schools by type of destination

	General	Type of Departures				
	(1)	(2)	(3)	(4)	(5)	(6)
	Leave School	Changed School	Changed to a school in a different municipality	Changed to private voucher school	Out of panel	Took time off
New Management Placebo Effect (A)	-0.07	-0.03	-0.00	0.00	-0.02*	-0.03
	(0.05)	(0.04)	(0.02)	(0.02)	(0.01)	(0.02)
Size Placebo Effect (B)	0.03	0.02	0.02	0.01	-0.00	0.02**
	(0.05)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	34432	34432	34432	34432	34432	34432
Number of schools	208	208	208	208	208	208

Note: Following Equation (i), this table reports the probability of departure of voucher schools' classroom teachers and school managers in the territory. Model 1 includes all types of teacher destinations. In contrast, models 2 to 6 predict types of teacher departure: change to a different school (any type) (2), transfer to a school in another municipality (any type) (3), change to another private voucher school (4), attrition from the public system (5), and temporary attrition from the system (6). An unbalanced panel of teachers and school managers was structured with fixed-effects at school level and year. The control variables include age and squared age, number of hours in the teacher's contract, novice teacher, professional degree in education, type of contract, educational level of specialization (pre-primary, primary, secondary, etc.), years of experience at the individual level. They include enrollment (N and log), rural (urban) at the school and territorial level. Period: 2003–2009. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: 3-year average policy effect on voucher schools – student level

	(1) Math 4th grade Test Score (Z)	(2) Language 4th Grade Test Score (Z)	(3) Student Attendance	(4) GPA	(5) Student Graduation	(6) Migration to other schools
New Management Effect (A)	-0.089 (0.074)	-0.018 (0.075)	-0.001 (0.003)	-0.022 (0.031)	-0.005 (0.007)	-0.039 (0.038)
Size Effect (B)	-0.049 (0.059)	-0.044 (0.048)	0.006 (0.004)	0.027 (0.045)	0.002 (0.003)	-0.131** (0.055)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	86,414	86,414	94764	94764	94764	94764
Number of Clusters	43	43	43	43	43	43

Note: This table reports the policy falsification test using individual primary school grade 4 data in non-municipal schools for municipalities created in 2004 and their respective controls. The reference year is 2002, two years before policy implementation. We include fixed effects at the municipality/territory level. Confidence intervals were constructed using standard errors with clusters at the municipality/territory level. The complete sample includes all 43 municipalities/territories. The control variables include the income and education of each student's parents, school size trend, and a fixed effect by macro-region of the country equivalent to Table 5. Period of models predicting academic performance: 2002–2007. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A9: 6-year average policy effect using paired sample

	(1) Math 4th grade Test Score (Z)	(2) Math 4th Grade Test Score (Z)	(3) Language 4th Grade Test Score (Z)	(4) Language 4th grade Test Score (Z)
New Management Effect (A)	-0.316**	-0.270*	-0.290	-0.223
	(0.139)	(0.145)	(0.194)	(0.180)
Size Effect (B)	-0.072	-0.065	0.007	0.026
	(0.124)	(0.095)	(0.133)	(0.099)
Covariates	No	Yes	No	Yes
School FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Region FE	No	Yes	No	Yes
Number of obs.	1440	1440	1440	1440
Number of schools	360	360	360	360
Number of Clusters	55	55	55	55

Note: This table reports the policy effect on average Mathematics and Language achievement using a paired alternative sample with similar characteristics. A balanced panel of non-municipal schools was structured using -5/-4 years up to 6 years after policy implementation. Confidence intervals were constructed using standard errors with clusters at the municipality/territory level. The complete sample includes all 55 municipalities/territories. All models include fixed effects per school and year. The control variables include the school's SEL, enrollment (log), enrollment rate in voucher schools, number of voucher schools, and distance in km to the headquarters of their Mother municipality. Period: 1992–2011. Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A10: Policy effect on dropouts (%) and overall student migration (%) and by average score (high and low percentiles, >75 and <25 respectively)

	All levels				Elementary levels			
	(1) Dropout (%)	(2) Exit (%)	(3) Exit GPA<p25	(4) Exit GPA>p75	(5) Dropout (%)	(6) Exit (%)	(7) Exit GPA<p25	(8) Exit GPA>p75
New Management Effect (A)	0.006	0.017	0.022	-0.046	0.027	0.017	0.022	-0.049
	(0.004)	(0.023)	(0.027)	(0.043)	(0.040)	(0.025)	(0.029)	(0.043)
Size Effect (B)	0.003	-0.005	0.012	-0.001	0.021	-0.001	0.011	-0.001
	(0.002)	(0.017)	(0.018)	(0.010)	(0.021)	(0.002)	(0.021)	(0.012)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	5808	5808	5808	5808	4932	4932	4932	4932
Number of schools	484	484	484	484	411	411	411	411

Note: This table reports the policy effect on the departure dynamics of elementary school students (columns 5 to 8) and students from all education levels in the school (columns 1 to 4). Student-level values were aggregated at the school level as percentages in four outcomes: (a) dropouts (percentage of students who leave school and do not appear as studying in another school on official MINEDUC records), (b) migration (percentage of students who transfer to another school), (c) exit GPA<p25 (students with a GPA below 25th percentile in the year before policy implementation who leave the school), and (d) exit GPA>p75 (students with a GPA over the 75th percentile in the year before policy implementation who leave the school). A balanced panel of schools was structured with a fixed-effect model at school level and per year. Models include clusters at the municipality/territorial level. The control variables include each school's average: Total enrolment, district socioeconomic level (2002 census), rural school trend and percentage of students in voucher schools. Period: 2002–2013. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix B: Identification Strategy predicting Teacher Turnover

We evaluated how the creation of municipalities affects the probability of teachers leaving their schools of origin. For estimation purposes, we assume this probability to be linear in the observables in equation (iii).

$$P(R_{kit} = 1|X_{kit}) = \gamma_1 H_i + \gamma_2 T_i + \gamma_3 post_t + \gamma_4 H_i post_t + \gamma_5 H_i T_i + \gamma_6 T_i post_t + \gamma_7 H_i T_i post_t + z'_{kt}\beta + x'_{it}\beta + \mu_t + v_i \quad (iii)$$

In the above equation, the variable R_{kit} takes the value 1 if the teacher k in school i in period t is no longer in that school in period $t+1$, and it takes the value 0 if that teacher remains in school i in $t+1$. The probability of this variable taking a value of 1, i.e., of teachers leaving the school, is a linear function of school and treatment characteristics, a vector of observable teacher characteristics z'_{kt}, a vector of school characteristics x'_{it}, fixed effects per year μ_t and fixed effects at the school level v_i. The observable characteristics of teachers in vector z'_{kt} include age, working hours, whether it is their first job, their educational level (degree in education, other, or unqualified), certification (for teaching in early, special, or regular education), the educational level at which they teach (primary or secondary), and their experience. The observable characteristics of schools x'_{it} are the same as those in equations (1) and (2) presented in Section 6.

In order to evaluate the scope of the effects according to the years of policy implementation, we propose a variation of equation (i) that evaluates the treatment effect over time, as expressed in equation (iv).

$$P(R_{kit} = 1|X_{kit}) = \gamma_1 H_{it} + \gamma_2 T_{it} + \sum_{s=-1}^{10} \gamma_3^s post_{it}^s + \sum_{s=-1}^{10} \gamma_4^s H post_{it}^s + \gamma_5 H_{it} T_{it} + \sum_{s=-1}^{10} \gamma_6^s T_{it} post_{it}^s + \sum_{s=-1}^{10} \gamma_7^s H_{it} T_{it} post_{it}^s + z'_{kt}\beta + x'_{it}\beta + \mu_t + v_i \quad (iv)$$

This variation of equation (i) keeps the exact specification while introducing the variable $post_{it}^s$, which breaks down the binary variable $post_t$ into pre-and post-treatment items. In this exercise, we included 12 cut-off points t, one value for pre-treatment years (-1), one for the year of treatment (0), and 10 for post-treatment years (1 to 10).

$$t = \begin{cases} -1 \\ 0 \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \end{cases}$$