Natural Hazards and Retrospective Voting: Evidence from Chile*

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Abstract

Incumbents' electoral outcomes tend to suffer following natural disasters if their response is deemed inadequate. This paper provides new evidence on the relationship between natural disasters and retrospective voting. I exploit the rich variation in earthquake intensity in Chile to study the effect of exogenous income shocks on incumbents' electoral performance through a two-way fixed effects strategy and a linear probability model. The results suggest that earthquake intensity has a positive effect on incumbents' electoral performance. However, these effects are heterogeneous across different types of elections. In particular, I find that earthquake shocks increase both the vote share and the probability of being the most voted candidate for incumbent presidents. In the case of local elections, this positive association extends exclusively to vote shares. Concretely, regression estimates suggest no systematic relationship between earthquake intensity and the probability of being the most voted candidate for local mayors. I contend that these findings do not seem to be driven by incumbents' disaster relief efforts, but rather by their increased media visibility following earthquakes in the case of local elections.

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1 Introduction

Elections are the primary mechanism through which citizens can hold their elected representatives accountable. Indeed, rational choice theory suggests that voters sanction incumbents' inadequate performance through the disciplining effect of elections. Under this framework, representative democracy becomes an effective instrument for aligning the interests of office-holders with that of citizens and improving public welfare. (Barro, 1973; Key and Cummings, 1966). However, the appropriate evaluation of incumbents' performance is hampered by the difficulty in determining the effects of their policies. Additionally, incipient behavioural approaches towards retrospective voting suggest that citizens' evaluation of incumbents may reflect cognitive and emotional biases (Healy and Lenz, 2014). Hence, both information asymmetries and attribution errors present a challenge for the effective exercise of democratic accountability. Given this context, natural disasters operate as exogenous income shocks that provide voters with an opportunity to update their beliefs on incumbents following their response to these events. From an estimation perspective, these shocks also offer researchers the possibility to test how voters react to outcomes unrelated to incumbents' actions after conditioning on disaster relief efforts. In theory, rational voters should effectively filter signal from noise so as to avoid rejecting politicians that are competent yet unlucky (Wolfers, 2002). This thesis provides new evidence on how the occurrence of natural disasters impacts the electoral outcomes of incumbents. In particular, I exploit the rich seismic activity of Chile to compare how the vote share and the probability of being the most voted candidate differ for both incumbent presidents and mayors in municipalities affected and unaffected by earthquakes. Chile is an exceptional case study due to its high variation in earthquake intensity. For example, in 2018, the country experienced over 200 noticeable earthquakes (National Seismological Center of the University of Chile, 2019) while the 2010 Chilean earthquake is considered the sixth strongest of all time (USGS, 2021a). I employ a generalized difference-in-differences strategy with continuous treatment intensity to estimate the impact of seismic activity on the electoral outcomes of incumbent mayors and presidents for elections held between 1993 and 2017. Additionally, I account for the effect of disaster relief efforts from both local and central governments, an aspect that has been widely ignored by the literature preceding Acuña-Duarte and Salazar (2021). Regression estimates suggest that a one-unit increase in earthquake intensity in terms of the Modified Mercalli scale leads to an increase in incumbents' vote shares that ranges from 0.737 to 1.480 percentage points for all types of elections. Similarly, the same increase in intensity is associated with roughly a 0.0131-0.0303 increase in the probability of being the most voted candidate. Further analysis suggests that these results are heterogeneous across presidential and local elections. In particular, incumbents' vote shares and the probability of being the most preferred candidate improve considerably following an increase in earthquake intensity in presidential elections. On the other hand, local mayors experience an improvement in their share of the vote but not in their probability of being the most voted candidate following increases in seismic activity. Finally, I examine potential mechanisms that might drive the observed voting behaviour. Concretely, I focus on news visibility and measures of fiscal performance of incumbents following earthquakes. Spending data is gathered from official sources while information on news visibility is obtained through a web scraping search strategy adapted from Masiero and Santarossa (2021) and Giommoni (2021). This procedure results in a novel data set of news mentions frequencies for both incumbents and their main challengers. The analysis suggests that the positive association between seismic intensity and local mayors' electoral performance seems to be driven by incumbents' increased news visibility following earthquakes rather than by their adequate fiscal response. Anecdotal evidence indicates that the improved electoral outcomes of central governments may require additional explanatory mechanisms. Thus, this thesis sheds new light on the effect of natural disasters on electoral outcomes in Chile, a developing country, while also elucidating the role of the media in shaping political attitudes under the context of adverse economic conditions.

The rest of the thesis is organized as follows. Section 2 reviews the theory and empirical evidence of retrospective voting. Section 3 describes the Chilean institutional context. Section 4 describes the data used and its sources. Section 5 presents the empirical strategy employed to tackle the research question. Section 6 discusses the main results. Section 7 tests the robustness of the results and the underlying assumptions of the empirical model. Section 8 discusses the main findings and examines potential channels driving voting behaviour. Section 9 concludes.

2 Theory and empirical evidence

The literature that studies the determinants of anti-incumbency from a theoretical perspective has a long-standing tradition. In general, most approaches fall into three non-mutually exclusive models of retrospective voting. In the first type of model, anti-incumbent voting is understood as the outcome of an agency problem where voters (principal) are attempting to reduce moral hazard on the part of elected representatives (agents) by sanctioning them citepkey1966responsible,barro1973control. Key and Cummings (1966) argue in their rather informal model of politics that "voters are not fools" (p. 7). Instead, they update their beliefs as information becomes available to them. Barro (1973) later formalized Key's intuition into a model composed of self-interested officeholders. His key conclusion is that the electoral process helps to align the interest of politicians with those of the public. More recently, Wolfers (2002) developed a standard agency model in which voters renew their beliefs in Bayesian fashion. These models predict that voters should not reelect bad politicians nor reward a politician's good luck. In the second type of model anti-incumbent voting is rationalized as a selection problem in which voters elect candidates that maximize their economic expectations. In this line, Fearon (1999) argues that retrospective voting is not necessarily a sanctioning process, but one in which voters select "good types" and take chances if they observe a promising alternative to the incumbent. Finally, behavioural models of voting suggest that electoral outcomes embody attribution errors due to cognitive limitations in voters (Healy and Lenz, 2014; Huber et al., 2012). Under this framework, evaluating a politician's performance is difficult due to their term's duration and the lack of a complete set of information. Voters, then, substitute fundamental but hard to access information for easily available attributes such as recent economic performance. Models of the first or second type operate within the framework of rational choice theory yielding consistent predictions: voters should not punish incumbents for events out of their control. Finding contrary evidence to any of these two models can be interpreted as indirect evidence in favour of behavioural approaches towards retrospective voting.

The empirical literature of retrospective voting also has a sizeable history. Initially, researchers examined the relationship between economic performance — measured through different indicators — and anti-incumbent attitudes. More recently, scholars have focused on the link between local economic conditions and retrospective voting. For example, Margalit (2011) finds a negative association between globalization-driven unemployment and the electoral performance of incumbent presidents. Wolfers (2002) finds that a rise in oil prices leads to a higher probability of reelection for incumbents in oil-producing states from the U.S. Reeves and Gimpel (2012) argue that local conditions, such as home foreclosure rates, have an impact on the electorate's evaluation of the national economy and thus shape attitudes towards political independents. However, new strands of the literature have moved away from research focused on the relationship between economic indicators and political attitudes due to a series of empirical challenges. In particular, the use of different economic indicators can yield contradictory results because said indicators might potentially be in opposition to one another.[1] Additionally, there is a long-standing debate on the degree of influence that elected officials have over economic outcomes (Alesina et al., 1991). Hence, researchers' focus has shifted towards voters' response to events outside the control of incumbents. Earthquakes are but one example of such events. This thesis is framed within this incipient strand of the literature.

In general, the electoral outcomes of incumbents tend to deteriorate following natural disasters if their response is deemed inappropriate (Akarca and Tansel, 2016; Eriksson, 2016). However, evidence on this relationship is still inconclusive. Achen and Bartels (2004) famously argued that incumbents' electoral outcomes tend to suffer following unexpected natural disasters such as floods, droughts or even shark attacks. Subsequent developments in the literature have painted a more nuanced picture of voters' attitudes. Healy and Malhotra (2009) find that voters reward incumbents for their disaster relief efforts, but not for

[1] Should politicians prioritize inflation or unemployment in the short run?

their preparedness and prevention against natural hazards. More recently, Gallego (2018) studied the effect of the 2011 floods and landslides in Colombia, concluding that the cash flow towards incumbents in the form of disaster aid increases funds for vote-buying, thus leading to improved electoral outcomes for incumbents. Masiero and Santarossa (2021) find that the occurrence of significant earthquakes improves the electoral performance of Italian local authorities. Their results seem to be mediated by incumbents' advantage to offer recovery aid and greater media exposure following these disasters. In general, empirical evidence suggests that "voters are not fools" as Key and Cummings (1966) famously argued. Nevertheless, they can still make attribution errors and are susceptible to external biases such as media representation.

With respect to Chile, this work does not materialize in a vacuum, as the literature that studies the effect of natural hazards on political attitudes in Chile has grown considerably over the past decade. Carlin et al. (2014) argue that citizens affected by the 2010 Chilean earthquake lowered their trust in democratic institutions. Their paper takes advantage of survey data captured in the near aftermath of the disaster, which allows them to measure a sense of public mood prior to disaster relief efforts which might confound their analysis. Visconti (2018a) finds that following floods, Chilean citizens tend to prioritize welfare and social policies, in addition to being more likely to vote for left-wing candidates. Visconti (2018b) further studies this relationship by examining the shift in political preferences of victims of the 2010 earthquake. He employs a canonical difference-in-differences model with synthetic controls. The regression estimates seem to confirm his previous findings (Visconti, 2018a) since affected citizens seem to favour policies focused on housing rather than infrastructure. Nevertheless, his work ignores the mediating effect of disaster relief efforts by the government — an omission that casts doubts on his conclusions. Fleming et al. (2014) study the effect of the 2010 earthquake on trust and reciprocity levels of rural villages through a quasi-experimental design. They find that while trust levels did not differ across communities following the disaster, reciprocity decreased significantly in affected areas. Their results shed light on the determinants of social capital accumulation under adverse conditions. Valdivieso and Villena-Roldán (2014) develop a rational choice model to investigate the process of social capital formation. They test this model empirically, finding that trust levels increased in municipalities affected by the 2010 earthquake. However, this effect is conditional on being unaffected by looting and by the tsunami that happened in the aftermath of the disaster. Finally, Acuña-Duarte and Salazar (2021) is the closest piece of research to this thesis. Their theoretical framework is similar to the one assumed here, in the sense that they treat the 2010 earthquake as an exogenous income shock beyond incumbents' control, but that still provides citizens with valuable information regarding incumbents' proficiency. Through a difference-in-differences design, they examine the impact of the disaster on local mayors' electoral performance, finding a positive effect conditional on governments having sufficient levels of human capital endowments. However, it should be noted that Acuña-Duarte and Salazar (2021) do not consider additional significant earthquakes that occurred in municipalities that they treat as control units.[2] This fact casts doubt on the validity of their control group and thus on their findings.

The contribution of this thesis to the literature is fourfold. First, I analyze for the first time the impact of earthquakes on incumbent central governments. Second, I examine these

[2]For example, the Zapallar 2012 earthquake affected central municipalities, which are treated as control units according to Acuña-Duarte and Salazar (2021).

effects in the context of all elections that have occurred since the return of democracy.[3] Third, I consider all significant earthquakes occurred during the whole period without focusing on a specific seismic event as in the rest of the literature. Finally, I consider the effect of the media under the context of natural disasters, a topic still underdeveloped in the greater literature. Hence, this thesis represents the first comprehensive study of the effect of earthquakes on electoral outcomes in Chile.

3 Chilean institutional context

3.1 Presidential elections

Chile is a presidential unitary republic in which democracy is exercised through a highly heterogeneous multi-party system. Since the defeat of dictator Augusto Pinochet in a country-wide referendum held in 1988, executive power has been delegated to the president, who is both the head of government and the leading political authority within the territory. After the return of democracy, seven presidential elections were held in 1989, 1993, 1999-2000, 2005-2006, 2009-2010, 2013 and 2017. One of the main characteristics of the Chilean political landscape is the existence of a plurality of parties ranging from the radical left to the extreme right. Independent politicians unaligned with traditional political parties also have considerable protagonism within Chile's institutional framework. Despite the existence of this broad political spectrum, two main party coalitions have dominated presidential politics since the return of democracy: a center-left bloc — commonly called "Concertación" — and a center-right coalition — usually called "Alianza". These two groups

[3]I omit the 1992 election for reasons explained in Section 3.

have exclusively attained the presidential seat keeping radical parties out of competition for the main office of the executive branch of government. The Chilean electoral system does not allow for the direct re-election of presidents, and thus each coalition internally agrees on a suitable successor (or challenger) to the incumbent president. Incumbents usually follow up by endorsing the candidate chosen by their coalition. However, the endorsed candidate might not necessarily belong to the incumbent's party. For example, in the 2017 presidential election, President Michelle Bachelet from the Socialist Party endorsed Alejandro Guillier, an independent politician aligned with the center-left coalition. Given this context, I focus on the electoral outcomes of the candidate supported by the incumbent coalition. Finally, presidential elections work under the two-round electoral system. That is, if a candidate receives over 50% of the vote in the first round, they are elected immediately; otherwise, the top two preferred candidates face each other in a final round in which the candidate who gets the most votes wins. For election years in which two rounds occurred, I prioritized second rounds over first rounds due to the steady increase of candidates over the years, which has resulted in much more widespread vote distributions. Giving precedence to second rounds keeps the number of candidates consistent over electoral periods and captures the population-wide sentiment regarding the candidate that belongs to the incumbent's coalition.

3.2 Local elections

Chile is organized through 345 municipalities across its territory. Each municipality is governed by its municipal council, in which the mayor performs the primary executive role. There have been seven local elections since the 1988 referendum: in 1992, 1996, 2000, 2004, 2008, 2012, and 2016. During the 1992 election, citizens did not directly elect their mayors. Instead, voters chose the members of the municipal council who in turn represented their parties in a negotiation for the main office. After this election, a few reforms were enacted. In particular, all candidates still shared the same ballot, but mayors were now elected based on who achieved the most votes on the ballot.[4] Since the 2004 election, members of the municipal council and mayors are chosen through different ballots. I decided to discard the 1992 election due to the contrasting nature of its electoral system. In many cases, parties negotiated the mayor's position, and the primary electoral preferences were not respected. Thus, the final panel only includes the electoral outcomes of incumbents from 2000 onward.

Chilean local politics, unlike its presidential counterpart, is characterized by a highly heterogeneous multi-party political landscape. In particular, the two main traditional coalitions exhibit a weaker electoral dominance. For example, a common scenario is for an incumbent to leave their party and run as an independent politician against their previous party. Alternatively, an incumbent may retire from politics at the end of their term and endorse another candidate from their party or coalition. Moreover, coalitions are not fixed, and their composition can change between elections. For instance, the Communist Party operated outside the traditional coalitions in the 1990s and 2000s but briefly joined the center-left bloc between 2014 and 2018. Due to the different scenarios that might appear, I decided to track the incumbent using the following ordering: their name first, their party second, and their coalition third. Finally, it should be noted that many single-issue parties appear during elections under different names.[5] I clustered single-issue parties that share policy

[4]Additionally, the most preferred candidate of each municipality was also required to be part of a coalition or party that achieved over 30% of the preferences. This requirement was lifted in 2004.

[5]For example, regionalist parties tend to change their name but not membership.

interests under the same coalition across the years to give continuity to their presence across the panel.

3.3 Government response to earthquakes

The Chilean constitution outlines a series of regulatory measures in times of catastrophe. In particular, the president has strong discretionary powers. He alone can determine what constitutes an emergency area and the amount of help to be directed towards them. The constitution specifies that the president must work in close collaboration with mayors of affected municipalities and regional authorities. In particular, disaster relief can be captured through public spending, which is categorized into three levels: the regional, the sectoral and the local. While the president is accountable for the first two dimensions of spending, mayors are responsible for the last dimension.

3.4 Central spending

Central spending is defined by its regional and sectoral components, both of which are organized and managed by the Chilean president through their chosen officials. For each region, the president selects a regional governor responsible for executing and designing plans for their respective region in direct cooperation with the president. The spending activities of each governor are funded through their assigned yearly budget, which is initially proposed by the president and approved in its final form by the national congress. Additionally, governors can fund investment initiatives through the National Fund of Regional Development (FNDR). The constitution outlines that regional governors have the duty to prevent and confront natural emergencies and to provide assistance to victims in coordination with other levels of government (Diario Oficial de la República de Chile, 1986a). In general, regional spending is characterized by high levels of investment as opposed to local spending, which is defined by its focus on the funding of communal services.

Sectoral spending is related to the activities and services provided by different ministries and offices of the central government. For example, secondary and tertiary public health services are managed by the Ministry of Health through each of its regional subdivisions. These ministries and offices usually work in close collaboration with regional governments when planning and executing investment projects in a particular region of the country. In general, both sectoral and regional spending are characterized by its strong presidential nature. For example, the legislative discussion of each year's budget bill can be exclusively initiated by the president. Ulimately, it is the president who is held accountable for all regional and sectoral expenditures.

3.5 Local spending

According to the Organic Constitutional Law of Local Governments, spending at the local level is managed by the major of each municipality. More specifically, each local government receives direct and indirect funding through which they finance services related to education, health, culture, social assistance, urbanization, and disaster relief, among others (Diario Oficial de la República de Chile, 1986b). Especially relevant to their activities is the funding and management of primary health care and secondary public education. Usually, these services represent a significant share of the municipal budget. Investment initiatives, including reconstruction efforts, are somewhat limited in scope when compared to the projects managed by the central government.

4 Data

4.1 Elections

Data on presidential and local elections are provided by the Chilean electoral service (Servel, 2016, 2017). For each election year and municipality, I computed two measures of electoral performance: (i) the share of the vote obtained by incumbents expressed in percentage points, and (ii) a binary indicator that equals one when the incumbent is the most voted candidate and zero otherwise. In particular, the share of the vote is computed over the total number of ballots, including null and blank votes. This data set additionally includes the incumbent's gender and their political party affiliation. These variables are also considered in the final data set.

4.2 Earthquake intensity and related natural disasters

Data on earthquake intensity was retrieved from The United States Geological Survey (USGS, 2021). The USGS maintains a collection of rasters — called ShakeMaps — that encode the shaking intensity for significant earthquakes occurred between 1900 to the present at the pixel level.[6] From this collection, I considered earthquakes that occurred in Chile between 1989 and 2017 and that also appear in the database of significant earthquakes from

[6]Earthquakes are classified as significant according to an index that combines magnitude and perceived intensity. In general, an earthquake with an intensity greater than five in terms of the Modified Mercalli scale qualifies as significant.

The National Oceanic and Atmospheric Administration (NOAA, 2021b). This filter yielded a final data set composed of 23 earthquakes. For each seismic event, I considered two different measures of intensity for robustness: the Modified Mercalli intensity scale (MMI) and the Peak Ground Acceleration (PGA). The MMI captures the shaking effect produced by an earthquake at a particular place as reported by observers. The PGA measures the maximum acceleration recorded by an accelerogram at a particular place. Table 1 provides an interpretation and comparison of both measures. For each earthquake and municipality, I computed both the average MMI and PGA. The extraction process involved computing the arithmetic mean of all raster values inside spatial polygons representing their respective municipalities.[7] Finally, for each election year I assign a treatment value equal to the maximum intensity registered between the previous election year and the current election year. If there was no earthquake, the treatment intensity is coded as 0. Figure 1 illustrates the spatial distribution of earthquakes graded by the maximum intensity experienced in each municipality over the entire period of study. In particular, it can be observed that southern municipalities perform the role of control units given their lack of exposure to any significant earthquakes.

For each seismic event, I gathered the maximum height of tidal waves that affected a coastal municipality following a significant earthquake as a way to capture the confounding shock of tsunamis generated in the aftermath of strong earthquakes. These measures were obtained from the "The Global Historical Tsunami Database" maintained by (NOAA, 2021a). Additionally, I account for the myopic attitude of voters by incorporating the number of days between the date of the main earthquake and the day of the election. If no

[7] Shapefiles containing the spatial polygons are provided by the Library of the Congress of Chile (Biblioteca del Congreso Nacional de Chile, 2021).

earthquake intensity is recorded between two elections, this variable is coded as the number of days between elections. Finally, I incorporated the number of earthquakes between elections as a measure of potential foreshock seismic activity. I further discuss the role of this variable in Section 8.1.

4.3 Characteristics of municipalities

Information on employment levels, income, literacy rates, poverty rates, and years of schooling were extracted from the National Socioeconomic Characterization Survey (CASEN). The Chilean government has administered this nationwide survey since 1985 between October and December of each survey year (Ministerio de Desarrollo Social y Familia., 2017b). For each control variable, I computed the weighted mean in accordance with the sampling weights provided by the Chilean government. For election years in which the survey was not administered, I use variables from the most recent survey year. Figure 2 illustrates the coverage of the survey over the years. It can be observed that the survey's coverage has steadily increased across the years. A potential issue that might arise is the insufficient coverage during its earlier years. Since most of the variation in earthquake intensity comes after 2000, I believe this a minor issue. Finally, population estimates were taken from the National Institute of Statistics (Instituto Nacional de Estadisticas, 2018).

4.4 Local spending and central investment

Data on expenditures executed by local governments were retrieved from the National System of Municipal Information (SINIM, 2020) and the General Accounting Office (Contraloría General de la República, 2020).[8] The combination of both sources yielded a panel of 345 municipalities from 2000 to 2017. For each election year, per capita spending is defined as the cumulative per capita expenditures executed between the previous election year and the year prior to the current election year. The current election year is omitted because it belongs to the next electoral cycle, and thus expenditures executed during that year will, for the most part, executed by the new incumbent.

Unfortunately, information regarding sectoral and regional expenditures has not been officially disaggregated at the municipal level. Nevertheless, one dimension of spending can still be computed: public investment. This information was retrieved from the Integrated Bank of Projects (Ministerio de Desarrollo Social y Familia., 2017a), a system of information maintained by the Chilean government that contains all investment initiatives that apply for public funding. I only consider investment initiatives that advanced to their execution phase. Additionally, I filtered out initiatives formulated or financed by municipal governments to avoid double counting. The end result is a panel of yearly investment data for all municipalities observed between 1996 and 2020. Similar to local spending, I computed the cumulative central investment between election years in per capita terms. Finally, some investment projects might concern more than one municipality at a time. The Integrated Bank of Projects identifies such projects at the regional level without defining their municipal components. I further disaggregated this residual investment through a process discussed in Section A1 of the Appendix. This process resulted in two measures of central investment: the simple cumulative central investment and an estimated cumulative central investment

[8] Local spending information between 2001 and 2017 was retrieved from SINIM while information for the year 2000 was provided by the General Accounting Office.

which incorporates the non-disaggregated residual.

I recognize that by neglecting non-investment central spending, I will be omitting a relevant variable as investment only represents about 8% of total public expenditures executed by the Chilean government (OECD, 2020). However, disaster relief is performed mainly through reconstruction efforts which are categorized as investment. Thus, these variables are the best proxy for the confounding effect of disasters given the available data.

Lastly, the final data set of all elections results from merging two independently constructed panels of local and presidential elections. This implies that variables capture changes that occurred between elections of the same type. For example, imagine the following schedule of elections: a local election in 2011, a presidential election in 2013, a local election in 2015, and a presidential election in 2017. Then, the cumulative spending for the year 2017 is coded as the total spending executed between 2013 and 2016. Contrarily, computing spending in 2017 as the total spending between 2016 and 2015 omits a relevant fraction of the spending executed by the incumbent. The same structure applies to earthquake intensity. Suppose the strongest earthquake experienced in a municipality between 2011 and 2017 occurred in 2014. Then, the intensity of this event is assigned to both 2015 and 2017. By constructing the data set in this way, I am accounting for all relevant changes between electoral rounds of the same type.

Table 2 reports descriptive statistics of the main variables for both treated and untreated municipalities. In accordance with Masiero and Santarossa (2021) and Belloc et al. (2016), I define the treatment group in a given year as all municipalities that experience an earthquake with an MMI greater than 5.[9] In particular, Table 2 evidences that differences in covariates

[9] Masiero and Santarossa (2021) and Belloc et al. (2016) use this definition not only for their descriptive

between affected and unaffected municipalities are not outstanding. This situation serves as modest evidence in favour of the exogeneity assumption of earthquakes. I further explore this premise in Section 7. Finally, a simple table of summary statistics is provided in Table 3.

5 Empirical strategy

I employ the two-way fixed effects (TWFE) estimator with the particularity of having continuous treatment intensity. Concretely, I estimate the following baseline model where m indexes municipality and t indexes year:

$$y_{m,t} = \gamma_m + \lambda_t + \beta Intensity_{m,t} + \delta LocalExp_{m,t} + \theta CentralInv_{m,t} + X_{m,t}\Gamma + \varepsilon_{m,t} \tag{1}$$

Concretely, $y_{m,t}$ represents two potential electoral outcomes: (i) the share of the vote obtained by the incumbent, and (ii) a binary indicator that equals one when the incumbent is the most voted candidate. When $y_{m,t}$ represents the binary indicator equation 1 becomes a linear probability model. Under this specification, the estimates closely approximate the marginal effects of each variable. β is the main parameter of interest. $Intensity_{m,t}$ represents earthquake intensity in terms of the Modified Mercalli scale. In Section 7 I further test the robustness of this specification by using the Peak Ground Acceleration as the indicator of intensity. $LocalExp_{m,t}$ and $CentralInv_{m,t}$ stand for cumulative local spending and cumulative central investment, respectively. $X_{m,t}$ is a matrix of additional controls including characteristics of municipalities, characteristics of candidates, and potential confounding disaster

statistics but also in their empirical strategy. I do not follow them in their convention for the latter.

shocks. Under this framework, random timing and assignment of earthquakes suffice for the identification of the treatment effect. However, threats to the validity of the estimates still exist in the form of confounding shocks that coincide with the timing of each earthquake and are correlated with it. I explore potential threats to the validity of the estimates in Section 7. Finally, I estimate the following model with leads and lags:

$$
\begin{aligned}
y_{m,t} = \gamma_m + \lambda_t + \sum_{\tau=0}^{m} \beta_{-\tau} Intensity_{m,t-\tau} + \sum_{\tau=1}^{q} \beta_{+\tau} Intensity_{m,t+\tau} \\
+ \delta LocalExp_{m,t} + \theta CentralInv_{m,t} + X_{m,t}\Gamma + \varepsilon_{m,t}
\end{aligned}
\tag{2}
$$

This specification serves two purposes. First, it allows for the estimation of the dynamic effects of earthquakes through time. Second, it acts as a falsification test in relation to the exogeneity assumption of the treatment variable. The idea is that, conditional on municipality and year fixed effects, an earthquake in the next period should not significantly affect the electoral outcomes from the current period. Hence, we expect statistically insignificant leads since an opposite result might indicate anticipatory behaviour by voters. Such behaviour would serve as problematic evidence against the main assumptions underlying earthquake occurrence.

6 Empirical estimates

6.1 All elections

Tables 4 and 5 report estimates for variations of equation 1 using the share of the vote obtained by the incumbent and the first preference binary indicator as outcome variables, respectively. In both cases, earthquake intensity is measured through the Modified Mercalli scale, and all types of elections are included. Column (1) employs municipality and time fixed effects in addition to concurrent disaster shocks such as tsunamis and foreshock seismic activity proxied through the number of earthquakes occurred between elections. Column (2) incorporates controls related to elections such as party fixed effects, the incumbent's gender, temporal proximity to the main earthquake, and the total number of candidates. Column (3) adds characteristics of municipalities such as employment, log-income per capita, literacy rates, poverty rates, and years of schooling.[10] Column (4) includes measures of fiscal performance in the form of local public spending and central government investment. Column (5) follows up by employing the disaggregated measures of investment explained in Section A1. Column (6) adds a municipality-specific linear time trend.

The estimates from Table 4 imply that an increase in earthquake intensity has a positive effect on the share of the vote obtained by the incumbent. In particular, the implied increase in the share of the vote obtained by the incumbent associated with a one-unit increase in earthquake intensity ranges from 0.737 to 1.480 percentage points and is significant at the 99% confidence level for all specifications. This result is robust to the inclusion of election-related controls in column (2), to the addition of municipal covariates in column (3) as

[10] Population is omitted since all variables are already normalized according to the population size.

well as to the addition of government spending in columns (4)-(5) and a linear time trend in column (6). Of particular interest is the lack of statistical significance of disaster relief efforts from the government. Similarly, Table 5 suggests that the effect of earthquake intensity on the probability of being the most voted candidate is positive and robust. Concretely, a one-unit increase in intensity implies an increase in the probability of achieving a simple plurality that ranges between 0.0131 to 0.0303. All specifications are significant at the 95% confidence level, and these findings are robust to the inclusion of electoral controls in column (2), to the addition municipality covariates in column (3), and disaster relief efforts in columns (4) to (6). As before, implied in these estimates is the idea that voters are indifferent to relief efforts.

Next, I analyze the dynamic effects of earthquakes on electoral outcomes as defined in equation 2. Figure 3 graphs the coefficients of this event study setting using the share of the vote obtained by the incumbent as the dependent variable. Control variables used include concurrent disaster shocks, municipality covariates, and spending variables as in column (4) of Table 4. The regression exhibits a statistically insignificant lead at the 95% confidence level, which suggests that no consequences in the share of the vote obtained by the incumbent can be observed before an increase in earthquake intensity. This is a favourable result when considering the exogeneity assumption briefly mentioned in Section 5. The statistically insignificant lags suggest that the positive effect of earthquake shocks on incumbent's electoral outcomes is short-lived and does not survive into subsequent electoral rounds. Figure 4 graphs the coefficients for an identical event study setting but using the first preference binary indicator as the dependent variable. The estimates yield similar conclusions as both leads and lags are insignificant at the 90% confidence level. That is, the positive effect of earthquake shocks on incumbents' probability of being the most voted candidate is brief. Additionally, no anticipatory effects can be observed. These findings lend credibility to behavioural approaches to retrospective voting rather than to models based on rational choice theory since citizens seem to reward politicians for events unrelated to their actions. Next, I analyze the degrees of heterogeneity in these results by examining presidential and local elections separately.

6.2 Presidential elections

Table 6 and 7 report estimates for presidential elections and their columns follow the same structure of Table 4 and 5. The gender of the incumbent, the number of candidates in each election, and party fixed effects are omitted because these variables remain constant across municipalities in any particular year. In general, the results seem to confirm previous estimates: an increase in earthquake intensity is associated with an improvement in electoral performance. Particularly, a one-unit increase in intensity is associated with an increase in the share of the vote obtained by the incumbent that ranges from 1.205 to 2.057 percentage points. These findings are robust to different specifications and are significant at the 99% confidence level. Similarly, Table 7 implies a positive association between earthquake intensity and the probability of being the most voted candidate. Concretely, the implied effect of a one-unit increase in the Modified Mercalli scale on the probability of achieving a simple plurality ranges between 0.0369 to 0.0755. The estimates are significant at the 99% confidence level in each specification.

6.3 Local elections

Table 8 and 9 reports estimates for local elections and their columns follow the same format of Table 4 and 5. The results from 8 suggest that the effect of earthquake intensity on the share of the vote obtained by the incumbent mayors is positive but not as robust as in the case of their presidential counterparts. Concretely, a one-unit increase in intensity is associated with an improvement in incumbents' vote shares that ranges from 0.444 to 1.006 percentage points. All estimates are significant at the 90% confidence level except for column (6), which incorporates a municipality-specific linear time trend. Finally, estimates from Table 9 suggest that the effect of seismic activity on the probability of being the most voted candidate in a municipality is both insignificant and ambiguous. None of the estimates are significant at the 90% confidence level except for column (6), which suggests a negative effect. It can be said with confidence that there is no systematic relationship between earthquakes and first preference probabilities for local mayors. Given that Chile is a strong unitary presidential republic, the heterogeneity in these findings might indicate that voters are more likely to assign responsibility to presidents for the occurrence of natural disasters.

7 Exogeneity of earthquakes and robustness checks

In this section, I explore the identifying assumptions of the baseline regression model. The identification of the parameter of interest in equation 1 rests on the assumptions of conditional unconfoundedness and common support. The former implies that outcomes are independent of treatment assignment conditional on covariates. The latter requires that each municipality has a positive (and less than unity) probability of being treated. The assumption of common support can be quickly corroborated after looking at the seismic history of Chile. Figure 5 shows all earthquakes with a magnitude greater than 5 in the Richter scale occurred in the country since 1900 according to the ANSS Comprehensive Earthquake Catalog (USGS, 2021b). In particular, it can be observed that all highly populated areas of the country have been affected by strong earthquakes. Austral municipalities, which serve as the control group in the main sample, have been affected too. Omitted in this figure due to limitations in the data is the famous Punta Arenas earthquake from 1893, which affected Chile's southernmost region and allegedly had an intensity of IX in the Modified Mercalli scale.

The assumption of conditional unconfoundedness is harder to demonstrate. At first sight, it is evident that the treatment will depend on at least some unobservables. For example, even if an earthquake's occurrence and magnitude do not depend on the quality of the soil, its destructive effects — that is, its intensity — might depend on it. Similarly, certain geographical locations have a greater propensity to being affected by earthquakes. Additionally, some municipalities have a persistent political culture that translates into a fixed advantage for candidates aligned with a given ideology. For example, the north of Chile has a political tradition rooted in strong syndicalism derived from the mining industry that has operated for decades in the region. Such municipalities have exhibited a historical preference toward left-wing candidates. It can be concluded that omitting these variables might induce bias in the regression estimates. I contend that the baseline specification takes care of confounding factors of this nature through municipality fixed effects under the assumption that said variables remain constant across time at the municipal level while allowing for heterogeneity across units. Another unobservable which might potentially confound the analysis is technology. As society advances, new construction techniques and technologies are devised against earthquakes. For example, housing legislation in Chile has a record of consistently considering the effects of earthquakes and improving upon previous legislation. Thus, all constructions must fulfill a series of regulations that ensure a certain level of homogeneity in their capacity to stand seisms.[11] Similarly, technology shapes the way citizens relate to their politicians through elements such as social media, leading to shifts in political attitudes. The baseline specification is robust to confounding factors of this type (i.e., variables which vary across time yet are homogeneous at the national level) because of the inclusion of year fixed effects. Next, it must be noted that the empirical strategy will not sufficiently account for variables that vary across municipality and time while also being correlated with earthquake intensity. For example, the destructiveness of earthquakes is mediated by disaster relief or by potential tsunamis generated in the aftermath of the disaster. These variables should be explicitly incorporated into the regression model as they are correlated with earthquake intensity and vary across municipality and time. Omitting mediators of this nature might lead to biased estimates of the direct effect of intensity on electoral outcomes. Finally, and more importantly, omitting confounders that vary across municipalities and time might cast doubts over the validity and interpretation of the results. For example, one might be worried about the potential bias introduced by the relationship between political corruption, earthquake intensity and electoral outcomes. However, as long as corruption is uncorrelated with earthquake intensity, the results will remain robust. In general, it is impossible to produce

[11]Specifically, both NCh 433 and NCh 2369 are the current documents that define standards regarding this issue.

an exhaustive list of all relevant confounders. Considering all these issues, I argue that the random nature of earthquakes conditional on fixed effects suffices for the robust estimation of the parameter interest. As evidence for the exogeneity of earthquakes, I estimate a fixed effects regression of earthquake intensity on covariates that are expected to be randomly distributed between municipalities affected and unaffected by earthquakes. Concretely, in this regression, we expect insignificant coefficients for the effect of each covariate on earthquake intensity. Table 10 reports the results. The estimates suggest that covariates do not exhibit consistent correlation with earthquake intensity as measured by the Modified Mercalli scale, the Peak Ground Acceleration, or the log-PGA. Concretely, the variable years of schooling is significant at the 10% level in columns (1) and (3), which use MMI and log-PGA as measures of intensity, respectively. However, the significance of this variable does not extend to column (2), which uses PGA. Finally, population seems to be a significant predictor at the 95% confidence level for PGA, but this result is not robust across specifications. In general, the estimates suggest no systematic association between intensity and covariates. In conclusion, this informal exogeneity test fails to disprove the main identifying assumption of conditional unconfoundedness.

Finally, I provide a series of robustness tests for the main findings. First, I reconsider equation 1 but using log-PGA as the measure of earthquake intensity. Estimates for the panel of all types of elections are reported in Table 11 and 12. The estimates seem to confirm the previous results, adding to their robustness. Second, I perform a placebo test on the baseline model by replacing the dependent variable with an unrelated outcome. Concretely, I examine the association between earthquake intensity and the minimum temperatures experienced during January of each election year conditional on covariates. We expect the coefficient for the main regressor to be insignificant. Table 13 reports the results for this model using both MMI and log-PGA as measures of earthquake intensity. None of the coefficients for both measures are significant. This result supports the validity of the primary findings.

8 Discussion and potential mechanisms

8.1 Main results

Thus far, I have interpreted the positive coefficient of earthquake intensity in the main regression results as an indication that natural disasters lead to improved electoral outcomes for incumbents. However, the regression estimates also imply that the number of earthquakes occurred between elections has a negative effect on pro-incumbent electoral outcomes as evidenced in Table 4 and 5.[12] Moreover, the correlation between earthquake intensity and the earthquake count is about 0.88, a rather odd statistic when considering the conflicting sign of their coefficients. In part, this result can be explained by the time placement of the main seismic events in relation to additional minor earthquakes. Figure 6 presents the mean intensity of earthquakes conditional on their time placement with 95% confidence intervals. The figure suggests that strong and weak earthquakes are associated with lateness and earliness, respectively. Thus, a strong earthquake is usually preceded by a series of relatively weaker earthquakes. In the earth sciences, this phenomenon is known as *foreshock seismic activity* (USGS, 2021). For my particular data set, about 54.59% of earthquakes with an intensity greater than 5 in the Modified Mercalli Scale exhibit signs of foreshock

[12] Tsunami height also has a negative effect, but the estimates for this regressor are consistently insignificant.

activity of at least two minor earthquakes. Given this context, the negative coefficient for the number of earthquakes occurred between elections can be seen as disciplining behaviour from citizens. Concretely, I contend that the electorate punishes incumbents for the lack of preemptive measures against stronger earthquakes. That is, voters do not punish incumbents if an earthquake cannot be foreseen at all. On the other hand, voters potentially sanction incumbents due to their insufficient proactivity against earthquakes.

8.2 Government response to earthquakes

As suggested by the literature, a positive association between incumbents' electoral outcomes and natural disasters can be driven by their adequate response to the crisis. (Bechtel and Hainmueller, 2011; Gasper and Reeves, 2011; Healy and Malhotra, 2009; Masiero and Santarossa, 2021). I examine this potential mechanism through a simple fixed effects model in the spirit of Masiero and Santarossa (2021). That is, I estimate equation 1 substituting the dependent variable by a series of spending indicators and controlling for covariates. I present the results for all three panels.

In general, the estimates from Table 14 suggest that an increase in earthquake intensity is associated with a decrease in all types of government expenditures per capita in all panels. This result is especially robust for spending executed by local governments. However, this relationship is somewhat puzzling given the positive association between intensity and electoral performance. For example, Masiero and Santarossa (2021) suggest that the improvement in electoral outcomes for Italian mayors following the occurrence of significant earthquakes is channelled by greater spending, investment and transfers from central governments in the prelude to electoral rounds. A similar conclusion is derived by Gasper and Reeves (2011) who argue that governors' electoral outcomes are highly dependent on their responsiveness to weather events. This result does not extend to Chile as suggested by both regression estimates and additional anecdotal evidence. Consider the case of Constitución, a small municipality strongly affected by a 29-meter tsunami in the aftermath of the 2010 earthquake. All evidence suggests that the central government underperformed in their reconstruction efforts. For example, in February 2011, one year after the disaster, the city's mayor claimed that "not a single house has been rebuilt yet" (El Mercurio, 2011a). Similarly, a news article from December 2011 reports on an agreement between the Ministry of Finance and private banks to reach a "sustainable solution" to reconstruct the city almost two years after the disaster (El Mercurio, 2011c). Private initiatives such as the NGO *Desafío Levantemos Chile*[13] suggests that the government was an insufficient actor in terms of disaster aid. These pieces of evidence corroborate the narrative, which paints both central and local governments as relatively inactive actors with respect to their reconstruction efforts and their spending activities. In the light of this evidence, additional mechanisms are required to explain the positive association between incumbents' electoral outcomes and earthquake intensity.

8.3 Media visibility

The relationship between political attitudes and media visibility is a well-studied subject within the literature (Giommoni, 2021; González and Prem, 2018). In general, it is understood that news visibility can produce shifts in public opinion and bias voters towards

[13] The name of this NGO translates to *Let's Raise Chile Challenge*. Their mission statement can be found at https://desafiolevantemoschile.org/

some politicians (Hetherington, 1996). However, research on this topic under the context of natural disasters is still limited. In what follows, I adapt the search strategy used by Masiero and Santarossa (2021) and Giommoni (2021) to measure media visibility. Through a web scraping process, I count the mentions of incumbent mayors and their main challengers in newspapers belonging to *El Mercurio S.A.P*, a Chilean news conglomerate that owns 21 regional newspapers in addition to their main national journal *El Mercurio*. In particular, I compute the news frequency for each candidate between the date of the current election and the date of the previous electoral cycle.[14] I use newspapers belonging to *El Mercurio*'s network due to the longevity of the conglomerate and because of their reliable search engine. Figure 7 suggests that news mentions are statically greater for incumbents in municipalities affected by significant earthquakes than for incumbents in unaffected municipalities. On the other hand, the occurrence of significant earthquakes does not seem to significantly affect the news visibility of incumbents' main challengers, as suggested by their overlapping confidence intervals. This visualization suggests that newspapers can indeed bias the electorate towards incumbents. This bias, however, does not seem to be driven by news networks' partisan attitudes as suggested by DellaVigna and Kaplan (2007), but rather by the simple exposure effect that is supplied to incumbents following natural hazards. I provide further evidence of this association by employing a simple fixed effects regression in which the outcome variable is the percentage difference in news frequency between incumbents and main challengers. This specification has the advantage of controlling for the population size through the outcome variable. Table 15 reports the results. The regression estimates suggest that shaking intensity positively correlates with the percentage difference in news frequency between in-

[14] A more detailed explanation with screenshots is provided in Section A2 from the Appendix.

cumbents and their main challengers. These findings are consistent with the conclusions of Masiero and Santarossa (2021), and they suggest that media visibility is a relevant channel for the improved electoral performance of local incumbents in municipalities affected by earthquakes. Some anecdotal evidence points out that incumbent mayors did enjoy greater media visibility following earthquakes. However, this media visibility was not necessarily linked to greater spending. As mentioned before, Constitución's mayor denounced the lack of disaster aid from the central government following the 2010 earthquake (El Mercurio, 2011a). On a similar note, Tomé's mayor stated that all reconstruction efforts initiated by the central government had been a "failure" (El Mercurio, 2011b). Both news articles report on local mayors criticizing the central government for their unsatisfactory management of the crisis. Given that Chile is a strongly concentrated presidential system, it is expected that presidents should have a larger contribution in the reconstruction process than mayors. The evidence presented here makes sense of the results found for local elections, where estimates suggest that earthquakes positively affect vote shares but not the probability of achieving a first preference. In particular, I contend that greater news visibility helps incumbent mayors, but this effect is not strong enough for them to win elections. This is because the electorate is more likely to identify the responsibility of earthquakes with the central government. Finally, it is not possible to affirm that these results extend to the case of incumbent presidents. If anything, the anecdotal evidence presented here paints the central government in a negative light. Moreover, the media presence of presidents is consistent and abiding across the whole territory. This makes it difficult to believe that media visibility might drive their results. Hence, additional channels are required to explain the relationship between the electoral performance of incumbent presidents and earthquake intensity. In particular, I contend that a more complete account of central government expenditures is needed to draw any meaningful interpretation out of the regression results for presidential elections as data on central investment activities might not be a sufficient proxy for disaster relief efforts.

8.4 Alternative mechanisms

Finally, I explore alternative mechanisms that might drive the positive association between intensity and electoral outcomes. First, it can be argued that variables correlated with intensity and that affect electoral outcomes have been omitted from the analysis. This issue was discussed in Section 7 in which I informally failed to corroborate said concerns. Second, it might be argued that the direction of causality flows in the opposite direction (i.e., that electoral outcomes cause higher earthquake intensity). I contend that given the random nature of the main regressor and the insignificant leads from the event study plots presented in Figure 3 and 4 it is hard to argue in favour of this hypothesis. Finally, thus far, I have argued that the empirical estimates suggest irrationality in the behaviour of citizens as they seem to reward incumbents for events unrelated to their actions. This is in line with standard interpretations of the literature (Healy and Malhotra, 2009; Wolfers, 2002). However, it is still possible to rationalize the observed voting behaviour. In particular, one might theorize that citizens value stability during times of crisis hence leading to improved electoral outcomes for incumbents. For example, in September 2020, British Columbia's Premier John Horgan from the New Democratic Party called a snap election, citing the need for a majority government capable of ruling without political uncertainty in times of a global pandemic (Lindsay, 2020). The New Democratic Party subsequently obtained a majority in the Legislative Assembly of British Columbia. I argue that this hypothesis holds some value. For example, if a strong earthquake were to happen in close proximity to an election, then the positive association between intensity and electoral performance might be explained by citizens' preference toward stability. Nevertheless, against this hypothesis is the fact that presidents and majors have fixed terms in Chile. In this sense, an incumbent's advantage could be explained through this mechanism only when the proximity between earthquakes and elections is high enough. If the proximity between elections and earthquakes is low, then this mechanism becomes less plausible considering that the disaster is an issue of the past rather than the present. The desire for higher stability, in such cases, cannot be a driving force under the assumption that the climax of the disaster has already been overcome.

While it is not possible to thoroughly evaluate this interpretation in the absence of data on voters' preferences at the individual level, it should still be noted that the mean proximity between the main seismic event and an election conditional on positive earthquake intensity is 868.5 days or about 2.5 years. This statistic suggests that this mechanism is improbable in the context of the average earthquake. Nevertheless, it is not possible to completely rule out this mechanism when earthquakes happen near elections. As an additional note, this interpretation of the results might lead to a critique of the normative value of democracy. Concretely, under this interpretation, rational citizens are voting in ways that derange the interests of elected representatives from the public's interest due to a lack of sanctioning behaviour from the electorate. Thus, the welfare-enhancing appeal of democracy loses merit.

9 Conclusion

Democracy is our primary instrument for political accountability. In an ideal world, rational citizens equipped with complete information would sanction politicians who underperform at their job. However, information asymmetries and the myopic nature of voters cast doubt on the effectiveness of democracy as a welfare-enhancing tool. Natural disasters provide a favourable contingency to examine the relationship between voters' attitudes towards incumbents and politicians' ability to manage and recover in the aftermath of such events. This thesis provided new evidence on this link. In particular, I exploited the rich variation in earthquake intensity within the Chilean territory to contrast the electoral performance of incumbents in affected and unaffected municipalities. I found that increases in earthquake intensity are associated with a higher probability of being the most voted candidate and with larger vote shares for incumbents. Nevertheless, these results exhibit some heterogeneity. In particular, both presidents and local mayors experience an increase in their share of the vote following the occurrence of significant earthquakes. However, only presidents experience a positive effect on the probability of being the most voted candidate in a given municipality. An additional finding is that the quantity of earthquakes between elections seems to negatively affect incumbents' electoral outcomes. I argued that the dissonance between the marginal effects of earthquake intensity and the earthquake count is explained by the phenomenon known as *foreshock earthquakes.* Concretely, a high frequency of smaller earthquakes might be a premonitory indicator of a stronger future earthquake. The lack of preparedness on the part of incumbents' given these signals might partially explain the sign of this coefficient. Finally, I discussed two potential channels of causality: disaster relief and media visibility. I found that government spending does not correlate positively with the intensity of earthquakes. Instead, media presence is a more likely driver of the observed results. However, this mechanism only seems appropriate as a driver of voting behaviour in the case of local elections. Additional channels are still required to understand the positive effect between intensity and incumbents' electoral outcomes for presidential elections. These findings lend credibility to behavioural theories of retrospective voting rather than to models of rational choice.

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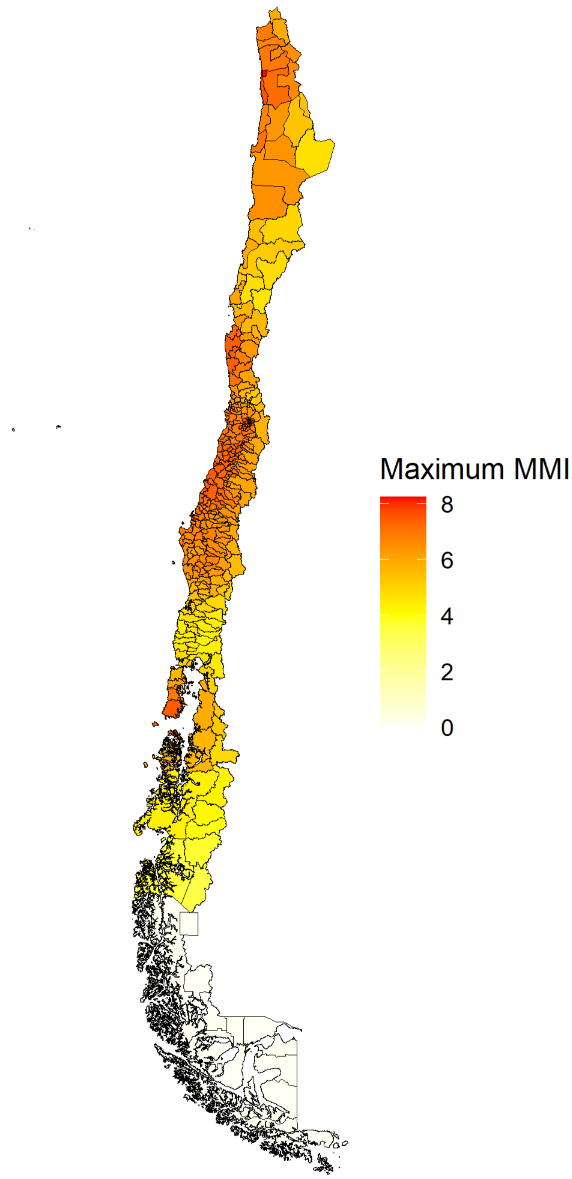
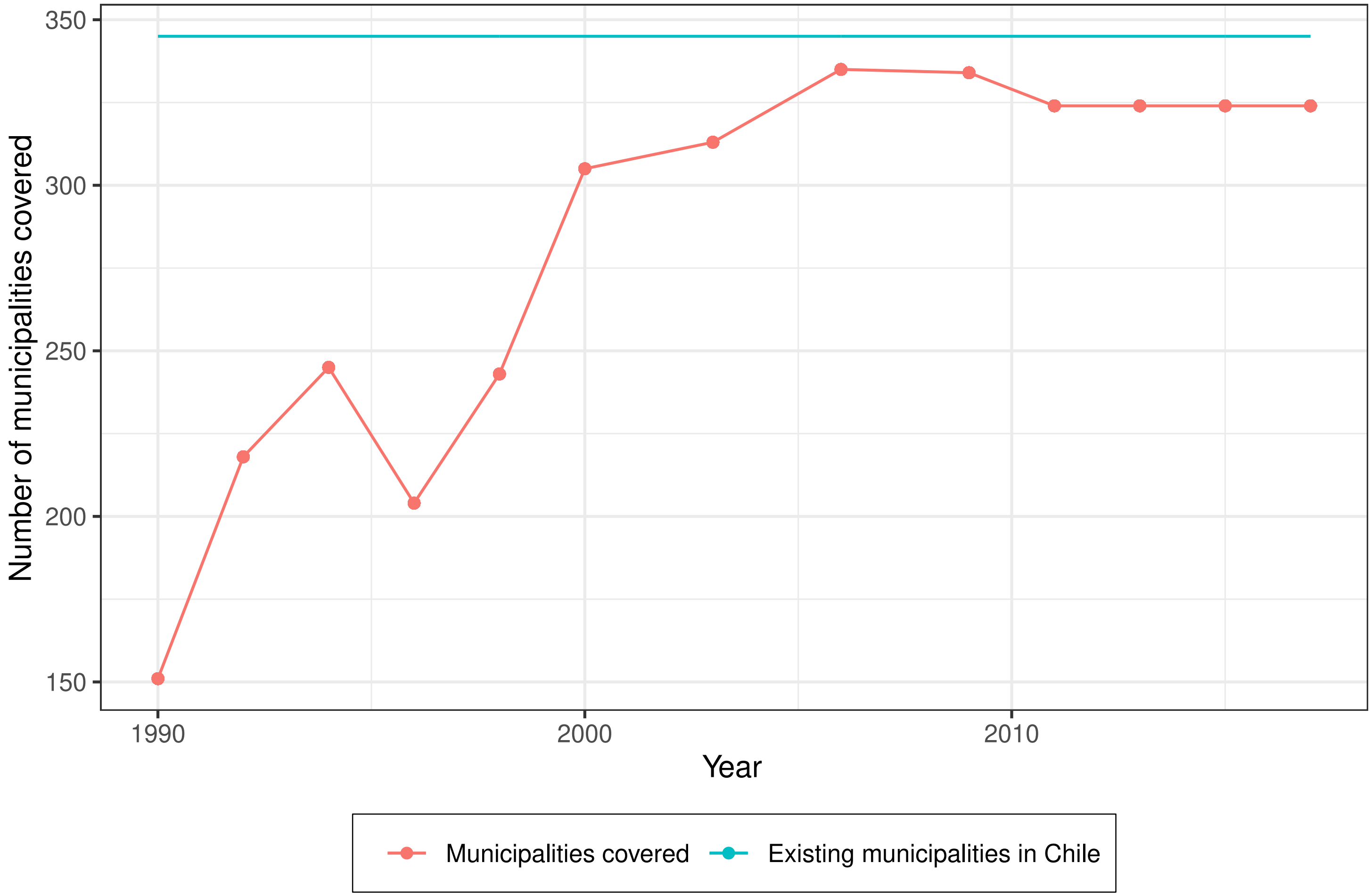
10 Figures

Figure 1: Maximum earthquake intensity by municipality between 1989-2017



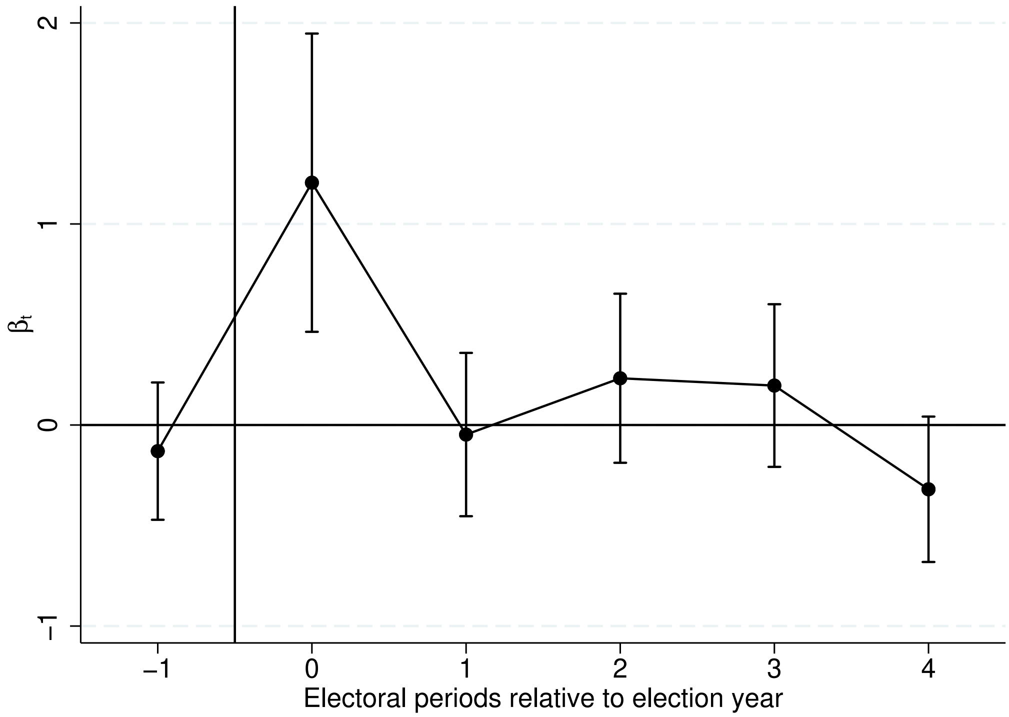
Intensity is measured using the Modified Mercalli scale. Each municipality is coloured according to the maximum intensity experienced between 1989 and 2017.

Figure 2: Coverage of the CASEN survey across the years



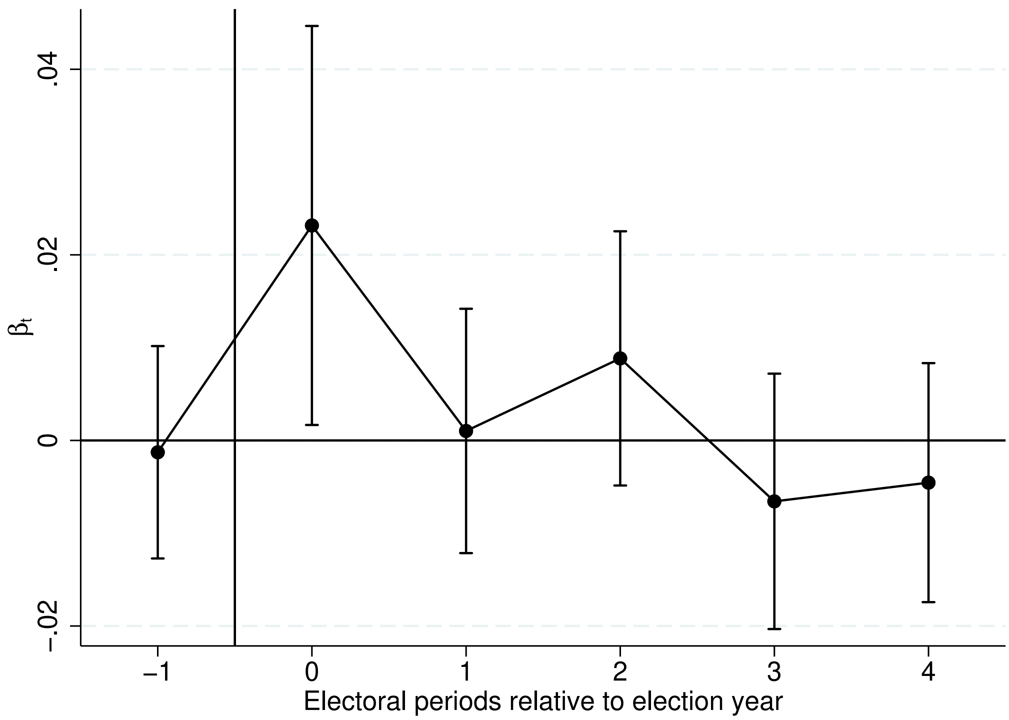
The coverage of the CASEN survey was limited during its early years. Because of this, the panel is highly unbalanced in early elections. Since the 2000 election the panel is more balanced with over 300 municipalities being covered.

Figure 3: Event study using share of the vote as outcome variable



This is a graphical representation of the estimated β_t coefficients from model 2. I particular, I include one lead and four lags. The specification follows the controls used in column (4) of Table 4. The vertical line represents the earthquake shock before the current election and the 0-index stands for the timing of the current election round. Circles represent point-estimates which are vertically surrounded by a capped spikes representing 95% confidence intervals.

Figure 4: Event study using binary indicator for most voted candidate as outcome variable



This is a graphical representation of the estimated β_t coefficients from model 2. I particular, I include one lead and four lags. The specification follows the controls used in column (4) of Table 4. The vertical line represents the earthquake shock before the current election and the 0-index stands for the timing of the current election round. Circles represent point-estimates which are vertically surrounded by a capped spikes representing 90% confidence intervals.

Figure 5: Significant earthquakes since 1900

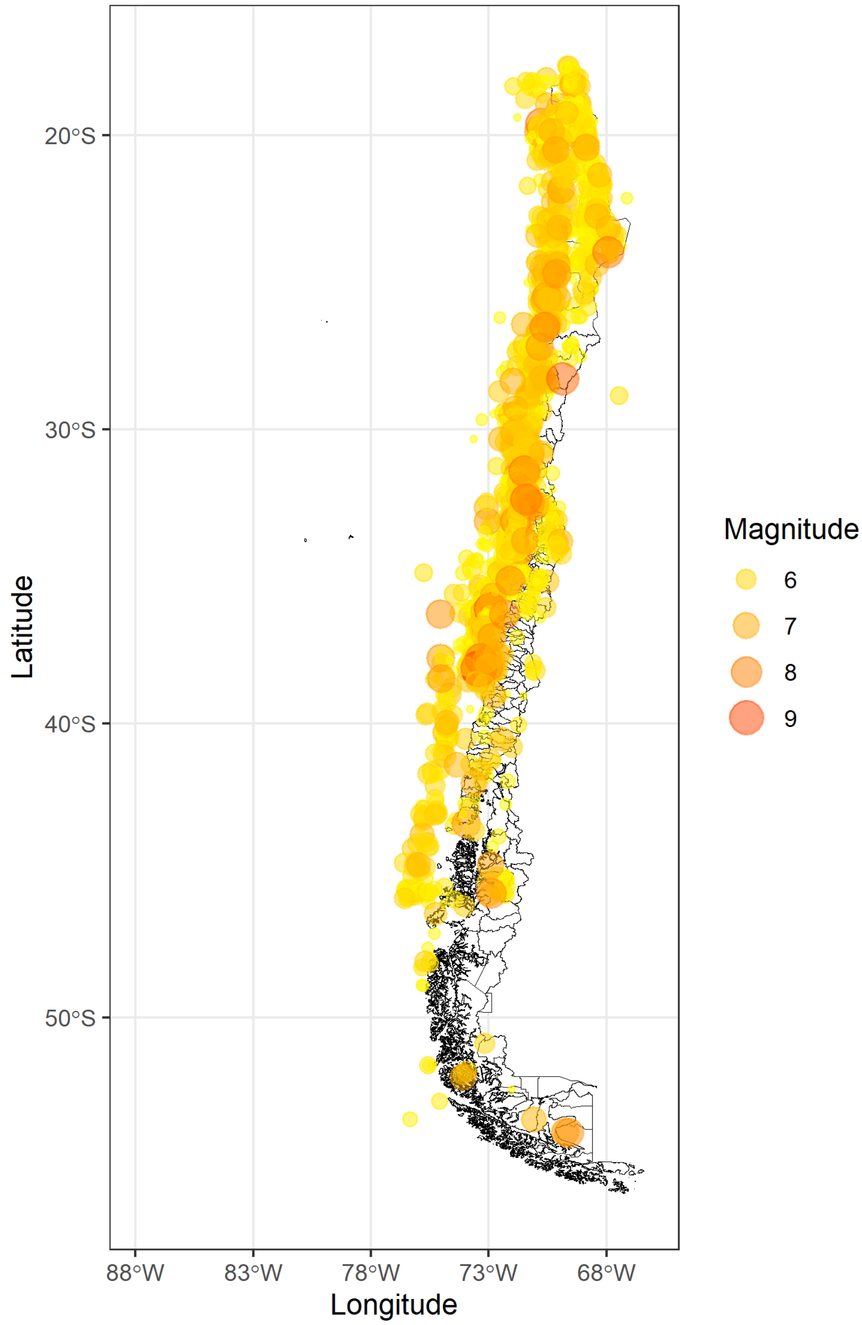
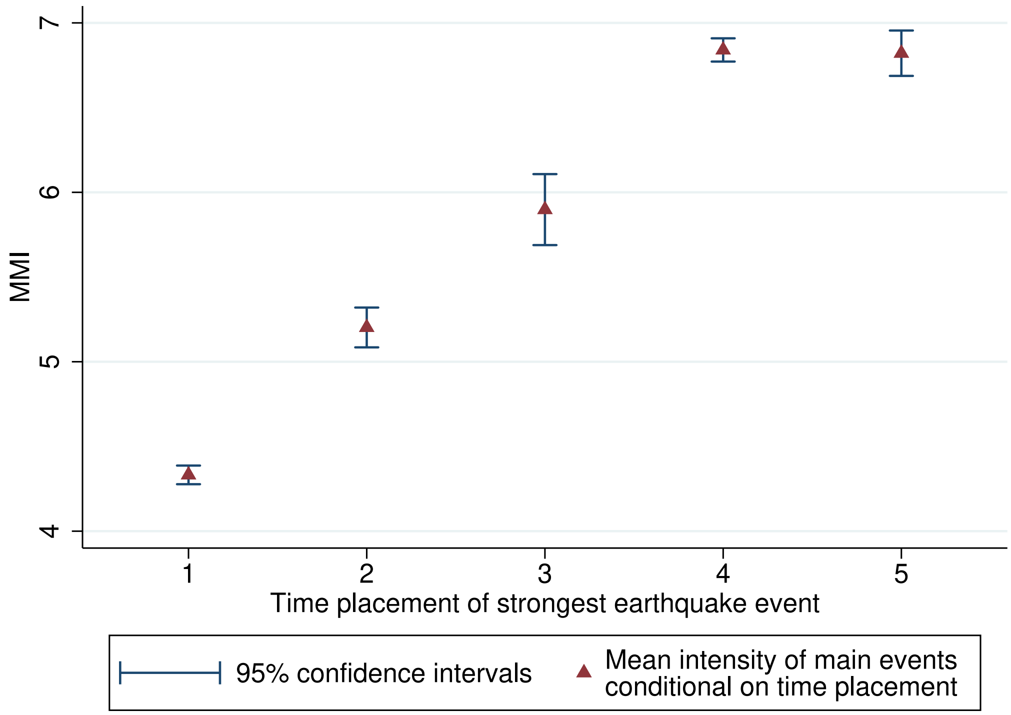
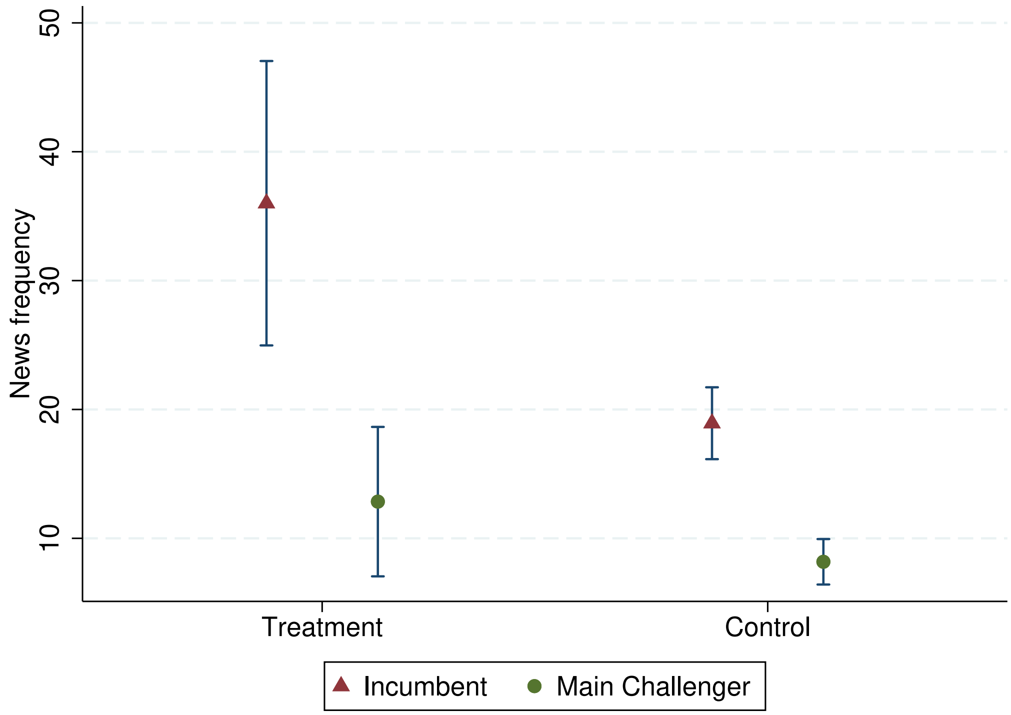


Figure 6: Position of main earthquake between elections



Intensity is measured using the Modified Mercalli scale. The x-axis represents the time placement of an earthquake while the y-axis represents its intensity in terms of the Modified Mercalli scale. For example, suppose that between 2010 and 2015, a municipality experienced five significant earthquakes, of which the strongest had an intensity of 8 points in the Modified Mercalli Scale. Moreover, suppose that the strongest earthquake was the third one to occur. Then, this earthquake would be represented by the coordinate (3, 8). This figure takes the average of the intensities of all events conditional on their time placement and plots the 95% confidence interval of each mean. Only events with positive intensity are plotted.

Figure 7: News frequency of incumbents versus main challengers in local elections



The treatment group in each year is defined as all municipalities which experience an earthquake classified as MMI > 5. Capped spikes represent 95% confidence intervals.

11 Tables

Table 1: Comparison of MMI scale and PGA as measurements of earthquake intensity

MMI	PGA (g)	Perceived shaking	Potential damage
I	0.0017	Not felt	None
II–III	0.0017 – 0.014	Weak	None
IV	0.014 – 0.039	Light	None
V	0.039 – 0.092	Moderate	Very light
VI	0.092 – 0.18	Strong	Light
VII	0.18 – 0.34	Very strong	Moderate
VIII	0.34 – 0.65	Severe	Moderate to heavy
IX	0.65 – 1.24	Violent	Heavy
X+	1.24	Extreme	Very heavy

Description of the MMI scale and its conversion to PGA abridged from USGS (2021). These conversion values should not be taken with complete confidence since MMI captures perceived damage while PGA is a measure of shaking intensity. To better understand the income shock measured by these scales consider an earthquake with an intensity of VII MMI. An even of this category entails negligible damage to well designed structures and considerable damage to poorly designed buildings. On the other hand, an earthquake with an estimated MMI of VIII implies considerable damages to all structures including monuments and walls (Wald and Shindle, 2004).

Table 2: Descriptive statistics for panel of presidential and municipal elections by treatment status

	$\text{MMI} \leq 5$			$\text{MMI} > 5$		
Variable	Obs.	Mean	Std. dev.	Obs.	Mean	Std. dev.
Dependent variable and main regressors						
Share of the vote obtained by incumbent (%)	2,921	45.44	12.43	813	43.58	13.53
First preference binary indicator	2,921	0.567	0.496	813	0.440	0.497
MMI	2,921	1.336	1.903	813	6.361	0.765
PGA (g)	2,921	0.00767	0.0142	813	0.202	0.102
log(PGA+0.001) (log (g))	2,921	-5.919	1.447	813	-1.739	0.563
Control variables related to earthquakes and elections						
Number of earthquake occurred between elections	2,921	0.408	0.658	813	2.899	1.288
Days between earthquake and election	2,921	1,329	521.8	813	983.4	380.0
Maximum height of tsunami (m)	2,921	0.0645	1.402	813	0.950	3.243
Female binary indicator	2,921	0.199	0.400	813	0.403	0.491
Number of candidates	2,921	3.652	3.573	813	3.006	2.232
Characteristics of municipalities						
Employment rate (%)	2,635	47.84	6.794	811	48.11	7.072
log(Income) per capita (CLP)	2,635	11.66	0.629	811	12.13	0.511
Literacy rate (%)	2,635	92.72	4.810	811	94.12	4.442
Poverty rate (%)	2,635	22.09	12.51	811	18.09	11.37
Years of schooling	2,635	8.755	1.554	811	9.622	1.602
Population	2,921	44,169	70,657	813	63,084	87,392
Government spending and investment						
Cumulative local spending per capita (M CLP)	2,262	1.202	2.059	792	1.214	1.824
Cumulative central spending per capita (M CLP)	2,542	2.623	11.13	790	1.679	4.582
Est. cumulative central spending per capita (M CLP)	2,542	7.768	35.11	790	5.727	12.21

Parentheses indicate the unit of measure for each variable. % stands for percentage points; g stands for standard gravity acceleration (9.80665 m/s^2); m represents meters; M CLP stands for a million Chilean pesos (1 USD exchanges for about 724 CLP as of February, 2021).

Table 3: Simple descriptive statistics for panel of presidential and municipal elections

Variable	(1) Obs.	(2) Mean	(3) Std. dev.	(4) Min	(5) Max
Dependent variable and main regressors					
Share of the vote obtained by the incumbent (%)	3,734	45.03	12.70	0	89.96
First preference binary indicator	3,734	0.540	0.498	0	1
MMI	3,734	2.430	2.695	0	8.234
PGA (g)	3,734	0.0500	0.0940	0	0.470
log(PGA+0.001) (log (g))	3,734	-5.009	2.165	-6.908	-0.752
Control variables related to earthquakes and elections					
Number of earthquake occurred between elections	3,734	0.950	1.325	0	5
Days between earthquake and election	3,734	1,254	514.6	167	2,227
Maximum height of tsunami (m)	3,734	0.257	1.990	0	50
Female binary indicator	3,734	0.244	0.429	0	1
Number of candidates	3,734	3.512	3.338	1	29
Characteristics of municipalities					
Employment rate (%)	3,446	47.90	6.860	24.61	100
log(Income) per capita (CLP)	3,446	11.77	0.636	9.693	14.36
Literacy rate (%)	3,446	93.05	4.762	66.95	100
Poverty rate (%)	3,446	21.15	12.37	0	75
Years of schooling	3,446	8.959	1.608	3.500	16.02
Population	3,734	48,288	75,016	215	604,744
Government spending and investment					
Cumulative local spending per capita (M CLP)	3,054	1.205	2.001	0.0504	28.03
Cumulative central spending per capita (M CLP)	3,332	2.399	9.978	0.000555	193.4
Est. cumulative central spending per capita (M CLP)	3,332	7.284	31.25	0.00139	673.8

Parentheses indicate the unit of measure for each variable. % stands for percentage points; g stands for standard gravity acceleration (9.80665 m/s^2); m represents meters; M CLP stands for a million Chilean pesos (1 USD exchanges for about 724 CLP as of February, 2021).

Table 4: Impact of earthquake intensity (MMI) on vote shares for all elections

Panel 1: All elections	(1) Share	(2) Share	(3) Share	(4) Share	(5) Share	(6) Share
Intensity	0.737***	1.441***	1.474***	1.434***	1.424***	1.480***
	(0.172)	(0.252)	(0.260)	(0.274)	(0.274)	(0.318)
Number of earthquake occured between elections	-1.119**	-1.861***	-1.677***	-1.699***	-1.682***	-1.908***
	(0.451)	(0.465)	(0.471)	(0.482)	(0.481)	(0.552)
Maximum height of tsunami	-0.113	-0.122	-0.125	-0.104	-0.104	-0.0874
	(0.104)	(0.104)	(0.108)	(0.111)	(0.111)	(0.143)
Days between earthquake and election		0.00225***	0.00252***	0.00220***	0.00219***	0.00253***
		(0.000624)	(0.000648)	(0.000776)	(0.000776)	(0.000857)
Female binary indicator		-4.304***	-4.189***	-4.058***	-4.056***	-5.084***
		(1.244)	(1.195)	(1.195)	(1.195)	(1.358)
Number of candidates		-2.231***	-2.202***	-2.152***	-2.151***	-2.227***
		(0.236)	(0.240)	(0.238)	(0.238)	(0.265)
Cumulative local spending per capita				0.266	0.279	0.451
				(0.248)	(0.255)	(0.384)
Cumulative central spending per capita				0.0781**		
				(0.0362)		
Est. cumulative central spending per capita					0.0123	-0.0577***
					(0.0174)	(0.0132)
Observations	3,734	3,734	3,446	2,877	2,877	2,877
Number of municipalities	345	345	336	335	335	335
Municipality covariates	No	No	Yes	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Time Trend	No	No	No	No	No	Yes
Adjusted R-squared	0.270	0.334	0.332	0.306	0.306	0.335

Standard errors clustered by municipality in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Share is measured in percentage points; Intensity is measured according to the Modified Mercalli scale; Tsunami height is measured in meters. Spending and investment variables are measured in a million Chilean pesos (M CLP); Est. is short for estimated. Municipality covariates include employment log-income, literacy, poverty, and schooling.

Table 5: Impact of earthquake intensity (MMI) on chances of being the most voted candidate for all elections

	(1)	(2)	(3)	(4)	(5)	(6)
Panel 1: All elections	First	First	First	First	First	First
Intensity	0.0131**	0.0279***	0.0298***	0.0303***	0.0302***	0.0284**
	(0.00577)	(0.00868)	(0.00902)	(0.00933)	(0.00930)	(0.0111)
Number of earthquake occured between elections	-0.0264*	-0.0426***	-0.0411***	-0.0434***	-0.0429***	-0.0436**
	(0.0139)	(0.0151)	(0.0153)	(0.0157)	(0.0157)	(0.0181)
Maximum height of tsunami	-0.00741	-0.00780*	-0.00671	-0.00612	-0.00614	-0.00366
	(0.00456)	(0.00463)	(0.00513)	(0.00505)	(0.00507)	(0.00669)
Days between earthquake and election		4.76e-05**	5.74e-05**	7.28e-05**	7.28e-05**	8.30e-05**
		(2.42e-05)	(2.45e-05)	(2.84e-05)	(2.84e-05)	(3.21e-05)
Female binary indicator		-0.103**	-0.0956**	-0.0894*	-0.0894*	-0.104*
		(0.0476)	(0.0484)	(0.0492)	(0.0492)	(0.0571)
Number of candidates		-0.0377***	-0.0379***	-0.0371***	-0.0371***	-0.0354***
		(0.00684)	(0.00705)	(0.00715)	(0.00715)	(0.00879)
Cumulative local spending per capita				0.0180*	0.0176	0.0180
				(0.0109)	(0.0111)	(0.0134)
Cumulative central spending per capita				0.00215		
				(0.00199)		
Est. cumulative central spending per capita					0.000598	-0.00151***
					(0.000666)	(0.000557)
Observations	3,734	3,734	3,446	2,877	2,877	2,877
Number of municipalities	345	345	336	335	335	335
Municipality covariates	No	No	Yes	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Time Trend	No	No	No	No	No	Yes
Adjusted R-squared	0.216	0.229	0.229	0.214	0.214	0.226

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Tsunami height is measured in meters. Spending and investment variables are measured in a million Chilean pesos (M CLP). Municipality covariates include employment log-income, literacy, poverty, and schooling.

Table 6: Impact of earthquake intensity (MMI) on vote shares for presidential elections

Panel 2: Presidential elections	(1) Share	(2) Share	(3) Share	(4) Share	(5) Share	(6) Share
Intensity	1.205***	1.918***	1.997***	2.055***	2.057***	1.746***
	(0.200)	(0.387)	(0.413)	(0.469)	(0.470)	(0.602)
Number of earthquake occured between elections	-2.305***	-3.101***	-2.759***	-3.238***	-3.233***	-2.662***
	(0.574)	(0.639)	(0.645)	(0.702)	(0.702)	(0.946)
Maximum height of tsunami	-0.129	-0.167	-0.193*	-0.142	-0.143	-0.102
	(0.114)	(0.114)	(0.115)	(0.110)	(0.110)	(0.135)
Days between earthquake and election		0.00242***	0.00311***	0.00328***	0.00328***	0.00522***
		(0.000817)	(0.000859)	(0.00103)	(0.00103)	(0.00177)
Cumulative local spending per capita				0.236	0.222	0.478
				(0.318)	(0.322)	(0.328)
Cumulative central spending per capita				0.0244		
				(0.0418)		
Est. cumulative central spending per capita					0.00894	-0.0632***
					(0.0136)	(0.0193)
Observations	2,058	2,058	1,840	1,307	1,307	1,307
Number of municipalities	345	345	336	335	335	335
Municipality covariates	No	No	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Time Trend	No	No	No	No	No	Yes
Adjusted R-squared	0.486	0.490	0.493	0.495	0.495	0.438

Standard errors clustered by municipality in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Share is measured in percentage points; Tsunami height is measured in meters. Spending and investment variables are measured in a million Chilean pesos (M CLP). Municipality covariates include employment log-income, literacy, poverty, and schooling.

Table 7: Impact of earthquake intensity (MMI) on chances of being the most voted candidate for presidential elections

Panel 2: Presidential elections	(1) First	(2) First	(3) First	(4) First	(5) First	(6) First
Intensity	0.0369***	0.0616***	0.0656***	0.0750***	0.0755***	0.0518***
	(0.00768)	(0.0123)	(0.0129)	(0.0142)	(0.0142)	(0.0174)
Number of earthquakes occured between elections	-0.0812***	-0.109***	-0.105***	-0.130***	-0.129***	-0.0864***
	(0.0181)	(0.0203)	(0.0209)	(0.0220)	(0.0220)	(0.0273)
Maximum height of tsunami	-0.00508	-0.00640	-0.00633	-0.00488	-0.00499	-0.00304
	(0.00603)	(0.00587)	(0.00630)	(0.00643)	(0.00646)	(0.00713)
Days between earthquake and election		8.38e-05***	0.000103***	0.000140***	0.000141***	0.000170***
		(2.90e-05)	(2.92e-05)	(3.57e-05)	(3.58e-05)	(5.84e-05)
Cumulative local spending per capita				0.0118	0.00885	0.0266**
				(0.0231)	(0.0222)	(0.0134)
Cumulative central spending per capita				0.00362*		
				(0.00212)		
Est. cumulative central spending per capita					0.00155***	-0.000699
					(0.000486)	(0.000693)
Observations	2,058	2,058	1,840	1,307	1,307	1,307
Number of municipalities	345	345	336	335	335	335
Municipality covariates	No	No	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Time Trend	No	No	No	No	No	Yes
Adjusted R-squared	0.408	0.410	0.416	0.396	0.398	0.499

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Tsunami height is measured in meters. Spending and investment variables are measured in a million Chilean pesos (M CLP). Municipality covariates include employment log-income, literacy, poverty, and schooling.

Table 8: Impact of earthquake intensity (MMI) on vote shares for local elections

Panel 3: Local elections	(1) Share	(2) Share	(3) Share	(4) Share	(5) Share	(6) Share
Intensity	0.444*	0.985***	0.853**	1.006***	0.987**	0.248
	(0.262)	(0.358)	(0.362)	(0.385)	(0.383)	(0.510)
Number of earthquake occured between elections	-0.0186	-0.477	-0.409	-0.514	-0.495	-0.0671
	(0.620)	(0.629)	(0.644)	(0.660)	(0.658)	(0.810)
Maximum height of tsunami	-0.0964	-0.0855	-0.0707	-0.0767	-0.0761	-0.00368
	(0.161)	(0.153)	(0.164)	(0.163)	(0.163)	(0.227)
Days between earthquake and election		0.00189	0.00115	0.00134	0.00138	-0.000992
		(0.00128)	(0.00133)	(0.00141)	(0.00141)	(0.00191)
Female binary indicator		-5.274***	-4.782***	-4.288***	-4.293***	-6.492***
		(1.504)	(1.500)	(1.503)	(1.502)	(2.146)
Number of candidates		-1.843***	-1.881***	-1.872***	-1.871***	-1.634***
		(0.243)	(0.251)	(0.250)	(0.251)	(0.304)
Cumulative local spending per capita				-0.0209	0.0239	0.960
				(0.353)	(0.351)	(0.835)
Cumulative central spending per capita				0.0929		
				(0.0858)		
Est. cumulative central spending per capita					-0.000786	-0.0452**
					(0.0249)	(0.0201)
Observations	1,676	1,676	1,606	1,570	1,570	1,570
Number of municipalities	345	345	336	335	335	335
Municipality covariates	No	No	Yes	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Time Trend	No	No	No	No	No	Yes
Adjusted R-squared	0.166	0.242	0.238	0.243	0.242	0.390

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Share is measured in percentage points; Tsunami height is measured in meters. Spending and investment variables are measured in a million Chilean pesos (M CLP). Municipality covariates include employment log-income, literacy, poverty, and schooling.

Table 9: Impact of earthquake intensity (MMI) on the probability of being the most voted candidate for local elections

	(1)	(2)	(3)	(4)	(5)	(6)
Panel 3: Local elections	First	First	First	First	First	First
Intensity	-0.000979	-0.00109	-0.00222	0.00147	0.00119	-0.0389*
	(0.00927)	(0.0133)	(0.0136)	(0.0139)	(0.0139)	(0.0204)
Number of earthquake occured between elections	0.0185	0.0192	0.0167	0.0141	0.0138	0.0492
	(0.0221)	(0.0236)	(0.0242)	(0.0244)	(0.0244)	(0.0315)
Maximum height of tsunami	-0.00946*	-0.00979*	-0.00800	-0.00827	-0.00821	-0.00287
	(0.00558)	(0.00580)	(0.00622)	(0.00619)	(0.00620)	(0.00983)
Days between earthquake and election		-1.55e-05	-2.42e-05	-8.16e-06	-8.13e-06	-0.000139*
		(4.85e-05)	(5.02e-05)	(5.17e-05)	(5.17e-05)	(7.71e-05)
Female binary indicator		-0.120**	-0.106*	-0.0969*	-0.0969*	-0.141*
		(0.0550)	(0.0567)	(0.0579)	(0.0579)	(0.0790)
Number of candidates		-0.0282***	-0.0305***	-0.0319***	-0.0319***	-0.0199*
		(0.00738)	(0.00777)	(0.00794)	(0.00795)	(0.0109)
Cumulative local spending per capita				0.00916	0.0108	0.0315
				(0.0208)	(0.0206)	(0.0332)
Cumulative central spending per capita				-0.000980		
				(0.00448)		
Est. cumulative central spending per capita					-0.000944	-0.00237***
					(0.00110)	(0.000859)
Observations	1,676	1,676	1,606	1,570	1,570	1,570
Number of municipalities	345	345	336	335	335	335
Municipality covariates	No	No	Yes	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Time Trend	No	No	No	No	No	Yes
Adjusted R-squared	0.00792	0.0223	0.0204	0.0209	0.0215	0.112

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Tsunami height is measured in meters. Spending and investment variables are measured in a million Chilean pesos (M CLP). Municipality covariates include employment log-income, literacy, poverty, and schooling.

Table 10: Regression of earthquake intensity on covariates

VARIABLES	(1) MMI	(2) PGA	(3) log(PGA+0.001)
Employment rate (%)	0.00941	-4.04e-05	0.00773
	(0.00840)	(0.000366)	(0.00705)
log(Income) per capita	0.328	-0.00955	0.194
	(0.245)	(0.00755)	(0.193)
Literacy rate (%)	-0.0255	-0.000771	-0.0231
	(0.0213)	(0.000739)	(0.0173)
Poverty rate (%)	0.00371	9.53e-05	0.00416
	(0.00660)	(0.000219)	(0.00536)
Years of schooling	0.166*	0.00343	0.140*
	(0.0923)	(0.00392)	(0.0757)
Population	4.72e-06	4.13e-07**	5.26e-06
	(4.06e-06)	(1.87e-07)	(3.53e-06)
Observations	3,446	3,446	3,446
Number of municipalities	336	336	336
Adjusted R-squared	0.545	0.493	0.533

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All columns include year and municipality fixed effects.

Table 11: Impact of earthquake intensity [log(PGA+0.001)] on vote shares for all elections

Panel 1: All elections	(1) Share	(2) Share	(3) Share	(4) Share	(5) Share	(6) Share
Intensity	1.152***	1.872***	1.912***	1.898***	1.886***	1.858***
	(0.212)	(0.278)	(0.286)	(0.311)	(0.311)	(0.361)
Number of earthquake occured between elections	-1.477***	-2.052***	-1.872***	-1.928***	-1.911***	-2.012***
	(0.447)	(0.443)	(0.452)	(0.463)	(0.463)	(0.526)
Maximum height of tsunami	-0.129	-0.142	-0.149	-0.129	-0.129	-0.115
	(0.104)	(0.103)	(0.106)	(0.108)	(0.109)	(0.139)
Days between earthquake and election		0.00208***	0.00236***	0.00215***	0.00215***	0.00223***
		(0.000546)	(0.000563)	(0.000716)	(0.000716)	(0.000778)
Female binary indicator		-4.291***	-4.186***	-4.051***	-4.049***	-5.089***
		(1.242)	(1.194)	(1.193)	(1.194)	(1.359)
Number of candidates		-2.209***	-2.180***	-2.128***	-2.127***	-2.218***
		(0.236)	(0.241)	(0.239)	(0.239)	(0.265)
Cumulative local spending per capita				0.231	0.246	0.416
				(0.255)	(0.261)	(0.377)
Cumulative central spending per capita				0.0786**		
				(0.0365)		
Est. cumulative central spending per capita					0.0117	-0.0578***
					(0.0174)	(0.0131)
Observations	3,734	3,734	3,446	2,877	2,877	2,877
Number of municipalities	345	345	336	335	335	335
Municipality covariates	No	No	Yes	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Time Trend	No	No	No	No	No	Yes
Adjusted R-squared	0.273	0.336	0.334	0.309	0.309	0.337

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Share is measured in percentage points; Intensity is measured using the Peak Ground Acceleration; Tsunami height is measured in meters. Spending and investment variables are measured in a million Chilean pesos (M CLP); Est. is short for estimated. Municipality covariates include employment log-income, literacy, poverty, and schooling.

Table 12: Impact of earthquake intensity [log(PGA+0.001)] on the probability of being the most voted candidate

	(1)	(2)	(3)	(4)	(5)	(6)
Panel 1: All elections	First	First	First	First	First	First
Intensity	0.0241***	0.0422***	0.0443***	0.0453***	0.0451***	0.0408***
	(0.00713)	(0.00977)	(0.0100)	(0.0105)	(0.0105)	(0.0128)
Number of earthquake occured between elections	-0.0378***	-0.0532***	-0.0514***	-0.0542***	-0.0536***	-0.0514***
	(0.0138)	(0.0145)	(0.0148)	(0.0153)	(0.0154)	(0.0177)
Maximum height of tsunami	-0.00782*	-0.00841*	-0.00742	-0.00684	-0.00687	-0.00442
	(0.00453)	(0.00452)	(0.00500)	(0.00492)	(0.00494)	(0.00651)
Days between earthquake and election		5.34e-05**	6.29e-05***	8.06e-05***	8.05e-05***	8.55e-05***
		(2.18e-05)	(2.20e-05)	(2.63e-05)	(2.63e-05)	(2.95e-05)
Female binary indicator		-0.103**	-0.0956**	-0.0893*	-0.0893*	-0.105*
		(0.0476)	(0.0483)	(0.0492)	(0.0492)	(0.0572)
Number of candidates		-0.0375***	-0.0376***	-0.0367***	-0.0367***	-0.0354***
		(0.00683)	(0.00704)	(0.00713)	(0.00713)	(0.00878)
Cumulative local spending per capita				0.0176	0.0173	0.0174
				(0.0111)	(0.0112)	(0.0134)
Cumulative central spending per capita				0.00220		
				(0.00202)		
Est. cumulative central spending per capita					0.000594	-0.00151***
					(0.000668)	(0.000559)
Observations	3,734	3,734	3,446	2,877	2,877	2,877
Number of municipalities	345	345	336	335	335	335
Municipality covariates	No	No	Yes	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Time Trend	No	No	No	No	No	Yes
Adjusted R-squared	0.217	0.231	0.231	0.216	0.216	0.227

Standard errors clustered by municipality in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Share is measured in percentage points; Intensity is measured using the Peak Ground Acceleration; Tsunami height is measured in meters. Spending and investment variables are measured in a million Chilean pesos (M CLP); Est. is short for estimated. Municipality covariates include employment log-income, literacy, poverty, and schooling.

Table 13: Placebo test

Panel 1: All elections	(1) Minimum Temperature	(2) Minimum Temperature
MMI	0.00599	
	(0.00583)	
log(PGA+0.001)		0.00823
		(0.00694)
Employment rate (%)	0.00250	0.00249
	(0.00251)	(0.00252)
log(Income) per capita	0.0165	0.0169
	(0.0657)	(0.0656)
Literacy rate (%)	0.00383	0.00387
	(0.00582)	(0.00582)
Poverty rate (%)	0.00453***	0.00452***
	(0.00141)	(0.00141)
Years of schooling	0.0235	0.0233
	(0.0285)	(0.0286)
Population	-2.13e-06**	-2.14e-06**
	(9.65e-07)	(9.65e-07)
Observations	3,446	3,446
Number of municipalities	336	336
Adjusted R-squared	0.749	0.749

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All columns include year and municipality fixed effects. Temperature data was retrieved from WorldClim (2021).

Table 14: Incumbent's fiscal performance between elections

Panel 1: All elections	(1) Local spending	(2) Central investment	(3) Est. central investment
Intensity	-0.0213**	-0.110**	-0.536**
	(0.0105)	(0.0428)	(0.261)
Observations	2,935	3,166	3,166
Adjusted R-squared	0.232	0.0742	0.0793
Panel 2: Presidential elections	(1) Local spending	(2) Central investment	(3) Est. central investment
Intensity	-0.0267**	-0.0422	-0.459
	(0.0128)	(0.0500)	(0.289)
Observations	1,329	1,596	1,596
Adjusted R-squared	0.124	0.0719	0.0749
Panel 3: Local elections	(1) Local spending	(2) Central investment	(3) Est. central investment
Intensity	-0.0214**	-0.176***	-0.609**
	(0.00962)	(0.0553)	(0.245)
Observations	1,606	1,570	1,570
Adjusted R-squared	0.254	0.0839	0.0902

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All specifications include year and municipality fixed effects in addition to municipality covariates.

Table 15: Effect of earthquake intensity on the percentage difference in news visibility between incumbent challenger

	(1)
Panel 3: Local elections	%Δ news (Incumbent - Challenger)
Intensity	6.170*
	(3.366)
Observations	1,603
Number of municipalities	336
R-squared	0.007

Standard errors clustered by municipality in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Includes year, municipality and political party fixed effects in addition to municipality covariates.

A Appendix

A1 Disaggregating regional investment

let $\theta^*_{r,m,t}$ be the estimated cumulative central investment in municipality m from region r in year t; let $\theta_{r,m,t}$ be the observed spending in each municipality and let $\epsilon_{r,t}$ be the regional, non-disaggregated investment. Then, the estimated cumulative central investment is computed as

$$\theta^*_{r,m,t} = \theta_{r,m,t} + \frac{\theta_{r,m,t}}{\sum\limits_{m \in M_r} \theta_{r,m,t}} \epsilon_{r,t}$$

where M_r is the set of municipalities belonging to region r. That is, the estimated investment in municipality m from region r equals the observed investment in addition to the residual non-disaggregated investment weighted by the regional proportion of investment observed in each municipality. Final measures of cumulative central investment were obtained after summing these estimates between election years.

A2 News frequency search strategy

I use the search engine from *El Mercurio* to gather mentions of incumbents. Figure A1 is a screenshot of this website. In particular, each search accepts two arguments: a vector of strings, and two dates. The search engine looks up each news in its database looking up keywords related to the provided vector of strings. Whenever dates are provided, the search is bounded by them. For each local election, I identify both the incumbent and their main challenger. Then, I search up all mentions of each candidate using the string "*candidate's name municipality*" for dates between the current election day and the previous election day. This result in a novel data set of mentions of incumbents and challengers for all local elections.

A3 Figures

Figure A1: Screenshot of *El Mercurio*'s search engine

Example of a search carried out on http://buscador.emol.com/emol/. In this case, I look up mentions of Constitución's mayor, Hugo Tillería between May 2008 and July 2012 finding 32 mentions.