Risk, uncertainty and electoral support

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Abstract

Natural disasters present a favorable setting to investigate the effects of risk and uncertainty on vote decisions and political consensus. In this study, we analyze how exogenous risk perception and uncertainty measured by the occurrence of natural-disaster shocks (earthquakes) affects incumbent mayor reelection probability and party votes using data from 5 municipal and 6 national-level electoral cycles (1993-2015) in Italy. To identify the causal impact of uncertainty on reelection probability and vote shares we use an empirical strategy with OLS and linear probability models that control for the electoral cycle, municipality time-invariant heterogeneity and several time-variant characteristics. We find that more uncertainty (destructive earthquakes) significantly increases the incumbent chance of being reelected and vote share in municipal elections, and shifts votes towards the center-right coalition in national-level elections. This effect shows some persistence in the following electoral cycles. These results may suggest a preference for less uncertain outcomes, a change in the response to the electoral manifesto by the struck population, looking for reassurance, or a change in the behavior of incumbent politicians that affects voter expectations on future outcomes. Moreover, we show that politicians benefit from higher visibility on the media and disaster relief spending in elections.

Keywords: Elections, Vote choice, Risk, Earthquakes

JEL codes: D72, D81
1 Introduction

Democracy in modern society allows voters to express their preferences on representatives and policies. Vote choice is the result of policy preferences, retrospective evaluation of and future expectations on politician performance. However, these factors may be influenced by uncertainty and individual risk perceptions and attitudes. Morgenstern and Zechmeister (2001) show that risk attitudes explain vote decisions in the 1997 national elections in Mexico. Risk averse individuals tend to prefer the status quo to minimize risk in exchange for a less uncertain outcome, while risk tolerant individuals are more likely to support parties providing more uncertain but potentially more beneficial outcomes. Risk perception may have similar implications on vote choice. For a given risk attitude in a context of uncertain political outcomes (e.g. politician performance and policies), individuals attributing more importance to negative outcomes may prefer a sure but less desired outcome to a preferred but more uncertain outcome. Therefore, higher risk perception may lead to prefer the status quo because the expected performance of the incumbent may be less volatile compared to alternative candidates, or to support parties/coalitions providing certain economic and social outcomes, even if the preferred set of policies belongs to a different party/coalition.

In this study, we want to investigate how risk and uncertainty affect electoral outcomes. To this aim, we use data from 5 municipal and 6 national electoral cycles between 1993 and 2015 in Italy. In particular, we analyze how risk and uncertainty affect reelection probability and vote share of incumbent mayors and party votes in national elections.

Previous studies on electoral outcomes use survey data including questions revealing the respondents’ risk perception and attitude (e.g. Morgenstern and Zechmeister, 2001; Selb, 2008). A growing strand of the literature shows that negative shocks, such as economic crises, violence and natural disasters, alter risk perception and attitudes (e.g. Brown et al. 2018; Callen et al., 2014). The main challenge of these studies is to identify a valid measure of risk perception which is exogenous to voters’ choices. The evidence on the direction of the effects of negative shocks is mixed and sometimes inconsistent showing both increasing (Kung and Chen, 2012; Lerner et al., 2015) and decreasing effects (Cameron and Shah, 2015; Hanaoka et al., 2018).

Using data on insurance choices from the Survey on Household Income and Wealth, crime rates from ISTAT and tourist arrivals from ONIT, we find anecdotal evidence...
that earthquakes in Italy tend to raise both risk perception and aversion. Moreover, we do not find any significant difference on access to information on politics and vote participation, which may suggest that the cost of access to information and the willingness to express vote preferences may remain unchanged when an earthquake occurs. Therefore, we exploit the exogenous occurrence of destructive natural-disaster shocks (earthquakes) to measure heterogeneity in risk perception and provide evidence on the effect of risk on electoral outcomes supported by a simple theoretical framework. We use data from an extensive and detailed database on earthquake occurrences between 1000 AD and 2014 to measure earthquake occurrence and use an empirical strategy to identify the causal impact of risk perception on electoral outcomes. We apply linear probability models of incumbent mayor reelection probability and OLS models of incumbent mayor vote shares in municipal elections. Then, we extend the analysis to national-level elections and investigate the impact of a shock on votes gained by the center-right versus center-left coalitions (only Senate election results are presented in the current paper version). In our regressions, we control for time-variant municipality characteristics, time-invariant unobserved heterogeneity and electoral cycle fixed effects.

We find that the occurrence of destructive earthquakes raises the support for the incumbent mayor by increasing both the reelection probability and the share of votes gained, and shifts votes towards center-right parties in national elections independently of the political orientation of the incumbent central government. We argue that the estimated effect is determined by increasing preferences for less uncertain outcomes due to earthquake shocks. Since voters can observe past performance of incumbent mayors, uncertainty on the performance of the incumbent is lower as compared to competing candidates. Therefore, voters with higher risk perception tend to prefer the status quo and reconfirm the incumbent. At national level, voters with higher risk perception may decide to support the party/coalition more likely to promote policies to recover from earthquake damages (e.g. transfers), more concerned with the adverse consequences of natural disasters according to their electoral manifesto, or just more effective in using media channels to discuss disaster issues. Moreover, we observe some persistence of these effects in the following electoral cycles.

Literature on the impact of natural disasters on electoral outcomes tends to converge on the result that the occurrence of these shocks reduces the support for the incumbent politician if his/her response is perceived as inadequate (Eriksson, 2016. Lay, 2009) or
if he/she takes actions which go to the detriment of voters welfare (Akarca and Tansel, 2016). Conversely, an appropriate response, generally measured by the size of financial transfers from the central government, raises the support for the incumbent government (Gasper and Reeves, 2011; Healy and Malhotra, 2009), although incumbents may use these tools to attract votes in an opportunistic manner (Bechtel and Hainmueller, 2011). Belloc et al. (2016) show that between 1000 and 1300, political and religious leaders (bishops) in autocratic Italian cities exploited the occurrence of earthquakes to maintain their power leveraging on fear and the religious sphere of individuals.

Our contribution to this literature is fourfold. First, we contribute by using a detailed data set on the occurrence of earthquakes to capture perception of and attitudes toward risk which affect vote decisions and, therefore, electoral outcomes. Second, we investigate on municipal electoral outcomes, an institutional level which has been neglected in this literature. Third, using the universe of Italian municipalities allows us to present the so far largest sample of election outcomes for analyzing the impact of natural disasters and to consider the largest number of units (municipalities) struck by a destructive shock. Fourth, we offer a contribution to the understanding of channels driving vote decisions. Following changes in risk and uncertainty, actions can be taken by incumbent politicians (passively or actively) that can affect the degree of uncertainty on their behalf (Ashworth et al., 2018).

Using a search strategy to collect frequencies of media appearances by politicians, we find that vote decisions are to some extent driven by a higher media coverage of the incumbent mayor in struck municipalities. Moreover, we find that higher spending levels following an earthquake tend to increase the support for the incumbent mayor, but this effect vanishes when corruption is ascertained before the polls. Similarly, center-right governments seem to be more keen in transferring financial resources to disaster areas, which give them more electoral support.

The remainder of this paper is structured as follows. Section 2 discusses the appropriateness of earthquake occurrences as a measure of risk perception and provides a simple theoretical framework of vote choice under uncertainty when an earthquake occurs. Section 3 provides an overview of electoral rules in local and national elections. Section 4

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1Exceptions are Nikolova and Marinov (2017) whose interest is in corruption determined by flood-driven relief funds and incumbent reelection is analyzed in relationship to flood-driven corruption, and Bodet et al. (2016) who analyze the effect of a flood on electoral support to a single mayor in a single election period.
describes the data and presents some preliminary evidence on the relationship between votes and risk and uncertainty. Section 5 presents our identification strategy, while Section 6 discusses the main results of the analysis. Finally, in Section 7 we provide evidence on possible channels driving our results. Section 8 concludes.

2 Earthquakes, risk and vote choice

Negative shocks, such as the occurrence of natural disasters, can alter individual risk perception and attitude. Earthquakes destroy lives and homes and force people to change their lifestyle. Moreover, destructive earthquakes are usually followed by several after-shocks which maintain fear at high levels. Fear and uncertainty about the future may affect how people relate to risk. For instance, Hanaoka et al. (2018) find that after the 2011 earthquake in Japan, men become more risk tolerant and this effect persists at least for 5 years. Therefore, earthquake occurrence seems to be a good measure of risk. However, literature has not converged yet on the direction of the effect of negative shocks on risk perception and attitude.

We exploit a number of data sources to provide anecdotal evidence on how earthquakes are related to changes in risk perception in Italy (see Section 3 for details on the institutional setting). To show how risk perception and attitudes differ between regions affected and not affected by earthquakes we focus on the 2009 earthquake in L’Aquila and compare characteristics of the struck region Abruzzo (denoted by Earthquake) with characteristics of the neighboring regions Marche, Lazio and Molise (denoted by Control) in the five years before and after the shock (Figure 1).

In the first panel (Figure 1a), we use data on insurance choices from the Survey on Household Income and Wealth (SHIW) performed by the Bank of Italy to show that individuals propensity to purchase insurance plans against damages increases in the struck region after the occurrence of a shock, while in the control regions we observe the opposite trend. Conversely, health insurance coverage tends to decrease in both groups, but much less in Abruzzo suggesting that individuals living nearby to the struck area tend to become more risk averse. To build more evidence on this aspect, Figure 1b shows how crime rates

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2 We limit the analysis to this earthquake and to a limited number of regions due to data limitations and to reduce unobserved regional and temporal heterogeneity. However, note that exploiting the universe of Italian regions or limiting the analysis to the 2012 earthquake in Emilia Romagna yields similar results.

3 Future developments of this paper will provide a more precise insight on the relationship between earthquake occurrence and risk using survey data from the Italian Institute of Statistics (ISTAT) providing information on the municipality of residence.
vary after the shock. Both theft and homicide rates follow opposite directions in the two groups of regions when the shock occurs. In control regions, crime rates tend to fall (thefts) or to remain stable (homicides), while in the struck region both thefts and homicides tend to increase. This may indicate that individuals struck by an earthquake face a more risky environment. Changes in the level of risk may also be visible in economic activities such as the tourism industry (Figure 1c). We find that both Italian and foreign tourists tend to avoid disaster areas after the occurrence of an earthquake, which increases uncertainty on the ability to recover wealth when natural disaster strikes. This evidence suggests that the occurrence of destructive earthquakes is a good measure of exogenous risk perception and attitudes. Earthquakes affect individual risk perception and tolerance both directly through fear and indirectly through social and economic implications provoked by the shock.

Note that we can exclude that all the evidence just discussed is related to the recent economic crisis of 2009 since the direction of characteristics variation after the earthquake shock is generally opposite for struck and unaffected regions. Moreover, analyzing the impact of the 2012 earthquake in Emilia Romagna (not reported here) yields similar results.

2.1 A simple framework of vote choice under uncertainty

We argue that voting decisions following natural disasters are affected by a change in the perceived level of uncertainty on different electoral manifesto or poorer access to information to assess differences among candidates. If the opportunity cost of getting information on alternative candidates is increased by the earthquake, then less informed voters may prefer the status quo (incumbent) to uncertain alternative outcomes (Morisi, 2016; Selb, 2008). In Figure 1d we show that the extent to which people get informed on politics does not change after an earthquake. Both the share of individuals who never or frequently get informed (at least once per weak) follow the same trend in control and struck regions. This suggests that earthquakes do not increase the cost of access to information on political candidates, rather they change the perception of risk attached to different candidates.

To further understand how rational risk-averse voters choose between an incumbent and a competitor when political outcomes are uncertain and an exogenous shock (earthquake) occurs, we consider a voter with a utility function strictly concave and increasing
with the level of wealth \((w)\). We assume uncertainty regarding the effects of policy measures presented by political competitors. If the incumbent \((I)\) wins, the individual expects some continuity in past policy measures providing a certain wealth \(w\). Conversely, the individual is uncertain about the effect of competitor policy measures expecting wealth \(w - \varepsilon\) (with \(\varepsilon > 0\)) with probability \(\pi \in [0, 1]\) and \(w + \varepsilon\) with probability \(1 - \pi\). The individual will vote for the incumbent if \(EU_I[w] \geq EU_C[w, \varepsilon, \pi]\). Because of risk aversion, the voter is indifferent between the incumbent and the competitor for a probability threshold \(\pi = \hat{\pi} < 1 - \hat{\pi}\) (see Appendix A.1 for details).

Now, assume that an earthquake occurs and that voters face a loss of wealth \(L > 0\). Expectations regarding the incumbent and the competitor ability to recover from the loss is \(p \in [0, 1]\). This clearly reduces the expected utility from both the incumbent and the competitor provided that \(p < 1\). Moreover, the incumbent can send a signal \((\delta)\) at zero cost that affects voter expectations regarding his/her ability to restore initial wealth. Therefore, voter expectations on incumbent ability to restore wealth is \(p_I = p + \delta\), which is higher than \(p\) if the signal is positive \((\delta > 0)\). The new indifference threshold that makes the voter indifferent between the incumbent and the competitor when an earthquake occurs \((\hat{\pi}_s)\) is an increasing function of \(p\), and a decreasing function of \(L\) and \(\delta\) and is defined in the Appendix (Equation 7).

For any \(p < 1\), we can show that \(\hat{\pi}_s < \hat{\pi}\), implying that the incumbent increases the chance of reelection. More precisely, if no signal is sent to the voter \((\delta = 0)\), we obtain \(\hat{\pi}_s < \hat{\pi}\), suggesting that the voter is more likely to support the incumbent when an earthquake occurs due to higher risk perception. However, if a positive signal is sent to the voter \((\delta > 0)\), then the likelihood of supporting the incumbent further increases. Conversely, if a negative signal is sent to the voter \((\delta < 0)\), then a threshold \(\delta \) exists for which \(\hat{\pi}_s \geq \hat{\pi}\). Consequently, for any values \(\delta > \delta\) the indifference threshold is \(\hat{\pi}_s < \hat{\pi}\). Conversely, for \(\delta < \delta\) the likelihood of voter’s support for the incumbent decreases.

\(^4\)Incumbent governments may benefit from increasing media exposure and transfers from central governments that allow an increase in expenditure, depending on their ability to exploit these channels.
3 Institutional setting

3.1 Local elections

Italy is organized in 20 regions, 110 provinces and almost 8000 municipalities.\textsuperscript{5} Substantial power is delegated to sub-national governments and each institutional level has a government with executive power and a council with legislative power. In this study, we focus on national and municipal elections. Local (municipal) governments have the task to provide a number of services to the resident population. The main services are primary education, waste disposal, urban road maintenance, public residential buildings and social protection. The mayor is the head of the Executive Committee (\textit{Giunta Comunale}) which holds executive power, and the Municipal Council (\textit{Conisglio Comunale}) exercises legislative power. The mayor and the Council members are elected directly by the electorate, while the Executive Committee is proposed by the mayor and approved by the Council.

Local government elections are ruled by two electoral systems (majoritarian and proportional) which are assigned based on the population size of the most recent population census. Municipalities with less than 15,000 inhabitants adopt a single-ballot majoritarian system and each mayor candidate can be supported by a single party/list. Municipalities with more than 15,000 inhabitants adopt a two-ballot proportional electoral system and each mayor candidate is supported by a coalition of parties. The second ballot takes place if no candidate wins the absolute majority in the first ballot and voters need to express their preference among the two candidates which obtained the largest shares of votes in the first ballot.

Until 2000, each term lasted 4 years. Afterwards, the term has been extended to 5 years and a term limit has been introduced for mayors. In municipalities with less than 3,000 inhabitants a mayor is allowed to rule for not more than three consecutive mandates, while in municipalities with more than 3,000 inhabitants only two consecutive mandates are allowed.

Municipal elections do not take place at the same moment in each municipality. Elections may be anticipated because a mayor loses the support of the Council or resigns, or the central government replaces the elected officials because of connections with the mafia. Between 1993 and 2015, the \textit{regular} election years are 1995, 1999 and every 5 years afterwards. Less than 50\% of municipalities have governments that reach the end of their

\textsuperscript{5}These numbers refer to 2015. Since 1993, provinces increased from 103 to 110 and municipalities have followed a consolidation process from 8100 to 7997 jurisdictions.
mandates in every electoral cycle.

### 3.2 National-level elections

Italy is a parliamentary republic with a multi-party system. The Council of Ministers (central government) exercises executive power and the Parliament exercises legislative power. The Parliament has a bicameral system, the House of Representatives and the Senate. The House of Representatives is composed of 630 deputies which are elected directly by voters aged 18 or above, while the Senate is composed of 315 senators which are elected directly by voters aged 25 or above. Besides exceptions, elections take place every 5 years. After the Parliament members are elected, the President of the Republic appoints the Prime Minister who usually is supported by the winning coalition. The Prime Minister proposes the Ministers forming the Council and needs to receive approval from the Parliament to start the mandate.

Over the period 1994-2013, the electoral rule for national elections has changed. Elections taking place between 1994 and 2001 adopted a two-tier system (called *Mattarellum*) with 75% of the representative elected by a majority rule and 25% by a proportional rule. In the following elections, representatives were elected with a closed-list proportional system (called *Porcellum*). In 2018, the electoral law has changed again, but this is beyond our scope.

The political context is mainly divided into center-left and center-right parties. Although there are some leading parties for each coalition, the system is relatively fragmented. Generally, each party states its commitment to support either the center-left or center-right coalition. An exception is the 2013 election where a third independent party called *Movimento 5 Stelle* took part and gained 25.55% of votes.

### 3.3 Response to earthquake risk

Between 1993 and 2015, 406 municipalities were struck at least once by a destructive earthquake (i.e. an earthquake with Mercalli scale intensity greater than 5). In addition, 1524 municipalities registered an intensity equal to 5 and many other jurisdictions below that threshold. Following the shocks, the central government intervenes through the Civil Protection, a department administered by the Presidency of the Council of Ministers with

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6In 1996 and 2008 elections were anticipated because the central government lost the support of the Parliament.
the task to manage prevention, response and forecast of natural and man-made disasters, and through delegates who can act notwithstanding the regulation in order to face the state of emergency. Large amounts of financial resources are transferred to local governments from both central and regional governments.\footnote{See for example Barone and Mocetti (2014), Di Giacomo (2014) and Masiero and Santarossa (2018) for a discussion on public transfers and expenditure in the aftermath of earthquake shocks in Italy.}

The response of local governments to the occurrence of an earthquake is generally immediate. Masiero and Santarossa (2018) show that local governments in struck municipalities increase expenditure by about 100 Euro per capita for 11 years after the shock. This expenditure variation is allowed by a higher availability of transfers from the central and regional governments. Moreover, local governments adjust the spending composition to face the consequences of the disaster. Local governments increase the share of resources for housing, Civil Protection, waste disposal, water services and services for environmental protection, and reduce the expenditure share of minor services such as justice, culture and sports.

The way in which the central government manages reconstruction funds is earthquake-dependent since there is no regulation forcing the central government to intervene and every shock may have case-specific implications. In particular, the approach used after the 2009 earthquake of L’Aquila in the region Abruzzo differed from other shocks. Individuals were not reimbursed directly for damages through transfers of financial resources to households but indirectly through local public authorities which had the task to recover from damages both to public and private goods and infrastructures.

4 Data and descriptive statistics

4.1 Sample and variables

To analyze the relationship between risk perception and electoral outcomes we merge a number of data sources with information aggregated at municipality level to obtain two data sets, one for municipal elections and one for national elections.\footnote{In the paper we present the results only for Senate elections since they are very similar to the results obtained for the other chamber. We use data from the House of Representatives to check the robustness of our results (see Section 6.2). The complete results are available upon request to the authors.} Data on municipal and national electoral outcomes are provided by the Italian Ministry of Interior and are available on the online historical election archive (Archivio storico delle elezioni). These data include information on election dates, candidates, lists/coalitions and vote participa-
tion and preferences for elections taking place between 1993 and 2015. Since these data lack some information on municipal elections, mainly in the autonomous regions (Valle d’Aosta, Friuli Venezia Giulia, Sicily and Sardinia) and provinces (Bolzano and Trento), we supplement the information with a second data set (Anagrafe degli amministratori locali) which includes yearly information on gender, age and education for all elected officials. Between 1993 and 2015, 41,361 municipal elections (about 5 per municipality) and 6 national elections took place.

The municipal election data set includes 16,266 observations relative to incumbent mayors running for reelection. Using these data, we define two electoral outcome measures. The first is a dummy variable equal to one if an incumbent mayor is reelected. The second is the share of votes received by the incumbent computed as the proportion of preferences relative to the total number of valid votes. The reelection dummy is a dichotomous measure that allows to assess the success of the incumbent in the electoral run, but it does not suggest if and how much the incumbent gains or loses support during his mandate. Instead, the vote share, especially if related to the votes received in the previous election, measures how much support an incumbent gains or loses, but looking at the vote share variation does not allow to make inference on electoral success. Note, however, that we lack information on vote preferences for 2,252 observations of the final sample.

Using the sources above we also compute the number of candidates participating in the electoral run and the political orientation of the incumbent government (center-left, center-right, independent or Movimento 5 Stelle). In municipalities with more than 15,000 inhabitants, we classify governments according to the political orientation of the parties forming the winning coalition.

The data set of national elections includes 39,908 observations. Since the parliament electoral system is a two-party system, we focus on the vote share received by parties forming the center-right coalition. This coalition governed in the periods 1994-1995, 2001-2006 and 2008-2011. In the other periods, the center-left coalition was in charge, except for the periods 1995-1996 and 2011-2013 when governments of experts ruled the country.

We use several other data sources to complete our data sets. Data on earthquake occurrence are provided by the Italian Institute for Geophysics and Volcanology (INGV)

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9Data on more recent electoral outcomes are available, but we cannot use them because we lack data on earthquake occurrences.


11About 60% of the lists supporting mayors are reported as civic lists, i.e. lists which do not have an explicit political orientation and generally are independent from national parties.
and these data are discussed in detail in the next section. We use population data for the period 1993-2015 provided by the Italian Institute for Statistics (ISTAT) to define sociodemographic indicators (percentage variation of population and variation in the share of elderly people) and population census data for the years 1991, 2001 and 2011 to classify municipalities by electoral system (proportional or majoritarian). Local government balance sheet data are provided by the Italian Ministry of Interior. Total expenditure and revenue data are available for the period 1993-2015 and detailed data (spending categories and revenue sources) for the period 1998-2015. We calculate per capita expenditure/revenues in Euro at 2010 prices and use this information in the year before elections take place to capture possible heterogeneity due to electoral cycles.

4.2 Measurement of risk perception

We already provided some evidence that earthquake occurrence is a good measure of risk (see Section 2). Since earthquakes occur randomly with large heterogeneity across time and space, the rich amount of frequency data may lead to different measures of risk. To define a precise measure of risk we use data on earthquake occurrences aggregated by municipality from the Italian Macroseismic Database DBMI15 (Locati et al., 2016) provided by INGV. This institute is managed by the Civil Protection and has the purpose to increase the knowledge of natural phenomena in terms of occurrence and relevance, with a particular focus on seismic and volcanic events. The DBMI15 database includes detailed information on earthquakes occurred in Italy between 1000 AD and 2014.\footnote{Data for 2015 are not available. Note, however, that in 2015 only a few earthquakes occurred and none of them was destructive.} We are interested in the Mercalli scale intensity ($I$), which measures observable effects caused by an earthquake on humans, animals, buildings and objects.\footnote{The alternative Richter scale measures the energy released by an earthquake. Although this is probably a more objective measure of earthquake strength, it is also less suitable to capture damages, and, therefore, risk perception, in the area.} Therefore, this is plausibly a good measure to identify how much voters are exposed to earthquakes.

Following Belloc et al. (2016), we classify earthquakes into destructive earthquakes ($I > 5$) and weak earthquakes ($2 < I \leq 5$). Belloc et al. (2016) consider both types of shocks because also weak earthquakes cause fear which political and religious authorities can exploit to keep their power. Although fear arises also when weak earthquakes occur, voters in modern economies are unlikely to reward or punish incumbent governments for negligible risk without any visible consequence. Therefore, we use destructive earthquakes
to distinguish between struck and unaffected municipalities.\textsuperscript{14} We define a dummy variable ($EQ_{it}$) equal to one if between two consecutive electoral periods ($t-1$ and $t$) at least one destructive earthquake occurs in the municipality area ($i$), and zero otherwise.

Between 1993 and 2015, the struck municipalities are 397 with 406 occurrences of destructive earthquakes between two electoral cycles (see Figure 2 for an illustration of earthquake occurrence across Italian municipalities). 60\% of these municipalities are located in 4 regions: Emilia Romagna, Umbria, Marche and Abruzzo. In municipal elections, we observe 216 incumbent mayors who run for reelection when an earthquake occurs.

4.3 Preliminary evidence on electoral outcomes

Before analyzing electoral outcomes, it is worth to observe that mayors decision to run for reelection is not significantly related to risk since it does not differ between municipalities struck by an earthquake between two electoral cycles and unaffected municipalities. The first line of Table 1 (Panel A) shows that the average probability of observing a mayor who decides to run for reelection is almost identical and not significantly different between the two groups of municipalities.\textsuperscript{15} Therefore, the incentive to run for reelection does not seem to differ according to risk. This suggests that the unconditional probability of reelection is not confounded by running decisions by incumbent mayors.

Figure 3 shows average electoral outcomes for municipal (3a and 3b) and Senate elections (3c). Municipal elections taking place outside the scheduled regular elections are included into the later electoral cycle (for instance, an election taking place in 2001 is included in the bars representing the 2004 cycle).\textsuperscript{16} The first figure (3a) shows incumbent mayor reelection probabilities. When a destructive earthquake occurs, mayors ruling in struck municipalities (red bars) seem to have a higher probability of being reelected compared to other municipalities in all cycles but 2004. Note, however, that the lower reelection probability in struck municipalities in 2004 seems to be determined by pre-existing characteristics of struck municipalities. Before the occurrence of the earthquake, the average reelection probability in these municipalities is 30\% lower compared to unaffected municipalities. Conversely, when the earthquake occurs (i.e. in 2004), the reelection prob-

\textsuperscript{14}We also extend the analysis to include non-destructive earthquakes. See Section 6.2.
\textsuperscript{15}To test mean differences, we use data from 29,901 municipal elections where an incumbent mayor has the possibility to decide whether or not to seek for reelection.
\textsuperscript{16}The regular 1995 electoral cycle is not included in the figure because we cannot observe if incumbent mayors sought for reelection in that cycle due to data limitations. Elections taking place in 2015 are grouped with 2014 regular elections.
ability grows by 21%. Therefore, our econometric approach should control for unobserved
time-invariant heterogeneity of municipalities in order to capture fixed characteristics af-
flecting vote choices. The second figure (3b) shows incumbent mayor vote share variations
relative to the previous electoral cycle. On average, vote shares grow in all municipalities,
but the growth is remarkably larger when an earthquake occurs. The positive differential
between vote share variations of struck and unaffected municipalities in the 2004 cycle
confirms our suggestion that the lower reelection probability in struck municipalities in
2004 is likely determined by unobserved heterogeneity.

The reelection probability in municipalities struck by an earthquake between two elec-
toral cycles is on average 3.7% higher and the vote share grows by an additional 3% com-
pared to unaffected municipalities (see Panel A in Table 1). Results of t-tests on mean
differences (reported with stars in column 2) show that both differences are statistically
significant. Panel A in Table 1 reports also other mean characteristics of municipalities
struck between two electoral cycles (column 2) and unaffected municipalities (column 1).
Vote participation is not affected by the occurrence of earthquakes which suggests that
shocks do not affect the willingness to express preferences for political representatives.
The number of candidates participating in elections is not significantly different when an
earthquake occurs and decreases slightly less between two electoral cycles in municipali-
ties struck by an earthquake. This suggests that earthquakes do not affect the decision
to run for election by alternative candidates and, therefore, the electoral competition is
apparently unchanged. Also characteristics of incumbent mayors are not significantly dif-
ferent between the two groups of municipalities, except for age which is about one year
lower in struck municipalities on average. Finally, the two groups are composed of a
non-significantly different share of municipalities with a proportional electoral system.

Looking at national-level elections, Figure 3c shows center-right vote share variations
between two consecutive Senate elections by electoral cycle.\footnote{The 2008 cycle is omitted because no destructive earthquake occurred between 2006 and 2008.} Blue bars represent vote
shares in municipalities not affected by a destructive earthquake over an electoral cycle and
red bars refer to struck municipalities. In each electoral cycle, the center-right coalition
gains more votes (or loses less votes) in struck municipalities as compared to unaffected
municipalities. Besides cycle-specific trends in vote choices, individuals with a higher
risk perception seem to prefer the center-right over the center-left coalition. Panel B in
Table 1 reports some statistics for municipalities struck by a earthquake between two
electoral cycles and unaffected municipalities. In struck municipalities, the center-right coalition gains (loses) on average 6.31% more (less) votes between two electoral cycles relative to unaffected municipalities. This difference does not seem to be significant, but we do not control for cycle-specific effects which are relevant in explaining vote choice in Senate elections. Finally, vote participation is almost equal and not significantly different between struck and unaffected municipalities. As for municipal elections, it appears that earthquake occurrence does not affect voters willingness to express their preferences in elections.

5 Methodology

5.1 Identification strategy

In order to identify the causal impact of risk perception on electoral outcomes, we propose a strategy using earthquake occurrence as an instrument and looking at the effects on vote shares and mayor reelection probability. The strength of this approach lies in the fact that earthquake occurrence, conditional on time and municipality fixed effects, are random exogenous shocks. We specify the following model:

$$ y_{it} = \beta_1 EQ_{it} + \beta_2 EQ_{i,t-d} + x_{it}' \gamma + \alpha_i + \delta_t + \varepsilon_{it} $$

where \( y_{it} \) is the electoral outcome (reelection or vote share of the incumbent mayor or center-right vote share in national elections) in municipality \( i \) at election point \( t \).

\( EQ_{it} \) is the earthquake occurrence measure (see Section 4.2). This is a dummy equal to one if, since the previous electoral cycle \( (t-1) \), a destructive earthquake (with intensity \( >5 \)) occurred. \( EQ_{i,t-d} \) is a dummy variable capturing the latest earthquake occurrence and is equal to one if \( d \) electoral cycles before \( t \) a destructive earthquake occurred. Therefore, \( EQ_{i,t-d} \) measures the occurrence of earthquakes in the past.

The main parameter of interest is \( \beta_1 \) which captures the impact of risk perception on electoral outcomes. Under the assumption of parallel trends, the effect captured by this parameter is a causal consequence of change in risky environment. We test this assumption in the next section. The parameter \( \beta_2 \) captures persistence of this effect in later elections.

\( x_{it}' \) is a vector of time-variant controls and \( \gamma \) is a vector of parameters. For municipal elections, we control for the variation in per capita local government expenditure, political
controls (variation in the number of candidates, electoral system and political orientation of the incumbent government), characteristics of the incumbent mayor (gender, age and years of education) and sociodemographic characteristics (percentage variation in population and variation in the share of the elderly). For national-level elections, we control for sociodemographic characteristics. $\alpha_i$ are municipality fixed effects, $\delta_t$ are electoral cycle fixed effects and $\epsilon_{it}$ is an iid error term.

Municipality fixed effects take into account persistent unobserved differences among municipalities which are likely correlated with both electoral outcomes, as also preliminary evidence suggests (see Section 4.3), and seismic risk. For instance, voters living in municipalities that are systematically exposed to corruption of politicians may take persistently different vote decisions as compared to voters living in non-corrupt towns. Also, municipalities characterized by a higher seismic risk may be persistently more risk averse. Finally, electoral cycle fixed effects are supposed to absorb the effect of changes in the electoral law, the political orientation of the central government and other macroeconomic shocks (e.g. the 2009 economic crisis).

To identify the effect of an earthquake on incumbent mayor reelection probability, we estimate Equation 1 using a linear probability model (LPM). This choice is determined by the inclusion of a large set of municipality fixed effects which would lead to the incidental parameter problem when using non-linear choice models (logit or probit) and yield inconsistent estimates. Moreover, if the fixed effect of a municipality is collinear to electoral outcomes (i.e. any mayor running for reelection is always/never reelected), then a fixed-effects logit or probit regression would drop information of that municipality because the success or failure would be perfectly predicted by time-invariant unobserved heterogeneity.\(^{18}\) However, municipalities struck by an earthquake in which incumbent mayors are systematically (not) reelected contribute to the identification of the impact of earthquakes, and so do unaffected municipalities because they contribute to estimate the effect of the other regressors on electoral outcomes. On the other hand, an LPM could provide imprecise marginal effects. We check the robustness of our preferred method using alternative models (fixed effects logit) to estimate the parameters (see Section 6.2).

Differently from the reelection probability, vote shares of incumbent mayors can be observed both in current and previous elections. Therefore, when using vote share as a dependent variable we further control for the lag of vote shares. In this way, the earthquake

\(^{18}\)This is a relevant issue in our sample because we would lose information from 5,549 municipalities (10,073 observations).
occurrence variable measures the differential between the variation in votes received by incumbent mayors of struck and unaffected municipalities.

For both the reelection probability model (LPM) and the vote share model, we estimate parameters using OLS with robust standard errors clustered by municipality to correct them for possible heteroskedasticity and serial correlation.

5.2 Parallel trends

Our identification strategy allows to obtain valid estimates of the effect of risk on electoral outcomes under the assumption that municipalities are characterized by pre-earthquake trends in electoral outcomes which do not differ between the the two groups of struck and unaffected municipalities.

Testing for parallel trends in municipal elections is a complex exercise because the timing of both earthquakes and elections differs across municipalities and because incumbent mayors seek reelection in less than 50% of runs. Therefore, we compare pre-earthquake incumbent mayor reelection probabilities and vote shares in struck municipalities with the respective outcomes in unaffected municipalities and run $t$-tests on mean differences to assess if the two groups are similar. Results are reported in Table 2. Reelection probability is 2.1% lower in affected municipalities before the occurrence of an earthquake (column 2) compared to unaffected municipalities (column 1), while mayor vote shares differ by 0.22%. However, $p$-values resulting from $t$-tests on mean differences (column 3) show that these differences are not statistically significant and, therefore, we can assume that the two groups of municipalities are similar in electoral outcomes before the occurrence of an earthquake.

To test for parallel trends for national-level elections, we compare average pre-earthquake center-right vote shares of struck municipalities with average vote shares of municipalities never affected by an earthquake. Trends are presented in Figure 4. The blue bold line represents average center-right vote shares for unaffected municipalities. We distinguish trends of municipalities struck in the periods 1996-2001 (red solid line), 2001-2006 (green dashed line), and 2008-2013 (yellow dash-dotted line).¹⁹ Independently of the electoral cycle, we do not observe divergent trends. The only exception may be for struck municipalities between 1996 and 2001 which show a slightly steeper decrease in vote shares, but

¹⁹Municipalities struck between 1994 and 1996 are omitted because we would have only a point estimate which does not allow us to compare trends. Moreover, note that during the electoral cycle 2006-2008 no destructive earthquakes occurred.
still quite parallel to the trend of unaffected municipalities. Moreover, the figure highlights that there are fixed differences in the support to center-right parties between the two groups of municipalities. This supports our decision to include municipality fixed effects in Equation 1.

6 Results

6.1 Impact of earthquakes on electoral outcomes

We now present the results from the estimation of Equation 1 in Table 3. Columns 1 and 2 report the results of incumbent mayor reelection probability using LPMs, columns 3 and 4 report OLS regression results of incumbent mayor vote shares, and columns 5 and 6 report OLS regression results of center-right vote shares in Senate elections. Columns 1, 3 and 5 control for municipality and time fixed effects. Columns 2, 4 and 6 include also the full set of time-variant regressors (see Section 5.1).

The occurrence of a destructive earthquake \((EQ_t)\) raises a mayor’s probability of being reelected by 10.1%-11.9% as compared to unaffected municipalities. Moreover, the mayor’s vote share grows by 6.41%-7.17% more than in unaffected municipalities, which suggests that the electoral support for the incumbent grows stronger in struck municipalities. This result is confirmed and is also slightly larger when controlling for the full set of time-variant controls (columns 2 and 4). Therefore, we can assert that more risk aversion leads individuals to prefer the less uncertain status quo by reconfirming the incumbent mayor rather than supporting alternative candidates with more uncertain performances. Mayors have the task to allocate the budget to local service provision and to claim the needs of the local population towards upper-level governments. Therefore, individuals with higher risk perception may prefer a mayor with known performance to an alternative candidate who provides potentially more beneficial, but more uncertain outcomes. Moreover, incumbent mayors may benefit from higher visibility on the media because of destructive earthquakes, which may provide more support to their manifesto.

Changes in risk perception seem to affect electoral outcomes with some level of persistence. The positive and significant coefficients of the variable measuring past earthquakes occurrence \((EQ_{t-d})\) through columns 1-4 suggest that both the probability of being reelected and the consensus for the incumbent mayor tend to increase if some earthquake took place in the past. Hence, the change in risk perception not only affect elections in
the short-run, but affects also electoral outcomes after several years.

Regarding national-level (Senate) elections, voters living in struck municipalities support center-right parties to a larger and significant extent by almost 2.6% and this effect shows some persistence in the following electoral cycles. Since the political orientation of the central government swings between center-left and center-right from one electoral cycle to another and struck municipalities generally show less support for center-right parties before a shock (see Section 5.2), the increasing support to center-right parties after a shock may not be explained by the lower level of uncertainty attached to the status quo. However, national representatives have generally more visibility on the media as compared to local politicians and may exploit this channel to provide a signal on the alignment to local preferences on policies after the shock. Voters may also perceive that politicians sitting in the Parliament can take decisions on the distribution of funds to recover from earthquake damages. Some evidence suggests that center-right parties are generally more prone to increase spending levels, reduce taxes and invest in economic development. Therefore, voters in struck municipalities may prefer a political manifesto emphasizing the use of public spending to face damages to human and capital resources, local economic activities, growth and welfare. Consequently, center-right parties may represent a better reassurance when earthquakes occur because voters perceive more stability and support to the needs in disaster areas. Quite often stock markets tend to punish the election of center-left governments in European countries suggesting that center-right parties are perceived as more stable and better performing in economic matters (Sattler, 2013).

The persistently larger support to a specific coalition in national elections is in line with previous findings. Giuliano and Spilimbergo (2013) find that individuals facing macroeconomic shocks (economic depression) in their youth are more likely to support left-oriented parties and to keep this position in the long-run because of a higher preference for income redistribution policies. Eriksson (2016) find that the inadequate response to the 2005 storm provided by the Swedish long-standing left-oriented government has shifted electoral support to the right-oriented coalition for at least 9 years since the shock. Similarly, we find that support to the center-right coalition persists for several electoral cycles after the shock, which may be determined by a higher commitment of center-right governments to disaster relief spending.

Besides the impact of earthquakes, we find evidence that higher local government expenditure in the year before elections raises incumbent mayor reelection probability and
vote share. Therefore, it appears that incumbents benefit from higher spending levels in elections which increase in municipalities struck by earthquakes (see Section 3.3 and further discussion in the Section 7).

6.2 Robustness checks

The robustness of our results is testified by the adoption of alternative model specifications, data sources and the use of an earthquake occurrence measure including weak shocks (intensity >2). The regression results from robustness checks are reported in Table 4.

To provide further support to the results of incumbent mayor reelection probability, we estimate the parameters using a fixed effects logit regression and obtain similar but not significant results (column 1). The lack of significance is most likely determined by the limitations of a logistic regression including a large set of fixed effects.\textsuperscript{20} Then, we use data on center-right vote shares in national elections from the House of Representatives instead of Senate and observe confirming results (column 2). The larger coefficient of the earthquake occurrence variable is most likely determined by the inclusion of voters aged between 18 and 25 years who cannot vote for Senate members (see Section 3.2) and whose decisions are more likely affected by extreme shocks (Giuliano and Spilimbergo, 2013).

Finally, we consider the occurrence of both weak and destructive earthquakes. In municipal elections, the coefficients of earthquake occurrence are positive but not significant in the reelection probability model (column 3). In the vote share model (column 4), coefficients are significant, although much lower in magnitude. While during the middle age weak earthquakes were sufficient to provoke fear exploited by political/religious leaders (Belloc et al., 2016), we believe that the very small size and perception of damages from weak earthquakes are unlikely to generate sufficient uncertainty to induce a significant change in voting decisions in modern societies. In national elections (column 5) the impact of earthquakes on center-right vote shares is positive and significant, although smaller in size because weak earthquakes damp the effect. This result may be determined by the fact that municipalities only slightly affected by an earthquake nearby benefit from disaster relief policies established by the central government for towns within a broad area around the epicenter.\textsuperscript{21}

\textsuperscript{20}See Section 5.1 for a discussion on the limits of a logistic regression including a large set of fixed effects.
\textsuperscript{21}See for instance Cipollone and Rosolia (2006).
7 Channels

7.1 Political visibility

Natural disaster receive extensive media coverage that provides information on the impact of the events. Both local politicians (mainly the mayor) and members of upper-level governments are frequently cited and interviewed by the media. Therefore, catastrophic events increase the visibility of politicians allowing them, either opportunistically or not, to send a signal of reassurance to the electorate and to reduce the degree of uncertainty about future expectations on policy outcomes.

To what extent higher visibility of incumbent politicians in earthquake areas alters risk perceptions of voters and affects electoral outcomes is worth to be analyzed. To measure political visibility, we use frequencies of news reporting the name of incumbent mayors geolocalized in the ruling municipality and issued while they are in charge. We apply this search strategy on the Factiva database and collect information from the main Italian press agency (ANSA) and newspapers (Corriere della Sera and Il Sole 24 Ore). Since our access is limited to news issued after 2001, we exclude electoral cycles before or overlapping with 2001. The sub-sample of electoral runs for which we collect news frequencies is composed of 5,857 observations. To control for media exposure of other political competitors, we apply a similar search strategy and build a competitor visibility measure using frequencies of news relative to the main challenger (most mentioned competitor).

On average, we collected 28.76 and 14.70 press-agency news per municipality on incumbent mayors and main challengers, respectively. The search on newspapers yielded much lower average frequencies with 8.46 and 9.77 news per municipality on incumbents and main challengers, respectively. The proportion of press agency news on incumbents exceeds news on the main challenger by almost 67% in municipalities struck by an earthquake, whereas the difference in unaffected municipalities is 47% (see Figure 5). The different distribution of news in struck municipalities is determined by a sharp increase

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22 The current version of the paper does not analyze the relationship between visibility and electoral outcomes in national elections.

23 This search strategy is an adaptation of the strategy used by Giommoni (2017).

24 Factiva is a research tool which provides access to news from all over the world. Along with ANSA, Corriere della Sera and Il Sole 24 Ore, several other Italian local and national news providers are accessible. We limit the search to the above three sources because they cover information over the entire country and for the longest period (since 2001).

25 We could use other measures, such as the average news frequencies of all competitors. However, the share of news issued on incumbents and main challengers is on average 96% of the total news issued on candidates suggesting that the remaining candidates have a marginal role in the electoral run.
of news on the incumbent (70.36 news on average), while news frequencies of competitors are not significantly different from unaffected municipalities (13.38 news on average). The news gap between incumbents and main challengers for newspapers is 24% in unaffected municipalities and it grows to 36% in struck municipalities.

Using these data, we estimate Equation 1 and control for earthquake occurrence measures ($EQ_t$ and $EQ_{t-d} \times Dist$), incumbent and competitor visibility (log news frequencies), political controls (electoral system and variation in the number of competing candidates), cycle fixed effects, and the lag of vote shares when using incumbent vote share as dependent variable.\(^{26,27}\) Regression results are reported in Table 5. Note that the different size and significance of the estimates of earthquake occurrence in the vote share models (columns 5 and 7) is likely determined by the omission of municipality fixed effects and by the limited number of observations which does not allow a consistent estimation of the impact of an earthquake on vote shares. Higher incumbent news frequency raises both his/her probability of being reelected (columns 1 and 3) and the vote share (columns 5 and 7), although the effect is not significant for newspapers (columns 3 and 7). Symmetrically, the higher the media coverage of the main challenger, the lower is the incumbent mayor reelection probability and the vote share.

In the columns 2, 4, 6 and 8, we extend the above models and include the interaction term between $EQ_t$ and news frequency of the incumbent to assess if the incumbent visibility has a different impact on electoral outcomes in struck municipalities. The results show that the estimated coefficient of the interaction term is positive and significant in all models, except for model 8. These results suggest that incumbent mayors in struck municipalities benefit from a higher visibility. Moreover, the coefficient of $EQ_t$ loses magnitude in all models and significance in the reelection probability models (columns 2 and 4), which suggests that higher visibility of incumbent mayors drives risk perception towards a rewarding vote for the incumbent. This result points at the prediction of our model that a positive signal sent by the incumbent (visibility) when an earthquake occurs reduces uncertainty on voter expectations from the incumbent and, therefore, increases his/her chances of winning the electoral competition (see Section 2.1).

\(^{26}\)We omit other controls and municipality fixed effects because we rely on a limited number of observations and do not benefit from repeated cross-sections over time.

\(^{27}\)To avoid the loss of information from municipalities where news frequencies of incumbents and/or competitors are zero, we compute log news frequencies as $\log(news + 1)$. 

21
7.2 Government expenditure, transfers and speed of recovery

A second channel that may explain electoral outcomes is the ability (or the promise) to recover from earthquake damages through the use of public spending and transfers. In Section 6.1, we showed that higher spending levels in the year before elections increase the reelection chances for the incumbent mayor. Previous studies argue that public financial windfalls from the central government increase the support for the incumbent party in national elections (Bechtel and Hainmueller, 2011; Healy and Malhotra, 2009). Even incumbent mayors may benefit from higher spending levels driven by financial windfalls from upper-level governments if voters observe a positive and quick response.

We provide evidence that local government expenditure following an earthquake, driven by increased transfers from the central government (see Section 3.3), have an effect on local and national electoral outcomes. In the year before elections, local governments in municipalities struck by a destructive earthquake spend on average 434 Euro per capita (at 2010 prices) more than local governments in unaffected municipalities. To analyze how disaster-driven expenditure affects municipal electoral outcomes, we estimate Equation 1 adding an interaction term between $EQ_t$ and per capita expenditure in the year before elections. The results are reported in columns 1 and 3 of Table 6 for incumbent mayor reelection probability and vote share, respectively. The coefficient of the interaction term is positive but not significant in both models. However, compared to the results discussed in Section 6.1 (columns 2 and 4 of Table 3), we find that the estimated coefficient of $EQ_t$ is smaller in magnitude and looses power, which may suggest that higher spending levels in struck municipalities drive the impact of earthquakes on electoral outcomes.

Because of the peculiar relief policy after the 2009 earthquake in the region Abruzzo (see Section 3.3), we further distinguish municipalities affected by this earthquake (columns 2 and 4). Indeed, reimbursements for the reconstruction of private goods were not delivered directly to individuals but were channeled to providers through local public authorities. Consequently, the per capita expenditure in municipalities struck by the 2009 earthquake was more than 1.5 times larger as compared to municipalities struck by other earthquakes (see Figure 6). To isolate the effect of these municipalities, we extend the models in columns 1 and 3 and include interaction terms between local government expenditure and a dummy variable equal to one if a municipality was struck by the 2009 earthquake (Abruzzo). The estimated coefficients of the interaction term between expenditure and $EQ_t$ are now larger and significant. Similarly to incumbent visibility, it appears that ex-
Expenditure is a positive signal on voters expectations that rewards the incumbent mayor. Conversely, there is no additional effect of expenditure when the 2009 earthquake strikes, although spending levels are remarkably larger. The contrasting result observed in Abruzzo is most likely determined by the relatively higher levels of corruption. Compared to the shock of 2012 in Emilia Romagna, media coverage of corruption scandals related to the 2009 earthquake was much higher (see Table 7), which possibly led to more pessimistic expectations about incumbent performance.

To analyze if the central government benefits from the response provided to disaster areas in national-level elections, we estimate Equation 1 using center-right vote share as dependent variable and control for per capita local government expenditure in the year before elections. Since the political orientation of the central government swings between center-left and center-right, we isolate both the effects of expenditure and earthquakes when the government is center-right oriented. In Table 8 (column 1) we observe that expenditure (expressed in thousand Euro per capita at 2010 prices) tends to increase the support for center-right parties when the government is center-right oriented (positive and significant coefficient of \( C\text{-right gov.} \times \text{Exp. p/c} \)), while it decreases the support for these parties when the left center-left coalition is in charge (negative and significant coefficient of \( \text{Exp. p/c} \)). Moreover, the effect of an earthquake on vote choice does not differ according to the political orientation of the central government (not significant coefficient of \( \text{EQ}_t \times C\text{-right gov.} \)). When we add the interaction term between expenditure and the earthquake occurrence variable \( \text{EQ}_t \) (column 2), the effect of this term is positive and significant if the government is center-right oriented, and it captures most of the effect of an earthquake occurring when the center-right coalition is in charge. Conversely, expenditure when a center-left government is in charge has a negative but not significant effect on center-right vote shares. These results suggest that center-right governments tend to send more resources to disaster areas or politicians of center-right parties are more effective in

\[ 28 \text{The sum of the coefficients } EQ_t \times \text{Exp. p/c and } EQ_t \times \text{Exp. p/c} \times \text{Abruzzo returns the additional effect of expenditure on electoral outcomes for municipalities struck by the 2009 earthquake. This effect is } -0.0127 \text{ and it is not significantly different from zero.} \]

\[ 29 \text{Note that the impact of expenditure on electoral outcomes when no earthquake occurs is not significantly different in municipalities struck by the 2009 earthquake (not significant coefficient of } \text{Exp. p/c} \times \text{Abruzzo).} \]

\[ 30 \text{See for instance Alexander (2013) and ¨Ozerdem and Rufini (2013) for an insight on corruption related to disaster relief after the occurrence of the 2009 earthquake.} \]

\[ 31 \text{We prefer to use expenditure rather than transfers to measure central government response because voters do not observe the amount of transfers received by the local government, but they perceive the benefits from higher local government spending levels driven by transfers.} \]

\[ 32 \text{The effect of an earthquake when a center-right government is in charge is given by the sum of the coefficients of the variables } EQ_t \text{ and } EQ_t \times C\text{-right gov.}, \text{ which is equal to } 0.317 \text{ in column 2.} \]
communicating their commitment to disaster areas.

8 Conclusions

Risk and uncertainty may affect voters expectations on politicians performance and, therefore, vote choice. Higher risk perception favors less uncertain outcomes to more uncertain, but potentially more beneficial outcomes. Using exogenous earthquake occurrence as a measure of risk, we provided evidence that higher risk perception generates more support for the incumbent local politician and center-right parties in national-level elections. We exploited data on municipal and national electoral outcomes from the universe of Italian municipalities for 5 municipal and 6 national-level electoral cycles, and the register of all seismic events since 1000 AD.

The occurrence of an earthquake increases incumbent mayor reelection probability by 11% and vote share by 7%, and center-right vote share in national (Senate) elections by almost 2.6%. This effect shows some persistence in the following electoral cycles. At local level, our results may suggest that individuals with higher risk perception tend to prefer the status quo. Moreover, we show that incumbent candidates benefit from higher political visibility on the media, and higher local government expenditure to face earthquake damages.

In national-level elections, the higher support for center-right parties as compared to center-left parties is related to more financial transfers sent to disaster areas. Moreover, we show that center-right governments benefit from higher levels of financial transfers sent to disaster areas, while center-left governments do not.

To conclude, we argue that natural disasters provide opportunities for strategic politician behavior to affect future expectations of voters through appearance on the media and public expenditure, which in turn may blunt political competitors and the speed of recovery.
References


Figure 1: The relationship between earthquakes, risk and uncertainty, and information.

Notes - The figures compare characteristics between regions struck by a destructive earthquake in 2009 (Abruzzo - denoted by Earthquake) and unaffected neighboring regions (Marche, Lazio and Molise - denoted by Control). Blue bars represent average characteristics for the 5 years before the occurrence of the earthquake and red bars for the 5 years after the shock. Figure (a) shows the share of people with insurance policies covering damages and health issues. Figure (b) shows theft rates per 100 people and homicide rates per 100,000 people. Figure (c) shows Italian and foreign tourist arrivals per 100 people. Figure (d) shows the frequency at which people get informed on politics (never or at least once per week). Source: Our elaboration on SHIW data sourced from the Bank of Italy (Figure a), on data from ISTAT (Figures b and d) and from ONIT (Figure c).
Figure 2: A map of risk and uncertainty - earthquake occurrence in Italy (1993-2015).

Notes - The map represents municipalities struck by a destructive earthquake (with intensity >5) between 1993 and 2015. Red areas represent struck municipalities.

Source: Our elaboration on data from the DBMI15 database of INGV (Locati et al. 2016). The shape map of the administrative borders is provided by ISTAT.
Figure 3: Electoral outcomes.

(a) Mayor reelection probability

(b) Incumbent mayor vote share

(c) Center-right vote share

Notes - The figures show electoral outcomes for municipal and Senate elections. Figure (a) shows average reelection probabilities of incumbent mayors and Figure (b) their vote share variation relative to the previous election by electoral cycle. Figure (c) shows average center-right vote share variation relative to the previous election by electoral cycle. Red bars represent municipalities struck by a destructive earthquake (with intensity >5) between two electoral cycles and blue bars represent municipalities which are unaffected. Municipal elections taking place outside the regular electoral cycles are grouped into the later regular electoral cycle. The 2008 Senate elections are omitted because no destructive earthquake occurred between 2006 and 2008.

Source: Our elaboration on election data provided by the Italian Ministry of the Interior.
Table 1: Descriptive statistics.

<table>
<thead>
<tr>
<th>Panel A: Municipal elections</th>
<th>(1) No earthquake</th>
<th>(2) Earthquake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runs for reelection (= 1)</td>
<td>0.487</td>
<td>0.486</td>
</tr>
<tr>
<td>Reelected (= 1)</td>
<td>0.792</td>
<td>0.829*</td>
</tr>
<tr>
<td>Δ Vote share of the incumbent</td>
<td>1.549</td>
<td>4.544**</td>
</tr>
<tr>
<td>Vote participation (%)</td>
<td>77.70</td>
<td>77.24</td>
</tr>
<tr>
<td>Δ No. of candidates</td>
<td>-0.109</td>
<td>-0.0291</td>
</tr>
<tr>
<td>Years of education of the incumbent</td>
<td>14.36</td>
<td>14.55</td>
</tr>
<tr>
<td>Incumbent is man</td>
<td>0.921</td>
<td>0.903</td>
</tr>
<tr>
<td>Age of the incumbent</td>
<td>46.22</td>
<td>45.14**</td>
</tr>
<tr>
<td>Proportional electoral system (=1)</td>
<td>0.0763</td>
<td>0.0972</td>
</tr>
<tr>
<td>Obs.</td>
<td>16049</td>
<td>216</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Senate elections</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Center-left vote share</td>
<td>-9.476</td>
</tr>
<tr>
<td>Vote participation (%)</td>
<td>79.86</td>
</tr>
<tr>
<td>Obs.</td>
<td>39544</td>
</tr>
</tbody>
</table>

Notes - The table reports mean characteristics of unaffected municipalities (column 1) and municipalities struck by a destructive earthquake (with intensity >5) between two electoral cycles (column 2). Panel A reports statistics for variables related to municipal elections where a mayor runs for reelection (except for Runs for reelection which exploits the universe of municipal elections). Panel B reports statistics for Senate elections. Stars in column 2 indicate significance levels that result from one-sided t-tests on mean differences between the two groups of municipalities. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. 

31
Table 2: Pre-earthquake electoral outcomes in municipal elections.

<table>
<thead>
<tr>
<th></th>
<th>(1) No earthquake</th>
<th>(2) Earthquake</th>
<th>(3) p-value ($H_0$: means are equal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reelected (=1)</td>
<td>0.772</td>
<td>0.751</td>
<td>0.471</td>
</tr>
<tr>
<td>Mayor vote share</td>
<td>56.38</td>
<td>56.16</td>
<td>0.779</td>
</tr>
</tbody>
</table>

*Notes* - The table reports mean municipal electoral outcomes. Column 1 reports means for municipalities never struck by a destructive earthquake (with intensity >5) between 1993 and 2015. Column 2 reports pre-earthquake means for municipalities struck by a destructive earthquake. Column 3 reports $p$-values resulting from $t$-tests on mean differences between the two groups of municipalities.

Figure 4: Pre-earthquake trends in national-level elections (Senate) by electoral cycle.

*Notes* - The figure presents pre-earthquake trends of center-right vote shares in Senate elections for municipalities struck by a destructive earthquake (with intensity >5) within different electoral cycles: 1996-2001 (red solid line), 2001-2006 (green dashed line) and 2008-2013 (yellow dash-dotted line). The blue bold line represents municipalities never struck by an earthquake between 1994 and 2013.

*Source:* Our elaboration on election data provided by the Italian Ministry of Interior.
Table 3: Impact of earthquakes on electoral outcomes.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Municipal elections</th>
<th>Senate elections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incumbent reelection</td>
<td>Incumbent vote share</td>
</tr>
</tbody>
</table>
| EQ
  \( t \)       | 0.106*** 0.112*** 6.211*** 6.763*** | 2.554*** 2.520*** |
| (0.0483) (0.0501) (2.332) (2.046) | (0.312) (0.310) |
| EQ
  \( t \) − \( d \) | 0.156*** 0.113** 5.557** 3.718* | 1.343*** 1.332*** |
| (0.0454) (0.0490) (2.273) (2.015) | (0.303) (0.304) |
| Exp. \( p/c \) | 0.0261*** 1.118*** | 0.0760*** 0.0745*** |
| (0.00625) (0.289) | (0.00725) (0.00727) |
| Vote share \((t − 1)\) | 0.0476*** 0.310*** | 0.0760*** 0.0745*** |
| (0.0180) (0.0190) | (0.00725) (0.00727) |
| Municipality fixed effects | Yes Yes Yes Yes | Yes Yes |
| Electoral cycle fixed effects | Yes Yes Yes Yes | Yes Yes |
| Political controls | No Yes No Yes | No No |
| Characteristics of the incumbent | No Yes No Yes | No No |
| Sociodemographic controls | No Yes No Yes | No Yes |
| Obs. | 16266 13474 14015 13026 40142 39845 |
| Overall R-sq. | 0.00698 0.0429 0.0367 0.305 0.379 0.374 |
| Within R-sq. | 0.0307 0.0478 0.0194 0.227 0.713 0.711 |
| Between R-sq. | 0.00522 0.00427 0.0473 0.333 0.814 0.640 |

Notes - The table reports OLS regression results. The dependent variable in columns 1 and 2 is a dummy equal to one if an incumbent mayor is reelected, and zero otherwise. In columns 3 and 4 the dependent variable is the share of votes received by the incumbent mayor. In columns 5 and 6 the dependent variable is the vote share of center-right votes in Senate elections. \( EQ \) is a dummy variable equal to one if a destructive earthquake (with intensity > 5) occurred between two electoral cycles. \( EQ \) − \( d \) is a dummy variable equal to one if earthquakes occurred in the past. \( Exp. \ p/c \) is the per capita local government expenditure (expressed in thousand Euro at 2010 prices) measured in the year before elections take place. Political controls include the electoral system, the political orientation of the incumbent government and the variation in the number of competing candidates participating in elections. Characteristics of the incumbent mayor include age, gender and years of education. Sociodemographic controls include the percentage variation in population and the variation in the share of elderly people. Significance levels: *** \( p < 0.01 \), ** \( p < 0.05 \), * \( p < 0.10 \). Robust standard errors clustered by municipality are in parentheses.
Table 4: Impact of earthquakes on electoral outcomes using different model specifications.

<table>
<thead>
<tr>
<th></th>
<th>(1) $EQt = 1$ if intensity &gt;5</th>
<th>(2) $EQt = 1$ if intensity &gt;2</th>
<th>(3) $EQt = 1$ if intensity &gt;2</th>
<th>(4) $EQt = 1$ if intensity &gt;2</th>
<th>(5) $EQt = 1$ if intensity &gt;2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Municipal elections</td>
<td>House of Representatives</td>
<td>Municipal elections</td>
<td>Senate</td>
<td>Senate</td>
</tr>
<tr>
<td></td>
<td>Reelection (FE Logit)</td>
<td>Center-right vote share</td>
<td>Reelection</td>
<td>Vote share</td>
<td>Center-right vote share</td>
</tr>
<tr>
<td>$EQt$</td>
<td>0.554</td>
<td>3.624***</td>
<td>0.6236</td>
<td>1.235**</td>
<td>0.594***</td>
</tr>
<tr>
<td></td>
<td>(0.386)</td>
<td>(0.329)</td>
<td>(0.0159)</td>
<td>(0.575)</td>
<td>(0.0966)</td>
</tr>
<tr>
<td>$EQt-d$</td>
<td>0.509</td>
<td>1.869***</td>
<td>0.0194</td>
<td>1.084*</td>
<td>0.188*</td>
</tr>
<tr>
<td></td>
<td>(0.388)</td>
<td>(0.331)</td>
<td>(0.0171)</td>
<td>(0.650)</td>
<td>(0.107)</td>
</tr>
<tr>
<td>Exp. p/c</td>
<td>0.287***</td>
<td>(0.0588)</td>
<td>0.0281***</td>
<td>1.180***</td>
<td>0.0734***</td>
</tr>
<tr>
<td></td>
<td>(0.00896)</td>
<td>(0.00019)</td>
<td>(0.283)</td>
<td>(0.283)</td>
<td>(0.00726)</td>
</tr>
<tr>
<td>Vote share $(t-1)$</td>
<td>0.129***</td>
<td>(0.00896)</td>
<td>0.308***</td>
<td>(0.0190)</td>
<td>0.0734***</td>
</tr>
<tr>
<td></td>
<td>(0.00896)</td>
<td>(0.0190)</td>
<td>(0.00726)</td>
<td>(0.00726)</td>
<td>(0.00726)</td>
</tr>
<tr>
<td>Municipality fixed effects</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Electoral cycle fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Political controls</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Characteristics of the incumbent</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Sociodemographic controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Obs.</td>
<td>5126</td>
<td>39590</td>
<td>13474</td>
<td>13026</td>
<td>39845</td>
</tr>
<tr>
<td>Overall (Pseudo) R-sq.</td>
<td>0.124</td>
<td>0.461</td>
<td>0.0240</td>
<td>0.303</td>
<td>0.372</td>
</tr>
<tr>
<td>Within R-sq.</td>
<td>0.734</td>
<td>0.0785</td>
<td>0.227</td>
<td>0.711</td>
<td>0.648</td>
</tr>
<tr>
<td>Between R-sq.</td>
<td>0.821</td>
<td>0.00373</td>
<td>0.332</td>
<td>0.648</td>
<td>0.648</td>
</tr>
</tbody>
</table>

Notes - Column 1 is a fixed effects logistic regression of incumbent mayor reelection probability. All other columns report OLS regression results. The dependent variable is the vote share of the center-right coalition in House of Representatives elections (column 2), the incumbent mayor reelection probability (column 3), the incumbent mayor vote share (column 4), and the center-right vote share in Senate elections (column 5). In columns 1-2, $EQt$ is a dummy variable equal to one if a destructive earthquake (with intensity >5) occurred between two electoral cycles, while in columns 3-5 $EQt$ includes also weak earthquake occurrences (intensity >2). $EQt-d$ is a dummy variable equal to one if earthquakes occurred in the past. Exp. p/c is the per capita local government expenditure (expressed in thousand Euro at 2010 prices) measured in the year before elections take place. Political controls include the electoral system, the political orientation of the incumbent government and the variation in the number of competing candidates participating in elections. Characteristics of the incumbent mayor include age, gender and years of education. Sociodemographic controls include the percentage variation in population and the variation in the share of elderly people. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Robust standard errors clustered by municipality are in parentheses.
Figure 5: Political visibility.

Notes - The figure illustrates average proportions of news on the incumbent mayor (blue bars) and on competing candidates (red bars for the main challenger and green bars for other challengers) over an electoral cycle. Bars denoted by Earthquake refer to municipalities struck by a destructive earthquake (with intensity >5) between two elections and bars denoted by No earthquake refer to unaffected municipalities. Press agency includes news issued by ANSA. Newspapers includes news issued by the Italian national newspapers Corriere della Sera and Il Sole 24 Ore. Source: Our elaboration on data collected from Factiva.
Table 5: Reelection probability and media coverage.

<table>
<thead>
<tr>
<th>News source</th>
<th>(1) Incumbent reelection</th>
<th>(2) Incumbent vote share</th>
<th>(3) News agency</th>
<th>(4) Newspapers</th>
<th>(5) Incumbent reelection</th>
<th>(6) Incumbent vote share</th>
<th>(7) News agency</th>
<th>(8) Newspapers</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ_t</td>
<td>0.131***</td>
<td>0.0483</td>
<td>(0.0472)</td>
<td>(0.0752)</td>
<td>0.147***</td>
<td>0.0842</td>
<td>(0.0470)</td>
<td>(0.0614)</td>
</tr>
<tr>
<td>EQ_{t-d}</td>
<td>0.0484*</td>
<td>0.0487*</td>
<td>(0.0272)</td>
<td>(0.0272)</td>
<td>0.0559**</td>
<td>0.0558**</td>
<td>(0.0272)</td>
<td>(0.0272)</td>
</tr>
<tr>
<td>EQ_t × News on the incumbent</td>
<td>0.0431**</td>
<td>0.108***</td>
<td>(0.0208)</td>
<td>(0.0330)</td>
<td>2.426**</td>
<td>2.794</td>
<td>(1.094)</td>
<td>(1.726)</td>
</tr>
<tr>
<td>News on the incumbent</td>
<td>0.0231***</td>
<td>0.0226***</td>
<td>0.00938</td>
<td>0.00863</td>
<td>0.775***</td>
<td>0.743***</td>
<td>0.140</td>
<td>0.121</td>
</tr>
<tr>
<td>News on main challenger</td>
<td>-0.0359***</td>
<td>-0.0358***</td>
<td>-0.0259***</td>
<td>-0.0261***</td>
<td>-1.603***</td>
<td>-1.602***</td>
<td>-0.880***</td>
<td>-0.883***</td>
</tr>
<tr>
<td>Vote share (t − 1)</td>
<td>0.437***</td>
<td>0.437***</td>
<td>0.438***</td>
<td>0.438***</td>
<td>(0.0162)</td>
<td>(0.0162)</td>
<td>(0.0163)</td>
<td>(0.0163)</td>
</tr>
<tr>
<td>Political controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Electoral cycle fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Obs.</td>
<td>5849</td>
<td>5849</td>
<td>5849</td>
<td>5849</td>
<td>5687</td>
<td>5687</td>
<td>5687</td>
<td>5687</td>
</tr>
</tbody>
</table>

Notes - The table reports OLS regression results. The dependent variable in columns 1-4 is a dummy equal to one if an incumbent mayor is reelected, and zero otherwise. In columns 5-8 the dependent variable is the share of votes received by the incumbent mayor. EQ_t is a dummy variable equal to one if a destructive earthquake (with intensity >5) occurred between two electoral cycles. EQ_{t-d} is a dummy variable equal to one if an earthquake occurred in the past. News on the incumbent and on competing candidates are expressed as log frequencies. Political controls include the electoral system and the variation in the number of competing candidates participating in elections. Significance levels: *** \( p < 0.01 \), ** \( p < 0.05 \), * \( p < 0.10 \). Robust standard errors are in parentheses.
Figure 6: Local government expenditure by region.

Notes - The figure represents average per capita local government expenditure at 2010 prices in the year before municipal elections by groups of regions. Bars denoted by Abruzzo (on the left) represent expenditure for municipalities located in the region Abruzzo, while the couple of bars denoted by No Abruzzo represent expenditure for all other municipalities. Red bars represent municipalities which are struck by a destructive earthquake (with intensity $>5$) between two elections and blue bars represent unaffected municipalities. Source: Our elaboration on data provided by the Italian Ministry of the Interior.
<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>(1) Incumbent reelection</th>
<th>(2) Incumbent reelection</th>
<th>(3) Incumbent vote share</th>
<th>(4) Incumbent vote share</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ_t</td>
<td>0.0435</td>
<td>0.0127</td>
<td>6.485*</td>
<td>5.245*</td>
</tr>
<tr>
<td></td>
<td>(0.0740)</td>
<td>(0.0702)</td>
<td>(3.320)</td>
<td>(2.929)</td>
</tr>
<tr>
<td>EQ_t−d</td>
<td>0.103**</td>
<td>0.112**</td>
<td>3.679*</td>
<td>4.623**</td>
</tr>
<tr>
<td></td>
<td>(0.0488)</td>
<td>(0.0503)</td>
<td>(2.041)</td>
<td>(2.090)</td>
</tr>
<tr>
<td>EQ_t × Exp. p/c</td>
<td>0.0297</td>
<td>0.0628***</td>
<td>0.118</td>
<td>1.829*</td>
</tr>
<tr>
<td></td>
<td>(0.0234)</td>
<td>(0.0214)</td>
<td>(1.262)</td>
<td>(0.944)</td>
</tr>
<tr>
<td>Exp. p/c</td>
<td>0.0255***</td>
<td>0.0243***</td>
<td>1.116***</td>
<td>1.156***</td>
</tr>
<tr>
<td></td>
<td>(0.00621)</td>
<td>(0.00676)</td>
<td>(0.288)</td>
<td>(0.311)</td>
</tr>
<tr>
<td>EQ_t × Exp. p/c × Abruzzo</td>
<td>-0.0706**</td>
<td>-3.356**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0287)</td>
<td>(1.371)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp. p/c × Abruzzo</td>
<td>0.0128</td>
<td>-0.165</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0148)</td>
<td>(0.736)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vote share (t − 1)</td>
<td></td>
<td></td>
<td>0.310***</td>
<td>0.310***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0190)</td>
<td>(0.0190)</td>
</tr>
</tbody>
</table>

Municipality fixed effects | Yes | Yes | Yes | Yes |
Electoral cycle fixed effects | Yes | Yes | Yes | Yes |
Political controls | Yes | Yes | Yes | Yes |
Characteristics of the incumbent | Yes | Yes | Yes | Yes |
Sociodemographic controls | Yes | Yes | Yes | Yes |

Obs. | 13474 | 13474 | 13026 | 13026 |
Overall R-sq. | 0.0251 | 0.0249 | 0.305 | 0.303 |
Within R-sq. | 0.0790 | 0.0796 | 0.227 | 0.228 |
Between R-sq | 0.00434 | 0.00427 | 0.333 | 0.329 |

Notes - The table reports OLS regression results. The dependent variable in columns 1-3 is a dummy equal to one if an incumbent mayor is reelected, and zero otherwise. In columns 4-6 the dependent variable is the share of votes received by the incumbent mayor. EQ_t is a dummy variable equal to one if a destructive earthquake (with intensity > 5) occurred between two electoral cycles. EQ_t−d is a dummy variable equal to one if earthquakes occurred in the past. Exp. p/c is the per capita local government expenditure (expressed in thousand Euro at 2010 prices) measured in the year before elections take place. Abruzzo is a dummy variable equal to one for municipalities located in the region Abruzzo. Time-varying controls are political controls (electoral system, the political orientation of the incumbent government and the variation in the number of competing candidates), characteristics of the incumbent mayor (age, gender and years of education) and sociodemographic controls (percentage variation in population and the variation in the share of the elderly). Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10. Robust standard errors clustered by municipality are in parentheses.
Table 7: Media coverage of corruption.

<table>
<thead>
<tr>
<th></th>
<th>L’Aquila 2009</th>
<th>Emilia 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Related to earthquake</td>
<td>Related to earthquake</td>
</tr>
<tr>
<td>Press agency</td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>53</td>
</tr>
<tr>
<td>Newspapers</td>
<td>8</td>
<td>23</td>
</tr>
</tbody>
</table>

Notes - The table reports frequencies of press news on mayors or local government councilors and corruption in the three years before (columns 1 and 4) and after the occurrence of destructive earthquakes (columns 2 and 5). Columns 1-3 report frequencies of news issued in the region Abruzzo, which is struck by an earthquake on April 7, 2009. Columns 4-6 report frequencies of news issued in the region Emilia Romagna, which is struck by an earthquake on May 29, 2012. Columns 3 and 6 report the share of news after the occurrence of an earthquake relating politicians corruption to earthquakes. Press agency groups news issued by ANSA and Newspapers groups articles issued by the national daily newspapers Corriere della Sera, Il Sole 24 Ore and La Repubblica.
Table 8: National-level electoral outcomes (Senate) and central government response.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.381)</td>
<td>(0.453)</td>
</tr>
<tr>
<td>EQ_t</td>
<td>2.425***</td>
<td>2.585***</td>
</tr>
<tr>
<td></td>
<td>(0.532)</td>
<td>(0.769)</td>
</tr>
<tr>
<td>EQ_t × C.-right gov.</td>
<td>0.0220</td>
<td>-2.268***</td>
</tr>
<tr>
<td></td>
<td>(0.323)</td>
<td>(0.319)</td>
</tr>
<tr>
<td>EQ_t−d</td>
<td>1.214***</td>
<td>1.160***</td>
</tr>
<tr>
<td></td>
<td>(0.381)</td>
<td>(0.453)</td>
</tr>
<tr>
<td>EQ_t × C.-right gov. × Exp. p/c</td>
<td>1.014***</td>
<td>(0.307)</td>
</tr>
<tr>
<td></td>
<td>(0.0522)</td>
<td>(0.0530)</td>
</tr>
<tr>
<td>C.-right gov. × Exp. p/c</td>
<td>0.310***</td>
<td>0.294***</td>
</tr>
<tr>
<td></td>
<td>(0.0474)</td>
<td>(0.0505)</td>
</tr>
<tr>
<td>EQ_t × Exp. p/c</td>
<td>-0.0715</td>
<td>-0.0715</td>
</tr>
<tr>
<td></td>
<td>(0.0956)</td>
<td>(0.0956)</td>
</tr>
<tr>
<td>Exp. p/c</td>
<td>-0.0799*</td>
<td>-0.0737</td>
</tr>
<tr>
<td></td>
<td>(0.00736)</td>
<td>(0.00737)</td>
</tr>
<tr>
<td>Vote share (t − 1)</td>
<td>0.0613***</td>
<td>0.0615***</td>
</tr>
<tr>
<td></td>
<td>(0.00736)</td>
<td>(0.00737)</td>
</tr>
<tr>
<td>Municipality fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Electoral cycle fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sociodemographic controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Obs.</td>
<td>39026</td>
<td>39026</td>
</tr>
<tr>
<td>Overall R-sq.</td>
<td>0.362</td>
<td>0.363</td>
</tr>
<tr>
<td>Within R-sq.</td>
<td>0.720</td>
<td>0.720</td>
</tr>
<tr>
<td>Between R-sq.</td>
<td>0.376</td>
<td>0.378</td>
</tr>
</tbody>
</table>

Notes - The table reports OLS regression results. The dependent variable is the share of votes received by the center-right coalition in Senate elections. EQ_t is a dummy variable equal to one if a destructive earthquake (with intensity >5) occurred between two electoral cycles. EQ_t−d is a dummy variable equal to one if earthquakes occurred in the past. C.-right gov. is a dummy variable equal to one if the incumbent government is supported by the center-right coalition. Exp p/c is the per capita local government expenditure (expressed in thousand Euro at 2010 prices) measured in the year before elections take place. Abruzzo is a dummy variable equal to one for municipalities located in the region Abruzzo. Sociodemographic controls are the percentage variation in population and the variation in the share of the elderly. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10. Robust standard errors clustered by municipality are in parentheses.
Appendix

A.1 Theoretical framework

We consider a voter with the following expected utility function depending on wealth \( w \) who rationally assumes unchanged policies by current politicians (incumbent):

\[
EU_I[w] = \log(w) \quad w > 0.
\]  

(2)

The effect of policies by alternative candidates (challenger) is uncertain. Therefore, the expected utility is:

\[
EU_C[w, \varepsilon, \pi] = \pi \log(w - \varepsilon) + (1 - \pi) \log(w + \varepsilon) \quad \pi \in [0, 1], \ 0 < \varepsilon < w
\]  

(3)

where \( \pi \) is the probability that the voter attaches to outcomes lower than the current level of wealth and \( \varepsilon \) is the loss/gain of policies in terms of wealth. Using (2) and (3), we can write a critical value of \( \pi \) that makes the individual indifferent between choosing the incumbent or the competitor:

\[
\hat{\pi} = \frac{\log(w + \varepsilon) - \log(w)}{\log(w + \varepsilon) - \log(w - \varepsilon)}
\]  

(4)

For \( \pi \geq \hat{\pi} \), the individual will vote for the incumbent.

Now, assume that an earthquake occurs and the voter faces a loss of wealth \( L \) (with \( \varepsilon < L < w - \varepsilon \)). The incumbent and the competitor’s ability to recover from the loss is assumed to be the same: \( p \in [0, 1] \). However, the incumbent can send a signal \( \delta \) \((\delta \in [-p, 1 - p])\) at zero regarding his/her ability to restore initial wealth and affecting voter expectations. After the earthquake, the voter expected utility becomes: The voter expected utility becomes:

\[
EU_I[w|L, p] = (p + \delta) \log(w) + (1 - p - \delta) \log(w - L)
\]  

(5)

and

\[
EU_C[w, \varepsilon, \pi|L, p] = p[\pi \log(w - \varepsilon) + (1 - \pi) \log(w + \varepsilon)]
\]

\[
+ (1 - p)[\pi \log(w - \varepsilon - L) + (1 - \pi) \log(w + \varepsilon - L)].
\]  

(6)
Using (5) and (6) and defining $\Delta = \delta[\log(w) - \log(w - L)]$, the new value of $\pi$ for which the individual is indifferent between choosing the incumbent or the competitor is:

$$\hat{\pi}_s = p[\log(w + \varepsilon) - \log(w)] + (1-p)[\log(w + \varepsilon - L) - \log(w - L)] - \Delta$$

which is an increasing function of $p$, and a decreasing function of $L$ and $\delta$.

From Equation 7 we see that the individual will vote for the incumbent if the probability of negative outcomes is $\pi \geq \hat{\pi}_s$. To compare vote choices before and after the shock, consider first the extreme case of full recovery with $p = 1$ and no signal by the incumbent ($\delta = 0$). In this case we obtain $\hat{\pi}_s = \hat{\pi}$ meaning that the chances of reelection of the incumbent do not change. However, if the incumbent sends a negative signal, he/she could reduce the likelihood of reelection since $\Delta$ is an increasing function of $\delta$ and $\hat{\pi}_s$ would increase.

Consider now the most realistic case in which full recovery is not expected (at least within a relatively short period of time or within one electoral cycle). For $p < 1$ and no signal by the incumbent ($\delta = 0$), then $\hat{\pi}_s < \hat{\pi}$. Clearly, if a positive signal is sent ($\delta > 0$), the likelihood of supporting the incumbent increases since $\Delta$ has a negative effect on $\hat{\pi}_s$. Finally, if the incumbent sends a negative signal ($\delta < 0$), then a threshold $\hat{\delta}$ exists for which $\hat{\pi}_s \leq \hat{\pi}$. The critical value of $\hat{\delta}$ can be written as:

$$\hat{\delta} = -(1-p)\frac{\beta(\gamma - \eta) + \lambda(\phi - \gamma) + \alpha(\phi - \eta)}{(\beta - \lambda)(\alpha - \gamma)}$$

where $\alpha = \log(w)$, $\beta = \log(w + \varepsilon)$, $\lambda = \log(w - \varepsilon)$, $\gamma = \log(w - L)$, $\eta = \log(w - \varepsilon - L)$ and $\phi = \log(w + \varepsilon - L)$. For $\delta \geq \hat{\delta}$, we have $\hat{\pi}_s \leq \hat{\pi}$ and the incumbent mayor benefits from the shock even though a negative signal is sent, provided it is not too negative.

---

\[33\] Using (4) and (7), we solve $\hat{\pi} = \hat{\pi}_s$ for $\delta$ ($\delta = \Delta/[\log(w) - \log(w - L)]$).