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Disrupted Schooling: Impacts on Achievement from the Chilean School Occupations

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Abstract
Disrupted schooling can heavily impact the amount of education pupils receive. Starting in early June of 2011 a huge social outburst of pupil protests, walk-outs, riots and school occupations called the Chilean Winter caused more than 8 million of lost school days. Within a matter of days, riots reached the national level with hundreds of thousands of pupils occupying schools, marching on the streets and demanding better education. Exploiting a police report on occupied schools in Santiago, I assess the effect of reduced school attendance in the context of schools occupations on pupils' cognitive achievement. This paper investigates whether or not there is a causal relationship between the protests and school occupations and the standardised test performance of those pupils whose schools were occupied.

Key words: Chilean Winter, Instructional Time, Protests, Educational Outcomes, School Occupations, Missing School Days, Riots, Human Capital Investment
JEL Codes: I21; I26; J24; J52

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1 Introduction

Disrupted schooling can heavily impact the amount of education pupils receive. Starting in early June of 2011 a huge social outburst of pupil protests, walk-outs, riots and school occupations called the *Chilean Winter* caused more than 8 million of lost school days. Within a matter of days, riots reached the national level with hundreds of thousands of pupils occupying schools, marching on the streets and demanding better education. Exploiting a police report on occupied schools in Santiago, I assess the effect of reduced school attendance in the context of schools occupations on pupils' cognitive achievement. This paper investigates whether or not there is a causal relationship between the protests and school occupations and the standardised test performance of those pupils whose schools were occupied.

The obvious—but not the only one—channel of disrupted schooling is a disruption in instructional time. Throughout the Chilean school occupations, the turmoil ranged from a few days to almost 50 days lost of instructional time. By instructional time I mean the time spent by a student under an instructor in order to acquire skills and knowledge and accumulate human capital. During instructional time, the instructor is expected to be actively facilitating the learning process while the student engages in the learning activity. Effects can be short-term such as reduction in student achievements as measured by standardised assessment tests and class repetition. And long-term effects in adulthood like lower earnings, lower-level employment, and fewer years of schooling and hence less educational attainment, including less participation in higher education. Moreover, disruption in instructional time can be assessed in two margins: extensive and intensive margin. By extensive margin I mean the length of the school year. While a long summer means a short school year, or a shorter extensive margin, summer-school indicates a larger extensive margin. By intensive margin I mean the length of the school day. The intensive margin may be longer and varied, if school days are extended temporarily or selectively to help disadvantaged students, or it can be longer and consistent, such as with the full school days implemented permanently for an entire community. To compare the findings in the literature, please refer to Table 1. In the table, I have summarised the findings of the most visible papers on the effects of disruptions to instructional time, including the findings of the present study. Pischke (2007) looks at mixed short- and long-term outcomes after a reduced extensive margin. He uses variation introduced by the West German short school years in 1966/7, which exposed some students to a total of about two thirds of a year less of schooling while enrolled. The paper finds that the short school years increased grade repetition in primary school, 2^{nd} grade, and led to fewer students attending higher secondary school tracks. But on the other hand, the short school years had no adverse effect on earnings and employment later in life (Pischke, 2007). Regarding Latin America, Hincapié, in the context of Colombia, shows that longer school days—intensive margin—are also associated with better pupil achievement—short-term effects. In 1994, the full school day reform was rescinded in Columbia, granting municipalities more flexibility to choose the length of the school day for their schools; thus while some schools offer a full school day (7 hours), others do only half school days (or two separate 4- or 5-hour shifts). Hincapié's results imply that the cohorts exposed to full school days have test scores that are about 13.8% of a standard deviation higher in 9^{th} grade than cohorts who attended half school days (Hincapié, 2016). Again, for intensive margin and short-term effect, Lavy (2015) focuses also not on a disruption but on the addition of one or more hours a week to mathematics, science, and language, the three subjects that 15-year-old pupils were tested on by the Programme for International Student Assessment (PISA). For the OECD sample, he finds 5.8% of a standard deviation for the very first additional hour added to the 3.38 average hours devoted to the three subjects. Lavy finds a non-linear function with a decline in the effect when more hours are added.

But contracted time is not the only relevant factor in evaluating instructional time. Also key is effective instruction time, i.e. days attended versus days membership. For example, strikes and work-to-rules exercised by teachers, who are the suppliers of educational services, or lockouts during labour relation disputes can imply a reduction in effective instructional time. In addition, instructional time may be negatively impacted by school closure, which can occur due to any one of a myriad of reasons: bomb alerts, issues with the infrastructure (e.g. leaks in the classroom, lack of water in the bathrooms, broken heating), a shooting, climate disasters (e.g. heavy snowfall or rain, a hurricane), or even a global pandemic (a discussion on the effects on UK pupil achievement of the current school shutdowns due to the Covid-19 epidemic can be found in Eyles et al (2020)). From the student side, poor school attendance can reduce instructional time as well. Absences, arriving late, or skipping classes are all issues. And in terms of more structured and collective actions, school attendance drops noticeably during riots and school occupations. Please refer again to Table 1. Where possible, the table shows the results for a 10-day disruption. The first paper, Johnson (2009), that analyses effective instructional time, studies the effects of strikes in Ontario. He finds that a 10-day strike is estimated to reduce the proportion of students achieving the provincial standard on the standardised tests in 6th grade by 1 percentage point (or 5% of a standard deviation) in mathematics. In 3rd grade the effect of a 10-day strike is effectively zero. Furthermore, by applying a different model on the same sample to include school fixed effects, Johnson (2011) finds that estimates of the average impact of a strike in 3rd or 6th grade are statistically insignificant, but there are statistically significant negative impacts of strikes once schools are distinguished by the education of residents in their surrounding area. A school two standard deviations below the mean of the normalized education of nearby residents variable is predicted to have a 4.1 percentage point (or 22% of a standard deviation reduction in the mathematics pass rate after a 10-day strike.). Another researcher, Baker (2013), analyses the same sample. This time this researcher finds that a long strike of at least 10 (and up to 17) school days is estimated to reduce the proportion of students achieving the provincial standard on the mathematics standardised tests in 6th grade by 4.6 percentage points (or 24% of a standard deviation". The paper says 29%, but my calculations suggest this is a typo). At the same time, Belot and Webbink (2010) studies again effective contracted time but now long-term effects for Belgium teacher strikes. From May 1990 until November 1990 teachers in the French community of Belgium went on strike to obtain a salary increase. The authors exploit the political division of Belgium in a French community and a Flemish community, with similar educational institutions, for estimating the long-term effects of the strikes. They find some evidence that the strikes reduced educational attainment and increased class repetition. They also find that the strikes led to a significant reallocation of students to a lower level of higher education (Belot and Webbink, 2010). Goodman (2014) attempts another assessment of a disruption, but focuses on attendances: absences and closures. Instrumenting attendances by heavy and light snow days, he calculates 5% of a standard deviation for each day of absence and what is effectively zero effect on closures. On average, students missed 10 days, eight for absences and only two for closures. 10 days of absences implies 50% of a standard deviation. A mammoth effect. Also, analysing a short-term effect and a disruption in effective contracted time, Jaume and Willén exploit variation on teacher strikes within and across provinces in Argentina to examine how teacher strikes affect long-term student outcomes. Exposure to the average incidence of strikes during primary school reduced the labour earnings of male and female graduates by 3.2% and 1.9%, respectively. The authors calculate a further aggregate annual earnings loss of $2.34 billion (Jaume and Willén, 2019). They also find an increase in unemployment and a decline in students' skill levels regardless of the occupations the students pursued. The researchers claim that these effects are driven by a reduction in educational attainment.

Education inherently involves time inputs from both students and teachers. New technology has changed the paradigm, but traditional face-to-face teacher/pupil interaction is still considered essential to learning. A recent report by the UK Department of Education, *Improving Attendance at School*, illustrates the fact that despite a diminishing trend in cancelled school days in England, there were still 57 million days of school missed in 2009/10. Second, there is a clear link—but not necessarily causal—between poor attendance at school and lower academic achievement. Third, of pupils who miss more than 50 percent of school, only three percent manage to achieve five or more GCSEs at grades A* to C, including mathematics and English. In contrast, 73 percent of pupils who have over 95 percent attendance achieve five or more GCSEs at grades A* to C. Fourth, when considering attendance, it is worth noting what a one percentage point improvement means in terms of days missed. An average-sized secondary school that manages to improve its attendance by one percentage point represents an additional 1,300 pupil-days spent in school in a year. That is a significant amount of education. Some of this evidence can be directly extrapolated to the case in Chile. School absence could be detrimental to pupil performance. Children who are persistently absent usually perform worse at school and have worse job prospects, which has the potential to increase poverty and crime rates. But these are only anecdotal associations, thus the need for more causal assessments. Estimates indicate that during the *Chilean Winter* almost 8 million pupil-days were missed from 205 occupied schools. To put this into perspective, while in England there are 8.2 million pupils attending 24,372 schools, Chile has roughly half of both, with 3.6 million pupils attending 12,063 schools. As noted above, in England there were a total of 57 million pupil-days of school missed in 2009/10. To restate, in Chile 205 out of 12,063 schools represented almost 8 million riot-related pupil-days missed. It is therefore a very plausible hypothesis that this period of absence plus the other multi-factorial detrimental factors of school performance during a spell of school occupations could have directly and negatively impacted the process of education in Chile. Therefore, this study seeks to establish a causal relationship between protests and standardised test results.

This paper uses a difference-in-difference identification strategy to measure at the value-added effect of the disruption due to the *Chilean Winter*. I analyse the increase in standardised test performance for the cohort in 4^{th}, 8^{th} and/or 10^{th} grades with a comparison before and after for a control group and the treated group with test data at the student-level. I repeat my estimates using also school level data, triple difference-in-differences estimators, and, in an appendix, a panel regression. There are two aspects of this methodology that need to be underlined. First, that the credibility of the methodology rests on whether the treated and control groups show parallel trends in outcome variables pre- and post-intervention and whether they match closely based on observable characteristics pre- and post-intervention. Using the attendance to the first SIMCE test, the Chilean standardised test, after the onset of the school occupations to distinguish between moderates, the ones who surrendered their schools occupations and took the test, and the hard-liners the ones who did not surrender and did not take the test, I can compare the intensity of the effect. While the moderates had a reduction in their effective instructional time of approximately 10 days, the hard-liners had almost 50 lost school days due to school occupations and protests. For the former I find a reduction of 13% of a standard deviation, while for the latter I find a 24% reduction.

In Section 2, the model is outlined, and in Section 3 the treatment and the outcome are defined. Section 4 offers a discussion on identifying assumptions. Section 5 shows pupil-level results; an analyses for school-level results; a number of triple difference-in-difference estimations; an evaluation of the identifying assumptions; and an evaluation of missed days as an extension of causality. Finally, Section 6 provides a conclusion. Five appendices include additional tables and figures, a falsification exercise (I), a survival analysis of the occupied dataset (II), estimation of causal effect of school occupation with panel regression (III), an outburst review of the Chilean Winter in the media at a national level (IV) and the complete police report list of 205 occupied schools in the central region of Santiago (V).

2 The Model

2.1 National register

The national register of attendance provides information on periods of school occupations and protests by the number of cancelled days experienced by the identified schools. At a school-level, cancelled days refer specifically to days missed because the school was occupied. Looking at general patterns of block school absences, I can exclude pupil sick days or absences for any other cause. On the other hand, when examining the data at pupil-level, it is easy to detect different types of cancelled days. For instance, school occupation cancelled days manifest themselves as the sharp end of variation in individual attendance and create a distinct difference between individual and average attendance for each occupied school. In Chile, the number of school days is not fixed nationally, but there is a regulatory framework issued for each administrative division which outlines general rules. Schools are then free to choose a calendar under these general rules. The regulatory framework fixes two weeks of winter holidays, the starting and ending days of classes, and some national holidays to be followed. In other words, there is no absolute baseline for attended school days to make comparisons, and this study must rely on a relative method to identify cancelled days. Cancelled days can be identified in the national register because schools report few open or school working days during occupations. Therefore, cancelled days are calculated directly as the difference in open or working days in the national registry of attendance between occupied and non-occupied schools. The study then holds the following unifying definition: “missed”/“cancelled”/“lost” school days are used interchangeably, meaning non-attended school days because of school occupations. As I will show below, the key identifying assumption is the police report list of occupied schools during the revolts in Santiago. This assumption plus the relative method to identify cancelled days work neatly to assess the number of schools occupied, the number of missed school days and the overall intensity of the protest in a timely manner.

2.2 The model

This study is concerned with estimating the effect of the number of days a school is occupied on the achievement of its pupils. The equation used to estimate this relationship is as follows:

$$\Delta \mathbf{Y}_{\mathbf{ist}} = \delta \mathbf{OCCUPY}_{\mathrm{s}} + \varepsilon_{\mathrm{ist}} \tag{2.1}$$

The indices are: **i** is individual; **s** is school; **t** is level of education/cohort, primary or secondary. The dependent variable is $\Delta \mathbf{Y}_{\mathbf{ist}}$, or the difference in standardised test score of pupil i going to school s at level of education t. The main independent variable is a dummy if referring to an occupied school during the *Chilean Winter*, $\textbf{OCCUPY}_{\textbf{st}}$. Finally, the error term $\varepsilon_{\textbf{ist}}$ represents possible serial correlation, heteroskedasticity, or unobserved characteristics (other teacher qualities outside of observable teacher evaluations, motivation of neighbours, or other local resources that improve pupil educational outcomes). The main assumption needed for identification is that there is no correlation between the causal regressor, $\textbf{OCCUPY}_{\textbf{st}}$, and the idiosyncratic error ε_{ist}. The standard errors are clustered at school level to make them robust to autocorrelation in unobservables across students within the same school and heteroscedasticity at school level.

In this model, I am comparing the achievement gains between pupil in 4^{th} (9-year-olds) and 8^{th} (13-year-olds) or 10^{th} (15-year-olds) grades in occupied schools with the achievement gains between grade 4^{th} and 8^{th} or 10^{th} grades in non-occupied schools. The key threat to identification is that the control group would have a different 4^{th} to 10^{th} grade gain even without the occupations. To confirm this is not the case, I am going to profusely test for differential pre-trends (see Tables 2, 3, and 8). As well as differences in pre-trends, the treatment and control groups might diverge even without the occupations due to some other contemporaneous shocks. To confirm this is not the case, I will use balancing in levels of the characteristics of the two groups. I attempt a number of triple difference set ups, where I compare test score gains in occupied and unoccupied schools, before and after the occupations in two pairs of identically spaced cohorts and also for the only triple observed cohort. To help to give credibility to my results I attempt a falsification exercise (see Appendix I) with 2002 to 2008 data previous to any treatment. In fact, I found no effect at all in this cohort when no treatment is in place. To define **OCCUPY** I use a police report leaked by one of the main Chilean newspapers (see Section below) and the control group are all non occupied schools according to the same report. I also "confirm" the **OCCUPY** list by looking at the Chilean national registry of attendance in Appendix II. In Chile, there is not a uniform school system. Some children attend one school from 1^{st} (6-year-olds) to 12^{th} (17-year-olds) grades. Others switch school around 6^{th} (11-year-olds) to 8^{th} (13-year-olds) grades. I can track pupils from all the schools in Santiago, including the 205 on the police report list, and because these pupils are examined before and after the school occupation I use this single cohort, i.e. I follow at a micro-level each pupil result and achievement gains before and after the school occupations, with the only caveat that 97 schools, the hard-liners did not sit for the first examination after the occupations. But since, I have many age/grade cohorts, i.e. multiple observations of 8th, and 10th grade cohorts, I can also attempt an identification strategy using multiple cohorts for school-level achievement gains, when average school results are used instead of students micro-level data.

Thus, I also estimate the following model at a school-level:

$$\Delta \mathbf{Y_{gst}} = \alpha + \delta \mathbf{OCCUPY}_s + \gamma_s + \varepsilon_{gst} \tag{2.2}$$

Where $\Delta \mathbf{Y_{gst}}$ means the difference in 8th graders SIMCE test between 2011 and 2009 and in 10th graders SIMCE test between 2012 and 2010. It can be thought as a panel of schools with two grades in each school, 8 or 10, and two time periods, pre and post, with school fixed effects, γ_s.

3 Data

3.1 The SIMCE

The SIMCE, the outcome this paper examines, is the Chilean standardised test which takes place regularly each year but for different cohorts. Chilean primary education is divided into eight grades, identified as 1st-2nd-3rd-4th-5th-6th-7th-8th. Secondary schools have four grades which will be identified here as 9th-10th-11th-12th. This period amounts to twelve years of education. The SIMCE test covers languages, math and science, in 4th and 8th grades, and just languages and math, in 10th grade; these are the three grades analysed. The data are gently provided by the Ministry of Education's Agency for Quality in Education of the Chilean Government (AQE, 2002/13).

In Figure 2, I show the SIMCE tests used in this paper, with yellow indicating pre-treatment tests and red indicating post-treatment tests. Along the horizontal axis, I can follow calendar or academic years and use a value-added gain in achievement strategy as I do in the main specification of the paper. In fact, in the first panel of Table 4, I show a difference-in-difference estimate that compares the mean 4th to 8th grade test score gain of the cohort of 4th graders in 2007 in occupied schools, with the same test score gain for the same cohort in non-occupied schools. These pupils appear in the bottom row of the figure, that is they are the younger cohort included in the data. Also, from Figure 2, it can be seen that the only test scheduled in 2011, the year of the initial outbreak and the main period of intensity of the school occupations, is an 8th-grade test. It is important to outline that 97 out of the 205 occupied schools on the police report did not surrender and so did not take this exam. So, these hard-liners are excluded from the estimation in the first panel of Table 4. The next year there is also only one scheduled test, a 10th-grade test. Almost all of the 205 schools sat for this test. So, I run a difference-in-difference for the achievement gain between 4th grade in 2006 and 10th grade in 2012. That is what is shown in the second panel of Table 4 for moderates and the third panel of Table 4 for hard-liners. Note that this cohort of students was not examined in 2011 so the distinction between moderates and hard-liners refers to school that were occupied with all the pupils in the school missing instructional time and the SIMCE for that year only for the 8th grade cohort. At the same time, a number of triple differences in achievement value-added gain can be performed (See Section 5.3 for these triple difference estimations). Finally, along the vertical axis, there are age or grade cohorts (a series of rows with pupils with the same age or the same grade in a given year) before the occupations compared during and after the occupations. Specifically, 8th graders in 2009 can be compared with 8th graders in 2011 and 10th graders in 2010 with 10th graders in 2012. Of course, the 2011 SIMCE lacks the hard-liners so they are excluded, and only moderates can be compared with the control group for this calendar year. This is done in the first panel of Table 5. In the case of the 10th graders analysed in 2010 and

2012, moderates and hard-liners sat for the test. Thus, the results in the second panel for moderates and the third panel for hard-liners of Table 5.

3.2 Treatment: Occupied schools

This study strictly follows the filtered Carabineros/LA TERCERA[1] list of occupied schools in Santiago (see Appendix V). Because this filtered list only identifies schools in Santiago (the Metropolitan Region of Santiago) all my samples are for the schools and pupils in the city. In the other administrative regions of Chile there were also protests but there is no way to identify the schools that were occupied outside Santiago, see Appendix IV for the statistics at a national level. It is possible to establish the following timing of the occupations in relation to the scheduled SIMCE test. Indeed, the first SIMCE test after the onset of the school occupations was scheduled on October 19th 2011, four months after the outbreak of the protests. In relation to this test, the list can be further divided into 108 occupied schools that gave up the occupation and held the test on that day, which this study calls Occupied-S/moderate schools (Occupied-S meaning occupied according to the police report + SIMCE). There are 97 Occupied-NS/hard-liner schools (Occupied-NS meaning occupied according to the police report + No SIMCE). The control group and all two *treatment* groups (Occupied-S and Occupied-NS) are compared in terms of observable characteristics in Table 2. In this table, columns CG, O-S and O-NS show the mean of each of 27 characteristics including educational, demographic, pre-treatment and compositional variables. There are three samples, the first panel shows educational and demographic characteristics from the parental survey that accompanied the 2012 SIMCE test (26,166 students); the second panel shows the cohort of 51,680 (46,567 control group + 5,113 moderates) metropolitan students that sat for the 2007 4th grade and, at the same time, for the 2011 8th grade SIMCE; and the third panel shows the cohort of 57,119 (44,113 controls + 5,248 moderates + 7,758 hard-liners) metropolitan students that sat for the 2006 4th grade and, at the same time, for the 2012 10th grade SIMCE.

[1]Carabineros is the Chilean police. LA TERCERA is the second most widely circulated newspaper.

While the last three columns, add t-statistics for the equality of means between the control group, the moderates and the hard-liners. From the table, it can be seen that in years of preschool, repeat year, parental education and indigenous ethnicity and housing equipment (pc, internet, and books) there is quite substantial comparability between the control group and the moderates, the control group and the hard-liners, and between the moderates and the hard-liners. That is their t-values are under a critical value of 2.326 (as an absolute value) which represents a 1% two-tailed significance level. Of a total of 24 possible t-test, 18 are under the cut-off. This is reassuring and strengthen the case for a balance in the characteristics of these three groups. Though, there are some differences, mainly in income and in the school composition of the groups. For instance, there is also a particularly higher income in the occupied-NS group which shows that families with above average income have their children in the hard-liner schools (because hard-liner schools include many top ranked public schools, they attract what in Chile is called an aspirational family). Also, while a 7% of the schools are private in the control group, none are almost none of them are private in the occupied groups. Or, while a 22% are public voucher schools, 80% are so in the hard-liner group, that is a t of -14.21. In the pre-treatment variables, i.e. the 2007 and 2006 SIMCE, at least one for each group is under the critical value which is of great help in the comparability of these groups. Finally, the high t-values for the moderate and the huge t-values for the hard-liners with respect of SIMCE difference are the first direct evidence in favour of a causal link of the school occupations and general student riots and protests effect on the educational outcomes. Also, importantly the high t-values (7.93) between moderate and hard-liners sheds evidence that the amount of the protests also affects differently. In other words, more moderate groups are affected less than hard-liners protesters. Occupations continued after this first SIMCE test and into 2012, the next year. However, on the next test date of November 6^{th}, 2012, almost all of the 205 schools sat for the test. Figure 1 shows a map with the treated groups: Occupied-S and Occupied-NS.

4 Identifying assumptions

Usually there are two possible threats to identification. First, pre-existing differences in trends which continue in to the post-occupation period. And contemporaneous shocks which cause trends which were previously parallel to diverge at the time of the occupations. If I provide support against these threats then I will credibly be stating the parallel trends assumption. In Table 3, I show eight points of time from 1998 to 2013. These are the 10^{th} grade math percentiles SIMCE results for all the schools in Santiago. The first column shows the control group, the second the overall occupied treated group, the third the moderates group, and the fourth the hard-liners. In each column, the mean for each group and year alternates with the number of schools in the sample. At the same time and for the treated groups, a sub-column appears with the difference in test mean between the control group and each of them. A quick look shows that this difference fluctuates meagrely but for the period after the onset of the student revolts in 2011. This trend is more active in the hard-liners group. Additionally, the table shows t-values (in bold) for a difference-in-difference test for each and every pair of test of means between the control and each occupied group, for one year and its previous test date. Very reassuringly, one can observe that all of them are under the cut-off for a two-tailed 1% significance level. But for the occupied (3.27) and hard-liners (4.11) precisely in the year after the protests which is again an anticipation for the DiD results proving the causal effect of protests on educational outcomes. Also, post-treatment trends are again parallel as confirmed by very low t-values for the comparison of 2013 versus 2012 trends difference-in-difference. Similar results can be found with language and science and with 8^{th} and 4^{th} grades (not shown). Thus the parallel trends assumption can be strongly secured by pre-policy and post-policy parallel trends verification. Furthermore, in Figure 3, I show graphically the same pre-treatment trends in SIMCE average[2] between non-occupied schools and hard-liners. From this figure is clear that between 1998 and 2010 the movement of the trends in test means is parallel and during the *Chilean Winter* it becomes independent, while the control group increases their mean, the hard-liners noticeably

[2] 250 points corresponds to the 50^{th} percentile. I use point averages instead of percentiles for ease in exposition, but results extend to them.

drop their scores. And after it stabilises again, maintaining the distance in means post-treatment.

At this point, I have provided analytical and graphical proves of parallel trends. In addition, I can add a full falsification exercise to give further credibility to its validity in this study. This exercise first repeats the DiD estimates. However, they are repeated for the SIMCE tests held in a full previous pupil cohort, which are SIMCEs from the 4^{th} grade level in 2002 and 10^{th} grade in 2008. In short, the third line of the DiD tables is reported in Table A1. The results are self-affirming because the DiD estimates are strictly insignificant with an almost negligible absolute value. This exercise further justifies confidence in the parallel trends assumption and provides a benchmark against which the principal results can be tested.

5 Results

5.1 Pupil-level analysis

Difference-in-Difference

Hereafter, I use the time length of events as a descriptor of the different samples, the reader should bear in mind as specified throughout the document that the reduction in instructional time in the disrupted schooling comes together with other unobservable causal factors like pupils denial to be actively in a learning activity or a heavily disrupted teacher-pupil relationship. Now I presents the results of the DiD estimates, Table 4 [1] shows the DiD estimate of the average test results per school before and after occupation for Occupied-S schools on October 19^{th}, 2011, where just Occupied-S schools sat for the test. The results (for the first row) show that the pre-treatment test results (the 2007 SIMCE for 4^{th} grade of primary school in languages, math, and science) were higher, higher and higher respectively in the 108 Occupied-S schools than the results in the control group (CG). Later, during the protests and school occupations that started in early June of 2011 and lasted until the date of the tests (October 19th 2011), an average of at least 11.58 days (or 2 calendar weeks) of normal school activities were lost in the schools that appeared on the police report list of occupied schools. These losses took place at the end of June, the climax of the occupations, and the occupations were suspended to sit for the post-treatment 2011 languages, math and science SIMCE tests. The post-treatment test results for Occupied-S schools are significantly lower than those of the control group. The third row shows that the difference in test results from pre- to post-treatment years is negative, showing a decrease in outcome for the treated units. That is, for Occupied-S, the three test results decrease with a drop in scores. Significant for math and science and not significant for language. Under the parallel trends assumption, this means that there is sufficient evidence to reject the *null* hypothesis that lost school days during school occupations do not affect pupil performance on standardised tests during the *Chilean Winter*. In particular, the average of 11.58 days of school occupation leads to a decrease in 0.24 (not significant), 1.71 and 1.57 (both significant) percentile points in the test result outcomes for the 108 Occupied-S schools for the sample of 51,680 students (46,567 controls and 5,113 moderates).

Table 4 [2] shows the same 108 Occupied-S schools after 9.56 lost school days for the other sample of 49,361 students (44,113 controls, and 5,248 moderates). This figure shows less time lost than in the previous sub-period because the Occupied-S schools implemented extra time activities to catch up with the control group. Again, the first-row results show that the pre-treatment test results for the 2006 SIMCE are lower and lower in the 108 Occupied-S schools than those of the control group (CG). These results represent the 2006 SIMCE for 4th grade of primary school, which took place six (not four) years before the post-treatment test in languages and math (science was excluded from the 10th SIMCE test). For the second row, post-treatment test results for Occupied-S schools are respectively lower than the control group. The third row shows that the difference in test results from pre- to post-treatment years is slightly positive in the control group as well. For Occupied-S schools, the two test results drop by 1.78 (language) and 3.71 (math) relative to the control group and before and after the treatment. Under the parallel trends assumption, this means that there is sufficient evidence to reject the *null* hypothesis that lost school days during the school occupations did not affect pupil performance on standardised tests during the *Chilean Winter*. Lost school days during the school occupations decreased pupil performance for Occupied-S schools during the period from June 2011 to November 6th, 2012.

Finally, Table 4 [3] overviews the 97 Occupied-NS schools that did not take the 2011 SIMCE but did take the November 6th, 2012 SIMCE. That is a sample of 51,871 students (44,113 controls, and 7,758 hard-liners). The results (for the first row) show that the pre-treatment test results (the 2006 SIMCE for 4th grade of primary school in languages and math) are lower and lower in the 97 Occupied-NS schools than those results in the control group (CG). The difference is strongly significant at the 5% level. During the period from June 2011 to the date of the second test after the onset of the revolts on November 6th, 2012, at least an average of 48.08 days (or 2 calendar months) of normal school activities were lost in the schools that appeared on the police report list of occupied schools at the end of June, the climax of the occupations. These absences took place in schools that did not take the 2011 SIMCE. For the second row, the post-treatment test results for Occupied-NS schools remain strongly, significantly lower than those of the control group. The third row shows that the difference in test results from post- to pre-treatment years is negative, indicating that treated units decrease in outcome. That is, for Occupied-NS schools, the two test results plunge with a strongly significant drop in scores by 2.48 (languages) and 6.97 (math) percentile points. Under the parallel trends assumption, this means that there is sufficient evidence to reject the *null* hypothesis that lost school days during the school occupations did not affect the pupil performance on standardised tests. Consequently, this study's main results hold for both school types. There is strong evidence that school occupations during the *Chilean Winter* significantly decreased the performance of the pupils of these two types of treated schools on their standardised tests. As a comparison, Hanushek (2003) suggests that a one standard deviation increase in overall teacher quality is associated with a 11% of a standard deviation increase in student performance. This increase compares to a 24% (-6.97/28.86, that is the point estimate divided by the standard deviation of the mathematics SIMCE test for this sample of 57,119 pupils) of a standard deviation decrease to which the 6.97 lower percentile points are equal for hard-liners and a 13%(-3.71/28.68, that is the point estimate divided by the standard deviation of the mathematics SIMCE test for the sample with the control and moderate groups) of a standard deviation decrease to which the 3.71 lower percentile points are equal for moderates. Therefore, an increase in approximately two standard deviations in teacher quality for the hard-liners and one standard deviation in teacher quality for the moderates cancel out by being on the occupied school list. Therefore, the effect outlined in this paper is a particularly strong one.

5.2 School-level analysis, i.e. same-grade-level analysis

Difference-in-Difference

This section presents the results of the DiD estimates for school-level analysis. These are not value-added components. Instead, they represent simple comparisons between one-year performance figures for a grade in a definite school and another cohort performance for the same grade and school in another year. These are not any value-added estimates because different cohorts are examined, and pupil averages or schools are analysed, not pupils themselves. Table 5 [1] shows the DiD estimate of average test results per school before and after school occupations for Occupied-S schools on October 19th, 2011, where just Occupied-S schools sat for the test. The shortest diagonal cohort of the same grade is used, 8th in 2011.

The results (for the first row) show that the pre-treatment test results (the 2009 SIMCE for 8th-year primary school in languages, math, and science) are, significantly, 5% lower in the 108 Occupied-S schools than in the control group (CG). Afterwards and during the protests and school occupations, which started in early June of 2011 and lasted until the date of the tests (October 19th, 2011), at least an average of 11.58 days (2 calendar weeks) of normal school activities were lost in the schools that appeared on the police report list of occupied schools at the end of June, the climax of the occupations. The occupations of these schools were ended to allow students to sit for the post-treatment 2011 languages, math and science SIMCE tests. In the second row, the post-treatment test results for Occupied-S schools are significantly lower than those of the control group, and with similar magnitudes to those above. The third row shows that the difference in test results from pre- to post-treatment years is not significant at a 5% level. Under the parallel trends assumption, this means that there is not sufficient evidence to reject the *null* hypothesis that lost school days during the school occupations do not affect pupil performance on standardised tests—at least for these schools and time periods. In particular, the average of 11.58 days of school occupation leads to an insignificant decrease of 1.31, an increase of 0.67, and again a decrease of 1.78 in percentile points in the test result outcomes for the 108 Occupied-S schools.

Table 5 [2] shows the same 108 Occupied-S schools, but now after 9.56 lost school days (approximately two calendar weeks). That is less time lost than before because the schools implemented extra time activities to catch up with the control group for the shortest diagonal cohort, 10^{th} grade, which is 2010.

Again, the results for the first row show that the pre-treatment test results (the 2010 SIMCE for 10^{th} grade of secondary school) were lower in the 108 schools (Occupied-S) than those of the control group (CG). However, this time the results come from the period two years before the post-treatment test in languages and math (science was excluded from the 10^{th} SIMCE test). The difference is strongly significant, at a 5% level. During the period from June 2011 to the date of the second test after the onset of the revolts on November 6^{th}, 2012, at least an average of 9.56 days (approximately 2 calendar weeks) of normal school activities were lost in the schools that appeared on the police report list of occupied schools at the end of June, the climax of the occupations. These schools also sat the previous year's SIMCE test. For the second row, post-treatment test results for the Occupied-S schools are significantly lower than the control group with similar magnitudes as those above. The third row shows that the difference in test results from pre- to post-treatment years was not significant at a 5% level. Under the parallel trends assumption, this means that there is not sufficient evidence to reject the *null* hypothesis that lost school days during the school occupations do not affect pupil performance on standardised tests—at least for these schools and this period. In particular, the average of 9.56 days of school occupation led to an insignificant increase of 1.72 and decrease in 1.01 in percentile points in the test result outcomes for the 108 Occupied-S schools.

Additionally, Table 5 [3] overviews the 97 Occupied-NS schools that did not take the 2011 SIMCE but did take the November 6th, 2012 SIMCE for the shortest diagonal cohort of 10th grade, which is 2010. The DiD estimate shows that before and after, the average test results of the Occupied-NS schools are 2.87 and 4.76 percentile. Both significantly lower relative to the control group, indicating a peak in decrement.

The results for the first row show that the pre-treatment test results (the 2010 SIMCE for grade 10th of secondary school, but two years before the post-treatment test in languages and math) are lower in the 97 Occupied-NS schools. The difference is strongly significant at the 5% level. During the period from June 2011 to the date of the second test after the onset of the revolts on November 6th, 2012, at least an average of 48.08 days (or over 2 calendar months) of normal school activities were lost in the schools that appeared on the police report list of occupied schools. Again, this loss took place at the end of June at the climax of the occupations, and these schools did not take the 2011 SIMCE. For the second row, the post-treatment test results for the Occupied-NS schools are more significantly lower than those of the control group. The third row shows that the difference in test results from pre- to post-treatment years is slightly positive in the control group. For the Occupied-NS, the two test results plunge with a strongly significant drop in scores. Under the parallel trends assumption, this means that there is sufficient evidence to reject the *null* hypothesis that lost school days during the school occupations do not affect pupil performance on standardised tests. Consequently, this study's main result holds, at least for the Occupied-NS school type. There is strong evidence that school occupations significantly decrease the performance of these schools' pupils on their standardised tests using a school level cohort approach. This effect is both significant and sizeable, representing an almost 16% of a standard deviation decrease in standardised test scores. This result is very close to the pupil-level approach and a particularly strong one.

Finally, it is important to note that different cohorts bear different biases. For instance, suppose there are just two schools, one with only one pupil in a 40^{th} percentile and the other, a larger school, with nineteen pupils all in the same lower 20^{th} percentile. The school-level average is a 30^{th} percentile while the pupil-level average is only a 21^{st} percentile. So outcomes for pupils in the same academic year do not correspond mechanically to outcomes for the age cohorts.

5.3 Triple difference (TD)

Figure 4 shows the extended calendar of the SIMCE and highlights the three possible DiDiD (Difference-in-difference-in-difference) strategies. There are two different approaches. The first compares two different diff-in-diff of two different cohorts. The so called DiDiD_1 and DiDiD_2. The second utilises only one cohort which is tested three times, DiDiD_3. The two different cohorts strategy relies in comparing the post-pre difference in value added in schools affected by the occupations with the post-pre difference in value added for schools unaffected by the occupations. That is a diff-in-diff-in-diff (the difference in the difference in test scores in occupied schools minus the difference in the difference in test scores in unoccupied schools). As said, this strategy relies on two different cohorts, so a further assumption is needed for the estimator to be valid. That is that the change in value added between the two cohorts would have been the same in the occupied and unoccupied schools, in the absence of the occupations. These two possible diff-in-diff-in-diff are as follows:

$$\mathrm{diff-in-diff-in-diff_{1a}} =$$

$$\{E(Y_{8^{\text{th}},2011} - Y_{4^{\text{th}},2007} | occupied = 1) - E(Y_{8^{\text{th}},2009} - Y_{4^{\text{th}},2005} | occupied = 1)\}$$

$$-$$

$$\{E(Y_{8^{\text{th}},2011} - Y_{4^{\text{th}},2007} | occupied = 0) - E(Y_{8^{\text{th}},2009} - Y_{4^{\text{th}},2005} | occupied = 0)\}$$

$$\text{diff} - \text{in} - \text{diff} - \text{in} - \text{diff}_{2\text{a}} =$$

$$\{E(Y_{10^{\text{th}},2012} - Y_{4^{\text{th}},2006} | occupied = 1) - E(Y_{10^{\text{th}},2008} - Y_{4^{\text{th}},2002} | occupied = 1)\}$$

$$-$$

$$\{E(Y_{10^{\text{th}},2012} - Y_{4^{\text{th}},2006} | occupied = 0) - E(Y_{8^{\text{th}},2008} - Y_{4^{\text{th}},2002} | occupied = 0)\}$$

Equivalent estimators which are perhaps more intuitive to plug into our previous results are the following:

$$\text{diff} - \text{in} - \text{diff} - \text{in} - \text{diff}_{1\text{b}} =$$

$$\{E(Y_{8^{\text{th}},2011} - Y_{4^{\text{th}},2007} | occupied = 1) - E(Y_{8^{\text{th}},2011} - Y_{4^{\text{th}},2007} | occupied = 0)\}$$

$$-$$

$$\{E(Y_{8^{\text{th}},2009} - Y_{4^{\text{th}},2005} | occupied = 1) - E(Y_{8^{\text{th}},2009} - Y_{4^{\text{th}},2005} | occupied = 0)\}$$

$$\text{diff} - \text{in} - \text{diff} - \text{in} - \text{diff}_{2\text{b}} =$$

$$\{E(Y_{8^{\text{th}},2012} - Y_{4^{\text{th}},2006} | occupied = 1) - E(Y_{8^{\text{th}},2012} - Y_{4^{\text{th}},2006} | occupied = 0)\}$$

$$-$$

$$\{E(Y_{8^{\text{th}},2008} - Y_{4^{\text{th}},2002} | occupied = 1) - E(Y_{8^{\text{th}},2008} - Y_{4^{\text{th}},2002} | occupied = 0)\}$$

In these equivalent versions of the estimators, what is being calculated instead is "the difference in the diff-in-diff in the test scores in the cohort that experienced the treatment and the diff-in-diff in the test scores in the cohort that not experienced the treatment". That is there are two cohorts with a diff-in-diff between two tests of the same cohort and the third differencing is between the two diff-in-diff of the two cohorts. The only caveat of these estimators is that the earliest cohorts includes the *Penguin Revolution* of 2006 where some schools were also occupied like the historic May 19^{th} 2006 school occupation of the Instituto Nacional just two days before that year President's Bachelet's traditional speech to the nation.[3] As far as I am concerned, there is no equivalent list for schools under school occupation for this previous outburst of riots. Thus, it is not possible to confirm how many schools where occupied in both or any of the two outburst of students protests apart of suggesting that hard-liners could be more lenient to undergo school occupation in both episodes and that in general 2006 school occupations seem to have been shorter in length of missed school days than the 2011 ones. Further avenues of research should try to measure the short-term effects on standardised test of the 2006 *Penguin Revolution* which will likely involve finding a reliable source of identification of the schools occupied in this specific revolt. And then, compare the effects in 2006 to the effects in 2011 *Chilean Winter*. Also, calculating and comparing medium- and long-term effects of both spell of riots should also be considered a further avenue of research. Consequently, the following results must be taken with caution. The results are shown in Table 6. For the first pair of cohorts $DiDiD_1$, ${8^{th}}_{2011}$-${4^{th}}_{2007}$ and ${8^{th}}_{2009}$-${8^{th}}_{2005}$, the trends increase the negative numbers, so now the three test are negatively affected by the treatment and in a higher magnitude. Still the Math test is the most affected as found elsewhere in the literature and also in my previous results. For the second pair of cohorts $DiDiD_2$, ${10^{th}}_{2012}$-${4^{th}}_{2006}$ and ${10^{th}}_{2008}$-${4^{th}}_{2002}$, for three out of four trends there is a reduction in the magnitude, but the values are still significant, both for moderates and hard-liners. After controlling for the trends, the new picture that arises is that the effects at the first SIMCE in 2011 are stronger than at the second SIMCE in 2012. This

[3] All my previous results used tests strictly after the *Penguin Revolution* including the ${4^{th}}_{2006}$ SIMCE that was taken on 7-8^{th} November of 2006 when 256,040 pupils sat for the test, i.e. 95% of the total (UCE, 2007) which is average for these kind of tests implying that, in principle, there were not pupils that refused to take the test as it occurred in the next revolt in 2011.

suggests that the effect in standardised tests is higher the shorter the period after the occupations. As shown in Figure 5, the bulk of the occupations are in 2011 in the period just after the onset of the riots and before the date of the SIMCE on October 19th 2011. For instance, moderates made up for lost time and reduced their lost days by 2.02 days in the following year before the next-in-line SIMCE on November 6th 2012. While hard-liners' only increased their lost days by 7.5 additional days, only a 15.6% of the total lost days during the whole period but allocated now in a period of more than double the length of time. Thus, the picture, that comes off form the DiDiD_1, DiDiD_{2S}, and DiDiD_{2NS}, is a particularly interesting one.

I can also use a TD/DiDiD/GDD (Generalised difference-in-difference) strategy (see Lee (2016)) to analyse now within a single cohort, DiDiD_3. This is the only three wave cohort in the data, which is precisely the one amid the onset and more active protests: 4th grade in 2007, 8th grade in 2011, and 10th grade in 2013. The estimator is as follows:

$$\text{diff}-\text{in}-\text{diff}-\text{in}-\text{diff}_3 =$$

$$\{E(Y_{10^{\text{th}},2013} - Y_{8^{\text{th}},2011}|occupied = 1) - E(Y_{10^{\text{th}},2013} - Y_{8^{\text{th}},2011}|occupied = 0)\}$$

$$-$$

$$\{E(Y_{8^{\text{th}},2011} - Y_{4^{\text{th}},2007}|occupied = 1) - E(Y_{8^{\text{th}},2011} - Y_{4^{\text{th}},2007}|occupied = 0)\}$$

This cohort is the one with no Occupied-NS who did not sit for the test in October 2011. The results are shown in Table 7 and are also reassuring because after controlling for unobserved divergent or convergent trends of the series of data the results are still negative and significant for math test. Meanwhile, language test results are still non-significant.

5.4 More on the identification strategy

Can the treatment effect be estimated for this study's sample? It is accepted that internal validity fails when there are differences between the treated components and controls (other than the treatment itself). In particular, difference-in-differences has two threats to validity. The first threat is credibility of parallel trends, which has been discussed above. The second threat is compositional difference, which is briefly discussed in this subsection. Repeated cross-sections are only valid when the composition of the target population does not change between the two periods. This condition is tested in this study by looking at the distribution of the control and treated groups, which suggests that their distributions are the same before the treatment. Table 8 (an elaboration of the first panel of Table 2) shows the compositional difference of the control and occupied groups for control variables. Control and occupied groups are homogeneous with each other before and after the treatment. These variables are the same shown in the upper part of Table 2. But this time the longitudinal variation is assessed. Every second line shows the results for a test of equality between the control group and each one of the occupied groups (moderates and hard-liners). The vast majority are under the cut-off which can be seen as reassuring. Although, apart from small sample size variation due to the constraint that observations should not be missing for both years, the findings are the same as for the relevant part of Table 2. In every third line the values for the differences in means for each variable are presented between the control group and the moderates, the control group and the hard-liners, and the moderates and the hard-liners with a further t-test in every third line under the last column representing the comparison between the moderate and hard-liners. This comparison is of great theoretical and practical importance because the fact that both group are comparable in cross-sections and also in time as the t-values under the cut-off show, makes the comparison between their outcomes a test of intensity of protests. Some variables as books, pcs, internet or income have a trend in time due to technological improvement, growth and even inflation. Overall, the compositional difference is satisfied.

The SUTVA assumption is crucial. The treatment mechanism of assignment can be individual, executed by third parties inside the model or by a researcher. In this case, there is a mixture of self-decision (a majority vote school decision) and third-party decision (a radical minority decision). The reduction in standardised tests in school A is unaltered regardless of whether school B is occupied. This could be challenged if there is friendship or partnership. If a boy's school and girl's school in proximity to each other are both occupied, it is possible that couples decide, for instance, to go to the beach. If just one school is occupied, students from the partner school may decide to study alone. The reduction in standardised tests for any school may or may not be the same whether it is occupied after a majority vote decision or under a third-party decision.

At the same time, external validity should be contrasted. In other words, can this study's estimates be extrapolated to other populations? Missed school days or a disruption in instructional time is quite a common event in schools all over the world. Comparable time deprivations in the context of school occupations, snow storms, natural disasters, most probably have a common path to diminishing test scores. But this event is also a one-of-a-kind because it includes disruptions in other working environments, in the context of school riots that involves potential disruptions on teachers' agenda, teacher-pupil relationship, disposition of pupil to engage in a learning activity and many other potential disruptions in the triad teacher-pupil-parents relationship . Consequently, these results extrapolates better to the teacher strikes literature of Baker (2013), Johnson (2009, 2011) where there is not only damage to the instructional time but a broader dysfunction in the accumulation of human capital.

5.5 Extension: Missed school days

Figure 5 graphically illustrates the lost school days for the pre-treatment when there were no missed school days and during the *Chilean Winter*. The number of missed school days can be identified until the October 19th, 2011 SIMCE and until November 6th 2012. The graph also shows the intensity of the treatment, which I call the *dose* of the treatment.

Table 9 summarizes the key information on the amount of time attended by the control group and lost by the relevant three treated groups. From June 2011 to the 8th grade SIMCE Exam on October 19th, 2011, 11.58 days were lost in Occupied-S (occupied schools that sat the 8th grade 2011 October SIMCE test). This represents over two calendar weeks of lost school days. Also, 40.58 days were lost in Occupied-NS (occupied schools that did not sit the 8th grade 2011 October SIMCE test), or approximately two calendar months of lost school days. From June 2011 to the 10th grade SIMCE exam on November 6th, 2012, the former treatment plus the cancelled days from October 19th, 2011 to November 6th, 2012, 9.56 (the previous 11.58 days minus 2.02 "catch-up" days) (or approximately 10 days) days were lost in Occupied-S (occupied schools that sat for the 8th grade 2011 October SIMCE test). This amounts to approximately two weeks of lost school days. During this period, Occupied-S schools attended more time relative to the control group. This is probably an attempt to catch up with the missing class material. Even so, the overall attendance rate was negative. Finally, 48.08 (the previous 40.58 days plus an additional 7.50 lost days) (or approximately 50 days) days were lost in Occupied-NS (occupied schools that did not sit for the 8th grade 2011 October SIMCE test). This was approximately two calendar months and one calendar week of lost school days.

6 Conclusion

This paper has addressed the impact on pupil achievement in disrupted schooling during the 2011/12 school occupations in Chile. Using an external variation in educational inputs due to school riots, protests, walk-outs and school occupations during the so-called *Chilean Winter*. The average effect for the hard-liners, a group of students that occupied their schools for more than ten consecutive weeks, or approximately 50 days, and did not surrender their school occupations to sit for the scheduled SIMCE test, is a decrease of 6.97 percentile points in math standardised tests, a

24% of a standard deviation decrease in performance and a decrease of 2.48 percentile points in language standardised tests, a 8.5% of a standard deviation decrease in performance. As it can be seen, the magnitude of the effect for language tests is lower than the math tests effect. Unlikely language, math is more affected by acute training. If a pupil interrupts her math training for more than two months and does not practice at all, she will probably lose momentum while her language skills will probably not be affected too much. This difference between educational achievements, and "educational momentum" is well represented in my results. Moreover, the results also shed light to different effects along different cohorts. The older cohorts (4^{th} to 10^{th} grades) are more affected because there is a higher component of procedural learning. Younger cohorts (4^{th} to 8^{th} grades) rely on more conceptual and slow evolving knowledge so protests affect them less. Furthermore, my results show that for young cohorts, short spell of protests and language tests there is no discernible effect of protests on performance (see for instance, the effect on language in Table 4[1]). That is, short spells of protests in primary education do not affect the educational outcome at a 10% significance level. Also, the fact that not only the control group and the occupied schools are comparable, but also that the moderates is comparable with the hard-liners is of particular interest. Because it permits to assess the dose in the causal effect. While mild disruptions sometime do not cause or just tenuously decrease cognitive educational outcomes, strong disruptions do cause intense deterioration in cognitive educational outcomes.

At the same time, my results mirror the literature cited here, Baker (2013), Johnson (2009, 2011), not only showing non-significant effects for young cohorts, and non-mathematical assignments, but also showing a comparable size of effect for older cohorts and mathematical assignments. For instance, Baker's size of effect for long strikes (more than 10 days), 24% of a standard deviation, is the same as my estimation for approximately 50 days of school occupation. The difference is that Baker's are one spell strikes while the Chilean school occupations expand for roughly a year and a half. Also, Johnson and Baker's are teacher strikes while the ones encompassed here are pupil-led disruption so the disposition to learn by the pupils could also be altered. Goodman

(2014) estimates are even bigger since 10-missed school imply a 50% standard deviation. But to assess my results in an explicit way, if the Instituto Nacional—whose pupils were leading the protests and walk-outs—were suddenly completely deprived of its top teachers, education would suffer from a similar drop in value added as it did in the years 2011 and 2012 when it was on strike with its students involved in walk-outs and protests. Therefore, the production function of education in Chile was seriously impeded in the occupied schools.

After controlling for the trends in TD settings, the new picture that emerges is that the effects measured at the first SIMCE in 2011 are stronger than the effects measured at the second SIMCE in 2012. This suggests that the effect in standardised tests is higher the shorter the period after the occupations as it would be reasonable to expect. As shown in Figure 5, the bulk of the action of the school occupations is in 2011 in the period just after the onset of the riots and before the date of the SIMCE on October 19th 2011. Thus, it is reasonable to find that the effects are stronger when measured at this 2011 SIMCE rather than in the 2012 SIMCE, more than a year after.

In this paper, I have analysed the short-term consequences of protests. Further avenues for future research can be performed on the long-term effects of the school occupations like the one discussed in Belot and Webbink (2010), Pischke (2007). I am referring, for instance, to social network outcomes, salaries and earnings, employment, and political outcomes as political visibility or student leaders reaching parliament, and social "conquests" as free higher education or demunicipalisation of the schooling system. I do not want to deter anybody from participating in politics. Democracy feeds on some dose of civilian turmoil and this kind of research helps to counterbalance both the negative and positive effects of student protests in order to assess the bottom line of the *Chilean Winter* and whether (some of the) students are better off despite the losses in educational achievement.

In summary, this research focused on, and hopefully identified, the change in educational achievement in the context of disrupted schooling during the 2011/12 Chilean student riots known as the *Chilean Winter*. The causal effects of these disruptions can be made evident through a decrease in student standardised test performances. This study does not claim that student protests are a negative activity or that students should not involve themselves in these activities, but merely seeks to disclose the relevant average cost of participating in such protests. This research could assist both interested scholars and students in recognising and balancing the real costs of school protests and occupations in cognitive educational outcomes as the ones experimented by Chilean students during the 2011 protests.

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TABLES

Table 1: Disruption of Instructional Time in the Literature

Source	Sample	Place & Year	Disruption	Subject	Type of Effect	% points	Std Dev	Effect (% of Std Dev)
Johnson 09	3rd grade	Ontario 1998/03	10-day Strike	M, R, W	Short-term	Non-sign	21	Non-sign
	6th grade	Ontario 1998/03	10-day Strike	M	Short-term	1	20	5%
Johnson 11	3rd grade	Ontario 1998/03	10-day Strike	M, R, W	Short-term	Non-sign	19	Non-sign
	6th grade	Ontario 1998/03	10-day Strike	M, R, W	Short-term	Non-sign	19	Non-sign
	6th grade & -2sdED	Ontario 1998/03	10-day Strike	M	Short-term	4.1	19	22%
Baker 13	6th grade	Ontario 1998/03	long Strike (more than 10, up to 17 days)	M	Short-term	4.6	19	24%
Montebruno 20	**Cohort 4th & 10th grade**	**Santiago 2011/12**	~**10-day school occupation**	**M**	**Short-term**	**3.71**	**28.68**	**13%**
(Current paper)	**Cohort 4th & 10th grade**	**Santiago 2011/12**	~**50-day school occupation**	**M**	**Short-term**	**6.97**	**28.86**	**24%**
Hincapié 14	5th-9th grades	Colombia 2002/09	No disruption. Full school day	M	Short-term			13.8% 9th- 8.2% 5th
Jaume & Willén 19	30-40 years/EPH 2003/15	Argentina 1977/98	372-day Strike (188 LPampa-531 RNegro)		Long-term			↓ 3.2%, M, & 1.9%, F, wage
Goodman 14	MCAS/Closures/<60 absences	Massachusetts 2003/10	10-day absence	M	Short-term			50%
Pischke 07	2nd grade/SSY states	West Germany 1966/67	66% shorten school-year (26 weeks)		Short- and Long-term			↑ repetition ↓ higher education = earnings and employment
Belot &Webbink 10	French- and Flemish-speaking born after 1972	Belgium 1990	May to November Strike		Short- and Long-term			↑ repetition ↓ level of higher education (vocational)
Lavy 15	15 year-old/PISA	OECD 2006	No disruption. Addition 1+ hour/week	M, S, L	Short-term			Non-linear: 1 hour/week: 5.8% of a sd for the first hour of addition; 1 additional hour in the range of 2-3 hours/week: 2.52% of a sd; 1 additional hour in the range of 4+ hour/week: 2.48% of a sd. Thus on average 3.6% of a sd for 1 additional hour through the whole range. So 10-hours more a week (more than two days additional of school a week) will increase 36%. The last extrapolation is completely dubious beyond the assumption of the actual sample of Lavy.

Author's calculations from given sources.
M math, R reading, W writing, S science, L language.
Montebruno 20 is the current paper's results.
EPH Encuesta Permanent de Hogares, Permanent Household Survey.
MCAS Massachusetts Comprehensive Assessment System
SSY is short-school-year state, all West German states except Bavaria that started school in the spring and for the transition to a fall start required two short years of 24 instead of 37 weeks [26=(37-24)X2].
Short-term is class repetion and Long-term are earnings, (level of) higher education, and employment
PISA Programmme for International Student Assessment

Table 2: Comparison statistics control group (CG), moderates (O-S), and hard-liners (O-NS)

Year	Variable	CG	O-S	O-NS	$t_{(1,2)}$ [1]	$t_{(1,3)}$ [2]	$t_{(2,3)}$ [3]
12	years of preschool	1.30	1.32	1.29	-0.76	1.44	1.62
12	repeat year	0.50	0.50	0.49	0.06	1.90	1.30
12	mother indigenous	0.07	0.07	0.06	-0.14	0.45	0.43
12	mother education	12.05	11.84	12.13	3.34	-1.42	-3.72
12	father education	12.31	12.17	12.43	2.01	-1.82	-2.95
12	pc	0.78	0.77	0.78	1.96	0.00	-1.62
12	internet	0.64	0.61	0.64	2.59	-0.04	-2.16
12	books	47.08	46.28	51.78	0.62	-3.89	-3.37
12	income	522.66	492.90	598.04	2.63	-6.19	-6.84
12	percentage public voucher schools	21.53	44.44	80.41	-4.69	-14.21	-5.72
12	percentage private voucher schools	71.10	54.63	19.59	3.35	12.37	5.57
12	percentage private schools	7.37	0.93	0.00	5.97	13.22	1.00
07	SIMCE pctile. pre-treat. Language 4^{th}	50.43	51.06	N.A.	-1.49	N.A.	N.A.
07	SIMCE pctile. pre-treat. Math 4^{th}	50.31	52.15	N.A.	-4.34	N.A.	N.A.
07	SIMCE pctile. pre-treat. Science 4^{th}	50.29	52.32	N.A.	-4.86	N.A.	N.A.
11	SIMCE pctile. Language 8^{th}	50.45	50.84	N.A.	-0.92	N.A.	N.A.
11	SIMCE pctile. Math 8^{th}	50.48	50.60	N.A.	-0.29	N.A.	N.A.
11	SIMCE pctile. Science 8^{th}	50.45	50.92	N.A.	-1.09	N.A.	N.A.
11-07	SIMCE pctile. diff. 8^{th}-4^{th} Language	0.02	-0.21	N.A.	0.69	N.A.	N.A.
11-07	SIMCE pctile. diff. 8^{th}-4^{th} Math	0.17	-1.54	N.A.	5.25	N.A.	N.A.
11-07	SIMCE pctile. diff. 8^{th}-4^{th} Science	0.16	-1.41	N.A.	4.59	N.A.	N.A.
06	SIMCE pctile. pre-treat. Language 4^{th}	51.37	46.70	47.91	11.29	9.52	-2.36
06	SIMCE pctile. pre-treat. Math 4^{th}	51.24	46.74	48.60	10.66	7.19	-3.54
12	SIMCE pctile. Language 10^{th}	51.90	45.45	45.95	15.57	16.09	-0.98
12	SIMCE pctile. Math 10^{th}	52.56	44.35	42.95	20.05	27.10	2.77
12-06	SIMCE pctile. diff. 10^{th}-4^{th} Language	0.52	-1.25	-1.96	4.99	8.45	1.64
12-06	SIMCE pctile. diff. 10^{th}-4^{th} Math	1.32	-2.39	-5.65	10.94	24.96	7.93

[1] Test of equality of means between control group and moderates (columns 1 and 2).

[2] Test of equality of means between control group and hard-liners (columns 1 and 3).

[3] Test of equality of means between moderates and hard-liners (columns 2 and 3).

[4] Author's calculation from research data provided by the Chilean Ministry of Education's Agency for Quality in Education. The data is available only to researchers after submitting a written proposal. The table shows the summary statistics of the control group, occupied-S and occupied-NS. It lists the type of school, pre- and post-SIMCE, difference in percentiles and control variables. Rows 1-12 for 2012 are based on 26,166 observations, rows 13-21 for 2007 & 2011 on 51,680 (46,567 CG + 5,113 O-S) and rows 22-27 for 2006 & 2012 on 57,119 (44,113 CG + 5,248 O-S + 7,758 O-NS).

Table 3: Parallel trends between control group (CG), occupied (O), moderates (O-S), and hard-liners (O-NS), 10th grade Math 1998-2013 SIMCE percentile.

Year	SIMCE CG	SIMCE O	diff	SIMCE O-S	diff	SIMCE O-NS	diff
	N	N	t_O [1]	N	t_{O-S} [2]	N	t_{O-NS} [3]
1998	54.63	35.43	19.20	35.36	19.27	35.47	19.16
	415	131		50		81	
2001	54.22	36.08	18.15	37.77	16.45	34.80	19.42
	481	142	**0.63**	61	**-0.13**	81	**0.95**
2003	53.67	37.65	16.02	38.89	14.78	36.59	17.08
	559	158	**-1.23**	73	**-0.07**	85	**-1.68**
2006	53.02	38.70	14.32	37.82	15.20	39.62	13.41
	699	176	**-0.51**	90	**0.29**	86	**-1.00**
2008	53.20	37.69	15.51	37.05	16.15	38.38	14.83
	737	181	**1.62**	94	**0.72**	87	**1.71**
2010	53.23	37.02	16.21	37.86	15.38	36.09	17.14
	779	186	**1.23**	98	**-0.21**	88	**2.12**
2012	53.43	35.21	18.22	37.78	15.64	32.30	21.12
	837	183	**3.27**	97	**0.88**	86	**4.11**
2013	53.46	35.06	18.40	38.63	14.83	30.76	22.70
	835	181	**0.00**	99	**-0.78**	82	**0.90**

[1] T-test of difference-in-differences (parallel trends) between a year SIMCE percentile and its previous year for control group (CG) and occupied schools (O = O-S + O-NS), in bold.

[2] T-test of difference-in-differences (parallel trends) between a year SIMCE percentile and its previous year for control group (CG) and moderates (O-S), in bold.

[1] T-test of difference-in-differences (parallel trends) between a year SIMCE percentile and its previous year for control group (CG) and hard-liners (O-NS), in bold.

[4] Author's calculation from research data provided by the Chilean Ministry of Education's Agency for Quality in Education. The data is available only to researchers after submitting a written proposal.

[5] The table shows the summary statistics of the control group, occupied, occupied-S and occupied-NS. It lists the mean of Math 10th grade SIMCE percentiles from 1998 to 2013 (eight points), the number of schools in each year and each group, the difference between the groups, and the t-test of the difference-in-differences for each pair of years. Data are available for pre-, during and post- treatment periods (*Chilean Winter*).

Table 4: Pupil-level value-added DiD estimates [4]

Pupil-level Occupied-S schools[1]

11.58 lost days (over 2 calendar weeks)

	Language test			Math test			Science test		
	control and occupied schools			control and occupied schools			control and occupied schools		
	CG	Occupied-S	Difference Occupied-S/CG	CG	Occupied-S	Difference Occupied-S/CG	CG	Occupied-S	Difference Occupied-S/CG
SIMCE 4th grade '07,	50.43	51.06	0.62	50.31	52.15	1.83	50.29	52.32	2.04
	(0.13)	(0.40)	(0.42)	(0.13)	(0.40)	(0.42)	(0.13)	(0.40)	(0.42)
SIMCE 8th grade '11,	50.45	50.84	0.39	50.48	50.60	0.12	50.45	50.92	0.47
	(0.13)	(0.40)	(0.42)	(0.13)	(0.40)	(0.42)	(0.13)	(0.41)	(0.43)
Change in means,	0.02	-0.21	-0.24	0.17	-1.54	-1.71***	0.16	-1.41	-1.57***
	(0.11)	(0.33)	(0.34)	(0.10)	(0.31)	(0.33)	(0.10)	(0.33)	(0.34)
N	46,567	5,113		46,567	5,113		46,567	5,113	

Pupil-level Occupied-S schools[2]

9.56 lost days (approximately 2 calendar weeks)

	Language test			Math test		
	control and occupied schools			control and occupied schools		
	CG	Occupied-S	Difference Occupied-S/CG	CG	Occupied-S	Difference Occupied-S/CG
SIMCE 4th grade '06,	51.37	46.70	-4.68	51.24	46.74	-4.50
	(0.14)	(0.39)	(0.41)	(0.14)	(0.40)	(0.42)
SIMCE 10th grade '12,	51.90	45.45	-6.45	52.56	44.35	-8.21
	(0.14)	(0.39)	(0.41)	(0.14)	(0.39)	(0.41)
Change in means,	0.52	-1.25	-1.78***	1.32	-2.39	-3.71***
	(0.12)	(0.34)	(0.36)	(0.11)	(0.32)	(0.34)
N	44,113	5,248		44,113	5,248	

Pupil-level Occupied-NS schools[3]

48.08 lost days (over 2 calendar months and 1 week)

	Language test			Math test		
	control and occupied schools			control and occupied schools		
	CG	Occupied-NS	Difference Occupied-NS/CG	CG	Occupied-NS	Difference Occupied-NS/CG
SIMCE 4th grade '06,	51.37	47.91	-3.46	51.24	48.60	-2.64
	(0.14)	(0.34)	(0.36)	(0.14)	(0.34)	(0.37)
SIMCE 10th grade '12,	51.90	45.95	-5.94	52.56	42.95	-9.61
	(0.14)	(0.34)	(0.37)	(0.14)	(0.33)	(0.35)
Change in means,	0.52	-1.96	-2.48***	1.32	-5.65	-6.97***
	(0.12)	(0.27)	(0.29)	(0.11)	(0.26)	(0.28)
N	44,113	7,758		44,113	7,758	

[1] The table shows the Difference-in-Difference (DiD) estimates of average test results before and after the school occupations and protests of 2011 which amount to at least 11.58 (over 2 calendar weeks) lost school days from normal activities since the onset of the pupil protests in the so-called *Chilean Winter* in the early days of June of 2011. The results are shown by schools and are calculated at a pupil level. The first two rows show all pupil observations and the third the balanced sample of pupils who sat for both the 2007 and 2011 SIMCEs. The table shows the average test result difference between the control group and the occupied schools that sat for the 8th grade 2011 SIMCE on October 19th of that year (108 schools of the 205 police report list). The other 97 schools did not sit for the test, so they are not considered. The test results are shown disaggregated by subject (language, math and science).

[2] The table shows the Difference-in-Difference (DiD) estimates of average test results before and after the school occupations and protests of 2011/12, which amount to at least 9.56 (approximately two calendar weeks) lost school days from normal activities since the onset of the pupil protests. The table shows the average test result difference between the control group and the occupied schools that sat for the 8th grade 2011 SIMCE on October 19th of that year and for the current November 6th 2012 SIMCE test (108 Occupied-S schools of the 205 police report list). The other 97 schools did sit for the current test and are considered in the next table. The test results are shown disaggregated by subject (language and math).

[3] The table shows the Difference-in-Difference (DiD) estimates of average test results before and after the school occupations and protests of 2011/12, which amount to at least 48.08 (over two whole calendar months and one week) lost school days from normal activities since the onset of the pupil protests. The table shows the average test result difference between the control group and the occupied schools who sat only for the 10th grade 2012 SIMCE on November 6th of 2012, but not for the 2011 SIMCE (97 schools of the 205 police report list). The test results are shown disaggregated by subject (language and math).

[4] Author's calculation from research data provided by the Chilean Ministry of Education's Agency for Quality in Education. The data is available only to researchers after submitting a written proposal.

Table 5: School-level DiD estimates

School-level Occupied-S schools[1]

11.58 lost days (over 2 calendar weeks)

	Language test			Math test			Science test		
	control and occupied schools			control and occupied schools			control and occupied schools		
	CG	Occupied-S	Difference Occupied-S/CG	CG	Occupied-S	Difference Occupied-S/CG	CG	Occupied-S	Difference Occupied-S/CG
SIMCE 8^{th} grade '09,	50.31	46.02	-4.29	50.59	45.37	-5.22	50.33	46.86	-3.48
	(0.74)	(2.62)	(2.73)	(0.74)	(2.64)	(2.74)	(0.74)	(2.68)	(2.78)
SIMCE 8^{th} grade '11,	50.37	44.77	-5.60	50.30	45.75	-4.55	50.23	44.97	-5.25
	(0.74)	(2.58)	(2.68)	(0.74)	(2.60)	(2.71)	(0.74)	(2.62)	(2.72)
Change in mean,	0.07	-1.25	-1.31	-0.28	0.39	0.67	-0.11	-1.89	-1.78
	(0.49)	(1.87)	(1.93)	(0.43)	(1.44)	(1.50)	(0.44)	(1.69)	(1.75)
N	1,539	106		557	88				

School-level Occupied-S schools[2]

9.56 lost days (approximately 2 calendar weeks)

	Language test			Math test		
	control and occupied schools			control and occupied schools		
	CG	Occupied-S	Difference Occupied-S/CG	CG	Occupied-S	Difference Occupied-S/CG
SIMCE 10^{th} grade '10,	53.42	35.84	-17.59	53.23	37.86	-15.38
	(1.02)	(2.49)	(2.69)	(1.03)	(2.54)	(2.74)
SIMCE 10^{th} grade '12,	53.44	37.63	-15.81	53.68	37.15	-16.54
	(1.02)	(2.54)	(2.74)	(1.02)	(2.51)	(2.71)
Change in means,	0.17	1.89	1.72	0.47	-0.54	-1.01
	(0.49)	(1.39)	(1.47)	(0.39)	(1.18)	(1.24)
N	780	98		779	98	

School-level Occupied-NS schools[3]

48.08 lost days (over 2 calendar months and 1 week)

	Language test			Math test		
	control and occupied schools			control and occupied schools		
	CG	Occupied-NS	Difference Occupied-NS/CG	CG	Occupied-NS	Difference Occupied-NS/CG
SIMCE 10^{th} grade '10,	53.42	35.98	-17.44	53.23	36.09	-17.14
	(1.02)	(3.02)	(3.18)	(1.03)	(2.97)	(3.14)
SIMCE 10^{th} grade '12,	53.44	33.56	-19.88	53.68	32.06	-21.63
	(1.02)	(2.97)	(3.14)	(1.02)	(2.72)	(2.90)
Change in means,	0.17	-2.70	-2.87**	0.47	-4.29	-4.76***
	(0.49)	(1.15)	(1.25)	(0.39)	(0.96)	(1.03)
N	780	88		779	88	

[1] The table shows the Difference-in-Difference (DiD) estimates of average test results before and after the school occupations and protests of 2011 which amount to at least 11.58 (over 2 calendar weeks) lost school days from normal activities since the onset of the pupil protests. The table shows the average test result difference between the control group and the occupied schools that sat for the 8^{th} grade '09 and '11 SIMCEs. The other 97 Occupied-NS schools did not sit for the test so they are not considered. The test results are shown disaggregated by subject (language, math and science).

[2] The table shows the Difference-in-Difference (DiD) estimates of average test results before and after the school occupations and protests of 2011/12, which amount to at least 9.56 (approximately 2 calendar weeks) lost school days from normal activities since the onset of the pupil protests. The table shows the average test result difference between the control group and the occupied schools that sat for the 8^{th} grade 2011 SIMCE on October 19th of that year and for the current November 6^{th} 2012 SIMCE test (108 Occupied-S schools of the 205 police report list). The other 97 schools did sit for the current test and are considered in the next table. The test results are shown disaggregated by subject (language and math).

[3] The table shows the Difference-in-Difference (DiD) estimates of average test results before and after the school occupations and protests of 2011/12, which amount to at least 48.08 (over 2 whole calendar months and 1 week) lost school days from normal activities since the onset of the pupil protests. The table shows the average test result difference between the control group and the occupied schools who sat only for the 10^{th} grade 2012 SIMCE on November 6^{th} of 2012, but not for the 2011 SIMCE (97 schools of the 205 police report list). The test results are shown disaggregated by subject (language and math).

Table 6: The two cohorts Diff-in-diff-in-diff

	Occupied-S		
	Language test	Math test	Science test
8^{th}_{2011}-4^{th}_{2007} grades	-0.24	-1.71***	-1.57***
8^{th}_{2009}-8^{th}_{2005} grades	1.89***	4.64***	1.64***
$DiDiD_1$	-2.13***	-6.35***	-3.21***
	Occupied-S		
	Language test	Math test	
10^{th}_{2012}-4^{th}_{2006} grades	-1.78***	-3.71***	
10^{th}_{2008}-4^{th}_{2002} grades	-1.15***	-1.56***	
$DiDiD_{2S}$	-0.63*	-2.15***	
	Occupied-NS		
	Language test	Math test	
10^{th}_{2012}-4^{th}_{2006} grades	-2.48***	-6.97***	
10^{th}_{2008}-4^{th}_{2002} grades	0.18	-1.25***	
$DiDiD_{2NS}$	-2.66***	-5.72***	

[1] The table shows the DiDiD for value-added results for the difference in two cohorts. This gives me the opportunity to control for unobserved divergent or convergent trends in a single cohort or three wave series of data.

Table 7: TD in the three wave cohort

	Occupied-S	
	Language test	Math test
8^{th}-4^{th} grades	-0.24	-1.71***
10^{th}-8^{th} grades	-0.35	-0.08
$DiDiD_3$	0.11	-1.63***

[1] The table shows the TD (Triple Difference) for value-added results for the only three wave cohort 4^{th} grade in 2007, 8^{th} grade in 2011, and 10^{th} grade in 2013. This gives me the opportunity to control for unobserved divergent or convergent trends in a single cohort or three wave series of data. This series is also important because it pertains to the exact moment of high protests. Data for Occupied-S protester is only available because Occupied-NS did not sit for the SIMCE 8^{th} grade test. Test subjects are language and math because science is not available for upper grades(10).

Table 8: Compositional difference: Occupied group before and after treatment

Variable	CG	Before, 4th grade O-S	O-NS	CG	After 10th grade O-S	O-NS
		t_{O-S} [1]	t_{O-NS} [2]		t_{O-S} [1]	t_{O-NS} [2]
		diff CG/O-S	diff CG/O-NS		diff O-S/O-NS	$t_{diff\ O-S/O-NS}$ [3]
mother indigenous	0.04	0.05	0.06	0.07	0.06	0.07
		-1.71	**-3.20**		**0.65**	**0.06**
		-0.01	-0.01		0.00	**0.22**
mother education	13.43	12.73	12.64	12.24	12.00	12.35
		9.06	**11.55**		**3.41**	**-1.69**
		0.46	0.89		0.44	**-3.42**
father education	13.58	12.85	12.71	12.46	12.24	12.53
		8.93	**12.02**		**2.67**	**-1.03**
		0.51	0.94		0.43	**-3.06**
pc	0.60	0.52	0.49	0.78	0.77	0.78
		6.52	**10.25**		**1.07**	**0.56**
		0.07	0.10		0.03	**-1.84**
internet	0.30	0.21	0.21	0.64	0.62	0.64
		8.90	**10.19**		**1.96**	**0.06**
		0.07	0.09		0.02	**-1.20**
books	43.34	36.14	39.48	49.12	47.91	53.58
		4.64	**2.82**		**0.76**	**-3.15**
		6.00	8.33		2.33	**-0.85**
income	466.24	313.13	302.82	555.83	518.48	623.30
		13.06	**16.05**		**2.53**	**-4.99**
		115.77	230.89		115.12	**-5.41**
N	13,586	2,072	2,815	13,586	2,072	2,815

[1] Test of equality of means between control group and moderates: 2006 (columns 1 & 2) and 2012 (columns 4 & 5), in bold.

[2] Test of equality of means between control group and hard-liners: 2006 (columns 1 & 3) and 2012 (columns 4 & 6), in bold.

[3] Test of equality of means for the difference-in-differences estimator between pre- and post-treatment values of the variables between the moderates and hard-liners, in bold.

[4] Author's calculation from research data provided by the Chilean Ministry of Education's Agency for Quality in Education. The data is available only to researchers after submitting a written proposal. The table shows the compositional difference in the control group and the occupied group. It shows the summary statistics of the control group, occupied-S and occupied-NS before and after the treatment in 2006 and 2012. It is based on 18,473 (13,586 CG + 2,072 O-S + 2,815 O-NS) observations, i.e. all the students for whom there is parental survey information for those years.

Table 9: Average attended for control group (CG) and lost school days for treated group (Occupied, Occupied-S and Occupied-NS for the relevant periods)

	June-until '11 SIMCE				
	obs	level	s.e	t-test	p-value
CG	2,589	80.83***	0.2268	353.33	0.000
Occupied	205	-26.09***	0.837	-31.16	0.000
Occupied-S	108	-11.58***	1.290	-8.97	0.000
Occupied-NS	97	-40.58***	1.161	-34.83	0.000
	June-until '12 SIMCE				
	obs	level	s.e	t-test	p-value
CG	2,589	263.64***	0.648	406.64	0.000
Occupied	205	-28.80***	2.410	-11.95	0.000
Occupied-S	108	-9.56***	3.330	-2.87	0.004
Occupied-NS	97	-48.08***	3.411	-14.09	0.000

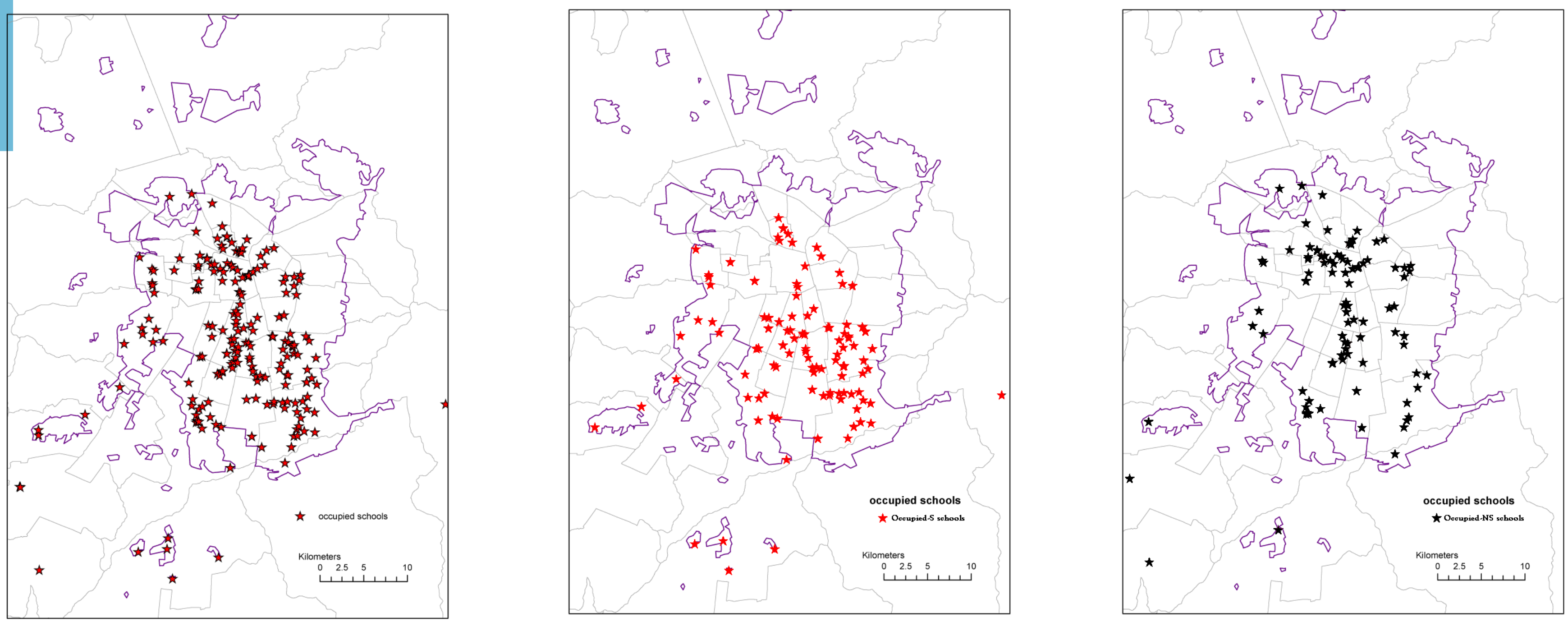
[1] CG=Control Group. O=Occupation (police report).

[2] Occupied-S=Occ (p.r.) + SIMCE. Occupied-NS=Occ (p.r.) + No SIMCE.

[3] *** p<0.1, ** p<0.05, *** p<0.01**

FIGURES

Figure 1: Occupied schools.



(a) Occupied schools.   (b) Occupied-S schools.   (c) Occupied-NS schools.

Figure 2: Outcome: The SIMCE (The Chilean standardised test).

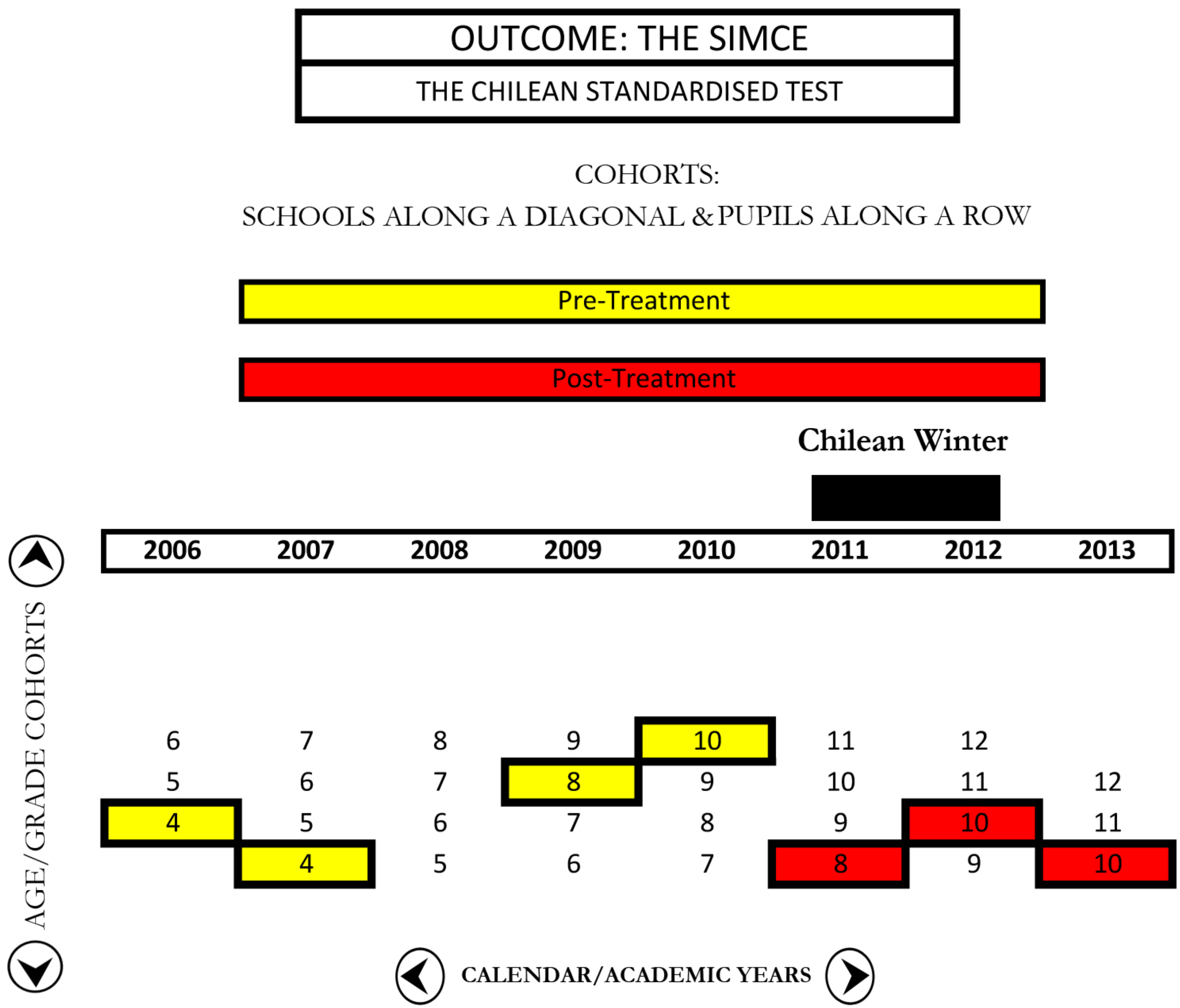


Figure 3: Pre-treatment parallel trends in 10th grade Math SIMCE average, 1998-2013

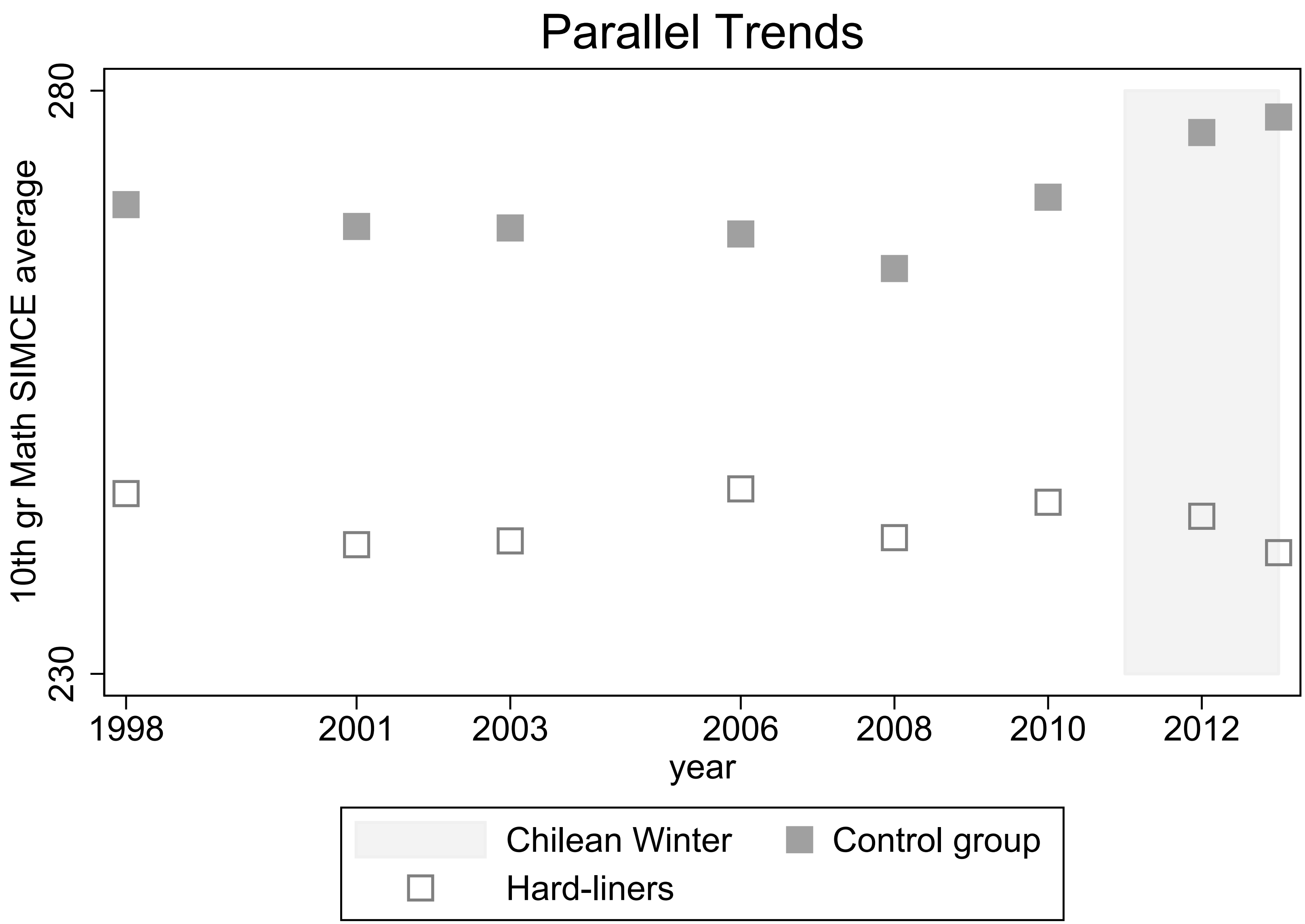


Figure 4: Outcome: The extended SIMCE schedule and DiDiD.

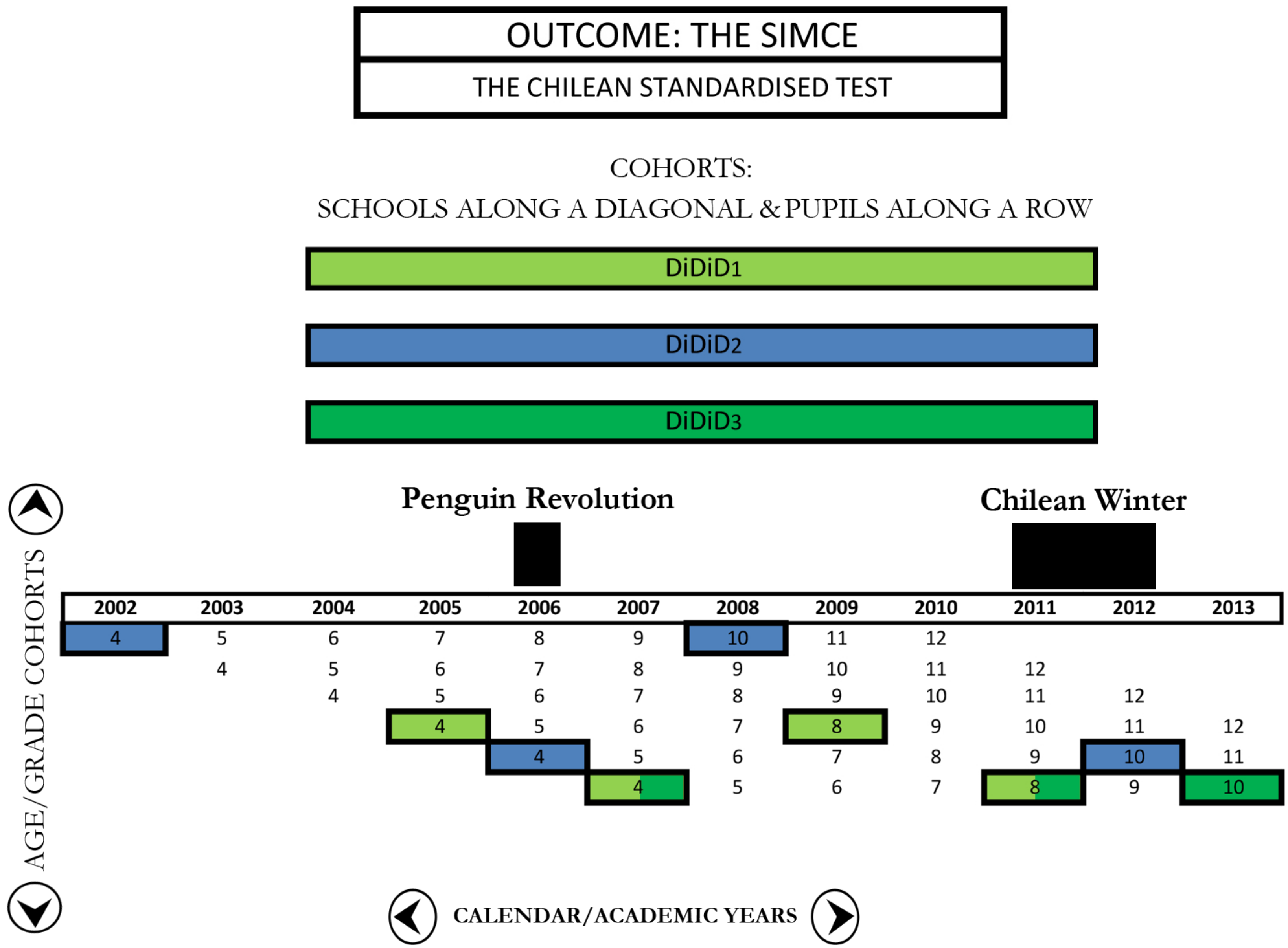
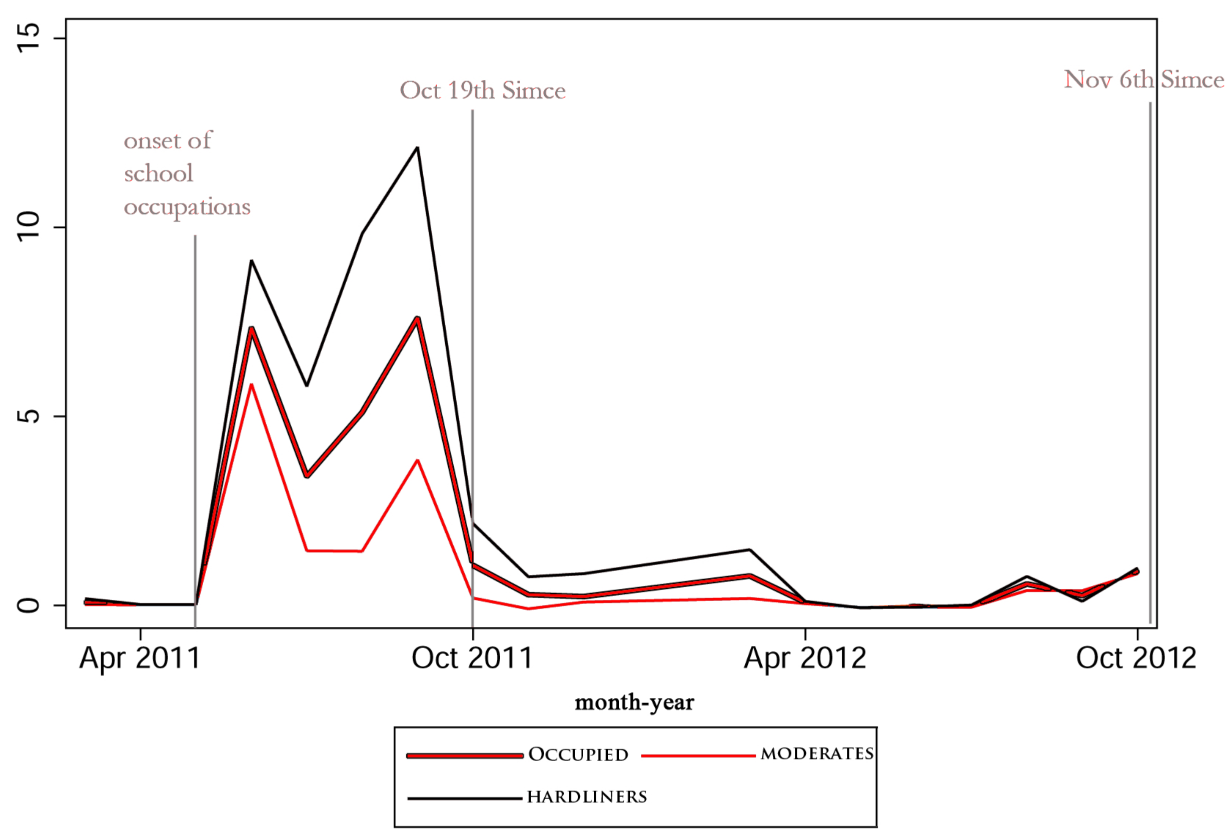


Figure 5: Monthly lost school days, (Mar 2011/Nov 2012).



APPENDIX

Appendix I

Parallel trends: Falsification exercise

Table A1: Falsification exercise. Previous treatment cohort. Occupied-S and Occupied-NS pupil-level

	NO missed days					
	Language test			Math test		
	CG	Occupied-S	Difference Occupied-S/CG	CG	Occupied-S	Difference Occupied-S/CG
Occupied-S. Change in mean,	-0.45	-0.50	-0.05	-0.51	-0.51	-0.00
	(0.30)	(0.21)	(0.37)	(0.21)	(0.30)	(0.37)
	CG	Occupied-NS	Occupied-NS/CG	CG	Occupied-NS	Occupied-NS/CG
Occupied-NS. Change in mean,	-0.43	-0.41	-0.02	-0.51	-0.51	-0.00
	(0.30)	(0.25)	(0.38)	(0.30)	(0.21)	(0.37)

[1] The table shows the Difference-in-Difference (DiD) estimates as a falsification exercise calculating average test results before and after NO treatment (on average the control group and each subdivisions of the *treated group* had the same number of lost school days). These estimates were calculated for the SIMCE 2002 and 2008 at least three years before the onsetf of the protests.

Appendix II

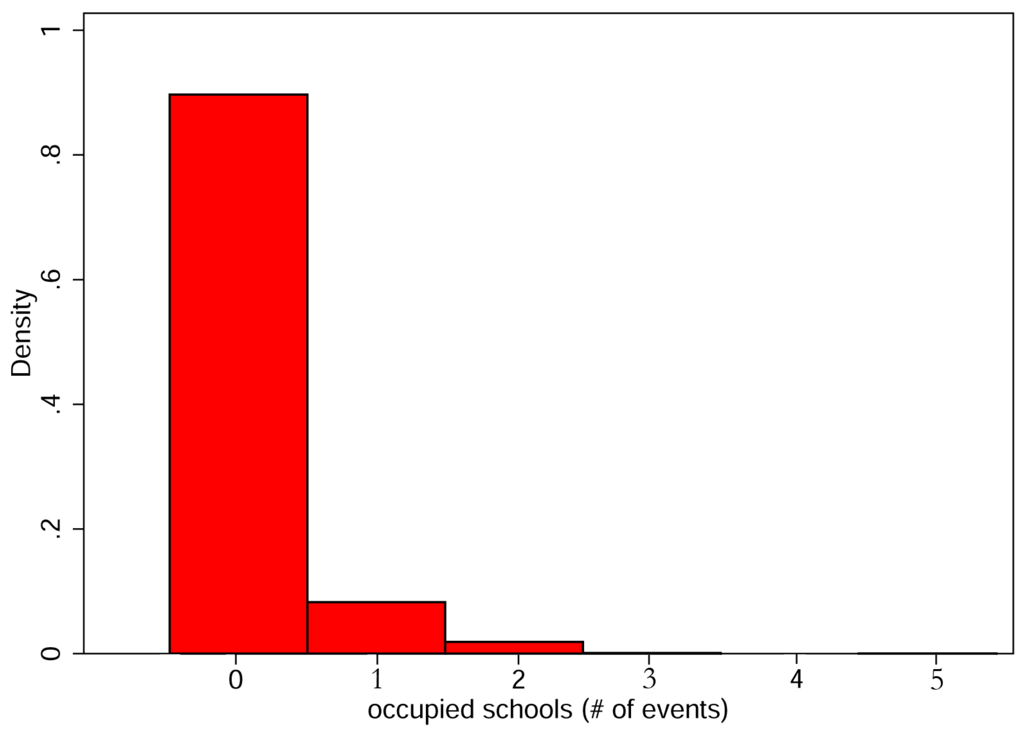
Survival Analysis of the occupied dataset

First, Figure A1 shows the number of times a school has been occupied during the 20 month period in the school calendar (March 2011 to December 2011 and March 2012 to December 2012) between 0 (approximate 90%) and 1 (approximate 10%) and 5 (less than 1%) times. While Figure A2 shows the length of the occupation (the spell of the event) from 1 month (approximate 80% of the occupied schools) to 8 months (less than 1% of the occupied schools).

At the same time Figure A3 shows the number of schools with different working days during the school calendar. April 2011 is an epitome of a normal month, with a mode of 23 and almost not dispersion apart from some little variation around this mode. Other normal patterns are March 2011 which is disperse because school terms start at different days (vacation does not end on the same day for each school). Something similar occurs in March 2012—at the beginning of the calendar—and in December 2011 and 2012—at the end of the calendar. Moreover, to some extent, in July 2011 and 2012 where the mode of working days drops dramatically to 15 because there are two weeks of Winter holidays. Having said this, what happened in June 2011 is completely abnormal, that dispersion during the regular school calendar puts in evidence that something underneath was going on. In other words, schools closed because of school occupations rightly explain this pattern. Similar high variation months from August 2011, September 2011, October 2011 and November 2011 reflect on-going very active riot periods. Even more during these months, there is a neat density at zero working days for 91 schools in June 2011 until 32 schools in November 2011; these correspond to hard-liners while schools with small reductions are moderates. The 2012 school calendar year shows less variation, but there is still an important activity for some schools: riots where more prominent in 2011 than later on but continued intermittently long after 2011. Also, it can be said that some school owners started not to report school occupations as missing working days because doing so imply they do not get the school vouchers. So in 2012, there is also some under-reporting of school occupation at least in the school register.

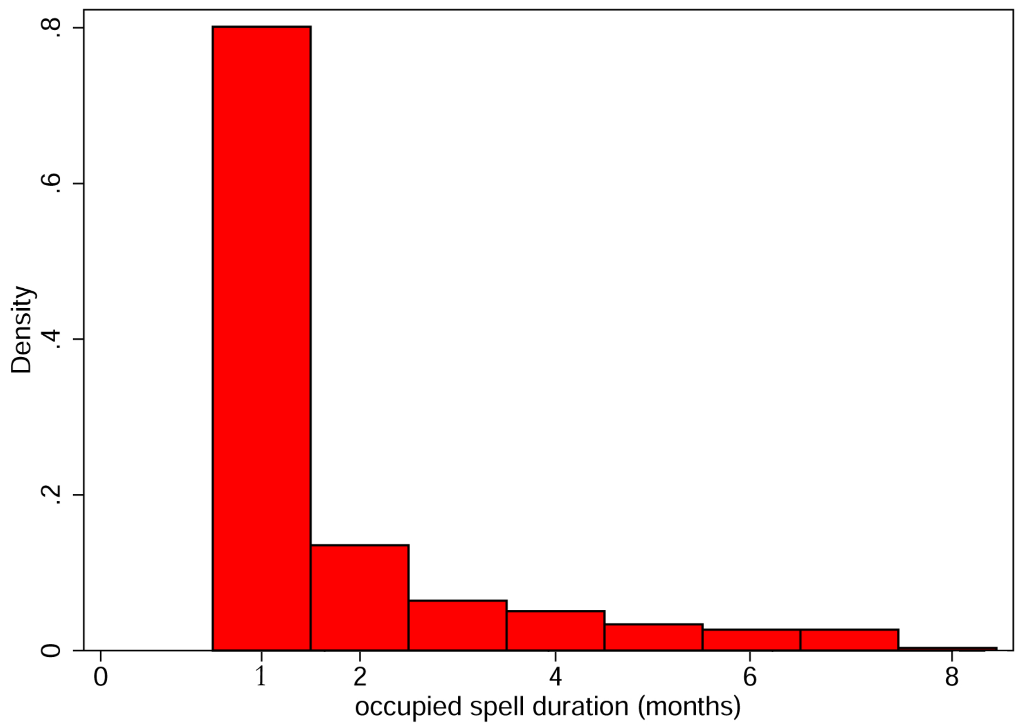
Suppose T is a non-negative random variable representing the time until some event of interest. In my case, T is the time until a school is occupied. The survival function, S(t), is the probability of the event has not occurred by time t, P(T>t). If T denotes time until the school is occupied, S(t) denotes the probability of not being occupied beyond time t. The following three figures are non-parametric estimations of the survival function. The failure event is the school being occupied and the time to event is the number of months passed since this happens. In Figure A4 the school occupation has been randomized so that the non-occupied, moderates and hard-liners have the same probability (I have used the same probability of being occupied than in the real sample, $\approx$8.5%) so the estimated survival function overlaps at a value around 1-0.085. The three of them are identical and represent an equal probability of being occupied by the non-occupied, moderates and hard-liners. Then in Figure A5, all non-occupied schools never suffer the event, and all moderates and hard-liners always are occupied by the first month. Thus, there is perfect selection. Finally, Figure A6, shows the real data (i.e. the real dates for school occupation in the three real groups as defined by the Carabineros/LA TERCERA police report), somehow in the middle of the previous random and perfect selection models. Now non-occupied schools are occupied only very little, moderates are occupied fairly often, and hard-liners almost always become occupied. The variation in the actual failure events, the school occupation, in the real data implies that the data are not as the perfect selection case nor they are completely random. So the Kaplan-Meier estimation of the survival functions is very meaningful showing patterns typical of the three groups, and it is not selected perfectly because some—a few—of the schools in the police report do not show a reduction in working days, so both sources of school occupation reporting do not agree for those particular cases.

Figure A1: Occupied schools by some events.



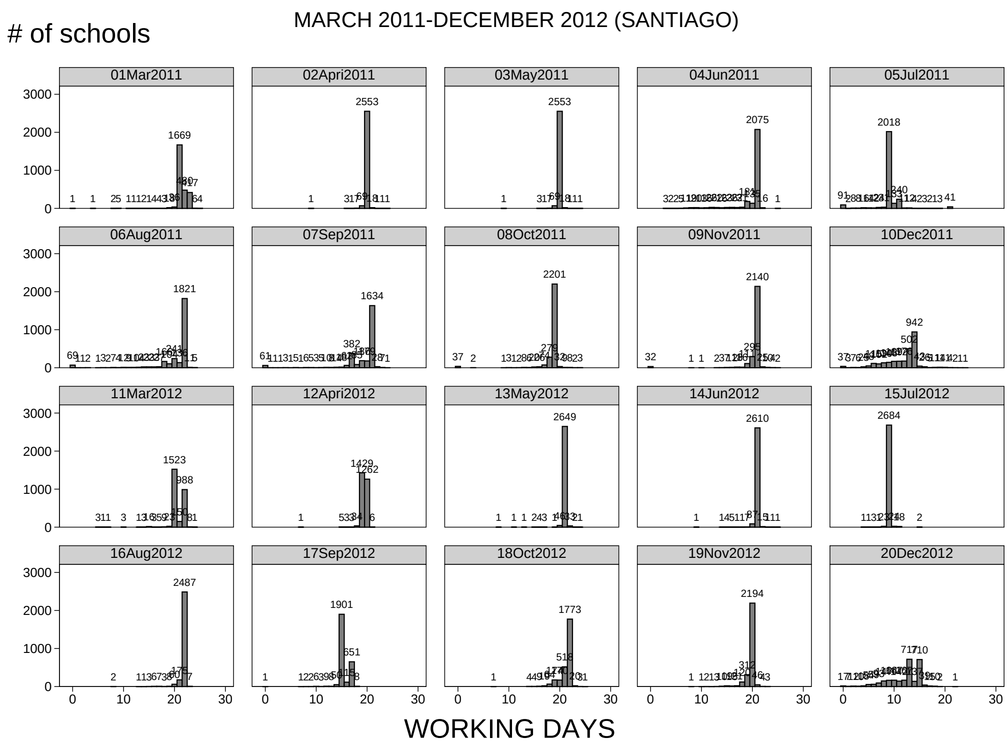
This figure shows the number of times a school has been occupied during the 20 month period from March to December which is the school calendar in 2011 and 2012. 90% of the schools were not occupied while approximately 10% were once. A minor percentage was occupied between 2 to 5 times.

Figure A2: Occupied schools by spell duration.



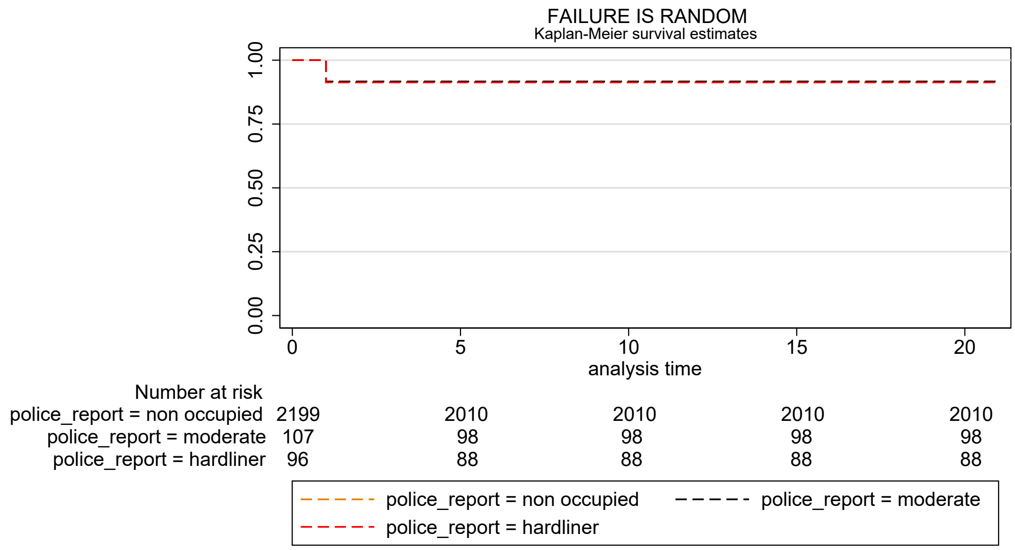
This figure shows how long the schools were occupied. 80% of the occupied schools were occupied for one month, 10% of the occupied schools were occupied for two months, and in less than 1% the occupation lasted for eight months

Figure A3: Number of schools by working days.



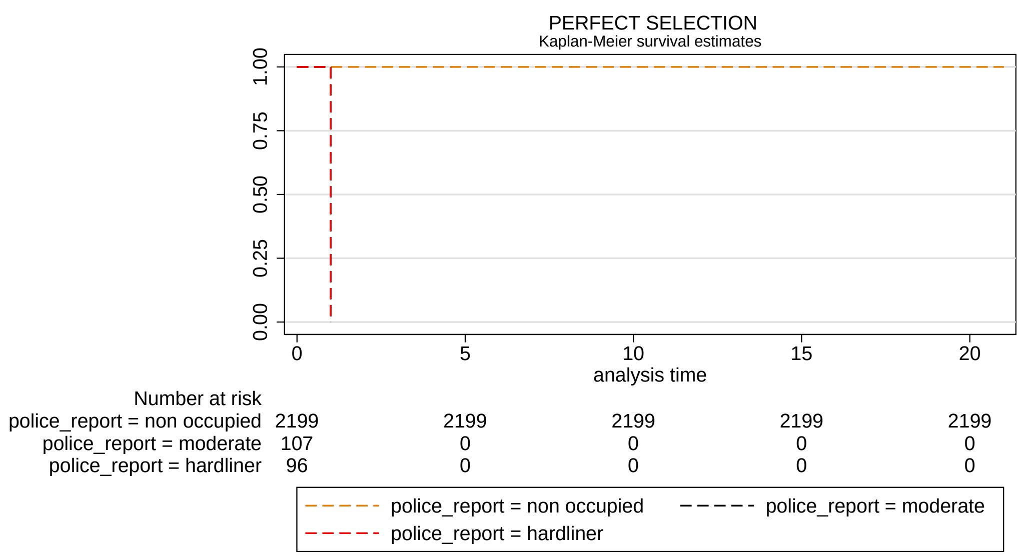
This figure shows the number of schools with different working days during the school calendars of 2011 and 2012. Some months have a recognisable variation due to holidays, but some others present a complete anomalous pattern due to school occupations. See text for a full explanation.

Figure A4: Kaplan-Meier survival estimates when failure is random.



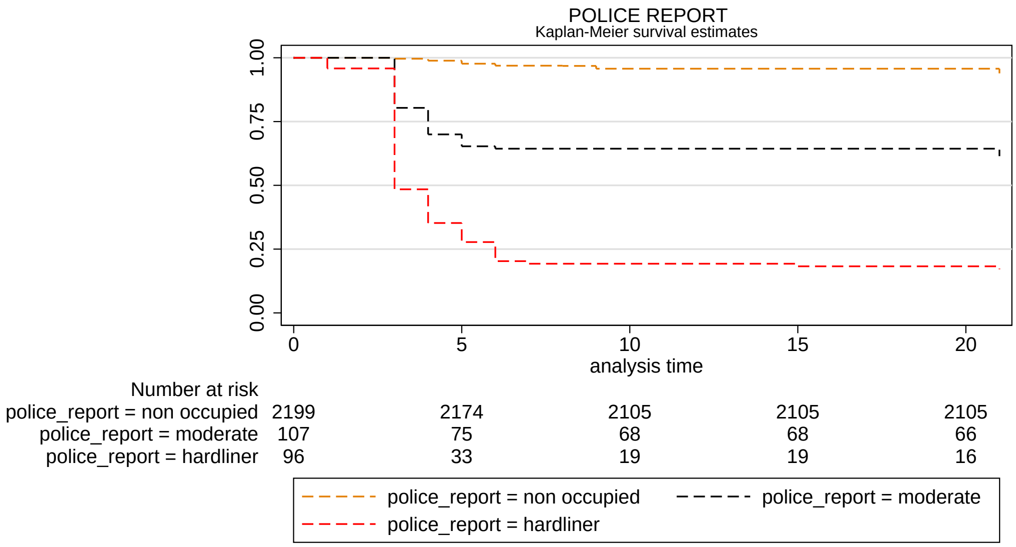
This figure shows three equal estimated survival functions because real data have been replaced by randomly assigned school occupation. Thus the three groups: non-occupied, moderates and hard-liners are indistinguishable between them.

Figure A5: Kaplan-Meier survival estimates when there is perfect selection.



This figure shows a fake data sample where all the moderates and hard-liners have occupied their schools while none of the non-occupied schools has been occupied. Thus, there is perfect selection, and the survival function estimates distinguish perfectly the three groups.

Figure A6: Kaplan-Meier survival estimates according to the police report.



This figure shows the real data. Each group defined by the Carabineros/LA TERCERA police report includes its real times to school occupation. The case is close to perfect selection but also has some variation or noise as the random case.

Appendix III

Estimation of causal effect of school occupation with panel regression

Another way to measure the causal effect of school occupation on test scores is to use a panel regression. There are various possible panels 2006-2012 or 2007-2011. I will use the first for simplicity and because it captures a more lengthy effect. The method is simple, for each student who sat for the SIMCE in 4th grade in 2006 I record the SIMCE outcomes (language and maths) then I record also the SIMCE outcomes in 10th grade. I then run a panel regression using a student fixed effect which permits to control for unobserved heterogeneity. The peculiar characteristic of each student is constant, so they become swiped out by the estimation. Thus, the estimates are causal and can be used to check for robustness of our previous estimations: a decrease in -5.78 percentage points for language and -7.23 percentage points for maths are very aligned with our previous results. Negative sings and stronger effect on maths. Also, hard-liners see they tests further reduced than moderates. See Table A2.

Table A2: Effect of school occupation on educational outcome
(Panel regression)

VARIABLES	(1) Language SIMCE	(2) Language SIMCE	(3) Language SIMCE	(4) Maths SIMCE	(5) Maths SIMCE	(6) Maths SIMCE
Overall occupied	-5.788***			-7.234***		
	(0.218)			(0.199)		
hard-liners		-6.073***			-8.575***	
		(0.283)			(0.258)	
Moderates			-5.366***			-5.249***
			(0.345)			(0.316)
Constant	57.67***	57.42***	57.26***	60.11***	59.87***	59.54***
	(0.0569)	(0.0549)	(0.0539)	(0.0518)	(0.0499)	(0.0493)
Observations	112,367	112,367	112,367	112,360	112,360	112,360
Number of students	59,136	59,136	59,136	59,126	59,126	59,126
Student FE	YES	YES	YES	YES	YES	YES
R-squared	0.013	0.009	0.005	0.024	0.020	0.005

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix IV

The outburst of the Chilean Winter in the media

Table A3: The onset and spread of school occupations in June 2011 at a national level in Chile (media reports)

Date				# of occupied schools
June	6th	2011	(1),(2)	3
-”-	7th	-”-	(3)	5
-”-	9th	-”-	(4)	26
-”-	10th	-”-	(5)	40
-”-	13th	-”-	(6)	$\approx$100
-”-	25th	-”-	(7)	$\approx$600

[a] **Source:** Wikipedia from the following media reports:

[1] *75 pupils arrested, 2 injured and millions in losses in protesters eviction from Barros Borgoño Lycée*. BíoBío Radio. June 6th 2011. Retrieved September 3, 2014.

[2] *Eviction is requested for the Lycée Enrique Molina of Concepción*. BíoBío Radio. June 6th 2011. Retrieved September 3, 2014.

[3] *pupils occupy the Amunategui and Aplicación Lycées*. ADN Radio. June 7th 2011. Retrieved September 3, 2014.

[4] *Occupations spread: there are already 26 occupied schools at a national level*. BíoBío Radio. June 9th 2011. Retrieved September 3, 2014.

[5] *Minister Lavín confirms that there are 40 occupied schools at a national level*. La Tercera Newspaper. June 10th 2011. Retrieved September 3, 2014.

[6] *Secondary pupils have occupied approximately a hundred schools across the country*. El Mercurio Newspaper. June 13th 2011. Retrieved September 3, 2014.

[7] *600 occupied schools in Chile*. Argentinian Public TV. June 25th 2011. Retrieved September 3, 2014.

[b] The table shows the exponential growth and spread of school occupations at a national level in Chile for the month of June of 2011 when protests started. The first schools were occupied at the beginning of June. Each new day dozens of new schools were occupied in an explosive pattern. By the end of the month approximately 600 schools were already occupied at a national level.

APPENDIX V
THE JUNE 28TH 2011 POLICE REPORT LISTS 205 OCCUPIED SCHOOLS IN SANTIAGO

The original list released in LA TERCERA newspaper on June 28th 2011* included 231 occupied schools that the Chilean police declared were *under control by students* in the Metropolitan Region of Santiago. Small inconsistencies and inaccuracies in the list reduced the number of occupied schools to 205. It was the only "official" list released throughout the protests.

* (http://www.latercera.com/iphone/noticia/educacion/2011/06/657-376037-9-conoce-la-lista-de-los-231-colegios-metropolitanos-que-se-mantienen-en-toma.shtml)

(List by municipalities)

BUIN

COLEGIO DE MAIPO
LICEO 131
LICEO ALTO JAHUEL
LICEO FRANCISCO JAVIER KRÜGGER ALVARADO
LICEO POLIVALENTE LOS GUINDOS
LICEO TECNICO PROFESIONAL DE BUIN

CERRO NAVIA

LICEO POLITECNICO SAN FRANCISCO SOLANO

CONCHALÍ

COLEGIO CRISTOBAL COLON
LICEO AGUSTIN EDWARDS

EL BOSQUE

CENTRO EDUCACIONAL MATIAS COUSIÑO
COLEGIO VILLA SANTA MARIA
LICEO CHRISTA MC AULIFFE
LICEO JUAN GOMEZ MILLAS

EL MONTE

LICEO POLIVALENTE LUIS HUMBERTO ACOSTA GAY

ESTACIÓN CENTRAL

ESCUELA PARTICULAR JOSE ANTONIO LECAROS
LICEO COMERCIAL B-72
LICEO DE ADULTOS ESTACION CENTRAL
LICEO POLIVALENTE A N°71 GUILLERMO FELIU CRUZ

INDEPENDENCIA

LICEO GABRIELA MISTRAL
LICEO IGNACIO CARRERA PINTO
LICEO MIGUEL RAFAEL PRADO
LICEO ROSA ESTER ALESANDRI RODRIGUEZ
LICEO SAN FRANCISCO DE QUITO
LICEO SANTA TERESITA
LICEO POLIVALENTE A80 PRESIDENTE JOSE MANUEL BALMACEDA

ISLA DE MAIPO

CENTRO DE EDUCACION GENERAL BASICA
CENTRO EDUCACIONAL ISLA DE MAIPO

LA CISTERNA

CENTRO EDUCACIONAL LINCOLN COLLEGE
CENTRO POLITECNICO PARTICULAR SAN RAMON
CHILEAN EAGLES COLLEGE N.3
COLEGIO JOSE LUIS LEGRANGE DE LA CISTERNA
COLEGIO SANTA ISABEL DE HUNGRIA
ESCUELA TECNICA SANTA ROSA
LICEO IND DE ELECTROTECNIA RAMON B
LICEO POLITECNICO ABDON CIFUENTES
LICEO POLITEC CIENCIA Y TECNOLOGIA
LICEO POLITECNICO GALVARINO N.2
LICEO POLIVALENTE LA CISTERNA N°1
LICEO POLIVALENTE OLOF PALME
LICEO PORTAL DE LA CISTERNA

LA FLORIDA

CHILEAN EAGLES COLLEGE
COLEGIO PART. ANDARES DE LA FLORIDA
COLEGIO PART. FAMILIA DE NAZARETH
COLEGIO PART. NEW LITTLE COLLEGE
COLEGIO PART. SANTA LUCIA DE LO CAÑAS
COLEGIO PARTICULAR ANTILHUE
COLEGIO PARTICULAR NUEVA ERA SIGLO XXI
COLEGIO POLIVALENTE EDUCADORA ELENA ROJAS
COLEGIO QUINTO CENTENARIO CORDILLERA
COLEGIO SAN CRISTOBAL DE LAS CASAS
COLEGIO SANTA CECILIA DE LA FLORIDA
COLEGIO SANTA MARIA
COLEGIO SHIRAYURI
COMPLEJO EDUC. MUN CARD.A.SAMORE
ESCUELA LAS ARAUCARIAS
ESCUELA MARCELA PAZ
ESCUELA PARTIC PHILIPPE COUSTEAU
ESCUELA RAIMAPU-TIERRA FLORIDA
LICEO ANDRES BELLO
LICEO BENJAMIN VICUNA MACKENNA
LICEO INDIRA GANDHI
LICEO NUEVO AMANECER
LICEO POLIVALENTE LOS ALMENDROS

LA GRANJA

COLEGIO CHRISTIAN GARDEN SCHOOL
COLEGIO NUESTRA SENORA DE GUADALUPE
LICEO LA GRANJA
LICEO POLIVALENTE FRANCISCO FRIAS V.
SAINT CHRISTIAN COLLEGE

LA PINTANA

CENTRO EDUCACIONAL MUN.MARIANO LATORRE
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ESCUELA PARTICULAR PDTE.J. J.PRIETO

LO ESPEJO

COLEGIO PARTICULAR KENNEDY
LICEO POLIVALENTE
LICEO TENIENTE FCO. MERY AGUIRRE

LO PRADO

COMPLEJO EDUCACIONAL PEDRO PRADO

MACUL

COMPLEJO EDUC. JOAQUIN EDWARDS BELLO.
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LICEO POLIVAL MERC. MARIN DEL SOLAR

MAIPÚ

COLEGIO, LICEO COMERCIAL SAN JOSE
ESC. BASICA BOSTON COLLEGE MAIPU
ESCUELA EL LLANO DE MAIPU
LICEO INDUSTRIAL ALBERTO WIDMER
LICEO JOSE IGNACIO ZENTENO
LICEO NACIONAL DE MAIPU
LICEO SANTIAGO BUERAS Y AVARIA

ÑUÑOA

ESCUELA BASICA JOSE TORIBIO MEDINA
ESCUELA JUAN MOYA MORALES
LICEO AUGUSTO D HALMAR
LICEO COMERCIAL GABRIEL GONZALEZ VIDELA
LICEO LENKA FRANULIC
LICEO REPUBLICA DE SIRIA
LICEO TECNICO B N° 58 JOSE MARIA NARBONA

PADRE HURTADO

COLEGIO LOS ROBLES DEL CURATO
LICEO PAUL HARRIS

PEDRO AGUIRRE CERDA

CENTRO EDUC OCHAGAVIA
COLEGIO GRACE SCHOOL
ESCUELA VILLA SUR

PEÑAFLOR

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CENTRO EDUCACIONAL SAN CARLOS DE ARAGON
COLEGIO EL SEMBRADOR
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COLEGIO MAIPO
COLEGIO NUEVA ERA SIGLO XXI SEDE PUENTE ALTO
COLEGIO OBISPO ALVEAR
COLEGIO PART. ACROPOLIS
COLEGIO PARTICULAR MIRADOR
COLEGIO POLIV. EL ALBORADA
COLEG POLIV PROF ILDEFONSO CALDERON
COLEGIO SANTA MARIA DE LA CORDILLERA
COLEGIO SENDA DEL SABER
ESCUELA CONSOLIDADA
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ESCUELA TECNICA LAS NIEVES
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LICEO SAN GERONIMO

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LICEO ALCALDE JORGE INDO

QUINTA NORMAL

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LICEO GUILLERMO LABARCA HUBERTSON
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LICEO INDUSTRIAL VICENTE PEREZ ROSALES
LICEO POLIVALENTE JUAN A.RIOS

RECOLETA

LICEO COMERCIAL LUIS CORREA PRIETO
LICEO COMERCIAL NORA VIVIANS MOLINA
LICEO INDUS Y DE MINAS IGNACIO DOMEYKO
LICEO PAULA JARAQUEMADA
LICEO VALENTIN LETELIER

RENCA

LICEO INDUSTRIAL BENJAMIN DAVILA LARRAIN

SAN BERNARDO

CENTRO EDUC. PADRE ALBERTO HURTADO DE SAN BDO
CENTRO EDUCACIONAL BALDOMERO LILLO
COLEGIO ADULTOS INST. BARROS ARANA
COLEGIO NOBEL GABRIELA MISTRAL
COLEGIO PARTICULAR SANTA LUCIA
COLEGIO POLIV. PDTE. JOSE MANUEL BALMACEDA
COLEGIO SEBASTIAN EL CANO SAN BERNARDO
ESCUELA DE PARV. Y ESP. EDIAL
LICEO CLARA SOLOVERA
LICEO COMERCIAL DE SAN BERNARDO
LICEO COMERCIAL GABRIELA MISTRAL
LICEO ELVIRA BRADY MALDONADO-SN.BDO
LICEO IND. MIGUEL AYLWIN GAJARDO
LICEO INDUSTRIAL HARDWARE
LICEO POLIV. LUCILA GODOY ALCAYAGA
LICEO POLIV A-127 FIDEL PINOCHET LE-BRUN

SAN JOAQUÍN

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LICEO INDUS DE SAN MIGUEL AGUSTIN ED
LICEO MUNICIPAL SAN JOAQUIN

SAN JOSÉ DE MAIPO

COLEGIO PART. ANDINO ANTUQUELEN
LICEO POLIVALENTE SAN JOSE DE MAIPO

SAN MIGUEL

CENTRO EDUC. PARTICULAR SAN LUIS
ESCUELA E INSTITUTO DE MADRID
ESCUELA PARTICULAR Y COLEGIO CHILE
LICEO ANDRES BELLO
LICEO BETSABE HORMAZABAL DE ALARCON
LICEO COMERCIAL INST. SUP. DE COM. DE CHILE (EX A99)
LICEO LUIS GALECIO CORVERA
LICEO TECNICO A-100 DE SAN MIGUEL

SAN RAMÓN

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ESCUELA ESPECIAL DE ADULTOS
LICEO MUNICIPAL PURKUYEN
LICEO MUNICIPALIZADO ARAUCANIA
LICEO SAN FRANCISCO

SANTIAGO

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COLEGIO POLIV. MANUEL BAQUEDANO
COLEGIO SANTA MARIA DE SANTIAGO
ESCUELA BASICA REPUBLICA DE MEXICO
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