POSTGRADO
ECONOMÍA Y NEGOCIOS
UNIVERSIDAD DE CHILE

Political aftershocks of an earthquake: The effect of the Chilean 2010 earthquake on participation in the 2011 student's protests.

TESIS PARA OPTAR AL GRADO DE
MAGÍSTER EN ANÁLISIS ECONÓMICO

Alumno: Juan Luis Fuentes Acosta
Profesor Guía: Francisco Pino

Santiago, Abril 2019

Political aftershocks of an earthquake: The effect of the Chilean 2010 earthquake on participation in the 2011 student's protests.

Juan Luis Fuentes Acosta

June, 2019

Abstract

Reasons to participate in protests are an ongoing debate in political economy. In this paper we study whether Chilean students affected by the earthquake of 2010 participated more in the subsequent protests of the Student's Movement of 2011. Using data for more than 600,000 students we document that those students who had their school damaged by the earthquake participated up to 24 p.p. more than those who were not affected. This effect is larger for students in public schools, that participated between 22 and 42 p.p. more. We find evidence supporting that this effect could be explained by the delay in the government's response to the catastrophe. Also, we show that affected schools presented more pro-social behavior between students, suggesting lower coordination costs in those schools.

Keywords: protest participation, earthquakes, natural disasters.

1 Introduction

To protest is a way of political participation that allows part of the society to express certain discontent with something. Examples around the world include the Umbrella Revolution in Hong-Kong in 2014; the 2011-2013 Russian protests or *Snow Revolution*; the anti-austerity movement or Indignados Movement in Spain in 2011; the Arab Spring that begun in 2010; or the Student's Movement in Chile in 2011. These social movements have the potential to affect political and economic outcomes, from pressuring the government to expand the public spending to bringing down a dictator.

Participation in protests and its causes are still an open debate in political economy. Recent empirical and theoretical works stresses that there are several things to keep in mind that may be the driving forces or key elements for protest participation. These include information, social ties, beliefs of others participation and psychological feelings of unfair treatment among others. Although there has been a large interest in studying participation in riots, one challenge that empirical works face is the lack of data at individual level.[1]

In this paper I address the question of how being affected by a natural disaster affects the decision to participate in subsequent protests. If we assume that the government is negatively affected by large manifestations, when people want to force a certain response to a claim they have, a way to put pressure is by protesting. This behavior has been modeled by Passarelli and Tabellini (2017), who propose a model where individuals face higher marginal benefits of protesting the more aggrieved they are. To test this prediction, clear definitions of benefits and aggrievement are needed, and a natural disaster could provide such definition. This paper uses as a case of study the earthquake that Chile suffered in 2010, and the participation of students in the protests of the Chilean Student's Movement of 2011.

One possible channel through which an earthquake could affect the participation of citizens in protests is through their evaluation of the government response to the disaster. The damage produced by a natural disaster, if it is large, requires government to assist those who resulted damaged and are most vulnerable. If the government assistance arrives late, mostly for providing destroyed public goods, people have reasons to feel aggrieved and protest. This was the case of the earthquake of February 2010 in Chile, that affected millions of citizens and among them, school students that would participate in the Student Movement of 2011. The reconstruction of schools lasted for more than four years, and hundreds of damaged schools had not even started their reconstruction by the date the Student Movement started. Another channel by which natural disasters could increase the participation in protests is by social channels. In cases, communities need to organize to self-help in terms of reconstruction and aid to the ones in need, for example. This may help to create social links that, in the face of public protests may facilitate the problem of coordination for collective action.

[1] Theoretical works regarding protest participation date from the mid 1960s. They include Olson (1965), Tullock (1971), Granovetter (1978), Tilly (2017), Kuran (1989), Kuran (1991), Marwell and Oliver (1993), Chwe (2000), Bueno De Mesquita (2010), Edmond (2013), Little (2016), Passarelli and Tabellini (2017), Barbera and Jackson (2017) among others.

The question about determinants and causes of participation has been answered from different perspectives in previous works, in cases not as the central issue. Examples of this are the papers by Acemoglu et al. (2017) or Madestam et al. (2013). The work of Acemoglu et al. (2017) documents a positive correlation between twitter activity and the number of attendants to the Tahrir Square protests in 2011. Madestam et al. (2013) use rain as an exogenous variation to instrument attendance to the Tea Party rallies in 2009, finding a negative and significant relation between rain and participation in the demonstrations. Studies like the ones of González (2018), Cantoni et al. (2018) seek to understand how peer's actions and beliefs about their future actions, affect individual participation in collective actions. Also relevant to this literature are the studies Manacorda and Tesei (2016) and Enikolopov et al. (2018), that analyze the role of social media and communication technologies as coordination tools for engaging in protests. One of the lessons that one can draw from this latter set of works is that social features are relevant because they lower the costs of participating, providing better information and facilitating coordination.

This paper also speaks to the branch of literature that seek to understand the political and economical effects of natural disasters. In a recent paper, Fair et al. (2017) studies the effect of Pakistani Floods of 2011 on the participation of citizens in elections three years after. For the case of Chile, Carlin et al. (2014) studies the earthquake of 2010, and its impact on public valuation of local institutions, political tolerance and democratic ideas. Also, effects of the Chilean 2010 earthquake have been documented in child births (Lillo (2017), Berthelon et al. (2018)); secondary students academic performance (Morales, 2012); and on unemployment (Karnani, 2015); among others.

To identify the effect of the earthquake damage in schools on the probability of participating in the Student's Movement of 2011 I build a database using different data sources. I use data of damaged schools collected by the Ministry of Education (MINEDUC) in 2010, and to proxy protest participation I use school absenteeism in protest days in 2011 (in a similar fashion as González (2018)), also provided by the MINEDUC. Since an ordinary least squares strategy would yield to an inconsistent estimation of the parameter due to omitted variable bias, I propose an instrumental variable approach, and use georeferenced earthquake intensity data, reported by the U.S. Geological Survey, for the earthquake of 2010 to predict school damage.

One of the contributions of this paper is to test whether citizens react politically to natural disasters. Previous literature has put its attention on formal political participation, such as election turnout. Empirical papers that have focused in protest participation such as González (2018) and Cantoni et al. (2018), have focused on social features as causes of participation in riots. This paper seeks to understand how students react different to a wave of protests after their schools were seriously damaged by a factor external to their community, like an earthquake. An earthquake could have had a direct and indirect impact, by incentivizing social mechanisms that lowered coordination costs later. I find that students that had their schools damaged by the earthquake participated more in the 2011 Student Movement. For affected students of 2010, the earthquake explains between 30% and 50% of the probability of protesting in 2011.

Jointly to the question if aggrieved people protested more than those not affected, this paper also addresses the question of the reasons why people react politically to a seemingly non political phenomena. One potential reason is that citizens that were affected are effectively reacting to a political decision of the government, related to the public assistance it provides after a catastrophe. If the government reacts poorly to the disaster, then people have political motives to be upset and in the scenario of protests they will be more likely to participate to show discontent. I show that in low damaged public schools, where the government had less to reconstruct, but reconstructed the damage after the beginning of the protests, students protested 20 percentage points (henceforth p.p.) more than those where government was opportune and repaired the damage.

Finally, I am also able to check if the earthquake affected in any way social relations inside affected scholar communities. Between the reasons that literature has found relevant for people to engage politically in the face of natural disasters is that communities react organizing themselves to solve problems and help the ones most in need (Fair et al., 2017). This may have an effect on political engagement and therefore in protest participation because of lower coordination and information costs. I find that affected schools present better indicators of relations inside the school community and classroom. Students in damaged schools report 5 p.p. more to perceive good relations between classmates, and 6 p.p. more to perceive good relations between schoolmates. Also I find that in schools affected by the earthquake it is 10 p.p. less frequent to observe robbery between members of the community.

The paper is structured as follows. Section 2 revises literature of protest participation and the effects of natural disasters on political outcomes. Section 3 gives a rapid review of the Student's Movement of 2011 and the earthquake of 2010. It also explains the link between the students protests and the 2010 earthquake. Section 4 explains the theoretical framework and the empirical strategy used to answer the main questions in the paper. Section 5 introduces the data to be used, and describes the sample that is going to be studied. Results and the mechanisms are presented in Sections 6 and 7 respectively. Finally Section 8 review, summarizes and concludes the paper.

2 Related Literature

2.1 Protests

Economic literature on revolts and protests is not abundant. Recent empirical and theoretical papers stress this fact. Passarelli and Tabellini (2017) states that it is surprising that political economists haven't payed enough attention to riots and protests. As lobbying, protests are useful to exert political pressure to the government. The authors claim that even governments enjoying high legislative support hear the *claims of the streets* when people riot. This subsection reviews the literature on protests, and particularly on protest participation, and it's subdivided in two: empirics and theory.

2.1.1 Theoretical literature

Protests can be useful as a mechanism to exert pressure, and also as a mechanism to aggregate preferences. Battaglini (2017) models the way in which public demonstrations and petitions serve as a mechanism to aggregate social information along a policy that later the policy maker -if informed- could use or not. This model is suitable for stable democracies where revoking the government entirely is out of question and the protest is useful to change a particular policy. The author shows that information aggregation in a society is possible with protests. Also the paper discusses that even when some conditions are not met, the information aggregation is still possible if social media is available. Even though Battaglini (2017) does not have its prime focus on protest participation, it suggest that participation could be encouraged when citizens want or need to inform the rest of the society of a particular issue that is affecting them. This issue, in the context of the Students Movement for example, could have been the high restrictions that students faced when going to college, and the poor quality of education they were receiving in secondary and tertiary education.

The theoretical literature has focused on the reasons and mostly on the consequences of riots on political change. Passarelli and Tabellini (2017) develop a model in which individuals protests because they feel aggrieved by the policies of the government. If the level of aggrieve is big enough, the benefits of participating in social unrest are bigger at some point than the costs of protesting. Their model is in someway similar to the pivotal voter models, and has some interesting predictions. More homogeneous groups are more likely to protest, and larger protests are more likely to succeed. Also, as policy entitlements (so the aggrievement feeling) depend on the budget constraints of the government, in a dynamic framework, future conflict could be mitigated as the government accumulates debt. This model gives an explanation to various traits of the post-protests Chilean government actions. Indeed the concerns that students put on the table were the center of the debate of the 2013-14 presidential elections. This speaks to the result of the importance of highly concentrated groups rioting and their influence in public policy. Also, policies implemented during the next government were oriented to augment the public spending. This stylized facts suggest that Passarelli and Tabellini (2017) model is indeed predicting well enough the behavior of the government. But it is not clear that the mechanisms that the authors state, principally the signal of a more indebted government, is the one operating.

Bueno De Mesquita (2010) models the role of information in triggering a rebellion. The author explains that when vanguards invest in violent actions (the informative signal) regime change can be successful because of people changing their beliefs about the social support of regime change. He also shows the conditions under which regime change fails. His main contribution is to model the relation of agents information of regime change support and participation in the rebellion. A key assumption in his model is that vanguards face lower costs of incurring in violent actions if their support in society is higher. So when they commit, say, a terrorist attack, society members change their beliefs about the support of regime change.

Edmond (2013) works on the question of how the media manipulation can help a regime to avoid a revolution. One striking result is that if the regime can invest in sending signals of its strength, and the signal is precise, even weak regimes can avoid revolutions. Also, if the regime is operating in an environment with many signal senders so that it cannot control everyone of them, the revolution may have a shot of success because it is harder for the regime to seem strong. In this model, citizens are assumed to be against the regime and willing to revolt only if the perceive a weak enough regime. Ease of media control is crucial to the perpetuation of the regime, and the precision of the signal is central on the decision of the citizens to protest.

2.1.2 Empirical litereture

The present paper builds partly upon the study that González (2018) made of the Chilean Student Movement. González (2018) explores the role of social networks in the decision to protest of students. The paper shows how the participation of peers affects the student decision to participate. The author uses a rich database, and takes advantage of the fact that in protests days students skipped school to attend the manifestations. The main finding is that student's behavior follows alike a threshold model regarding their network participation, like the one proposed by Granovetter (1978). González (2018) shows that the reaction of a student to its network is non-linear, and has a critical point at 40% of peers participation. When 40% of the student social network skips school in protest days, she is more likely to skip school too.

Another paper that studies protests is Cantoni et al. (2018). The authors seek to answer whether the decision to protest is explained better as a complement or a substitute of others participation. They implement a field experiment in Hong-Kong in the framework of the Umbrella Revolution and survey around a thousand students of the Hong Kong University of Science and Technology. In the survey, they are able to randomize the provision of information about others participation in a protest. The authors find causal evidence supporting the fact that students see participation of others as a substitute of their own participation. Authors explain that the substitutability of own participation with others participation could be explained by three reasons: i) viewing protests as a political public good (Olson (1965); Tullock (1971); Palfrey and Rosenthal (1984)); ii) fearing that the protest may lead to a political crackdown if it is too massive; iii) viewing the protest as a way to sending a signal, that when few people attend to the protest, it is stronger.

Regarding protests and social media, Enikolopov et al. (2018) provide causal evidence of how social media pumps protest participation. The study analyzes protests in Russia in 2011, and finds evidence supporting the hypotheses that the penetration of social media facilitated protests and caused higher participation in anti-government protests. The mechanisms that the authors test are two: i) the information channel and ii) the coordination channel. The first mechanism is that social media allows information about the government to flow more truthfully between people. In countries that have media controlled by the government -as Russia-, social media outlets become an alternative source of information. The intuition behind the second channel is that social media allows people to connect, interact and coordinate better and more efficiently. Social media outlets makes available a platform to plan further actions, and reduces the costs involved in collective action. Authors find suggestive evidence that the second channel was the one fostering protest participation, suggesting that it lowering the costs of coordination facilitate the participation in protests.

In a related work, Manacorda and Tesei (2016) study protests and how they are affected by the availability of information and communication technologies (ICT). The particular case that the authors study is the penetration of mobile phones in Africa, and how they changed riot behaviors. Using an instrumental variables approach, they find that the mobile phone coverage boosted protests when the economy faced downturns. Using georeferenced data for cells of 50km$\times$50km of the whole African continent, authors find that in in zones covered with mobile phone signal, economic downturns augment the number of protests between 7 and 25 percent. Mechanisms that author explore are of two kinds: i) information mechanisms and ii) coordination mechanisms. Manacorda and Tesei (2016) use information of the Afrobarometer survey and find that mobile phones make individuals more informed about the state of the economy, but does not seem to be changing the costs related to participation.

Madestam et al. (2013) study the effect of protests and rallies on political outcomes. The authors use an instrumental variable approach for estimating the causal effect of the size of rallies on several electoral outcomes, policy outcomes and mechanisms for the effects found. Their main findings is that the Tea Party Movement rallies of 2009 had a positive causal effect on shifting policies to the right. They argue that the effect mechanisms was both a direct effect and via candidates selection, suggesting that congress people do listen to protesters. This paper is related to Madestam et al. (2013) in several ways, but mainly in relating natural phenomena to protest participation. Madestam et al. (2013) uses rain as instrument for protest participation, suggesting that the mechanism by which both are related is that a rainy day brings less incentives to participate.

2.2 Earthquakes

Pelling and Dill (2006) present several hypotheses for the reasons of a natural disaster to affect political action. These hypotheses are related with natural disasters highlighting inequalities, since they affect typically in a greater way most vulnerable people. Other hypotheses have to do with the role of the state, previous decisions regarding prevention policies and later response related to the reconstruction process. Finally, there is other group of hypotheses that have to do with politics, previous political links between affected areas and repositioning of politicians after the disaster.

In the literature of natural disasters and political outcomes the focus has been mainly in formal political participation, such as elections. Recent work on the effect of severe floods on political engagement has been made by Fair et al. (2017). In their work, authors study the floods of 2010-11 in Pakistan and found that affected areas were more prone to participate in following elections. The main channel they find is that floods led to government to intervene, making population more aware of government action and importance. Since government aid was opportune and well executed, authors argue that political engagement grew due to citizens learning about the state capacity. On the other hand, Gasper and Reeves (2011) finds that natural disasters and particularly weather damage in the US has negative effects on incumbent vote share, but that is attenuated if the incumbent had incurred in actions to alleviate the damage. Authors used a fixed effects model, and show evidence that support the hypothesis that the electorate is attentive to government action. Cole et al. (2012) finds evidence for voters reaction to disasters and government disaster relief in India. Authors find that voters do punish de incumbent coalition for disastrous rains, specifically in years immediately before the election. Also they find that even though voters punish the incumbent coalition, if the coalition provide aid to alleviate the damage fewer voters react negatively. For the case of the effect of natural disasters on political participation, Rudolph and Kuhn (2018) found that for the case of Germany floods caused citizens to participate less in following elections few weeks after. Using a Differences in differences approach, authors find that citizens were less prone to vote in following elections, possibly due to the rise in costs of voting surpassing the increase in civic duty that the floods may have caused.

For the case of Chile and the earthquake of February 27 2010, the study of Carlin et al. (2014) shows suggestive evidence that the earthquake could have lowered citizens valuation of democratic institutions. Authors use matching techniques and regression analysis to argue that people more affected by the earthquake had lowered their support for the municipal government, were more supportive to military coups and less politically tolerant. Finally, and related to this paper, authors also find suggestive evidence supporting the idea that the earthquake raised participatory attitudes in political events. For the same earthquake, Visconti (2018) studies how political preferences changed before the earthquake. Using a Differences in differences and matching approach, the author finds that people affected by the earthquake had a change in their views about political priorities in the country, shifting towards a more individualistic view.

This paper addresses the question of how natural disasters can affect informal political participation, such a participation in protests. To the best of my knowledge, this is the first paper attempting to find a causal path through which natural disasters affect participation in protests.

3 General Context

In this section the general context in which the paper is framed is detailed. Both the story of the Student's Movement and how it is related to the earthquake one year before are explained.

The Chilean Student's Movement of 2011 consisted in a series of manifestations that took place all over Chile in 2011, particularly between May and November. It started as public demonstrations of discontent due to a delay in the assignment of scholarships and demands regarding students' benefits of transportation. In short time the protests augmented in participation and the demands were broadened. Students demanded free tuition for higher education and improvements in public education quality. Protests were organized by university students grouped in a students representative organization called *Confederación de Estudiantes de Chile*, CONFECh. The CONFECh convoked to the first national protest of the year in May 12, and after an unfruitful dialogue with the government, the CONFECh convoked protests in June 1st and June 16. It was on the protest of June 16 that the movement had a massive attendance and from then on gained large support from the public opinion. The movement only started decaying in November of 2011, due to formal negotiations and the finish of the school year. In terms of results, the Student Movement achieved important goals. The first and most relevant one was to install the demand for free tuition in higher education, policy that was going to be implemented by the following government of Michelle Bachelet (2014-2018). Also, some of the leaders of the Student Movement became candidates to the congress in 2013, and even created their own political parties.[2]

In the context of the protest of 2011, despite secondary students did not start the conflict and were not involved in the organization of riots (at least the first ones), they were a key player. Secondary students skipped school to attend the marches, and in occasions they occupied their schools for months. Their participation can be explained because the demands for better quality education and access could also have spoked to them. Is in that context that the protests can be linked to the earthquake of 2010. On February 27 of 2010 at 03:34 am local time, Chile suffered one of the largest earthquakes in the history. The earthquake was of magnitude 8.8 M_w and was located off the coast of Chile's Maule Region about 100 km north of Concepción. Despite the fact that in general terms Chile is a well prepared country to face an earthquake, the consequences of the 27F (as it was named) were devastating. The earthquake damaged severely many schools, leaving them without the means to operate normally during the year. Nearly 1.2 million students could not start their school year in proper conditions in 2010, and 796 schools were completely destroyed or with serious structural damage (MINEDUC, 2013).

After the earthquake the Ministry of Education began to work immediately. They collected data of schools that were affected by the earthquake, so they could begin the reconstruction as soon as possible. The main task that was imposed was that they had to start the school year on April 26 at most. To accomplish this goal, they carried out several actions that included the recollection of information regarding the status of the public and private-subsidized schools. They assigned five damage levels to each school, that described mainly the availability of the school to host classes. These categories included: no damage, low damage, moderate damage, high damage and total damage. The last three categories were indicative that the school was not able to operate in proper conditions. The Ministry of Education collected information for more than 7,600 schools and of these schools, those with high-school education and with geo-referenced information are 1,988.

The earthquake harmed a significant portion of the education system, and certainly affected the quality of education that students received. In a context where protests are being organized and convoked by university students, it is interesting to ask whether the high school students affected by the earthquake changed their decisions of participation in protests.

[2]For more details of the history of the Student's Movement see Vallejo (2012) and Jackson (2013).

4 Theoretical and empirical frameworks

4.1 Theoretical Framework

The decision to protest has been explained in the theoretical literature from several perspectives. A notion that can summarize them is that individuals weight the benefits and costs of participating in a public protest, and if benefits are higher then they participate. A challenge this approach faces is to define benefits and costs of engaging in a public protest. In this section I describe the theoretical approximation I will use to build the hypotheses that this paper will be testing.

Benefits of participation in a public protest have been modeled as a function of the level of unfair treatment perceived by individuals by Passarelli and Tabellini (2017). This way of modeling the incentives to participate assumes that individuals have a preferred policy $\hat{q}^i$ to which they feel entitled. If the policy maker does not implement that particular policy, then individuals feel aggrieved. This aggrievement increases the marginal benefit of participation in protests. In their model, participation also depends on others participation as a strategic complement and individuals face costs from participating. If the marginal benefit of participation is grater than the marginal cost, then individuals protest.

In the particular case of this paper, students affected by the earthquake presumably perceive a higher level of aggrievement than those unaffected. This aggrievement could have arisen because of attending schools that were destroyed or highly damaged made more difficult to get the expected educational experience that they would have gotten otherwise. The fact that the government prioritized some schools over others for the reconstruction may have pumped this feeling of unfair treatment even more. Therefore the marginal benefit of participation of affected students could be higher, and following the logic previously stated, they should have participated more on average.

4.2 Empirical Framework

The empirical approach proposed is straightforward and aims to check if students that were more affected by the earthquake changed their decision to participate in protests compared to those who were slightly affected or not affected at all.

First of all, the measure of protest to use is school absenteeism in protest days. This measure is used by González (2018) and its characteristics and discussion as a proxy of protest participation is detailed in section 5. To test whether students affected by the earthquake changed their decisions on engaging in protests I propose a linear model where participation depends on school earthquake damage and individual and school level covariates. In the specification

$$P_{i,s} \quad = \quad \beta \cdot \mathrm{D}_{i,s} + x'_{i,s}\Gamma + \varepsilon_{i,s}, \tag{1}$$

$P_{i,s}$ is the student i of school s participation on a given protest measured as school absenteeism, $D_{i,s}$ is school s of student i earthquake damage and $x_{i,s}$ are covariates that include gender, age, GPA among others.

This approach has several problems of endogeneity. School damage could be correlated with the quality of infrastructure and other key characteristics of education quality that could affect the decision to participate in the Student's Movement protests. For example, students demands were mainly focused on access to tertiary education, but also included demands regarding education quality which could have been affected by the earthquake damage. In addition to this, public and poorer schools could have been less prepared to face a natural disaster of this magnitude. This could confound results because poorer people (hence, more income restricted people) attend public schools, and could be protesting more for demands related to tertiary education free tuition. Finally, the geography of the disaster could be hiding certain aspects such as rurality and connectivity to urban areas of students. This could confound the effect because it is plausible to think that the purpose of engaging in public protests is to make visible to others (the country citizens) one's demands, and media coverage in rural areas could be less intensive than in urban areas, so benefits of participating are lower. All these issues may be affecting the decision to participate in a public demonstration in different ways and, even after controlling for some of them, school damage could still be correlated with $\varepsilon_{i,s}$.

To overcome the endogeneity problem I will use an instrumental variable approach. The following equations describes the model to be estimated:

$$\mathrm{P}_{i,s} = \beta \cdot \hat{\mathrm{D}}_{i,s} + x'_{i,s}\Gamma + \varepsilon_{i,s}, \quad (2)$$

$$\mathrm{D}_{i,s} = \delta \cdot \mathrm{Z}_{i,s} + x'_{i,s}\Phi + \eta_{i,s}. \quad (3)$$

In the model $\mathrm{D}_{i,s}$ is an indicator of a school being conditioned due to earthquake damage, $\mathrm{Z}_{i,s}$ is the instrument uncorrelated with $\varepsilon_{i,s}$, and $\mathrm{x}_{i,s}$ are a set of exogenous covariates. To estimate this model I propose an instrument based on a measure of earthquake intensity.

One measure that could be used is distance to the epicenter. Unfortunately, even though one could think distance to the epicenter is not directly related to protests away from damage of the earthquake, the particular context of Chile makes that $\mathrm{E}(\mathbf{z}, \varepsilon) = 0$ is not ensured. Early protests, including the one of June 16 and 30, were organized by college students. Since the Metropolitan Region is both far from the epicenter and the region with more college students, it is likely that distance from the epicenter captures this effect jointly with the earthquake one.

The measure I use for proxying the earthquake intensity is the *Peak Ground Acceleration*. This measure is available at the U.S. Geological Survey webpage.[3] The USGS has data in the form of raster maps and shapefiles with information of PGA and other measures of earthquake intensity for every registered earthquake. The PGA is the maximum acceleration of movement the floor in a determined area. It is determined by $\mathrm{PGA}_{max} = \max\{\mathrm{PGA}_x, \mathrm{PGA}_y\}$ and then bounded between 0 and 1. The

[3] https://earthquake.usgs.gov/data/shakemap/

PGA estimations provided by the USGS are estimated in raster areas approximately of $2.6\text{km} \times 2.6\text{km}$. This raster layer is combined with georeferenced schools, and for each school, the respective PGA measure is imputed. An example of how these layers look can be seen in Figures 1 and 2. This measure, although it is correlated with distance to the epicenter, expresses in a more precise fashion the intensity of the earthquake in a given location. As will be shown in section 5, highly affected areas are present also in the Metropolitan Region and in the Region of Valparaíso. This would not be the case with a measure such as distance to the epicenter. Then, PGA is a plausible exogenous measure that likely affects the decision to protest only via earthquake damage, and therefore meets the exclusion condition $\mathrm{E}(\mathbf{z}, \varepsilon) = 0$.

Figure 1: Regions V to IX

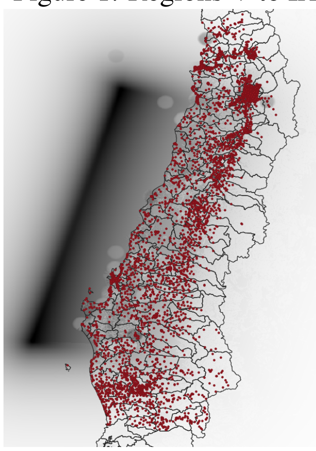
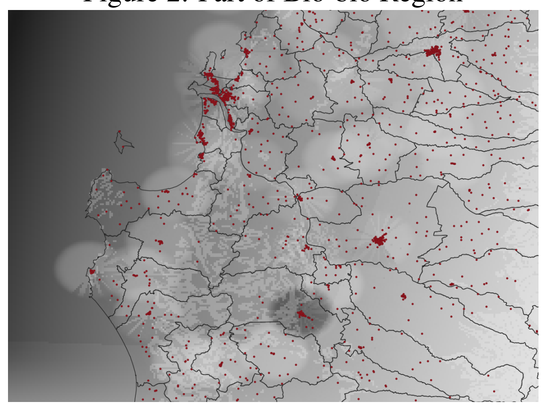


Figure 2: Part of Bío-bío Region



Note: Raster maps with schools georeferenced. Own elaboration from data provided by the Ministry of Education, National Institute of Statistics (INE) maps and the United States Geological Survey data. Darker areas signal zones where the peak ground acceleration was higher.

Since earthquakes -to the date- cannot be predicted, the location of one is orthogonal to preferences of individuals regarding protest participation. Having that in mind, non-spurious correlation could arise because of family decisions on where to settle and therefore live or study. If family decisions for living in *safer* places are correlated with decisions of the student to engage in a protest, the empirical strategy would not work. This is because the PGA of a particular location would affect the decision to protest by another channel different from earthquake damage. This is unlikely to happen since Chile is a highly seismic country placed over the Nazca Plate edge. This turns almost every region of Chile a non-earthquake-safe region.

Control variables include age, a dummy for gender, average school attendance of 2009, GPA of 2009, and mother's amount of years of schooling.

A reasonable question to ask is why use a linear model when the model clearly suggests using a limited dependent variable model, like a probit. Reasons have to do mainly with the purpose of the model. Since the main goal is to give an answer to a question related to marginal effects, and marginal effects are well identified by an instrumental variables linear model given the assumptions previously stated, the model would be sufficient to answer the question. Non-linear models that address the endogeneity problem with an instrumental variable, such as Control Function models and Special Regressor approach to mention some, need more conditions that the present case does not meet. For example, to get a Control Function estimator one needs to have a continuous endogenous regressor, rather than binary as it is the case in this paper. Special regressors on the other side need strong assumptions about the special regressor that even when the exogeneity condition is met, the regressor could fail meet.

5 Data and descriptive statistics

In this section the data and sample are described. The students and school datasets were provided by the Ministry of Education of Chile. Students data can be categorized in three groups: i) data of daily school attendance; ii) data of their school performance and personal data such as gender and age; and iii) data regarding schools that contains variables of dependence (public or private), rurality, earthquake damage and reconstruction. These datasets are collected by the Ministry of Education and its different sub-departments.

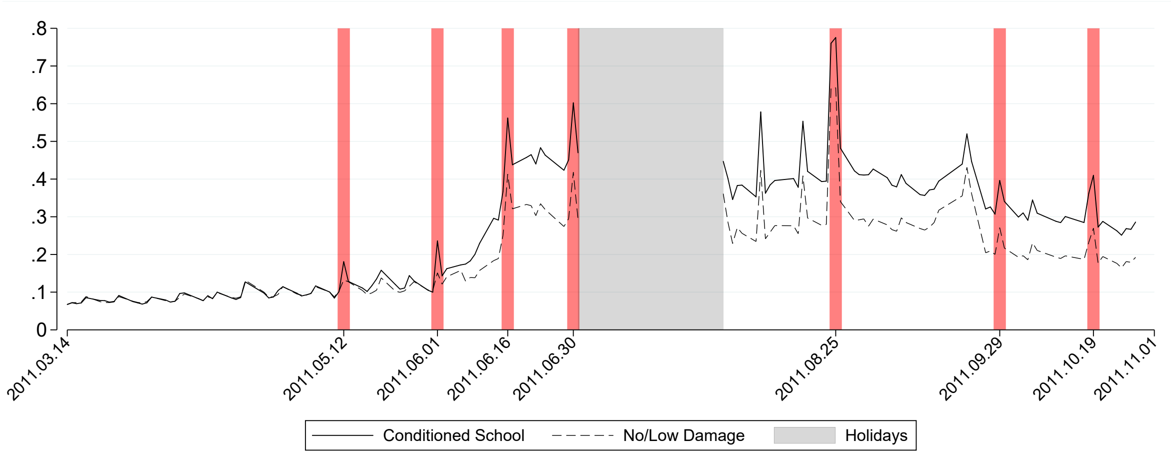
Following González (2018), I use school absenteeism in protest days to proxy protest participation. Students skipped school to attend protests, and as can be seen in Figure 3, the variable of absenteeism peaks on planned protests days (highlighted). I wont be focusing in a particular protest since the earthquake might have affected all of them. Instead I will use the average of the protests of the first semester to proxy protest participation. As can be seen in Figure 3 and also in Table 1, protests that were scheduled in May 12, June 1st, 16 and 30 are easily identifiable and present an average absenteeism of 13% (s.d. 33%), 16% (s.d. 37%), 44% (s.d. 50%) and 46% (s.d. 50%) respectively.

The sample corresponds to students that were born in 1997 or older that were studying in the affected regions in the year 2010. This threshold is set because students that were born in 1997 or before, by 2011 could have been in high school. Younger students born after have no other choice but to attend a middle school class. There are 680,891 students with information regarding attendance. A proxy used to account for socioeconomic status –mother's education– is available for 477,186 students. Students on average are 15 years old and 49% of them are female. Regarding school attendance before 2010, the average year attendance was 93%. In terms of GPA, of a total of 7 points, the average corresponds to 5.4. Socioeconomic status measured as mother's school years is 10.7.

In the sample there are 6,233 schools. Of them, 55% correspond to public schools and 30% are rural. This percentages when compared with the whole country numbers are pretty similar (50% of municipals and 30% of rural). School sizes are very heterogeneous, ranging from schools of 2 students up to 4,714 with a mean of 458 students.

Data of the earthquake intensity is from the United States Geological Survey (USGS) and has information about the peak ground acceleration in the form of a raster map, that is later merged with

Figure 3: Absenteeism in 2011 Time Series



Note: Own elaboration upon data provided by the Ministry of Education of Chile. Two series of average school absenteeism are plotted. The solid and wider line corresponds to the average absenteeism on each day of students who attended a school that was conditioned on its use after the earthquake. Dashed and thinner line corresponds to the average absenteeism of students who attended low or non-damaged schools. The days where national protests were convoked are highlighted in red. Highlighted in grey area corresponds to July, month in which schools are on vacations.

georeferenced schools. The damage of schools is measured by a scale of five levels. This information was collected by the Ministry of Education of Chile, after the earthquake and revalidated when public funds were involved in the reconstruction. The five levels were *no damage*, *low damage*, *moderate damage*, *severe damage* and *total damage*. Low damaged corresponded to a school where little damage was observed, that was needed to be repaired but it do not made impossible to use the school. Moderate damage was when the school had damage that was not structural, but it conditioned the usage of the school. Severe damage was when structural damage was present, that conditioned the usage of the school. Finally, Total damage corresponded when the infrastructure of the school was damaged in more than 50% and made the school irrecuperable.

The distribution of the damage is shown in Figures 4 and 5. There are 1,253 that resulted conditioned in their usage for 2010. This is, that they were catalogued in levels moderately, severely or totally damaged. This schools are distributed mainly in regions VIII and Metropolitan, but the share of conditioned schools are higher in regions VII and VIII. This is consequent with the fact that these regions are the closer ones to the earthquake's epicenter.

Table 4 sums the measures of earthquake damage. If school damage is dichotomized between conditioned and non-conditioned schools, 24% of the schools in the sample are conditioned. The mean of PGA inputted to schools is 0.33; and schools are dispersed between 6 km and 450 km from the epicenter.

Table 1: Students descriptive statistics

	Mean	Std. Dev.	Min.	Max.	Obs.
May 12	0.13	0.33	0	1	680,891
June 1st	0.16	0.36	0	1	
June 16	0.44	0.50	0	1	
June 30	0.46	0.50	0	1	
Average absenteeism	0.30	0.29	0	1	
Age	15.36	1.51	13	21	
Female	0.49	0.50	0	1	
Attendance 2009	0.93	0.07	0	1	
GPA 2009	5.44	0.61	1	7	
Mother's education	10.66	3.27	0	23	477,186

Note: Own elaboration upon data provided by the Ministry of Education. Protest participation is measured as school absenteeism in protest days. Female is a dummy variable that takes the value of 1 if the student is female. Sch. attendance 2009 is a variable that goes from 0 to 1 representing the average attendance that the student had in the whole year 2009. GPA is measured as a grade that has a scale from 1 to 7. Mother's education is the average mother's years of schooling. Finally, test score 2009 is the last SIMCE score of the student up to 2009. When observations are ommited is because it is the same sample of the last number of observations.

Table 2: Schools descriptive statistics

	Mean	Std. Dev.	Min.	Max.	Obs.
Public School 2010	0.52	0.50	0	1	6,233
Rural school 2010	0.27	0.44	0	1	
School students in 2010	474.69	441.95	2	4,714	

Note: Own elaboration upon data provided by the Ministry of Education.

Figure 4: Number of schools by damage

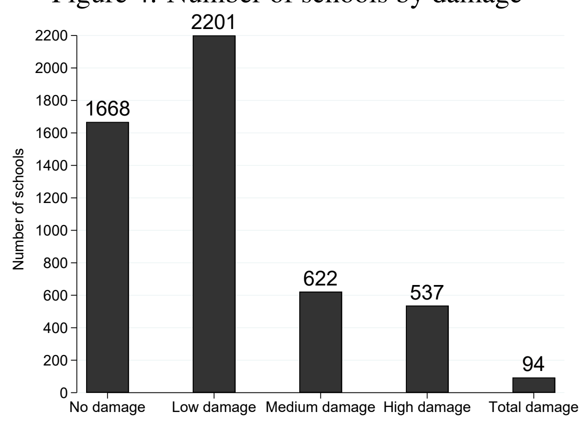


Figure 5: Schools by level of damage

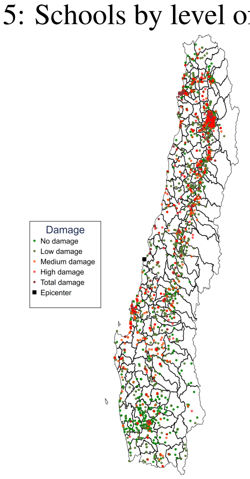


Table 3: Damage by region

Region	No	Low	Moderate	Severe	Total	Condit	Dist
V	301	248	72	51	43	23%	351
VI	91	224	72	45	4	28%	231
VII	49	302	86	84	18	35%	117
VIII	166	461	195	148	14	36%	134
IX	428	220	43	31	6	11%	309
Metropolitan	633	746	154	178	9	20%	325

Note: Own elaboration upon data provided by the Ministry of Education Low damage correspond to a school where little damage is observed, that is needed to be repaired but it do not makes impossible to make use of the school. Moderate damage is when the school has damage that is not structural, but it conditions the usage of the school. Severe damage is when structural damage is present, that conditions the usage of the school. Finally, Total damage corresponds when the infrastructure of the school is damaged in more than 50% and makes the school irrecuperable. The last two columns show the percentage of conditioned schools in the region and the average school distance to the epicenter measured in kilometers.

Table 4: Schools damage statistics

	Mean	SD	Min.	Max.	Obs.
Conditioned school	0.24	0.43	0	1	5,117
School PGA 2010	0.33	0.11	0	1	
Distance from the epicenter (kms)	259.84	97.40	6	450	

Note: Own elaboration upon data provided by the Ministry of Education and data of the USGS.

Figure 6: Number of schools by PGA

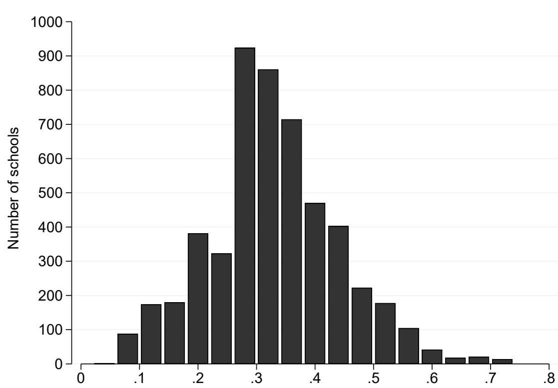
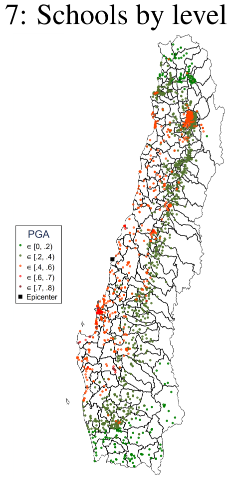


Figure 7: Schools by level of PGA



5.1 Treated and control groups characterization

In this section students in conditioned schools are characterized and compared to those in non or low damaged schools. This exercise is useful to know how the complier group is composed so the interpretation of the IV strategy results can be more complete.

Table 5 shows stats for both damaged and non-damaged students. Columns 6 and 7 show the results of the regression in equation 4, where $x_{i,s}$ is the variable where differences between groups is being tested.

$$x_{i,s} = \alpha + \beta \cdot \mathbb{1}\left[\text{Conditioned Sch.}\right] + \eta_{i,s} \tag{4}$$

Results of the simple regression show that significant differences appear in age, GPA, school type, rurality and school size. Compliers appear to be on average .13 years older, to have 0.07 points higher GPA (in a scale from 1 to 7), to come from municipal schools with a probability 23% higher, and from schools with 230 students more.

Table 5: Group characterization

	Low/No Damage		Conditioned		Regression	
	Mean	SD	Mean	SD	Coef.	p-val
Age	15.32	1.52	15.45	1.49	0.13	0.00
Female	0.49	0.50	0.49	0.50	0.00	0.69
Sch. attendance 2009	0.93	0.07	0.93	0.07	0.00	0.13
GPA 2009	5.42	0.61	5.49	0.61	0.07	0.00
School type 2010	0.38	0.49	0.65	0.48	0.26	0.00
Rural school 2010	0.08	0.27	0.06	0.23	-0.02	0.03
School students in 2010	922.73	613.06	1,152.19	916.22	229.46	0.02
Mother's education	10.71	3.26	10.52	3.28	-0.19	0.16

Note: Own elaboration upon data provided by the Ministry of Education. Mean and standard deviations shown in columns 2 and 3 correspond to students not affected or slightly affected by the earthquake. Columns 4 and 5 show statistics for students that saw their school conditioned because of damage produced by the earthquake. Finally, columns 6 and 7 show the regression coefficient and respective p-value of a regression of a dummy equal to 1 if the school was conditioned, against the variable on the first column. Standard errors of the regression are clustered at municipal level.

6 Results

In this section I report the results of the model presented in section 4.2. First, results of PGA on school damage in 2010 are presented. In second place, results for the main question of the paper are presented, the effect of the earthquake damage on protest participation. Then, results on the effect of reconstruction of schools on protest participation are shown. Finally, estimations for the effect of the earthquake on several social and school variables are presented.

6.1 Earthquake in school damage

This subsection assess the question whether the 27F earthquake had an effect in schools. To measure the relation between both variables, Table 6 shows five linear specifications of school damage as a function of PGA. PGA is standardized so the interpretation of the coefficient is the effect of one standard deviation increase of PGA on damage percental points. When no other control variables are included, one standard deviation in PGA augments in 11 p.p. (point estimate of 0.11) the probability of a school to be categorized as conditioned after the earthquake. This coefficient drops by 2 p.p. when controls that account for school dependence (municipal or private), rurality and log of school size (measured as the log of number of students) are included. Results are also robust to the inclusion of regional fixed effects and distance to the epicenter. The coefficient of the different specifications range between 19% and 35% of the total percentage of conditioned schools in the sample (31% of schools). Results of the effect of Peak Ground Acceleration on school damage suggest that the instrument is appropriate for predicting school damage.

Table 6: OLS of PGA on School Damage due to 27F.

	(1)	(2)	(3)	(4)	(5)
PGA Std. (SD = .1)	0.11[a]	0.09[a]	0.07[a]	0.06[a]	0.07[a]
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
Public School 2010		0.23[a]	0.21[a]	0.21[a]	0.21[a]
		[0.03]	[0.03]	[0.03]	[0.03]
Rural school 2010		0.00	-0.02	-0.02	-0.02
		[0.03]	[0.04]	[0.04]	[0.04]
Log school size 2010		0.08[a]	0.10[a]	0.09[a]	0.10[a]
		[0.02]	[0.02]	[0.03]	[0.02]
Log Dist Epicenter-School				-0.16[a]	-0.05
				[0.04]	[0.07]
Constant	0.31[a]	-0.34[b]	-0.44[a]	0.50[c]	-0.19
	[0.02]	[0.16]	[0.16]	[0.30]	[0.42]
Regional FE			X		X
N of students	675,034	675,034	675,034	675,034	675,034
N of schools	5,117	5,117	5,117	5,117	5,117
Dep. variable mean	0.31	0.31	0.31	0.31	0.31
R-squared	0.05	0.12	0.15	0.15	0.15

Note: Own elaboration upon data provided by the Ministry of Education and the U.S. Geological Survey. School damage is measured recoding the variable of damage level that had five levels of damage into a binary variable that signals if the school had enough damage to be considered as conditioned to be used in 2010. Standard errors clustered at municipal level. Significance marks a: $p < 0.01$; b: $p < 0.05$; c: $p < 0.1$.

6.2 School damage in protest participation

In this section the main empirical question is assessed. Table 7 show the results for the full sample, and then separated by public and private schools. For each sample OLS estimation is in the first row and IV estimation is in the second row. The columns differ in the controls included. The first column is without controls. The second column includes individual controls such as age, gender, GPA in 2009, school attendance in 2009 and mother's years of education as a proxy of socioeconomic status. The third column adds regional fixed effects. All standard errors are clustered at municipal level.

OLS results of the first column show that on average, students of conditioned schools in 2010 present around 10 p.p. (s.e. = 3 p.p.) more absenteeism in protest days. This estimations remain almost unchanged when adding individual controls and regional fixed effects.

Results for the variable of attending to a damaged and conditioned school in 2010 instrumented with the Peak Ground Acceleration in the school location are shown in the second row of each section of Table 7. In all specifications shown the instrument is strong with a First Stage F-Statistic ranging between 22 and 33 for the full sample. Coefficients for the instrumented variable are notably bigger than the ones from the OLS specifications, providing evidence of a downward bias due to the correlation of omitted variables with school earthquake damage. In the specification without controls, the effect of attending a damaged school is statistically significant and indicates that students that had their school conditioned due to earthquake damage in 2010 participated 24 p.p. more in the protests of the Student's Movement in 2011. Compared to the OLS coefficient, the effect is 2 times bigger. Results of the IV specification should retrieve a consistent estimation of the parameter while the exclusion condition cov $(\mathrm{Z}_{i,s}, \varepsilon_{i,s}) = 0$ holds. Since this is the case argued before, the inclusion of control variables should aim to help the precision of the point estimates or shed some light on potential mechanisms. As long as controls and PGA are orthogonal, no endogeneity issues should be a concern. Controlling for individual covariates reduced the point estimate to 0.20 (s.e. = .09), and reduces the F-Stat of the first stage. Adding regional intercepts changes the interpretation of the coefficient to a within region variation, producing loss in the precision of the first stage. The earthquake effect seems to be no different from zero for the instrumental variable model, suggesting that when students are compared with those damaged in the same region they present no differences between damaged and non damaged ones. Since school level controls are not added because they may be a function of the earthquake (students and their families could have chosen to change or stay because of the 2010 earthquake), and therefore a function of the PGA, I separate the sample to show if there is any difference between students in public and private schools. When the sample is separated between public and private schools, the whole effect of the earthquake on protest participation appears to be driven by the damage on public schools and their students participation. Private schools show no difference in participation due to damage, and show a negative effect of damage on protest participation when regional fixed effects are included.

Table 8 shows estimations for the reduced form of the instrumental variable approach. Since the variable of Peak Ground Acceleration is standardized by substracting the mean and dividing for the standard deviation, the interpretation of the coefficients is straightforward. In the first two columns, the point estimates suggest that on average one standard deviation in PGA leads to 2-3 p.p. more absenteeism in protest days. Public and private school estimates yield to similar conclusions as Table 7.

The results shown in Table 7 and 8 suggest that the earthquake damage had a positive causal effect in the probability to protest in 2011.[4] This effect seems to be driven by students in public schools, and may account for third up to a half of the whole participation of students in public schools. For private schools, the earthquake damage of schools had a negative effect in participation. This difference between damaged public and private schools may have different interpretations. One of them is that the reconstruction process could have been different between the two groups. Other is that the earthquake, as other natural disasters, may have a greater impact on vulnerable people and thus, may have unchained different reactions between families that could afford for private education and those that could not.

[4]Estimations with standard errors clustered at a higher level of aggregation can be found in Appendix **??**.

Table 7: OLS and IV for absenteeism in protest days.

	(1)	(2)	(3)	(4)	(5)	(6)
Full Sample						
OLS	0.10[a]	0.10[a]	0.10[a]			
	[0.03]	[0.02]	[0.03]			
Instrumented				0.24[b]	0.20[b]	0.09
				[0.10]	[0.09]	[0.14]
OLS R-Squared	0.02	0.09	0.11			
First Stage F Stat.				33.47	30.89	22.84
Control Group $\bar{Y}$	0.27	0.25	0.25	0.27	0.25	0.25
Observations	675,034	473,681	473,681	675,034	473,681	473,681
N of Schools	5,117	4,616	4,616	5,117	4,616	4,616
Public schools						
OLS	0.07[b]	0.06[b]	0.08[a]			
	[0.03]	[0.03]	[0.03]			
Instrumented				0.26[b]	0.22[b]	0.42[b]
				[0.11]	[0.10]	[0.20]
OLS R-Squared	0.01	0.10	0.15			
First Stage F Stat.				28.93	28.10	12.14
Control Group $\bar{Y}$	0.40	0.39	0.39	0.40	0.39	0.39
Observations	313,919	207,171	207,171	313,919	207,171	207,171
N of Schools	2,814	2,490	2,490	2,814	2,490	2,490
Private schools						
OLS	-0.01	-0.00	0.00			
	[0.01]	[0.01]	[0.01]			
Instrumented				0.11	0.07	-0.21[c]
				[0.12]	[0.11]	[0.12]
OLS R-Squared	0.00	0.05	0.11			
First Stage F Stat.				22.04	21.98	17.69
Control Group $\bar{Y}$	0.19	0.18	0.18	0.19	0.18	0.18
Observations	361,115	266,510	266,510	361,115	266,510	266,510
N of Schools	2,303	2,126	2,126	2,303	2,126	2,126
Ind. Controls		X	X		X	X
Regional FE			X			X

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. Protest participation is measured as average school absenteeism in protests days of the first semester. Conditioned school is a dummy that takes the value of 1 if the school was totally, highly or had medium damage that conditioned its usage. Individual controls included are: average attendance in 2009, GPA in 2009, gender, age and mother's years of schooling. Standard errors are presented in brackets and are clustered at municipal level. Significance is marked as follows: a = $p < 0.01$; b = $p < 0.05$; c = $p < 0.1$.

Table 8: Reduced Form estimates for PGA on absenteeism in protest days.

	(1)	(2)	(3)
Full Sample			
PGA Std. (SD = .1)	0.03[b]	0.02[b]	0.01
	[0.01]	[0.01]	[0.01]
Control Group $\bar{Y}$	0.27	0.25	0.25
OLS R-Squared	0.01	0.07	0.09
Observations	675,034	473,681	473,681
N of Schools	5,117	4,616	4,616
Public schools			
PGA Std. (SD = .1)	0.03[a]	0.02[b]	0.03[a]
	[0.01]	[0.01]	[0.01]
Control Group $\bar{Y}$	0.40	0.39	0.39
OLS R-Squared	0.01	0.10	0.15
Observations	313,919	207,171	207,171
N of Schools	2,814	2,490	2,490
Private schools			
PGA Std. (SD = .1)	0.01	0.01	-0.02[c]
	[0.01]	[0.01]	[0.01]
Control Group $\bar{Y}$	0.19	0.18	0.18
OLS R-Squared	0.00	0.05	0.11
Observations	361,115	266,510	266,510
N of Schools	2,303	2,126	2,126
Ind. Controls		X	X
Regional FE			X

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. Protest participation is measured as average school absenteeism in protests days of the first semester. Conditioned school is a dummy that takes the value of 1 if the school was totally, highly or had medium damage that conditioned its usage. Individual controls included are: average attendance in 2009, GPA in 2009, gender, age and mother's years of schooling. Standard errors are presented in brackets and are clustered at municipal level. Significance is marked as follows: a = $p < 0.01$; b = $p < 0.05$; c = $p < 0.1$.

6.3 Robustness checks

6.3.1 Attendance previous to student's protests

One possible story that could invalidate the results is that schools affected by the earthquake presented more absenteeism for other reason different than protest participation. This concern should be alleviated if student absenteeism before protests had no difference between damaged and non damaged schools. Estimates that emulate those in Table 7 but with absenteeism in April 2011 are shown in Table 9. As can be seen, no previous differences in absenteeism exist before the start of the Student's Movement protests. All specifications show coefficients no different from zero for the IV specifications.

Figure 8 shows the point estimates without controls of the effect of school damage on absenteeism in periods before the Student's Movement protests. For the average absenteeism in 2010 coefficient is 0.02 and it is not significantly different from zero with a 95% confidence interval, but coefficient seems to be significant with a 90% confidence interval. Since 2010 was the year of the earthquake, an explanation for a 2 p.p. difference in absenteeism could be that many students entered school late and had to change school location due to damages. Absenteeism in March 2011 on the other side seems to be a lot higher. This could be for two reasons. One of them is that the reconstruction process had a due date at the beginning of March, and that could have implied school location changes and adjustment costs that could explain students skipping school. Another reason that explains damaged schools absenteeism is that on March the 1st an earthquake of magnitude 7 M_w affected Easter Island and on March 11 an earthquake of magnitude 9 M_w affected Japan. Both earthquakes brought with them tsunami threats to the continental part of Chile, and could explain school absenteeism in damaged schools. The latter event seems to be the one driving March 2011 absenteeism, as shown in Figure 9.

Table 9: OLS and IV for average absenteeism in April.

	(1)	(2)	(3)	(4)	(5)	(6)
Full Sample						
OLS	0.00	-0.00	0.00			
	[0.00]	[0.00]	[0.00]			
Instrumented				0.01	0.00	-0.00
				[0.01]	[0.01]	[0.01]
OLS R-Squared	0.00	0.10	0.10			
First Stage F Stat.				33.47	30.89	22.84
Control Group $\bar{Y}$	0.07	0.06	0.06	0.07	0.06	0.06
Observations	675,034	473,681	473,681	675,034	473,681	473,681
N of Schools	5,117	4,616	4,616	5,117	4,616	4,616
Public schools						
OLS	-0.00	-0.00	0.00			
	[0.00]	[0.00]	[0.00]			
Instrumented				0.01	0.00	0.01
				[0.02]	[0.01]	[0.02]
OLS R-Squared	0.00	0.10	0.10			
First Stage F Stat.				28.93	28.10	12.14
Control Group $\bar{Y}$	0.08	0.07	0.07	0.08	0.07	0.07
Observations	313,919	207,171	207,171	313,919	207,171	207,171
N of Schools	2,814	2,490	2,490	2,814	2,490	2,490
Private schools						
OLS	-0.01[b]	-0.00[b]	-0.00			
	[0.00]	[0.00]	[0.00]			
Instrumented				0.01	-0.00	-0.01
				[0.02]	[0.01]	[0.01]
OLS R-Squared	0.00	0.09	0.10			
First Stage F Stat.				22.04	21.98	17.69
Control Group $\bar{Y}$	0.07	0.06	0.06	0.07	0.06	0.06
Observations	361,115	266,510	266,510	361,115	266,510	266,510
N of Schools	2,303	2,126	2,126	2,303	2,126	2,126
Ind. Controls		X	X		X	X
Regional FE			X			X

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. Protest participation is measured as average school absenteeism in protests days of the first semester. Conditioned school is a dummy that takes the value of 1 if the school was totally, highly or had medium damage that conditioned its usage. Individual controls included are: average attendance in 2009, GPA in 2009, gender, age and mother's years of schooling. Standard errors are presented in brackets and are clustered at municipal level. Significance is marked as follows: a = $p < 0.01$; b = $p < 0.05$; c = $p < 0.1$.

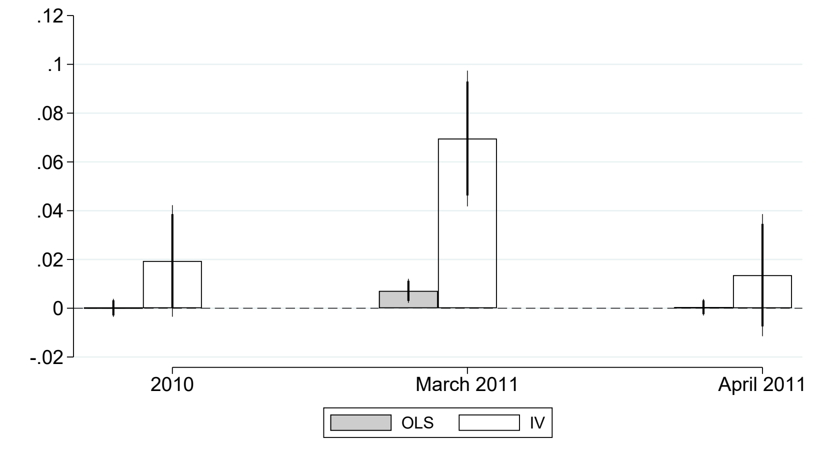


Figure 8: Point estimates absenteeism before protests.

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. Each coefficient corresponds to a OLS/2SLS regression without control variables. Standard errors clustered at municipal level. Wither CI indicate 95% confidence, and CI bars indicate 99% confidence.

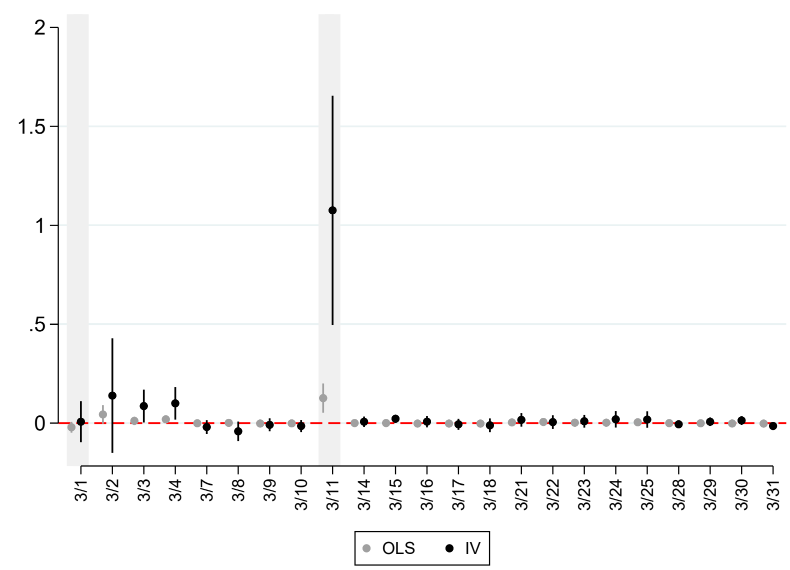


Figure 9: Point estimates of absenteeism in March 2011.

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. Each coefficient corresponds to a OLS/2SLS regression without control variables. Standard errors clustered at municipal level. CI bars indicate 90% confidence.

6.3.2 Concerns with the exclusion restriction

Classical concerns with the instrumental variables approach point to the possibility that the exclusion restriction does not hold. In this paper this could happen if the earthquake intensity measured as the

Peak Ground Acceleration in a 2.6 km $\times$ 2.6 km square elicited other channel different from school damage that could affect subsequent protest participation of students.

One possible way to test if there are other channels working is to characterize the compliers that did not had their schools damaged, with the purpose of comparing them to students in schools that were not affected by the earthquake at all. Since the earthquake affected center-south regions of Chile, there are schools in the north and south that had not been exposed to the earthquake. If schools in earthquake areas that had no damage but behaved different from those who were not affected at all, then there may be another channel not considered.

Descriptive statistics for public schools are shown in Table 10. Non-damaged schools in earthquake regions show less participation than schools in regions not affected by the earthquake. Propensity score matching estimations shown in Appendix **??** do not show either that there are any significant differences for public schools. For private schools, if there are any differences, they go in the opposite direction to the effects found in Table 7 and are small in magnitude. This evidence suggest that, if any alternative channel is open, the earthquake affected participation in protest negatively through this channel for public schools, and positively for private schools. Both of these results go in the opposite direction of the effects found, and their magnitude is negligible.

Table 10: Propensity score descriptive statistics. Public Schools.

	Mean	SD	Min	Max	Obs
Affected regions					
Av. absenteeism	0.43	0.25	0	1	1767
Age	15.31	0.97	13	21	1767
Gender	0.47	0.22	0	1	1767
Mother Schooling	9.54	1.37	1.5	14	1629
Non-affected regions					
Av. absenteeism	0.48	0.26	0	1	1037
Age	15.37	0.93	13	18.04	1037
Gender	0.48	0.17	0	1	1037
Mother Schooling	9.72	1.3	1	17	932

Note: Own elaboration upon data provided by the Ministry of Education. Affected regions correspond to regions from the V to the IX region, including the Metrpolitan Region. Non-affected regions correspond to I to IV and X to XV regions. Schools are weighted by the number of students that they have. Public schools only.

7 Mechanisms

One possible story behind the fact that students of damaged schools participated more in the Student's Movement is that the reconstruction of their schools was not ready within a year since the earthquake. This delay in the reconstruction could have provoked students to be angry with the government if the delivery of reconstruction dates were not achieved, incentivizing them to protest more. Another possible story is that the earthquake may have inspired pro-social behavior, and that may have enhanced political engagement among other things. This mechanism could have worked because in environments that have better relations between participants, information may have spread more easily and coordination costs could have decreased. In this section I explore both hypothesis.

7.1 Reconstruction

7.1.1 A brief story of the reconstruction

The reconstruction, as explained before, begun from the first day after the earthquake. It was urgent that near 1.2 million affected school students started their year as soon as possible. For this purpose, the government funded several reconstruction programs. The first ones were aimed to put as much students as possible in provisionary schools and relocate others in different schools so they could start the year. Then, in July of 2010, the reconstruction of more damaged schools started. Several programs were made available for schools to apply for funding. The first and second *big* programs were available for applying on July 6 and August 19 of 2010 (PRM 1 and PRM2 for they names in Spanish, *Programa de Reparaciones Menores*), and they funded up to a top of USD 120,000 and USD 90,900 in reparations respectively. Schools were asked to fund 20% of the whole reparation, and the government funded the rest. For the PRM 1, 601 projects were funded and the government spent nearly 30 million USD. For the PRM 2, 333 projects were funded and the government spent near 13,2 million USD (MINEDUC, 2013). The rest of the programs were opened during 2011 and following years.

For the programs PRM 1 and PRM 2 the idea was to fund projects that could be executed before the start of the 2011 school year. This meant that the schools should be ready to be used before March. To this end, schools were prioritized and ordered with a score that included the following criteria:

1. School SIMCE scores corrected by socioeconomic status of the students (15%).

2. Total number of students (15%).

3. Total funds asked divided per number of students (20%).

4. Level of damage to be repaired with the project (20%).

5. Co-funding of the school (20%).

6. Priority of the project self-reported by the school (10%).

Despite the efforts of the government to fund projects that could be finished before the start of the 2011 school year, many of them could not reach the goal. As can be seen in Figure **??**, there were many schools that could not be repaired before March the 1st. This fact allows me to propose an estimation method to assess the question of whether students in repaired schools were less prone to protest than students in non-repaired schools.

7.1.2 Empirical strategy and results

To asses the heterogeneity of effects due to the delay in the reconstruction, I will take a subsample of reconstructed schools and separate them in two comparable groups. The subsample corresponds to students in schools that posited to and were awarded reconstruction projects. I divide this subsample in two: schools that were reconstructed before the start of the Student's Movement, and schools reconstructed after. The date of the beginning of the Student's Movement I will consider is when the CONFECh convoked to the first national manifestation in May 12. The march announcement was made in May 3, as can be seen in Figures **??** and **??** in the Appendix.

Descriptive statistics of the students in reconstructed schools can be seen in Table 11. The average absenteeism is higher than in the whole sample, in concordance with the findings in the pasts sections. Age, Gender, past attendance, GPA and SES proxy seem to behave in a similar fashion as the whole sample. In Figure 10 the school's level of damage for this subsample are presented. As can be seen, only damaged schools were awarded reconstruction projects. Non-conditioned schools are present in the sample, but only the *low-damaged* ones.

Schools with no damage are out of the subsample, which makes the first stage of the IV strategy imprecise, leading to weak first stages. Because of this, I will proceed to estimate only OLS and reduced form specifications. The OLS estimations are presented in Table 12. For the sample of schools reconstructed after the Student's Movement began, students that saw their school conditioned present between 8 and 10 p.p. more probability to participate in the protests. Differences are significant when individual controls and regional fixed effects are added. For students that had their schools repaired before, differences between students in conditioned and non-conditioned schools are no significantly different from zero in all the specifications. When samples are separated between public and private schools, differences also are not statistically different from zero for all specifications, except for the fixed effects specification for students in public schools. This model shows 7 p.p. higher participation for students that had their school conditioned by damage, but the coefficient is significant only with a 90% confidence interval.

For the reduced form estimation, the results are presented in Table 13. For the full sample of schools, and for both subsamples, the point estimates are no statistically different from zero. For Public Schools the point estimates are also no statistically different from zero, except for the specification with fixed effects. This suggests that when comparing students within the same region, one standard deviation in PGA causes 4 p.p. more probability of absenteeism in students in schools that were reconstructed after May 5. For private schools, no difference is statistically significant.

OLS results provide evidence of damage conditioning the school being especially relevant when the school was reconstructed after the start of the student movement (Table 12). Comparing the point estimates, heterogeneous effects between schools repaired before and after the start of the student movement in the full sample appear to be driven mainly by Private Schools (although coefficients are not statistically significant). Coefficients for the before and after specifications in Public Schools are very similar, suggesting that the earthquake did not have heterogeneous effects for students in these schools.

Causal evidence provided by the reduced form estimation of earthquake intensity (PGA) on absenteeism in protest days (Table 13), also suggest that heterogeneous effects exist. Although coefficients for the full sample are not statistically different from zero, point estimates for the sample reconstructed after the protests are higher than those reconstructed before. Also, students in Public Schools exhibit 4 p.p. more of absenteeism for every extra standard deviation in PGA if their school was repaired early, and -1 p.p. (non-significant) if the reconstruction was late. This difference with the interpretation for Public Schools of Table 12 could be explained due to non-observed heterogeneity downward biasing the point estimates for early-reconstructed Public Schools in Table 12.

Table 11: Reconstructed schools student's descriptive statistics

	Mean	Std. Dev.	Min.	Max.	Obs.
Av. Absenteeism	0.37	0.3	0	1	267,396
Age	15.36	1.51	13	21	
Gender	0.5	0.5	0	1	
2009 attendance	0.93	0.07	0	1	
2009 GPA	5.48	0.62	1	7	
Mother's Schooling	10.36	3.34	0	23	187,570

Note: Own elaboration upon data provided by the Ministry of Education. Protest participation is measured as school absenteeism in protest days. Female is a dummy variable that takes the value of 1 if the student is female. Sch. attendance 2009 is a variable that goes from 0 to 1 representing the average attendance that the student had in the whole year 2009. GPA is measured as a grade that has a scale from 1 to 7. Mother's education is the average mother's years of schooling. When observations are ommited is because it is the same sample of the last number of observations.

Figure 10: Reconstructed schools by damage level

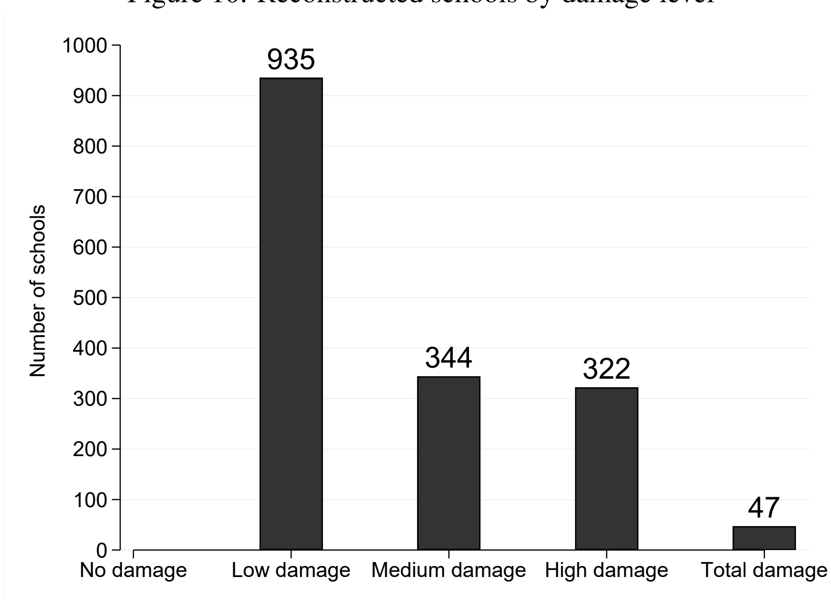


Table 12: OLS for absenteeism in protest days. State-reconstructed schools only.

	Reconstruction after 05/03			Reconstruction bef. 05/03		
	(1)	(2)	(3)	(4)	(5)	(6)
Full Sample						
Conditioned Sch.	0.08	0.09[c]	0.10[b]	0.03	0.03	0.03
	[0.06]	[0.05]	[0.04]	[0.05]	[0.04]	[0.04]
OLS R-Squared	0.02	0.10	0.17	0.00	0.06	0.09
Control Group $\bar{Y}$	0.33	0.31	0.31	0.33	0.32	0.32
Observations	151,281	106,261	106,261	119,279	83,044	83,044
N of Schools	923	891	891	724	712	712
Public schools						
Conditioned Sch.	0.04	0.03	0.06	0.05	0.04	0.07[c]
	[0.06]	[0.05]	[0.04]	[0.05]	[0.04]	[0.04]
OLS R-Squared	0.00	0.11	0.25	0.01	0.11	0.19
Control Group $\bar{Y}$	0.46	0.44	0.44	0.47	0.47	0.47
Observations	102,534	69,659	69,659	66,054	42,663	42,663
N of Schools	705	685	685	519	510	510
Private schools						
Conditioned Sch.	0.06	0.06	0.04	-0.01	-0.01	-0.02
	[0.04]	[0.04]	[0.04]	[0.03]	[0.03]	[0.02]
OLS R-Squared	0.02	0.07	0.18	0.00	0.07	0.17
Control Group $\bar{Y}$	0.13	0.13	0.13	0.17	0.17	0.17
Observations	48,747	36,602	36,602	53,225	40,381	40,381
N of Schools	218	206	206	205	202	202
Ind. Controls		X	X		X	X
Regional FE			X			X

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. Protest participation is measured as average school absenteeism in protests days of the first semester. Conditioned school is a dummy that takes the value of 1 if the school was totally, highly or had medium damage that conditioned its usage. Individual controls included are: average attendance in 2009, GPA in 2009, gender, age and mother's years of schooling. Standard errors are presented in brackets and are clustered at municipal level. Significance is marked as follows: a = $p < 0.01$; b = $p < 0.05$; c = $p < 0.1$.

Table 13: Reduced Form estimates for PGA on absenteeism in protest days. State-reconstructed schools only.

	Reconstruction after 05/03			Reconstruction bef. 05/03		
	(1)	(2)	(3)	(4)	(5)	(6)
Full Sample						
PGA Std. (SD = .1)	0.00	0.00	0.02	-0.02	-0.02	-0.03
	[0.01]	[0.01]	[0.02]	[0.02]	[0.02]	[0.02]
Control Group $\bar{Y}$	0.33	0.31	0.31	0.33	0.32	0.32
OLS R-Squared	0.00	0.08	0.15	0.00	0.07	0.10
Observations	151,281	106,261	106,261	119,279	83,044	83,044
N of Schools	923	891	891	724	712	712
Public schools						
PGA Std. (SD = .1)	0.00	-0.00	0.04^{b}	-0.01	-0.01	-0.01
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
Control Group $\bar{Y}$	0.46	0.44	0.44	0.47	0.47	0.47
OLS R-Squared	0.00	0.11	0.26	0.00	0.11	0.18
Observations	102,534	69,659	69,659	66,054	42,663	42,663
N of Schools	705	685	685	519	510	510
Private schools						
PGA Std. (SD = .1)	0.02	0.01	0.01	-0.01	-0.01	-0.02
	[0.02]	[0.02]	[0.01]	[0.02]	[0.02]	[0.02]
Control Group $\bar{Y}$	0.13	0.13	0.13	0.17	0.17	0.17
OLS R-Squared	0.01	0.06	0.17	0.00	0.07	0.17
Observations	48,747	36,602	36,602	53,225	40,381	40,381
N of Schools	218	206	206	205	202	202
Ind. Controls		X	X		X	X
Regional FE			X			X

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. Protest participation is measured as average school absenteeism in protests days of the first semester. Conditioned school is a dummy that takes the value of 1 if the school was totally, highly or had medium damage that conditioned its usage. Individual controls included are: average attendance in 2009, GPA in 2009, gender, age and mother's years of schooling. Standard errors are presented in brackets and are clustered at municipal level. Significance is marked as follows: a = $p < 0.01$; b = $p < 0.05$; c = $p < 0.1$.

7.2 Pro-Social behavior

One possible explanation that the political science literature and psychological literature have highlighted is that after natural disasters occur, civil society organizations arise in the affected community to help and self-help. This organizations could motivate people in the community to have more prosocial attitudes, lower barriers to organize for other purposes and therefore make the engagement in collective action easier. The effect of natural disasters on social capital has been studied by Hawkins and Maurer (2009) for the Hurricane Katrina, Yamamura (2010) for the Earthquakes of Japan among others. The relation between social capital and political outcomes has been studied by Satyanath et al. (2017) for the entry of the Nazi party in Germany, showing how more socially active cities experienced a faster penetration of the Nazi party.

In this subsection I will explore how different social features were affected by the earthquake. For this purpose, I will use a survey that the Ministry of Education implements jointly with the SIMCE test. In 2010, students of 10th grade had to give the test, and also answer the survey. In this survey, questions about the school, how comfortable it is, how relations are between classmates and schoolmates, and other questions related to the educational process are asked. For testing how the earthquake affected social features inside each school I use variables related to the feeling of satisfaction with the school, how were the relations with classmates, and how high was the level of robbery and violence. To test this mechanisms I use the model described by equations 2 and 3, changing the dependent variable for the ones of interest.

Results for the OLS and IV specifications are presented in Tables 14, 15 and 16. There are no differences between conditioned and non-conditioned schools in the variables regarding school satisfaction. Table 14 shows that both groups seem to be equally happy about attending school, and equally reluctant about changing to other school. With respect to the questions asking about the relations between classmates and schoolmates, Table 15 shows that the earthquake damaged schools present on average around 5 p.p. more probability of having a student that perceives the relations inside the classroom are good, and 6 p.p. of students perceiving schoolmates have a good relation between them. Table 16 shows that students report around 9 p.p. less robbery in schools damaged by the earthquake, and that there are no differences in terms of physical violence inside the schools. Figures 11 to 16 present the reduced form coefficients of the reduced-form specification for 2009 and 2010, suggesting that no differences were present in the questions asked for the previous year.

These results suggest that affected students did not report different levels of satisfaction with their school, but they did report better social relations. This difference in social relations may have made easier the flow of information and the organization between students for engaging in the 2010 protests. Despite of these suggestive results, it must be kept in mind that this survey corresponds only to students of 10th grade in 2010.

Table 14: OLS and IV for students feelings towards their school.

	(1)	(2)	(3)	(4)	(5)	(6)
Happy going to school						
OLS	0.02[c]	0.01	0.00			
	[0.01]	[0.01]	[0.01]			
Instrumented				0.01	-0.00	-0.06
				[0.04]	[0.04]	[0.05]
OLS R-Squared	0.00	0.02	0.02			
First Stage F Stat.				22.91	21.29	20.41
Control Group $\bar{Y}$	0.35	0.36	0.36	0.35	0.36	0.36
Observations	128,923	111,025	111,025	128,923	111,025	111,025
N of Schools	1,703	1,683	1,683	1,703	1,683	1,683
Sad if changed of school						
OLS	0.02	0.01	0.01			
	[0.01]	[0.01]	[0.01]			
Instrumented				0.04	0.05	0.03
				[0.03]	[0.03]	[0.04]
OLS R-Squared	0.00	0.04	0.04			
First Stage F Stat.				23.03	21.36	20.51
Control Group $\bar{Y}$	0.68	0.71	0.71	0.68	0.71	0.71
Observations	128,790	110,922	110,922	128,790	110,922	110,922
N of Schools	1,702	1,682	1,682	1,702	1,682	1,682
Ind. Controls		X	X		X	X
Regional FE			X			X

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. The questionaire applied in the SIMCE 2010 is used. Questions used in this table are 1) Thinking about how you feel today, how happy are you coming to your school?; and 2) How would you feel if you had to change from your actual school?. Responses were dichotomized. For the first question, alternatives were i) Very happy (=1); ii) A little happy (=0); iii) Not happy at all (=0). For the second question options were i) Happy (=0); ii) Indiferent (=0); iii) Sad (=1); Very sad (=1). Individual controls included are: average attendance in 2009, GPA in 2009, gender, age and mother's years of schooling. Standard errors are presented in brackets and are clustered at municipal level. Significance is marked as follows: a = $p < 0.01$; b = $p < 0.05$; c = $p < 0.1$.

Table 15: OLS and IV for students relations within their class and school.

	(1)	(2)	(3)	(4)	(5)	(6)
Good relations. Class						
OLS	0.01	0.01	0.00			
	[0.01]	[0.01]	[0.01]			
Instrumented				0.05[c]	0.04	0.04
				[0.03]	[0.03]	[0.03]
OLS R-Squared	0.00	0.01	0.01			
First Stage F Stat.				23.99	22.24	20.71
Control Group $\bar{Y}$	0.69	0.72	0.72	0.69	0.72	0.72
Observations	124,666	107,364	107,364	124,666	107,364	107,364
N of Schools	1,696	1,672	1,672	1,696	1,672	1,672
Good relations. School.						
OLS	0.00	0.00	-0.01			
	[0.01]	[0.01]	[0.01]			
Instrumented				0.06[b]	0.06[b]	0.06[c]
				[0.03]	[0.03]	[0.03]
OLS R-Squared	0.00	0.01	0.02			
First Stage F Stat.				24.14	22.37	20.75
Control Group $\bar{Y}$	0.63	0.66	0.66	0.63	0.66	0.66
Observations	124,074	106,828	106,828	124,074	106,828	106,828
N of Schools	1,696	1,672	1,672	1,696	1,672	1,672
Ind. Controls		X	X		X	X
Regional FE			X			X

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. The questionaire applied in the SIMCE 2010 is used. Questions used in this table are two: i) Thinking now about what happens in general in your school, how much do you agree with the following phrases? The relationship between students is good. ii) Thinking now about what usually happens in the classroom of your course, how much do you agree with the following sentences? There is a good relationship between most of the classmates in my course. Responses were dichotomized as follows: Strongly agree (=1); Agree (=1); Neither agree nor disagree (=0); Disagree (=0); Strongly disagree (=0). Individual controls included are: average attendance in 2009, GPA in 2009, gender, age and mother's years of schooling. Standard errors are presented in brackets and are clustered at municipal level. Significance is marked as follows: a = $p < 0.01$; b = $p < 0.05$; c = $p < 0.1$.

Table 16: OLS and IV for student violence within their school.

	(1)	(2)	(3)	(4)	(5)	(6)
Frequent theft in school						
OLS	-0.02	-0.02	-0.01			
	[0.02]	[0.02]	[0.02]			
Instrumented				-0.10[c]	-0.09	-0.07
				[0.05]	[0.05]	[0.06]
OLS R-Squared	0.00	0.01	0.01			
First Stage F Stat.				22.83	21.25	20.51
Control Group $\bar{Y}$	0.64	0.66	0.66	0.64	0.66	0.66
Observations	128,644	110,791	110,791	128,644	110,791	110,791
N of Schools	1,703	1,682	1,682	1,703	1,682	1,682
Frequent fights in school						
OLS	0.00	0.00	0.01			
	[0.01]	[0.02]	[0.01]			
Instrumented				-0.00	0.01	-0.01
				[0.06]	[0.06]	[0.07]
OLS R-Squared	0.00	0.02	0.02			
First Stage F Stat.				22.92	21.39	20.66
Control Group $\bar{Y}$	0.66	0.68	0.68	0.66	0.68	0.68
Observations	128,578	110,739	110,739	128,578	110,739	110,739
N of Schools	1,703	1,682	1,682	1,703	1,682	1,682
Ind. Controls		X	X		X	X
Regional FE			X			X

Note: Own elaboration upon data provided by the Ministry of Education and the USGS. The questionaire applied in the SIMCE 2010 is used. Questions used in this table are two: How often have the following situations occurred in your establishment in the last year? i) Robberies or thefts. ii) Fights between partners (pushing, kicking, etc.). Responses were dichotomized as follows: Always or almost always (=1); Sometimes (=1); Never or almost never (=0). Individual controls included are: average attendance in 2009, GPA in 2009, gender, age and mother's years of schooling. Standard errors are presented in brackets and are clustered at municipal level. Significance is marked as follows: a = $p < 0.01$; b = $p < 0.05$; c = $p < 0.1$.

Figure 11: Feeling about the school

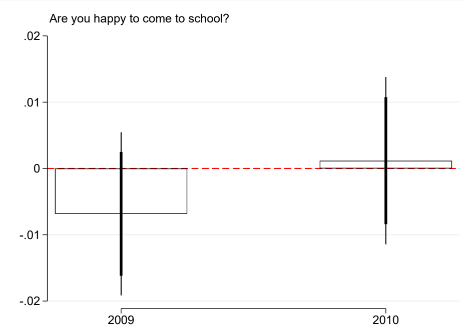


Figure 12: Feeling about the school

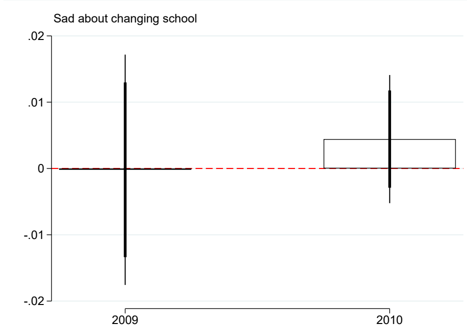


Figure 13: School relations

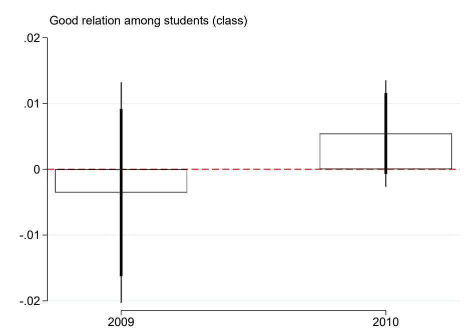


Figure 14: School relations

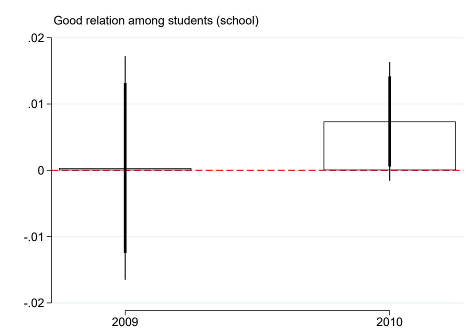


Figure 15: School safety

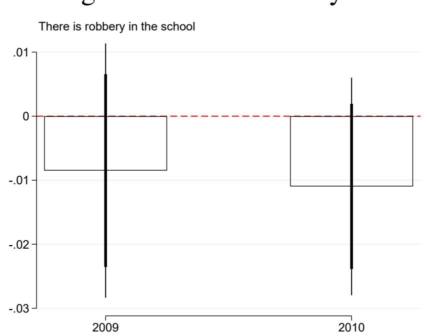
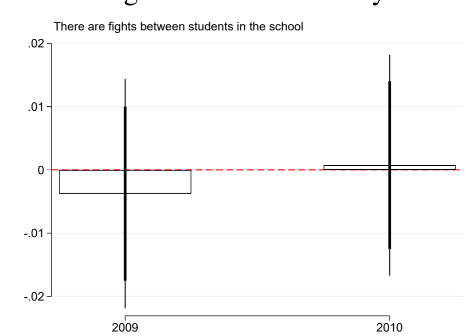


Figure 16: School safety



8 Summary and Concluding Remarks

The reasons for participating in a protest are still an open debate for political economists. This paper presents an effort to shed some light on this topic, and digs in the effect that the damages of a natural disaster has on the decision to protest. The case of study is the effect that the 2010 earthquake in Chile, and how it changed the decision of secondary students to participate in the 2011 Student's Movement protests. The earthquake damaged a large portion of the country schools, producing the loss of infrastructure, classes and forcing the government to provide aid to affected institutions.

Findings show that the damage produced by the earthquake had a positive and significant effect on students protest participation. Students of affected public schools in 2010 participated more in protests of 2011, and the opposite occurred to students in private schools. The reconstruction process seems to be a relevant channel through which the earthquake damage translated to protest participation. Students in schools that had damage that could have been repaired before the start of 2011, but was not repaired until after the start of the Student's Movement, show more participation than those students that had their schools repaired before the start of the protests. Also, students of affected schools show better social relations and less crime inside in their communities, conditions that facilitate the coordination and organization of protests and collective action.

The fact that natural disasters have an effect on political engagement such as protest participation, helps the policy maker in at least two ways. The first learning is that citizens are responsive to bad management of catastrophes, and presumably other events where the government has agency but exerts it poorly. This conclusion may sound obvious but shows that the government has less space to improvise if its goal is to resolve a public problem such as the reconstruction of public schools after a natural disaster. The second learning that can be drawn out of this is that communities with better relations do not only engage more in formal political processes, but also are more prone to organize protests and participate in non-formal political processes. This is useful because it provides empirical support to the prediction of Passarelli and Tabellini (2017) about more cohesive communities protesting more and, following Battaglini (2017), this provides alternative mechanisms for aggregating useful information for policy besides elections and polls.

Finally, future research on this topic could dig in governments optimal reactions to natural disasters, in terms of aid and reconstruction. It is not clear and easy to prioritize the use of resources, and the political consequences should be taken into account. Also, the generalization of the behavior here documented for the Chilean students is not obvious, and studies for other contexts could bring interesting insights.

References

Acemoglu, D., Hassan, T. A., and Tahoun, A. (2017). The power of the street: Evidence from egypt's arab spring. *The Review of Financial Studies*, 31(1):1–42.

Barbera, S. and Jackson, M. (2017). A model of protests, revolution, and information.

Battaglini, M. (2017). Public protests and policy making. *The Quarterly Journal of Economics*, 132(1):485–549.

Berthelon, M., Kruger, D. I., and Sánchez, R. (2018). Maternal stress during pregnancy and early childhood development.

Bueno De Mesquita, E. (2010). Regime change and revolutionary entrepreneurs. *American Political Science Review*, 104(3):446–466.

Cantoni, D., Yang, D. Y., Yuchtman, N., and Zhang, Y. J. (2018). Protests as strategic games: Experimental evidence from hong kong's democracy movement. Technical report.

Carlin, R. E., Love, G. J., and Zechmeister, E. J. (2014). Natural disaster and democratic legitimacy: The public opinion consequences of chile's 2010 earthquake and tsunami. *Political Research Quarterly*, 67(1):3–15.

Chwe, M. S.-Y. (2000). Communication and coordination in social networks. *The Review of Economic Studies*, 67(1):1–16.

Cole, S., Healy, A., and Werker, E. (2012). Do voters demand responsive governments? evidence from indian disaster relief. *Journal of Development Economics*, 97(2):167–181.

Edmond, C. (2013). Information manipulation, coordination, and regime change. *Review of Economic Studies*, 80(4):1422–1458.

Enikolopov, R., Makarin, A., and Petrova, M. (2018). Social media and protest participation: Evidence from russia. *Available at SSRN 2696236*.

Fair, C. C., Kuhn, P. M., Malhotra, N., and Shapiro, J. N. (2017). Natural disasters and political engagement: Evidence from the 2010–11 pakistani floods. *Quarterly Journal of Political Science*, 12(1):99–141.

Gasper, J. T. and Reeves, A. (2011). Make it rain? retrospection and the attentive electorate in the context of natural disasters. *American Journal of Political Science*, 55(2):340–355.

González, F. (2018). Collective action in networks: Evidence from the chilean student movement.

Granovetter, M. (1978). Threshold models of collective behavior. *American journal of sociology*, 83(6):1420–1443.

Hawkins, R. L. and Maurer, K. (2009). Bonding, bridging and linking: how social capital operated in new orleans following hurricane katrina. *British Journal of Social Work*, 40(6):1777–1793.

Jackson, G. (2013). *El país que soñamos*. Debate.

Karnani, M. (2015). Labor shakes: Mid-run effects of the 27f earthquake on unemployment.

Kuran, T. (1989). Sparks and prairie fires: A theory of unanticipated political revolution. *Public choice*, 61(1):41–74.

Kuran, T. (1991). The east european revolution of 1989: is it surprising that we were surprised? *The American Economic Review*, 81(2):121–125.

Lillo, N. (2017). Earthquakes and birth outcomes in chile. *Working Paper (July)*.

Little, A. T. (2016). Communication technology and protest. *The Journal of Politics*, 78(1):152–166.

Madestam, A., Shoag, D., Veuger, S., and Yanagizawa-Drott, D. (2013). Do political protests matter? evidence from the tea party movement. *The Quarterly Journal of Economics*, 128(4):1633–1685.

Manacorda, M. and Tesei, A. (2016). Liberation technology: mobile phones and political mobilization in africa.

Marwell, G. and Oliver, P. (1993). *The critical mass in collective action*. Cambridge University Press.

MINEDUC (2013). *La reconstrucción en Educación*. Ministerio de Educación, Gobierno de Chile.

Morales, M. (2012). Desastres Naturales y Resultados Educacionales: Evidencia a partir del terremoto en Chile 27/F. Master's thesis, Universidad de Chile, Chile.

Olson, M. (1965). *Logic of collective action: Public goods and the theory of groups (Harvard economic studies. v. 124)*. Harvard University Press.

Palfrey, T. R. and Rosenthal, H. (1984). Participation and the provision of discrete public goods: a strategic analysis. *Journal of public Economics*, 24(2):171–193.

Passarelli, F. and Tabellini, G. (2017). Emotions and political unrest. *Journal of Political Economy*, 125(3):903–946.

Pelling, M. and Dill, K. (2006). Natural'disasters as catalysts of political action. *Media Development*, 53(4):7.

Rudolph, L. and Kuhn, P. M. (2018). Natural disasters and political participation: Evidence from the 2002 and 2013 floods in germany. *German Politics*, 27(1):1–24.

Satyanath, S., Voigtländer, N., and Voth, H.-J. (2017). Bowling for fascism: Social capital and the rise of the nazi party. *Journal of Political Economy*, 125(2):478–526.

Tilly, C. (2017). *From mobilization to revolution*. Routledge.

Tullock, G. (1971). The paradox of revolution. *Public Choice*, 11(1):89–99.

Vallejo, C. (2012). *Podemos cambiar el mundo*. Ocean Sur.

Visconti, G. (2018). Self-interested citizens: How disaster victims modify their political priorities.

Yamamura, E. (2010). Effects of interactions among social capital, income and learning from experiences of natural disasters: A case study from japan. *Regional Studies*, 44(8):1019–1032.