Peer effects in the classroom: Evidence from a natural experiment in Chile

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Abstract

The causal effect of classmates on own academic performance is a question still open to debate in the field of economics of education, and for policy makers. This can be seen from the heterogeneity of results in the literature, and on the different policies regarding allocation of students into classes. In the paper I use the 8.8 earthquake that struck Chile in 2010 as a natural experiment. The earthquake is used as an exogenous variation of peers that year before sitting a national standardised exam approximately 8 months after the natural disaster, using the fact that the earthquake hit a random area of the country and forced some students to move into new schools. I both an OLS and an instrumental variables econometric specification, with data of students observed in 2010 or 2011, in affected or non-affected areas, to answer this question. More than 50% of the students were studying in schools located in the area affected by the earthquake. My results show that the peer effects are positive across all specifications. However, the significance is more robust in the sample in eighth grade compared to students analysed in fourth grade. An increase of one point in the average score of the peers has an effect of approximately a quarter point in the students own score, with some differences depending on grade or subject.

1 Introduction

The influence of classmates on own performance, known as "peer effects", has been studied widely in education, as well as other contexts such as the workplace for example. Intuition may suggest that, everything else being equal, a person surrounded by more able peers should perform better than a similar person interacting with less able ones. In the classroom one of the arguments is that students with higher ability for instance can ask to the teacher questions that are more relevant for the learning experience of the whole group. Or it could be the case that the same student has a higher motivation to study if surrounded by better peers (Epple and Romano, 2011). On the contrary, if the same student is surrounded by peers of low ability, it may be the case that the teacher will spend more time focusing on them, slowing down the whole process. Hence, the research question of this paper is, how does the average academic achievement of peers affect the student's own performance?

The importance of this comes from the fact that if there is a relationship between peer's and own's performance, it may be possible to find an allocation of students which leads to an outcome more desirable than the current one (Epple and Romano, 1998). This could be either improving overall performance and/or reducing the inequality in the results between poor and wealthy students. In the particular context of Chile, recently was approved a new reform in education, which tries to reduce the segregation in the school system. The advocates of this reform use the "peer effect" argument in favour of it, saying that mixing different kind of students would lead to an improvement of those with lower ability, given that they would benefit from being surrounded of students with higher ability. However, the international evidence is rather mixed in the existence, direction and magnitude of peer effects (Sacerdote, 2011). Moreover, there are not too many published articles using data from Chile. One of the published papers is McEwan (2003)

Regarding previous work, Steven Gibbons and his co-authors have a series of papers in which they look for peer effects either in the school or in the neighbourhood, using a similar dataset of students in England who have sat Key Stage 1 (KS1), Key Stage 2 (KS2) and Key Stage 3 (KS3) tests. In Gibbons et al. (2013) they study if the "quality" of the neighbours, measured by their past school performance, has an influence on students who remain in the neighbourhood, finding no effects on test scores but some effects for behavioural outcomes. In a similar line, also focusing in the "stayers", in the study by Gibbons et al. (2017) the research question is if a higher neighbourhood turnover of same-school-grade students, has any causal effect on the students who do not change neighbourhood, finding a small negative effect on the value added gained by the stayers. With a similar dataset but now looking for peer effects at the school level, using variation coming from the transition from primary to secondary school, the study by Gibbons and Telhaj (2016) finds a positive effect of peer quality on student achievement.

From the papers which use a natural experiment as the main source of variation, one that uses an estimation strategy similar to the one followed by this study is Imberman et al. (2012). They look for peer effects arising from evacuees due to hurricanes Katrina and Rita on the students in schools which received these evacuees. In a similar line of the findings in Gibbons et al. (2013), they find little or no effect on average scores, but some effects in behavioural outcomes, in particular in absenteeism and discipline. Also using a similar source of variation, the study by Gould et al. (2009) finds a negative effect of movers on stayers on some high school outcomes such as dropout rates or passing a higher education matriculation exam. However, a big difference that might explain part of that result is the context, because in their paper the movers are migrants from former Soviet Union countries moving into Israel, different from Imberman et al. (2012) where the movers are from the same country.

The paper by Tincani (2017) is related to this because the natural experiment used is the same, the earthquake that happened in Chile in 2010, although both the research question and the identification strategy differs. Tincani studies the effort choices in a classroom and show that at least partly the peer effects seen on scores are due to rank concerns. The variation comes from the assumption that the intensity of the earthquake at a student's home town increases their cost of effort to study. Since in a classroom not all the students live in the same place, in some classroom this dispersion in the cost of effort increases more than in other classrooms.

The methodology that I use follows the one used in Imberman et al. (2012). I use the earthquake that happened in Chile in 2010 as an exogenous source of variation in the composition of peers in the classroom. Because of the earthquake, some students had to move to other schools either because their school was destroyed by it or because their parents had to move. Therefore, some classrooms received a share of displace students for exogenous reasons. Similar to Imberman et al. (2012), I use instrumental variables strategy, having the proportion of displaced students in a classroom as an instrument for the average mean performance of peers (the average score of the students in the classroom discarding the score of the student). The assessment used is a national standardised exam in Mathematics and Spanish, taken every year by those students in fourth grade (mostly aged between nine and ten years old) and every other year by students in eighth grade (thirteen to fourteen years old).

The contribution of this paper is to adapt a methodology already in the literature of peer effects to a context in which has not been used, in this case Chile. The mixed evidence in peer effects may show that the context is important when studying these effects, hence this can help to understand more the Chilean case. This is especially relevant now that new policies are being implemented under the assumption of the existence and certain structure of peer effects, without much evidence to support it.

My results show that the peer effects are positive across all specifications. However, the significance is more robust in the sample in eighth grade compared to students analysed in fourth grade. An increase of one point in the average score of the peers has an effect of approximately a quarter point in the students own score, with some differences depending on grade or subject. This may not seem as a big effect, especially when taking into account that my sample is of students with at least 9 peers. The rest of the study is organised as follows: section 2 gives an overview to the Chilean school system and the Earthquake, section 3 covers the data, its sources and some descriptive statistics, section 4 is about the empirical strategy, in section 5 I go through the results while in section 6 I conclude and I present some limitations.

2 The Chilean school system and the Earthquake

2.1 Chilean school system

The Chilean school system is composed of three types of schools: public, private subsidised, and private schools (Valenzuela et al., 2014). The public, or municipal, are run by the municipalities, cannot charge any fees to the students and receive funding from the state. The private subsidised also receive funding from the state but in addition they were allowed to charge some tuition fees to the students at the time of the exams analysed in this study. Finally, private schools do not receive any funding from the state and are allowed to charge tuition fees. Around 90% of the students attend either public or subsidised schools, while less than 10% are enrolled in private schools in fourth grade. Public schools cannot select students before seventh grade. On the other hand, private subsidised and private schools interview parents, hold some playing sessions for the children or do other type of selection processes. The system is organised in three tiers: primary school from first to fourth grade, lower secondary school from fifth to eighth grade, and upper secondary school from ninth to twelfth grade. Children usually start primary school at the age of six-seven years old and leave upper secondary school at the age of seventeen-eighteen years old.

To measure the quality of education, there are exams called "SIMCE", that are sat by students in fourth, eighth and tenth grade. In the case of students in fourth grade, this is every year, and for the other two cases only every other year.

In order for a student to progress to the next academic year, the following rules apply. From first to second grade and from third to fourth grade, every student with an attendance rate of at least 85% will be automatically promoted to the next year. In addition to this, which also applies for other grades, from second to third grade and from fourth to eighth grade, students must either have passed all their subjects (minimum of 4.0 in a scale from 1 to 7), have an average of 4.5 if they have failed one subject, or an average of 5.0 if they have failed 2 subjects.

Within schools, students are assigned to classrooms of up to 45 students. In the case of primary school, the same person will teach most of the subjects. From fifth grade onwards, in most schools students will be taught each subject by a different teacher.

2.2 Earthquake

Chile is a seismic country. According to the information from the National Seismological Centre (*Centro Sismologico Nacional*), before 2010 there were 109 earthquakes of magnitude at least 7.0, from Arica (northernmost part of the country) to Tierra del Fuego (southernmost part of the country). This, considering all the earthquakes from 1570. More accurate measures are from the beginning of the 20th century, and in that case the number of earthquakes before 2010 is 77. This represents on average 0.7 earthquakes per year, compared to 14.6 in the whole world since 1990 (or 0.07 per country per year).[1] Another way to look at this is to say that Chile's surface is 0.56% of the world's, and it's share of earthquakes is 5%. Chile was struck by an earthquake on 27th February 2010, at 3:34 am local time. Its magnitude was 8.8 Richter in the epicentre, approximately 400 km south of Santiago, the capital and it was the fifth-largest ever instrumentally recorded in the world (Astroza et al., 2010). It affected six of the fifteen regions of the country. Approximately 80% of the population lived in that area. The earthquake occurred just 2 days before the official start of the school year, set to be the 1st of March 2010 and to include 40 weeks of teaching. According to the information retrieved from the Chilean Ministry of Education (MINEDUC), more than half of all schools (4635 out of nearly 9000) were damaged. The damage was classified as no damage minor, moderate, severe or school closed. Schools closed either because the damage was too severe or because they did not have enough students, possibly because of migration due to the earthquake.

In figure 1 there is a map of the whole country at the left and a map of the area affected by the earthquake at the right, which covers the three most populous cities in the country: Santiago, Valparaiso and Concepcion. In the area in which the estimated shaking intensity is marked as "Strong", this intensity was approximate 7.0 in the Richter scale or higher. As can be seen in the maps, the epicentre was on the coast, hence after the earthquake there was a tsunami which was responsible of most of the deaths due to the earthquake. The official number of deaths related to the earthquake and the subsequent tsunami was 525, according to the National Office for Emergencies ONEMI (*Oficina Nacional de Emergencias del Ministerio del Interior*).

[1] Statistics from the United States Geological Survey

3 Data

I use two sources of data. One is an administrative data from the Ministry of Education, which includes the following information at the student level: yearly academic performance measured by the teacher, a full record of schools attended every academic year, school location.[2] The second main source comes from the national standardized exam called Sistema de Medicion de la Calidad de la Educacion, SIMCE (System to Measure the Quality of Education), organised by the Agency for the Quality of Education. Its main purpose according to the Agency is to provide information about students' learning in different areas of the national curricula, and to contribute to the improvement of the quality and equity of education. The exam is sat every year by students in fourth grade (nine to ten years old), and every other year by students in eighth grade (thirteen to fourteen years old). In practice, the information collected from the SIMCE is used by the government to allocate resources to schools beyond the base funding, especially the results in fourth grade.

One dataset is about students in eighth grade, year 2011, so one year after the earthquake.[3] Information about the students include the results in both Math and Spanish and their previous performance from fourth grade in 2007. In addition, there is information about gender, parents' education, household income, number of books available at home and also a full record of the schools attended before. Furthermore, I use an equivalent dataset for students in fourth grade in 2010, the year of the earthquake. It includes the same information as the dataset for students in eighth grade with only one difference: students in fourth grade do not have any previous score in the SIMCE exam. However, in the main specifications I use the teacher assessment as measure of ability rather than the previous score. Therefore, both samples are comparable in terms of information available.

From the information that comes from the dataset I created, following Imberman et al. (2012), a variable called *displaced*. In my paper, the definition of *displaced* is such that takes value 1 if the school attended by the student in time t is different to the school attended in 2009, the year before the earthquake and the student was attending a school in the affected area, or value 0 otherwise.[4] Therefore, children who were studying at schools out-

[2]A small proportion of students change school at the end of the academic year

[3]For students in eighth grade there is also information of SIMCE for 2009 but not 2010, the year of the earthquake

[4]The definition of affected area comes from the Chilean Government, which defined regions V-VI-VII-VIII-IX as areas officially affected by the earthquake. Note that for the concept of affected areas I use the regions as were defined in 2010. Part of Region VIII is

side the affected area in 2009 are not considered as displaced even if they did change school afterwards. Summary statistics of the main variables used in the regression are shown in Table **??**, Table 1, Table **??** and Table 2. The first two variables are the score of the students in mathematics and Spanish, then "fracDisplaced" is the fraction of displaced students in a classroom, father_ed and mother_ed indicate how much education did the student's parents received, and Female is a dummy which takes value 1 if the student is female and 0 if the student is male.

3.1 Subsample analysed

From the total of more than 200,000 students observed in each exam, approximately 60% are used in the main analysis. First, in order to include controls as as parents' education, I restricted the sample to those in which the parent's survey was answered, which reduces the sample size in approximately 10%. Also, I only considered students who didn't repeat any grade, reducing my sample by a further 5%. However, in the peer group I do consider all the students who sat the exam. Hence, if there is a classroom with 30 students, including one who repeated some level before and another one for whom I don't have additional information, the final sample will consist in 28 students, but for the peer group I will consider those 2. In addition, there are some students, especially in rural areas, who have less than 10 classmates, so I restricted my sample to students in a class with at least 10 students.[5]. Furthermore, to use school fixed effects I had to restrict the sample to students in schools with at least 2 classrooms per year. Therefore, my final sample is slightly above 100,000 students in fourth grade approximately 90,000 students in eighth grade.

Region XVI since August 2017.

[5] I tried different thresholds, also having a minimum of 15 or 20 students, without any significant variation in the main results

4 Empirical Strategy

The aim of the paper is to identify the causal effect of peers on students' academic achievement, measured with exam scores. One way to claim causality, the main issue when working with peer effects, is to look for an exogenous variation in the composition of the peers. One may think that students are not randomly allocated into schools, it may be more likely that if parents can choose, they will try to put their children in a "good" school instead of a "bad" one.[6] Manski (1993) argues that peers may have similar outcomes because of the following reasons: exogenous effects that come from peers' knowledge acquired in the past, endogenous effects from peers' current outcome and correlated effects from self-selection into peer groups (see also Sacerdote (2014)).

This paper is based in the methodology used by Imberman et al. (2012), hereafter referred as IKS, in their article about peer effects using the Katrina Hurricane as a natural experiment. There are some variations due to the differences in the data available for the case of Chile. The specifications are used for both samples of students in fourth and eighth grade. The only difference between the two samples is in the number of controls available, since for students in eighth grade the previous score in the SIMCE exam is also available.[7]

First, I start comparing the scores between stayers, movers and displaced students. The equation can be written as:

$$Y_{ics} = \beta_0 + \beta_1 M_{ics} + \beta_2 D_{ics} + \beta_2 X_{ics} + k_s + \epsilon_{ics} \tag{1}$$

where Y_{ics} is the Spanish or mathematics score in SIMCE for student i in classroom c, attending school s; M_{cst} is a dummy which takes value 1 if the student i in classroom c, attending school s changed school between 2009 and 2010 (a "mover"); D_{cst} is a dummy which takes value 1 if the student i in classroom c, attending school s is a "displaced" using the definition from the previous section. Therefore, a student is considered "displaced" if he is a mover who was in the affected area in 2010. The "stayers" are the baseline group. X_{ics} are observable characteristics of the student, k_s are school fixed effects and ϵ_{ics} is the error term that captures unobserved factors that determine academic achievement .

[6] What is good or bad will vary from case to case but one possible measure could be the performance of students in that school in a national exam

[7] This is included in one of the robustness checks

The main specification to look for peer effects uses the fraction of displaced students in the classroom as an instrument for average peer performance. Therefore, the first stage regression (results in the appendix) can be written as:

$$\bar{Y}_{-ics} = \alpha_0 + \alpha_1 \frac{D_{cs}}{N_{cs}} + \alpha_2 X_{ics} + k_s + \epsilon_{ics} \tag{2}$$

where $\bar{Y}_{-ics}$ is the average peer performance of all the students excluding student i in classroom c, attending school s; D_{cs} is the number of displaced students and N_{cs} is the number of students in classroom c, attending school s.

The second stage regression then is:

$$Y_{ics} = \beta_0 + \beta_1 \hat{\bar{Y}}_{-ics} + \beta_2 X_{ics} + k_s + \epsilon_{ics} \tag{3}$$

In addition, in the appendix I report the results of a reduced form of the effect of the proportion of displaced students in a classroom, the equation can be written as:

$$Y_{ics} = \beta_0 + \beta_1 \frac{D_{cs}}{N_{cs}} + \beta_2 X_{ics} + k_s + \epsilon_{ics} \tag{4}$$

As a benchmark, I include a linear-in-means OLS regression for peer effects in a classrom:

$$Y_{ics} = \beta_0 + \beta_1 \bar{Y}_{-ics} + \beta_2 X_{ics} + k_s + \epsilon_{ics} \tag{5}$$

5 Results

The results of equation 1, equation 2 and equation 4 are not reported in this draft.

5.1 Main results

The main results of the effect of peers on students' performance are summarised in four tables, one for each combination of cohort-outcome. The combinations are: mathematics in fourth grade (M4), Spanish in fourth grade (S4), mathematics in eighth grade (M8) and Spanish in eighth grade (S8). The sample analysed is composed by students in schools with at least 2 different classes and at least 10 students per classroom.

The tables with the main results for each of the groups analysed contain four columns. The first three columns are regressions estimated using OLS and the fourth column using instrumental variables. The first column includes individual controls: gender and previous performance measured by the teacher. In the second column I add class size, class size squared and school fixed effects. Furthermore, in the third column I add some controls from the family environment, such as parents education, information about books at home and an interaction between parents education and student's gender. The fourth column contains the same variables but is estimated using IV. In the main specification, equation (3), shown in Table 3 together with equation (5), the coefficient of the peer effect remains positive and significant when adding the different controls, with only minor differences between columns (1) and (2) (without any controls) and columns (9) and (10) (with all the controls included). This is true for both the OLS and the IV specifications. The interpretation is that, for every point that peers improve on average in the subject, the student improves roughly half a point according to the OLS and nearly a full point according to the IV.

Looking at Table 3, the coefficient of peer effects is positive and significant when including only the individual controls. The magnitudes are similar in the other 3 tables, between 0.659 and 0.793 and significant at the 1% level. However, once I include information about the school, the same coefficient halves for M4 and decreases even more in the other three groups. Nevertheless, it remains positive and significant. The coefficients for peer effects remain virtually the same after I include the family background in the third column. The main differences between the four groups happen in the last column, when I estimate equation (5), the instrumental variables specification. For M4 in Table 3 it decreases to 0.146 and is not significant even at the 10% level. For S4 in Table 5 the decline is smaller, and it remains significant at the 10% level. This is in line with the findings of Imberman et al. (2012). On the other hand, the coefficients for peer effects in eighth grade are significant at the 1% level for both groups M8 in Table 4 and S8 in Table 6. Moreover, these coefficients are slightly higher than those in column (3). The goodness of fit, reported at the end of each table, does not vary much after including information about schools and class size.

6 Conclusion and limitations

The first conclusion is that apparently the main bias of the peer effects come from the self selection into schools. Across all the four specifications the coefficient decreases by nearly 50% or more once controlling for school fixed effects and class size. Secondly, the main difference between students in fourth grade compared to those in eighth grade is that for the latter, in both mathematics and Spanish the coefficients of peer effects are always positive and significant at the 1% level. A possible interpretation for this is that the importance of the peers is higher when students are older.

Among the limitations of my study, there are two variables which I cannot define precisely with the data that I have. The first one is the dummy for "displaced". This is relevant for the instrument, hence relevant for the instrumental variables specification. The second limitation is related to the assumption that within schools the new students are allocated randomly. If that is not true, then the school fixed effects do not address entirely the endogeneity issues due to self-selection. In **??** there are some tests using data from Chile that suggest that this may not be a severe problem once accounting for observables.[8]

One extension to this study is to go beyond the linear-in-means specification and look for non-linearities in the result. [9] If they exist, then from a social point of view it is relevant the existence and magnitudes of peer effects, and it may be the case that a non-random allocation of students within classrooms is desirable.

[8] I am still working on some robustness checks to see if this is the case or not.

[9] This is the next step in my project.

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A Figures

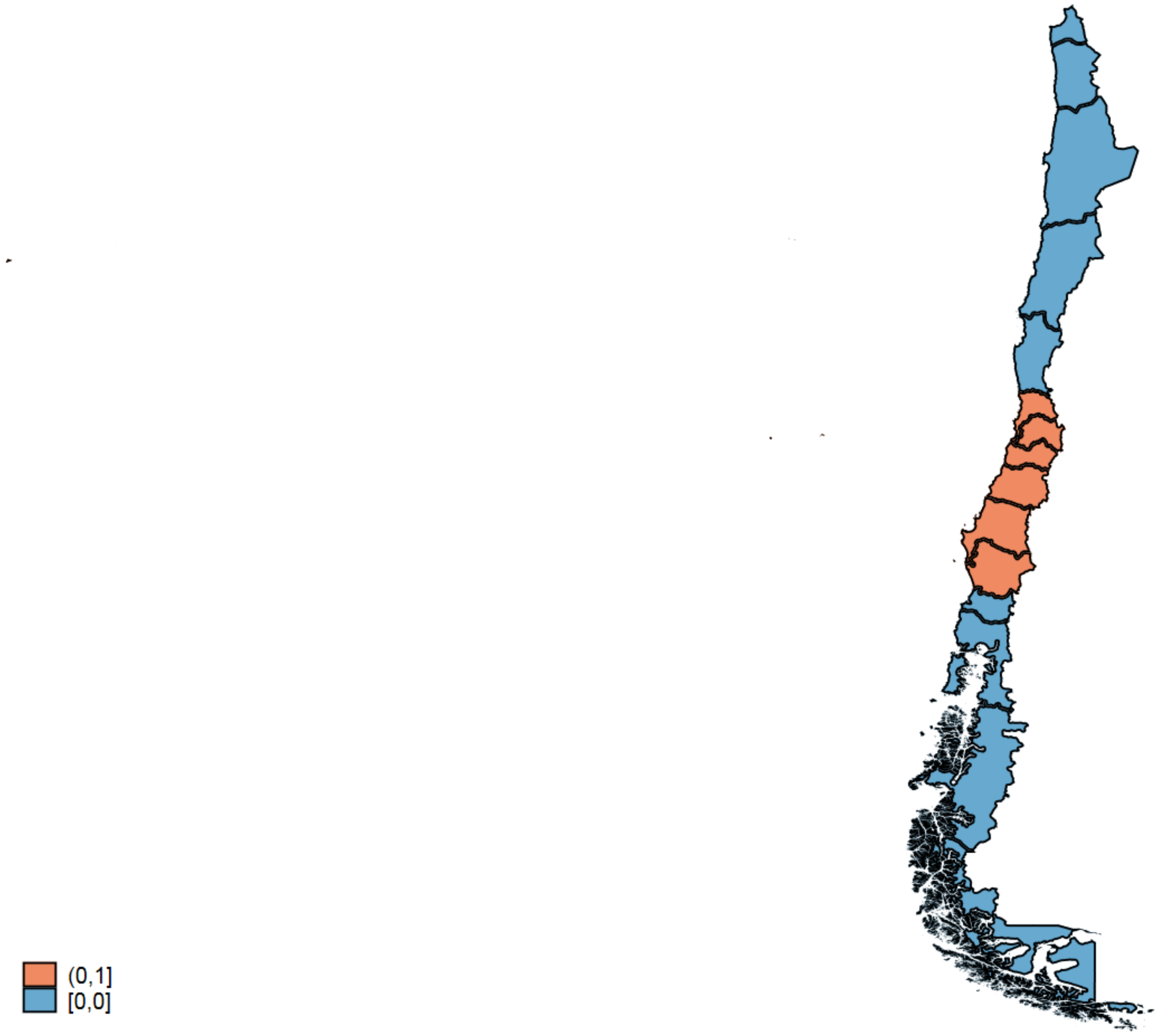

Figure 1: Map of the area affected by the earthquake

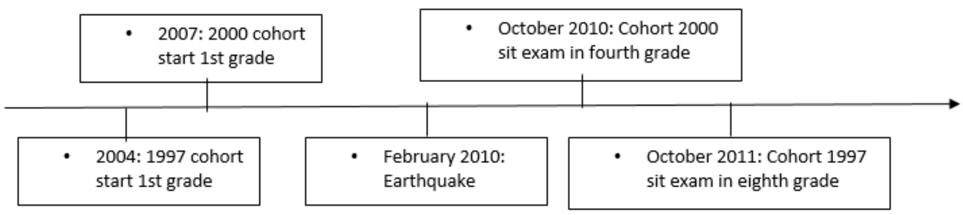

Figure 2: Timeline of events

B Tables

Table 1: Summary statistics for students in fourth grade, 2 or more classrooms, 2010

Variable	Mean	Std. Dev.	N
Math score in 4th grade	259.075	53.081	134017
Spanish score in 4th grade	275.419	49.523	133297
displaced	0.097	0.296	134017
fracDisplaced	0.097	0.117	134017
fathered	11.689	3.204	134017
mothered	11.61	3.038	134017
Female	0.504	0.5	134017
class_size	28.72	7.376	134017
class_size_1_9	0.007	0.084	134017
class_size_10_19	0.102	0.303	134017
class_size_20_29	0.416	0.493	134017
class_size_30_39	0.406	0.491	134017
class_size_40_45	0.068	0.252	134017

Table 2: Summary statistics for students in eighth grade, 2 or more classrooms, 2011

Variable	**Mean**	**Std. Dev.**	**N**
Math score in 8th grade	264.15	49.291	117947
Spanish score in 8th grade	258.882	49.789	117152
displaced	0.162	0.369	117947
fracDisplaced	0.162	0.198	117947
fathered	11.301	3.399	117947
mothered	11.348	3.119	117947
Female	0.512	0.5	117947
class_size	25.337	7.302	117947
class_size_1_9	0.013	0.114	117947
class_size_10_19	0.207	0.405	117947
class_size_20_29	0.488	0.5	117947
class_size_30_39	0.269	0.443	117947
class_size_40_45	0.023	0.15	117947

Table 3: Peer effects on stayers, OLS and IV FE (4th grade, Mathematics)

	(1)	(2)	(3)	(4)
	math4	math4	math4	math4
mean_othersmath4	0.726***	0.376***	0.374***	0.146
	(0.00659)	(0.0146)	(0.0146)	(0.125)
female	-11.64***	-13.86***	-13.04***	-13.00***
	(0.255)	(0.233)	(0.969)	(0.969)
gpa_1	7.732***	8.721***	8.674***	8.867***
	(0.475)	(0.426)	(0.425)	(0.444)
gpa_2	13.22***	13.83***	13.74***	13.65***
	(0.574)	(0.515)	(0.513)	(0.525)
gpa_3	35.42***	43.96***	43.47***	43.47***
	(0.522)	(0.473)	(0.473)	(0.480)
class_size_math		0.238	0.198	0.800*
		(0.298)	(0.298)	(0.471)
class_size_math2		-0.00637	-0.00598	-0.0127*
		(0.00470)	(0.00470)	(0.00657)
books			0.341	0.369
			(0.480)	(0.481)
fathered			0.618***	0.627***
			(0.0689)	(0.0691)
mothered			0.244***	0.259***
			(0.0750)	(0.0750)
f_fathered			-0.0730	-0.0732
			(0.0865)	(0.0864)
f_mothered			0.0146	0.0145
			(0.0936)	(0.0933)
_cons	-264.0***			
	(2.301)			
N	111344	111344	111344	111344
R^2	0.517	0.575	0.576	0.574
adj. R^2	0.517	0.567	0.568	0.566

Standard errors in parentheses. F statistic of weak identification for IV: 58

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Peer effects on stayers, OLS and IV FE (8th grade, Mathematics)

	(1)	(2)	(3)	(4)
	math8	math8	math8	math8
mean_othersmath8	0.793***	0.130***	0.124***	0.210***
	(0.00508)	(0.0180)	(0.0178)	(0.0663)
female	-14.37***	-16.31***	-20.99***	-21.02***
	(0.251)	(0.250)	(0.954)	(0.954)
gpa_5	12.87***	12.91***	12.65***	12.61***
	(0.452)	(0.456)	(0.455)	(0.456)
gpa_6	8.019***	10.68***	10.66***	10.69***
	(0.533)	(0.543)	(0.541)	(0.540)
gpa_7	21.15***	23.99***	23.67***	23.59***
	(0.467)	(0.474)	(0.473)	(0.475)
class_size_math		0.627***	0.587**	0.447*
		(0.237)	(0.236)	(0.241)
class_size_math2		-0.00903**	-0.00852**	-0.00734*
		(0.00397)	(0.00396)	(0.00378)
books			3.095***	3.056***
			(0.773)	(0.774)
fathered			0.315***	0.312***
			(0.0643)	(0.0642)
mothered			0.323***	0.316***
			(0.0704)	(0.0707)
f_fathered			0.160*	0.160*
			(0.0836)	(0.0836)
f_mothered			0.270***	0.272***
			(0.0903)	(0.0904)
_cons	-175.9***			
	(1.718)			
N	93800	93800	93800	93800
R^2	0.520	0.565	0.567	0.567
adj. R^2	0.520	0.555	0.556	0.556

Standard errors in parentheses. F statistic of weak identification for IV: 128

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Peer effects on stayers, OLS and IV FE (4th grade, Spanish)

	(1)	(2)	(3)	(4)
	spanish4	spanish4	spanish4	spanish4
mean_otherspanish4	0.659***	0.249***	0.247***	0.221*
	(0.00749)	(0.0163)	(0.0162)	(0.127)
female	4.330***	3.490***	7.856***	7.843***
	(0.246)	(0.243)	(1.043)	(1.046)
gpa_1	4.325***	4.423***	4.373***	4.389***
	(0.485)	(0.465)	(0.464)	(0.470)
gpa_2	12.92***	13.44***	13.36***	13.35***
	(0.565)	(0.541)	(0.539)	(0.540)
gpa_3	29.94***	37.07***	36.58***	36.58***
	(0.495)	(0.480)	(0.480)	(0.481)
class_size_spanish		0.777***	0.737**	0.797*
		(0.290)	(0.290)	(0.421)
class_size_spanish2		-0.0136***	-0.0132***	-0.0139**
		(0.00466)	(0.00466)	(0.00582)
books			0.985*	0.986*
			(0.519)	(0.519)
fathered			0.760***	0.760***
			(0.0751)	(0.0752)
mothered			0.225***	0.226***
			(0.0788)	(0.0788)
f_fathered			-0.172*	-0.171*
			(0.0941)	(0.0940)
f_mothered			-0.190*	-0.189*
			(0.101)	(0.101)
_cons	-192.9***			
	(2.446)			
N	110816	110816	110816	110816
R^2	0.385	0.435	0.436	0.436
adj. R^2	0.385	0.424	0.425	0.425

Standard errors in parentheses. F statistic of weak identification for IV: 50

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Peer effects on stayers, OLS and IV FE (8th grade, Spanish)

	(1)	(2)	(3)	(4)
	spanish8	spanish8	spanish8	spanish8
mean_otherspanish8	0.733***	0.261***	0.257***	0.310***
	(0.00608)	(0.0152)	(0.0151)	(0.0612)
female	1.469***	0.938***	0.202	0.215
	(0.266)	(0.274)	(1.038)	(1.038)
gpa_5	14.42***	14.58***	14.28***	14.26***
	(0.481)	(0.484)	(0.484)	(0.484)
gpa_6	8.990***	11.93***	11.88***	11.90***
	(0.569)	(0.585)	(0.583)	(0.582)
gpa_7	20.43***	22.85***	22.53***	22.48***
	(0.487)	(0.497)	(0.496)	(0.500)
class_size_spanish		0.119	0.0824	0.00444
		(0.252)	(0.252)	(0.258)
class_size_spanish2		-0.00112	-0.000746	-0.000322
		(0.00416)	(0.00416)	(0.00402)
books			5.009***	4.982***
			(0.830)	(0.832)
fathered			0.422***	0.422***
			(0.0691)	(0.0690)
mothered			0.448***	0.444***
			(0.0762)	(0.0765)
f_fathered			0.0656	0.0649
			(0.0885)	(0.0886)
f_mothered			0.0171	0.0165
			(0.0975)	(0.0975)
_cons	-179.8***			
	(1.877)			
N	93180	93180	93180	93180
R^2	0.449	0.490	0.492	0.492
adj. R^2	0.449	0.478	0.480	0.480

Standard errors in parentheses. F statistic of weak identification for IV: 135

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$