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Abstract

How do voters react to large shocks that are (mostly) outside the control of politicians? We address this question by studying the electoral effects of wildfires in Spain during 1983-2011. Using a difference-in-difference strategy, we find that a large accidental fire up to nine months ahead of a local election increases the incumbent party's vote share by almost 8 percentage points. We find that a rally-behind-the-leader effect best explains the results. A simple formalization of this mechanism yields an implication – that the effect should be larger for stronger (more voted) incumbents – that is supported by the data.

Keywords: voting behavior, rally behind the leader, difference-in-differences.

JEL classification: D72, D91.

Resumen

¿Cómo reaccionan los votantes ante *shocks* que están (en su mayor parte) fuera del control de los políticos? Este artículo aborda esta cuestión a través del estudio de las consecuencias electorales de los incendios forestales en España en el período 1983-2011. A través de una estrategia de diferencias en diferencias, encontramos que un incendio forestal accidental y de gran tamaño producido hasta nueve meses antes de unas elecciones locales aumenta el porcentaje de votos del partido en la alcaldía en hasta ocho puntos porcentuales. También encontramos que la explicación más coherente con los resultados es un movimiento de apoyo al líder «rally behind the leader». Además, una formalización simple de este mecanismo tiene una implicación, que el efecto debería ser mayor para los alcaldes más votados, que es corroborada en los datos.

Palabras clave: comportamiento electoral, movimiento de apoyo al líder, diferencias en diferencias.

Códigos JEL: D72, D91.

1 Introduction

How do voters react to large shocks that are (mostly) outside the control of the incumbent? This is a crucial question to understand and model voting behavior. Accordingly, it has attracted a lot of attention in the political economy literature (Achen and Bartels (2016), Bagues and Esteve-Volart (2016)). However, no consensus has emerged yet with respect to both the electoral impact of these shocks and the mechanisms behind the response of voters.

In this paper, we study how an accidental fire affects the incumbent's vote share at elections in Spain. Our results show that a fire in the last months before a local election *increases* the vote share of the incumbent party. This finding goes against most of the previous literature, which finds that bad shocks *decrease* the incumbent's vote share.

We exploit a unique dataset that contains data from all wildfires in Spain from 1983 to 2014. This dataset is well suited to address our research question. First, we can identify the dates of detection and extinctions of fires. Second, we know the surface burnt *by municipality.* This allows us to have a precise measure of how much a given municipality was affected by the fire. We focus on large fires, as we want to study the response of voters to sizable shocks. Our "benchmark" is to study the effect of fires that burns at least 1% of the municipality's surface area—on average, 195 hectares—and we analyze the effects of fires of a wide range of sizes.[1] Third, we can identify the cause of the fire. To reduce endogeneity concerns as much as possible, we focus on accidental (as opposed to intentional) fires, caused by either negligence or thunderbolts.

We follow a difference-in-difference estimation strategy, and discuss in detail its validity. Identification relies on the assumption that in a given province-term, having a large accidental fire is not correlated with other factors that affect the incumbent's vote share. We argue that our empirical strategy is likely to uncover the true ballot effects of large fires for five reasons. First, we focus on *accidental* fires, which have a large component of randomness, and therefore they are less likely to be correlated with other unobservable variables determining the incumbent political fortunes. Still, one might worry that, even though we focus on accidental fires, mayors could affect the probability of fire in the municipality (e.g. through prevention policies). Second, we show that the results are robust to a battery of fixed effects, ranging from province-year to municipality dummies, and including a combination of those. This accounts for possible omitted variables that do not change within province-term or within municipalities over time. Third, we show that accidental fires are not correlated with economic conditions or with past vote shares, which provides evidence of their true random nature. Fourth, we note that any remaining bias is likely to be downwards, i.e. it would go against finding a positive effect of wildfires, since more able mayors are more likely to reduce the odds of a fire and to receive a larger vote share for reasons unrelated to fires. And fifth, we consider an alternative specification that relies on a milder identification assumption. Specifically, this assumption asserts that although mayors might affect the likelihood of accidental happening, they cannot control their precise *timing.* We compare municipalities with a fire early in the term with those experiencing such an event in the months close to the election. The results from this strategy reinforce the findings from the baseline. Hence, any remaining concern about identification is unlikely to explain the differential effects of fires by time to election.

[1] One hectare is equal to 100 x 100 squared meters, that is, roughly one soccer stadium.

We argue that the results are driven by a “rally” effect. By this, we mean that a fire increases voters’ preferences to support the government, *regardless of which party is in office and of the response of the government*. The literature has found evidence on rallies after international crises or terrorist attacks. Our evidence suggests that natural disasters can generate similar effects. This is, to some extent, unsurprising, given that they share many of the key characteristics of international crises and terrorist attacks that facilitate the existence of rallies—they are dramatic, specific, and sudden (Mueller (1973)).

To formalize the mechanism, we develop a simple extension of the canonical model of probabilistic voting (Persson and Tabellini (2002), chapter 3.4). According to previous work, a rally translates into an increase in popularity or approval rate of the government. However, the literature does not explicitly discuss how it affects the behavior of voters when they face an election: voters would like to support the government that comes out of the polls, but cannot know ex ante which party is going to form the government. Hence, we model a rally in elections as an increase in the utility that voters derive from voting for the party that they believe will form the government. In the model, there are two parties, A and B. Suppose that party A is stronger, meaning that more voters ideologically prefer party A to party B, and that voters know this (in an appendix we provide an alternative model in which voters are uncertain about the strength of parties and update their priors based on the previous election’s vote shares). Voting is probabilistic—hence, in some cases, the weaker party will win the election. If there is no fire, voters vote for their ideologically preferred party. If there is a fire, voters derive some utility from voting for the expected winner, as in Callander (2007). Hence, in case of a fire, bandwagon behavior arises, as voters rally behind the expected government. In the example, some voters (those which are sufficiently close to the indifference in ideology) will vote for party A even if they ideologically prefer party B, because they believe that party A will win the election. The model yields two main predictions. First, a fire increases the vote share of the incumbent. The intuition is simple—given that party A is the stronger party in the municipality, the incumbent is more likely to be of party A. That is, the incumbent is more likely to win the next election than the challenger, and hence a rally behind the expected winner benefits the incumbent, on average. And second, the model yields an additional testable prediction: that the effect of a fire on the incumbent’s vote share is increasing in the incumbent’s vote share in the previous election. In other words, more voted incumbents (those that won, for example, by 70-30) should benefit more from a fire than less voted incumbents (e.g those that won by 52-48). The intuition is that the share of party A incumbents is increasing in the incumbent’s vote share in the previous election. That is, among weak incumbents, there are many cases in which the incumbent is of party B and, therefore, not very likely to win the next election. In those cases, the rally will not favor the incumbent and, on average, the effect on the incumbent’s vote share will be small. Strong incumbents are, however, overwhelmingly of party A and therefore most of them will benefit from the rally, hence creating a large effect of a fire. We find strong evidence for this additional prediction.

While we cannot provide a direct test of this mechanism, it is the most consistent with the available evidence. First, it can naturally explain why the effect of a fire on the incumbent’s vote share is positive. Second, it can explain why the effect is larger for stronger incumbents, while alternative mechanisms cannot easily account for this observed heterogeneity. Third, this mechanism provides a compelling argument for why only fires close to the election increase the incumbent’s vote share. The reason is that rallies are temporary—they only last while the triggering event remains a salient issue. For example, the duration of three rallies examined by Hetherington and Nelson (2003) was 8, 10, and 14 months, which approximately coincides with the timing that we find in this paper.[2] Fourth, it can explain why a fire increases the votes for the party of the local government but not for those at the regional or national governments. The main theory about rallies argues that they are a psychological phenomenon—they arise as a consequence of a patriotic reflex to support the government of the affected area. In rallies due to international events or terrorism, it is the whole nation that it is in crisis, and therefore citizens rally behind the national government—hence the expression "rally round the flag". Fires, by contrast, affect one municipality in particular, and therefore voters will rally behind the local government of that municipality.

We also discuss in depth other possible mechanisms. The two main theories on voters' response to shocks—blind retrospection (Achen and Bartels (2016)) and "rational updating" (Ashworth, De Mesquita, and Friedenberg (2017))—cannot fully explain our results. According to the former, voters compare their well-being at the beginning and at the end of the term, and are irrational—they punish (reward) the incumbent if their well-being decreased (increased) even if it was due to events outside the control of the incumbent. Hence, only if large fires were a positive shock to the municipality, blind retrospection could rationalize the positive effects of wildfires on the incumbent's vote share. We analyze two reasons why fires could be a positive shock. First, the affected municipality might receive aid after the fire, this aid offsetting the negative effects of the fire. However, aid is approved by national or regional governments, not local governments, so it is not obvious why it is local governments who gain votes. Furthermore, we have gathered data on national aid and show that: a) aid is not very common, b) aid takes time to be approved, so many of the fires that are close to the election and benefit the incumbent have not received any aid by election day, and c) there is no evidence that municipalities receive more aid in election years, so this cannot explain the differential effect by time to election. Second, the local government might use the fire to rezone the burnt land to urban or developable land, and this could in term generate a wealth effect through the increase in land value. We use data from land use and rule out that this happens.

According to the "rational updating" theory, recently formalized in a model by Ashworth, De Mesquita, and Friedenberg (2017), it can be rational for voters to change their voting behavior after a shock, even if it was due to events that are outside the control of the incumbent. The argument is that the shock can help reveal (or mute) the quality of the incumbent, for example, through the response given to the disaster. There are four reasons why this theory cannot fully explain our findings. First, most of the competences on prevention and extinction are at the regional and national levels. Although mayors also have some role in the management of the crises, especially as representative leaders of municipalities, there is no reason to think that the quality of regional or national governments should be revealed less than that of local governments—if anything, the opposite should be true. Hence, if the effect is driven by a "revealing-the-quality" argument, it is not obvious why there is an effect on local elections but not on regional or national elections. Second, this mechanism cannot explain why only fires close to the election matter—the quality of the incumbent should be revealed (or muted) no matter when the fire happens. Third, while the model by Ashworth, De Mesquita, and Friedenberg (2017) is general enough to allow for either a

[2]These were rallies in the US after the Cuban missile crisis, the Operation Desert Storm, and the September 11 attacks, respectively.

positive or a negative effect o a shock on the incumbent's vote share, we believe that the more reasonable assumptions in the model would lead to a *negative* effect. Fourth, it is not obvious how such a model would explain that stronger incumbents gain more votes than weaker incumbents.

Finally, we discuss and rule out two other possible mechanisms. First, fires may change partisan preferences of voters. For example, suppose that voters become more concerned with environmental issues and favor left-wing parties more after a fire. If most local governments are left-wing, then that could explain why incumbents gain, on average, vote share after a fire. Against this possible mechanism, we show that there is no effect of a fire on the vote share for the two main parties in Spain. We also show that incumbents of both parties gain votes after a fire. Second, fires may make voters more willing to have their local government ideologically aligned with upper-level (regional or national) governments. If most local governments are aligned, then that could explain the incumbent's vote share increase after a fire. We show, however, that there is no effect of a fire on the party that is aligned with the regional (or national) government. We also show that incumbents that are aligned with upper-level governments enjoy a similar boost than those that are not.

This paper contributes to the growing literature on how voters react to natural disasters. One of the best-known papers is Achen and Bartels (2004), which shows that voters punish incumbents after shark attacks, droughts, and floods.[3] In a recent book, Achen and Bartels (2016) summarize those findings and discuss in detail the theory of "blind retrospection". Heersink, Peterson, and Jenkins (2017) find support for Achen and Bartel's thesis, providing evidence that voters widely punished Herbert Hoover at the polls after a catastrophic flooding in the American South in 1927. Similarly, Cole, Healy, and Werker (2012) show that voters punish the incumbent in state elections after catastrophic rainfall in India. Healy, Malhotra, et al. (2010) find that voters punish the incumbent party in presidential elections for economic damage resulting from tornadoes. However, they provide evidence that is more consistent with voters rationally evaluating government's performance: the incumbent party only appears to lose votes when no disaster declaration takes place in response to the tornado. Similarly, Gasper and Reeves (2011) find that electorates punish presidents and governors for severe weather damage but that the effects are dwarfed by the response of attentive electorates to the actions of their officials. Fair, Kuhn, Malhotra, Shapiro, et al. (2017) find that the 2010–2011 floods in Pakistan increased turnout but did not have an effect on the incumbent's vote share. Finally, in one of the pioneer works of this literature, Abney and Hill (1966) studied the effects of a hurricane that struck Louisiana in 1965, and found that it did not have an effect on the next election. Our results therefore go in the opposite direction to most previous work, as we find that a natural disaster *increases* the vote share of the incumbent party. A few papers have indeed found similar effects, but in all these cases it has been through the aid response to the disaster, which we show is unlikely to occur in our case. Bechtel and Hainmueller (2011) find that *the aid response* to the Elbe flooding in 2002 increased vote shares for the incumbent in subsequent elections. Chen (2013) shows that hurricane disaster *aid* awards in Florida increased the incumbent party vote share. Healy and Malhotra (2009) find that voters reward the incumbent presidential party for delivering *disaster relief* spending in the US.

Our paper is also related to the work that studies the response of voters to *exogenous* changes in economic conditions. Bagues and Esteve-Volart (2016) study the effect of good economic conditions on voters' behavior exploiting the evidence from the Spanish Christmas lottery. They find that

[3] Fowler and Hall (2018), however, have questioned the causality of the shark attacks findings.

incumbents receive more votes in prize-awarded provinces. This is consistent with Achen and Bartel's theory—the well-being of voters increase and they reward the incumbent, even if the change was due to events outside the control of the incumbent. Leigh (2009) compares the effect of world growth (more related to luck) and national growth relative to world growth (more related to competence). He finds that luck matters more than competence, which is also consistent with a theory of irrational voters. Wolfers (2002) shows that voters in oil-producing states tend to re-elect incumbent governors during oil price rises, and vote them out of office when the oil price drops. He concludes that voters are at best characterized as "quasi-rational". Although the nature of these shocks is a bit different to ours (economic versus natural disasters), our findings are not easily reconciled with this literature—since it finds that a negative shock is bad (or neutral) for the incumbent, while we find the opposite.

Finally, this paper speaks to the literature on bandwagon behavior. This literature has provided several cases in which voters have a preference to vote for the winner (Bischoff and Egbert (2013), Callander (2007), Hong and Konrad (1998), Morton and Ou (2015)). The mechanism outlined in this paper suggests that natural disasters can increase this type of behavior. Furthermore, the model shows two novel results *on the consequences* of bandwagon behavior: that an increase in bandwagon behavior will benefit incumbents, and that stronger incumbents will benefit more.

The rest of this paper is organized as follows. The next section discusses the data and the institutional framework of fires and elections in Spain. Section 3 presents the empirical strategy. The main results are presented in Section 4. Section 5 discusses the mechanisms. Section 6 concludes.

2 Data and Institutional Framework

2.1 Wildfires in Spain

Dry hot weather conditions and strong winds make Spain, along with the rest of Southern Europe, prone to suffer from wildfires. For instance, in the period 1983-2014, there have been more than 8,000 wildfires affecting at least 100 ha in Spain, which have burned roughly 7% of the country's total surface area. Moreover, at least 3,000 municipalities have suffered this event at least once.

In Spain, the competences on prevention and extinction of wildfires are shared by the three layers of government (local, regional, and national), the bulk of the responsibility falling onto the regional administration. Local governments are involved mainly on prevention tasks, such as controlling some activities prone to ignition, setting the reforestation policy, authorizing scrub burning, etc. Regarding extinction, local governments handle only small fires, mainly through volunteers. Large fires, which are the focus of our paper, are dealt with by the regional government in cooperation with the national government, if the latter is required.[4]

[4]Once a fire is detected, officials of the regional government must classify it into one of four levels. Level 0 fires are those that pose no threat to people beyond those engaged in their extinction and whose damage is expected to be small. These fires are put off either by volunteers of the local government or by regional firemen. Level 1 fires are those that require measures to protect people and goods threatened by the fire. The extinction of these fires is managed by officials of the regional government. If the extinction of the fire requires national resources, then the regional government can ask for them, declaring the fire to be of level 2. In this case, the regional government heads a team of regional and national officials that manages the fire. Finally, the Ministry of Domestic Affairs can declare a fire to be of "national interest", thereby the state government heads the team acting to stop the fire. It must be noted that no fire in Spain has ever reached level 3.

We exploit a dataset that contains micro data on all forest fires that happened in Spain during the period 1983–2014. These data, provided by the Ministry of Agriculture, Fishing, Food, and Environment, stem from the reports that a local specialist must fill in after every fire. There are four reasons why this dataset is very well suited to our purposes. First, it is made up from administrative records and it covers the population of events during a long period of time. Second, the day of each fire's detection (and extinction) is precisely recorded. Third, it provides the surface area burned by every fire *by municipality*. Hence, we can have a measure of how much a municipality was affected by any given fire. Because we want to study the response of voters to sizable shocks, we focus on large fires. In our baseline specification we study the effects of wildfires burning at least 1% of the municipality's surface area—these fires burned approximately 200 ha on average.[5] And fourth, the reports provide the cause of each fire, which allows us to restrict the analysis to accidental wildfires. As we discuss below, this is especially important since intentional fires can obey to motivations that could independently affect the electoral outcomes, such as economic conditions.[6] A fire is labeled as intentional if it was the perpetrator's motivation to set the forest on fire, and it is tagged as accidental otherwise. Accidental fires can have two origins: thunderbolts and negligence. Fires among the latter are usually provoked by small burnings of stubble that go out of control and extend to the forest, as well as by bonfires, smokers, burning of waste, etc.

2.2 Elections in Spain

Local elections are held simultaneously in all municipalities every four years. Mayors are chosen according to a "parliamentary" system: voters elect a city council on the election day and then the city council elects the mayor among its members in the first meeting after the election.[7] Our focus in on the electoral results of the party of the mayor in office, i.e. the incumbent party.

We also study the effect of fires on regional and national elections. There are 17 regions in Spain, and each elects a regional parliament in elections every four years. Parliaments then elect the president of the region.[8] The same pattern applies to elections for the national Congress—it is elected every four years (although the Prime Minister can call an early election) and the Congress then elects the prime minister. In both regional and national elections, our attention is how the vote share for the party of the regional president or the prime minister, i.e. the incumbent party, evolves in any given municipality after a fire strikes.

For local and national elections, the data are from the Ministry of Domestic Affairs. For regional elections, we have collected the data from the webpages of the regional governments.[9] All the data are publicly available.

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[5] Fires burning at least 1% of a municipality's surface area have large disruptive effects. On average, they require 130 people, 3 airplanes or helicopters, and 9 other physical units (e.g. bulldozers) to be extinguished. 14% require roadblocks or the evacuation of people. The estimated direct losses were close to half million euros for the average fire, according to the fire reports.

[6] Among fires that burn at least 1% of the municipality's surface area, 29% are random, 44% are intentional, and 27% of unknown origin.

[7] The election for city council follows a single-district, proportional representation system, with a number of seats that is increasing in the population size of the municipality. Municipalities with 250 inhabitants or fewer follow a different system, namely, an open list, plurality-at-large system.

[8] Regional elections are held on the same day as local elections in 13 regions. The four other regions—Andalusia, the Basque Country, Catalonia, and Galicia—hold their regional elections on different days.

[9] Unfortunately, we have some missing data for regional elections as some of the regions do not provide the data—Aragon, Balearic Islands, Canary Islands, Extremadura, Galicia, Murcia, and Valencian Community (until 1995).

3 Empirical Strategy

Our goal is to estimate the effect of an accidental fire on the incumbent's vote share in the following election. We consider this estimating equation:

$$\Delta IncVoteShare_{it} = \alpha_{SM,pt} + \beta_{SM} Fire_{SM,it} + \epsilon_{SM,it}, \tag{1}$$

where $\Delta IncVoteShare_{it}$ is the difference in votes for the incumbent party between the election at year t and the previous election (at $t-4$), $Fire_{SM,it}$ is a dummy variable that takes the value of 1 if there has been (at least) one fire burning more than S hectares in the last M months of the term, α_{pt} is a province-year fixed effect, $i \in \{1, 2, ..., 8117\}$ denotes a municipality, and $t \in \{1987, 1991, ..., 2011\}$ denotes an election-year. That is, we consider one separate regression for each combination of surface area S and months to election M. Additionally, to assess the robustness of the results, we see how they change when we add some controls and include other fixed effects (e.g., municipality or party-province-year fixed effects). We cluster the standard errors by municipality.[10]

The identification assumption is that, in a given province-year, having a large accidental fire is not correlated with other factors that affect the change in votes for the incumbent. In particular, one may be concerned that mayor's ability is correlated with having a fire during the term, and also with her votes in the next election. We now discuss in detail the validity of this assumption.

First, recall that we focus on *accidental* fires, which are due to negligence or thunderbolts. These fires therefore have a large component of randomness and are naturally less likely to be correlated with other factors that affect the incumbent's votes. In particular, fires caused by property speculators trying to build in forest land or by ranchers aiming to create pasture areas, which may correlate with economic conditions, are excluded, as they are intentional. Still, even though we focus on accidental fires, one may still worry that mayors could affect the probability of an accidental fire happening in the municipality. For example, she could do awareness campaigns to prevent negligence, or she could put more resources into cleaning the forest so that fires cannot grow fast. The remaining points address this concern.

Second, we show that the results are robust to a battery of fixed effects, ranging from province-year to municipality dummies, as well as a combination of those. This accounts for possible omitted variables that do not change within province-term or within municipalities over time. For example, if municipalities with a drier weather have more fires and, for some reason, tend also to vote more for the incumbent, that is captured by the municipality fixed effects.

Third, we provide evidence that, once the fixed effects are included, accidental fires do seem to be exogenous. In particular, we show that accidental fires are not correlated with economic conditions (unemployment rate, population size) or with past vote shares. For example, municipalities undergoing a reduction in their unemployment rate are not more or less likely to have a fire than those in which unemployment is increasing.

Fourth, we note that any remaining bias is likely to be downwards, i.e. it would go against finding a positive effect of wildfires. This is because more able mayors are more likely to reduce the

[10] By doing so, we control for possible autocorrelation of the error term within municipalities over time. One could be concerned that, if fires are spatially correlated, there is some autocorrelation also at some larger level. In the Appendix, we show that clustering the standard errors by province does not change the results.

odds of a fire and to receive a larger vote share for reasons unrelated to fires. One possible caveat is that, if mayors "know" that experiencing a fire is good for them at the next election, then more able mayors could "attempt" to have more fires. Note, however, that there is no evidence that there are more fires in the last months before an election, when fires have an effect, as we explain below.[11]

And fifth, we consider an alternative specification that relies on a milder identification assumption. This assumption asserts that, although mayors might affect the likelihood of an accidental fire happening, they cannot control its precise *timing during the term.* Specifically, we estimate the following equation:

$$\Delta IncVoteShare_{it} = \alpha_{SM,pt} + \beta_{1SM}Fire_{SM,it} + \beta_{2SM}Fire_{S48,it} + \psi_{SM,it}, \tag{2}$$

where $Fire_{48,it}$ takes the value of one if the municipality suffered from (at least) one accidental fire burning at least S hectares in the last 48 months before the election, that is, at any point during the term. The coefficient β_1 therefore captures the differential effect of a fire in the last M months of the term, relative to the effect of a fire earlier in the term. Suppose that conditional mean independence holds, that is:

$$E(\psi|Fire_M, Fire_{48}) = E(\psi|Fire_M), \tag{3}$$

where ψ is the error term in Equation 2—for example, the ability of the mayor. Under this assumption, the estimate of β_1 is consistent even if that of β_2 is not. Intuitively, this condition establishes that mayors might influence the probability of a fire during the term, but cannot exert precise control on the timing of accidental fires. Hence, β_2 is consistently estimated under a milder assumption than β in Equation (1). We will show that the results from this strategy reinforce the findings from the baseline. Hence, any remaining concern about identification is unlikely to explain the differential effects of fires by time to election.[12]

In Panel A of Table 1, we show the mean and standard deviation of the main variables used in the paper, averaged by municipality. The first column considers the full sample, the second column only municipalities that have had at least one fire of size $S = 1\%$ (at any point), and the third column only municipalities that have had at least one fire of size $S = 1\%$ in the last 6 months before a local election ($M = 6$). These summary statistics indicate that municipalities that are affected by wildfires are similar to the average Spanish municipality. Appendix Figure A1 shows a map with the distribution of fires over Spain.

In Panel B of Table 1, we show the number of observations with $Fire_{SM,it} = 1$, for different values of S and M. For example, there are 665 observations with (at least) one accidental fire that burned at least 1% of the municipality's surface area in the last 12 months before a local election.

[11] Also, note that, even under this hypothesis, the "true" effect would be positive (but larger than the estimated one). The only case in which the true effect is negative but our estimate is positive is that mayors *wrongly* believe that a fire will benefit them in the next election.

[12] A possible concern would be that mayors could somehow induce different probabilities of having a fire at different points of the term, and that more able mayors are better able to do so. Given that, if anything, there seem to be *fewer* fires at the end of the term (Table 1), it seems that mayors avoid having fires at the end of the term. Then, $Corr(Fire_{SM,it}, \psi_{it}|Fire_{S48,it}) < 0$, i.e., conditional on the number of fires during the term, more able mayors have fewer fires towards the end. This would generate a *downwards* bias in $\hat{\beta}_1$. That is, the true value of the differential effect would be even larger in magnitude.

In the last 6 months, there are 58. Hence, the number of fires is proportionally much lower in the last 6 than in the last 12 months before an election. This is because local elections take place in May or June—hence, the last 6 months cover the winter, when fires are less likely. To study if there are more fires right before an election, in the right-hand side of the table we show the number of observations with $Fire_{SM,it} = 1$, but focusing on the same calendar months of the year. As mentioned, there are 58 fires in the last 6 months before an election, that is, between January and May or June of the election-year, for size $S = 1\%$. Between 18 and 12 months before an election, that is, between January and May or June of the *previous* year, there are 87 observations with a fire. Between 24 and 30 months (36 and 42), there are 96 (69). Hence, there is no evidence that municipalities experience more fires in the last months before an election—if anything, there seems to be fewer fires. This addresses the possible identification concern that politicians anticipate the beneficial effects of a fire close to the election, thus leading to more fires in those months.

4 Results

4.1 Main results

We begin by studying the effect of fires on local elections. We estimate Equation (1) for different combinations of burned surface area (S) and months before the election (M). Figure 1 shows the results for different values of M in the x-axis, fixing the size of the fire at $S = 1\%$ (195 ha, on average). The dots are the estimated βs, and the lines are 95% confidence intervals. The results indicate that there is no effect of fires 11 months or more before the election. The effect steadily increases from that point on, reaching 5 p.p. at $M = 4$ months. The estimates to the right of the vertical line are placebo tests that show the "effect" of fires that happen *after* the election. They are all very close to zero and insignificant, lending credibility to the empirical approach. Panel A of Table 2 shows the corresponding estimates and standard errors. The effect at 6 months before the election is 4.2 p.p. and significant at the 1% level. This effect is large quantitatively: it is equivalent to approximately one fourth of the standard deviation of the dependent variable and, given that the mean incumbent vote share is 58%, it is equivalent to a 7.2% effect (4.2/58).

Figure 2 does the opposite: it fixes the time to election at $M = 6$ months, and considers different sizes of fires in the x-axis. When smaller fires are included, there is little or no effect on the votes for the incumbent. The effect increases steadily up to fires burning at least 1.5%, and then flattens out at an effect of approximately 8 p.p. Panel B of Table 2 displays the corresponding coefficients. The effects are significant at the 1% level for fires burning from at least 1% to at least 3% of the surface area. Significance decreases from that point due to larger standard errors: fires burning at least 5% of the surface area are significant at the 10% level.[13]

We next study the effects of wildfires on regional and national elections, following the same empirical strategy. In the first row of Table 3, we show the effects of a fire that burns at least 1% of the municipality's surface area in the last 6 months before the election, for local (column 1), regional (column 2), and national elections (column 3). As we know, the effect on local elections is 4.2 p.p. and significant at the 1% level. The effect on regional and national elections, although

[13]In Appendix Figures A2 and A3, we show that the results are very similar when, instead of defining the size of a fire as a fraction of the surface of the municipality, we define it in absolute size or as a fraction of population size. Appendix Figure A4 shows that the results remain significant when clustering the standard error by province.

also positive, is much smaller (0.7 and 0.26 p.p., respectively) and not statistically significant. The same pattern arises when we focus on larger fires that burn at least 2% of the municipality's surface area—see the results on the second row of Table 3. That is, although most of the competences regarding fires are at the regional and national levels, rather than at the local level, we find that the elections outcomes only change at the local level. We interpret this as evidence against a "revealing-the-quality" argument and in favor of a rally effect, as we discuss in the next section.

4.2 Robustness

Here we assess the robustness of the finding that fires increase the incumbent's vote share in local elections.

Different fixed effects and controls. First of all, we analyze whether the results are robust to different specifications. Table 4 fixes both the size of the fire $S = 1\%$ and the months to the election $M = 6$, and studies the robustness of the results. The first column is the benchmark result, and therefore coincides with the one presented above. The second adds controls for unemployment and population size. The last four columns consider different combinations of fixed effects, therefore exploiting different sources of variation: province and year fixed effects separately ($\alpha_p + \alpha_t$), municipality and year fixed effects ($\alpha_m + \alpha_t$), both province-year and municipality fixed effects ($\alpha_{pt} + \alpha_m$), and party-province-year fixed effects (α_{rpt}). The results are quantitatively similar across all specifications and significant at least at the 5% level.

Placebo tests. To examine the exogeneity of accidental fires, we do two sets of placebo tests. The intuition behind these tests is that if, after including the fixed effects, accidental fires are truly exogenous, then the variable $Fire_{SM,it}$ should not be correlated with past conditions—in particular, with lagged values of the outcome and of economic variables.

First, we estimate how fires that happen after the election affect the election results. If the identification strategy is valid and accidental fires are exogenous, then there should be no correlation between the change in votes for the incumbent and experiencing a large accidental fire in the next term, so $\gamma = 0$. However, if mayors that are becoming stronger can somehow avoid fires during the term, then $\gamma < 0$. In the main results in Figure 1, we have already shown that fires up to 12 months after the election do not have any effect. Here we show further tests on the same line. In particular, we estimate:

$$\Delta IncVoteShare_{it-4} = \alpha_{SM,pt} + \gamma_{SM} Fire_{SM,it} + \eta_{SM,it-4}, \tag{4}$$

where $\Delta IncVoteShare_{it-4}$ is the change in the votes for the incumbent *in the previous election* (that is, the change in votes from t-8 to t-4) and γ serves as a placebo test. Hence, we test how a fire in the M months before an election affects the *previous* election results.[14] The results are displayed in Table 5 and represented graphically in Appendix Figure A5. No coefficient is statistically different from zero, even at the 10% level, providing assurance about the validity of the empirical strategy.

[14] That is, the placebos in Figure 1 show how fires in the, for example, three months after an election affect that election's results. Here we estimate how fires that happen, for example, three months before an election, affect the previous election's results—or, equivalently, how fires that happen between 3 years and 9 months and 4 years after an election affect that election's results.

Second, we do placebo tests to see if fires can be explained by the economic conditions. In particular, we estimate

$$UnemRate_{it} - UnemRate_{it-j} = \alpha_{SM,pt} + \zeta_{SM} Fire_{SM,it} + \theta_{SM,it}, \qquad (5)$$

for different values of j ($j \in 1, 2, 5$). For example, if $j = 2$, we test whether a fire of size S in the last M months of the term correlates with the unemployment rate change in the last two years before the election. If accidental fires are exogenous, then we expect $\zeta = 0$. If, for example, more economic activity increases the probability of fire—for example, people do more barbecues outdoors—then $\zeta < 0$. The results from these tests are displayed in Panel A of Table 6. All of the coefficients are close to zero and insignificant. Panel B does the same test for (log) population size instead of unemployment. Again, no coefficient is statistically different from zero at conventional levels.

Alternative specification. In Table 7, we show the results of the alternative specification given by Equation (2), for different combinations of M (Panel A) and S (Panel B). Recall that the coefficients β_{1SM} capture the differential effect of a fire in the last M months before the election relative to earlier (from 48 to M months) fires. The estimated coefficients, shown in the first row of the two panels, are positive and significant for fires in the last 9 months before the election and burning at least 1% of the surface area (or larger). The coefficients β_{2SM} capture the effect of earlier fires. Their estimated values are in the second row of the two panels, and are close to zero and not statistically significant at the 5% level for any combination of S and M.

5 Mechanisms

In this section we discuss several mechanisms that may drive the results presented so far. We argue that a rally-behind-the-leader effect is the most consistent with the evidence. We start by discussing this mechanism, which we illustrate with a simple model. We then consider other possible mechanisms: blind retrospection, rational updating, and explanations based on partisan preferences and preferences for alignment. We provide several arguments that indicate that these alternative mechanisms do not drive the results.

5.1 Rally

5.1.1 Discussion

Our results can be explained by voters rallying behind the government after fires. We say that an event generates a rally if it increases voters' preferences to support the government, *regardless of which party is in office and of the response of the government.* Traditionally, rallies were associated to international crises, such as wars. More recently, however, Chowanietz (2011) has shown that there have also been rallies after "domestic" terrorist attacks.[15] For example, it is well known that George W. Bush's approval rating increased dramatically after September 11. Our evidence suggests that natural disasters can generate similar effects. This is, to some extent, unsurprising, given that they share many of the key characteristics of international crises and terrorist attacks that

[15]Montalvo (2011), by contrast, finds that the Madrid attacks in 2004 reduced the incumbent's vote share. Note, however, that it is a study about one specific event, and hence a bad response of the government can drive the results. In Chowanietz (2011) or in the present paper, we study many events and hence good and bad responses should average out.

facilitate the existence of rallies. In particular, they are dramatic, specific, and sudden (Mueller (1973)). The latter point is crucial—Mueller claims that only sudden events can trigger rallies, whereas the impact of gradual changes on public attitudes is likely to be diffused. Large wildfires clearly share all these characteristics.

The main theory about rallies argues that they are a psychological phenomenon—they arise as a consequence of a patriotic reflex to support the government of the affected area.[16] In traditional rallies due to international events or terrorism, it is the whole nation that it is in crisis, and therefore citizens rally behind the national government or president—hence the expression "rally round the flag". In the case of fires, they affect one municipality in particular, and therefore it makes sense that the rally is behind the leader of that municipality—its mayor or local government. The mayor is the visible head of the municipality and acts as its symbolic leader after a fire. Spared from the responsibility of putting off the fire, she is the visible representative of the town in order to demand an adequate response from the regional and national governments.[17]

According to previous work, a rally translates into an increase in popularity or approval rate of the government. However, the literature does not explicitly discuss how it affects the behavior of voters when they face an election: voters would like to support the government that comes out of the polls, but cannot know ex ante which party is going to form the government. Hence, we model a rally in elections as an increase in the utility that voters derive from voting for the expected winner—or, in other words, for the party that they believe will form the government. That voters have a preference to vote for the winner has been found in some cases in the literature. Voters whose original favorite candidate is not the leading candidate may switch their votes when they know the identity of the leading candidate, because those voters may perceive less benefit from voting for the candidate whom they feel is going to lose, thus creating "bandwagons" (Zech (1975)). We follow this literature and model rallies as an increase in the utility that voters derive from voting for the winner.

There are two plausible alternative ways to model rallies in elections. One is to assume that voters will derive more utility from voting for the current, as opposed to the expected, government after a shock. In this case, it is obvious that a shock will increase the expected incumbent's vote share. However, this model could not explain why stronger incumbents gain more from a fire. If voters simply rally behind the incumbent, independently of whether they think the incumbent is going to win or not, then all incumbents will equally benefit from a fire, independently of their previous vote share. The other alternative is to assume that voters will derive more utility from having a stronger government after a shock. In other words, they want to empower the government. A model with this feature is essentially equivalent to the one we outline, so this is a plausible alternative interpretation of the rally in elections.

To formalize our mechanism, we develop a simple extension of the canonical model of probabilistic voting. The goal of the model is not to explain why rallies happen, that is, why voters derive

[16]Another reason argues that the key driving factor is that, during crises, the opposition subdues criticism of the government (Brody (1991)). Of course, the question is then why the opposition does so. One possible answer is that it is for patriotism, in which case this theory is very similar to the "patriotic reflex". Another answer is that it is a consequence of the opposition being "out of the loop", that is, it lacks information to criticize the government.

[17]The mayor acts as the leader of the municipality during and after a large fire: she lobbies for resources to be deployed and for an emergency declaration, coordinates the request for aid, and talks to the press—see, for example, these newsreports (in Spanish): https://goo.gl/BXWNYR; https://goo.gl/nttgU5; https://goo.gl/jMHxYn; https://goo.gl/dCHDJ7; https://goo.gl/H7LRsh; https://goo.gl/Bt2YP3; and https://goo.gl/eFF7U4.

more utility from supporting the expected government in a crisis. Rather, the model takes this as given and shows that, under mild conditions, a rally increases the vote share for the incumbent party.

In the model, there are two parties, A and B. Suppose that party A is stronger, meaning that more voters ideologically prefer party A to party B, and that voters know this (in Appendix B we provide an alternative model in which voters are uncertain about the strength of parties and update their priors based on the previous election's vote shares). Voting is probabilistic—hence, in some cases, the weaker party will win the election. If there is no fire, voters vote for their ideologically preferred party. If there is a fire, voters derive some utility from voting for the expected winner, as in Callander (2007). Hence, in case of a fire, bandwagon behavior arises, as voters rally behind the expected government. In the example, some voters (those which are sufficiently close to the indifference in ideology) will vote for party A even if they ideologically prefer party B, because they believe that party A will win the election. The model yields two main predictions. First, a fire increases the vote share of the incumbent. The intuition is simple—given that party A is the stronger party in the municipality, the incumbent is more likely to be of party A. That is, the incumbent is more likely to win the next election than the challenger, and hence a rally behind the expected winner benefits the incumbent, on average. And second, the model yields an additional testable prediction: that the effect of a fire on the incumbent's vote share is increasing in the incumbent's vote share in the previous election. In other words, more voted incumbents (those that won, for example, by 70-30) should benefit more from a fire than less voted incumbents (e.g those that won by 52-48). The intuition is that the share of party A incumbents is increasing in the incumbent's vote share in the previous election. That is, among weak incumbents, there are many cases in which the incumbent is of party B and, therefore, not very likely to win the next election. In those cases, the rally will not favor the incumbent and, on average, the effect on the incumbent's vote share will be small. Strong incumbents are, however, overwhelmingly of party A and therefore most of them will benefit from the rally, hence creating a large effect of a fire. We find strong evidence for this additional prediction.

We believe that this mechanism is the most consistent with the available evidence. First, it can naturally explain why the effect of a fire on the incumbent's vote share is positive. Second, this mechanism explains why the effect is larger when the incumbent is stronger, while alternative mechanisms cannot easily account for this. Third, this mechanism provides a compelling argument for why only fires close to the election affect the results. The reason is that rallies are temporary—they only last while the triggering event remains a salient issue. For example, as mentioned in the introduction, the duration of three rallies examined by Hetherington and Nelson (2003) was 8, 10, and 14 months. A rally mechanism can therefore explain why only fires up to 9 months before the election increase the incumbent's vote share. Fourth, it can explain why fires increase the votes for the party of the local government but not for those at the regional or national governments. Even though most of the competences are at the regional and national levels, it is the local government who specifically represents the affected municipality, and mayors are its symbolic leaders. While international crises affect the whole country, that is not the case for wildfires, which affect very specific locations.

5.1.2 Model: Setup

There are two parties, A and B, and a continuum of voters, with utility function:

$$u_i(A) = \lambda_i + \gamma P(Awins) + \epsilon \tag{6}$$

$$u_i(B) = \gamma P(Bwins) \tag{7}$$

where $u_i(j)$ denotes the utility that voter i derives from voting for party j, $j \in \{A, B\}$. The utility depends on two components: an ideological component and a bandwagon component. In particular, λ_i is voter's i ideological preference for party A relative to party B, $P(Awins)$ denotes the probability that party j wins the election, as estimated by the voter, and γ captures the relative importance of the ideological and bandwagon components. Voters are distributed according to their ideological preference for party A as follows: $\lambda_i \sim U(-1/2, 1/2)$.[18] Finally, ϵ is a popularity shock, $\epsilon \sim N(-1/2 + n_A, \sigma^2)$.[19] Hence, n_A captures the relative strength of party A. If $n_A = 1/2$, then both parties have equal strength. If $n_A > 1/2$ ($n_A < 1/2$), then party A is stronger (weaker) than B. Voters know n_A and σ^2—in the Appendix model, we consider an alternative model in which they do not know n_A: rather, they have a prior and use the vote shares of the previous election to update their beliefs. This alternative model yields similar predictions.

As argued above, we claim that a fire will generate a rally, increasing the utility that voters derive from voting for the winner. Without loss of generality, we assume that $\gamma = 0$ if there was no fire, and $\gamma > 0$ if there was a fire during the term. Suppose that there are two periods, $t \in \{1, 2\}$. In each period there is an independent realization of the shock ϵ_1, ϵ_2. In period 1, there is no fire, and in period 2 there is a fire before the election with some probability $p > 0$, and this is independent of all other variables. Hence, the timing is as follows:

1. Nature draws ϵ_1.
2. Voters vote ($t = 1$ election).
3. The party that wins the election (that is, obtains more than 1/2 vote share) forms government and becomes the incumbent.
4. Nature draws $fire$ and ϵ_2.
5. Voters vote ($t = 2$ election).

There are two main differences between this model and the standard probabilistic voting model (Persson and Tabellini (2002), chapter 3.4). First, we include a term to capture the rally, $\gamma E(Awins)$. Second, in our model, parties are not players of the game. In the original model, parties fix their platforms to maximize their probability of election. Here, policy platforms are fixed. This is a reasonable assumption for Spanish local elections, especially in small or medium-sized municipalities: given that parties are national, their local branches are associated with the position of the party at the national level and do not have much flexibility to adjust their platforms. Indeed, there are many municipalities in which one party systematically beats the other at the polls in local elections, which is not consistent with parties adjusting their platforms locally.

[18] In the original probabilistic voting there is an additional parameter to capture the dispersion of the uniform distribution. This only matters, however, if there are several groups of voters. In the model in this paper, therefore, introducing such a parameter would not affect any result.

[19] While we assume normality for clarity, the results go through other distributions—in particular, all beta distributions. In the remaining of the model, we assume that the probability that the variance of the shock is sufficiently low so that the probabilities that vote shares are outside the (0,1) interval are negligible.

5.1.3 Model: Solution

The model's main prediction is given by the following proposition.

Proposition 1. *There exists an equilibrium in which a fire increases the expected incumbent's vote share at $t = 2$. If voters do not anticipate the rally, this equilibrium is unique.*

Proof. See Appendix A.

The model yields an additional prediction, which we test in the data in the next subsection.

Proposition 2. *The expected effect of a fire on the incumbent's vote share at $t = 2$ is increasing in the incumbent's vote share at $t = 1$.*

This proposition says that incumbents that were more voted in the previous election gain more from a fire than less voted incumbents.

Proof. See Appendix A.

5.1.4 Testable implication

The model predicts that the effect of a fire on the incumbent's vote share should be increasing in the incumbent's vote share in the previous election (see Proposition 2).

Here we test this prediction, by estimating the following equation:

$$\begin{aligned}\Delta IncVoteShare_{it} = \alpha_{SM,pt} + \beta_{b,SM} Fire_{SM,it} + \beta_{s,SM} Strong_{z,it} \\ + \beta_{a,SM} Fire_{SM,it} * Strong_{z,it} + \epsilon_{SM,it}. \qquad (8)\end{aligned}$$

where $Strong_{z,it}$ is a dummy that indicates whether the incumbent was above the z percentile in the vote share of incumbents in the previous election (at $t-4$). For example, if $z = 50$, this considers the median, which amounts to a vote share of 56.25%. Hence, $Strong_{50,it} = 1$ if the incumbent obtained more than 56.25% of the vote in the previous election, and $Strong_{50,it} = 0$ otherwise. We are interested in the coefficients $\beta_{b,SM}$ and $\beta_{a,SM}$, which capture the effect of a fire on "weak" incumbents, and the differential effect of a fire on "strong" incumbents (relative to weak incumbents). We expect $\beta_{a,SM} > 0$.

The results of this test are displayed in Table 8. We consider three values of z: $z = 25$, $z = 50$, and $z = 75$. Column 1 shows the results for $z = 50$ and $S = 1\%$. While fires do not help weak incumbents much (the point estimate is 1.4, and it is not significant), strong incumbents obtain 6.4 p.p. more votes after a fire relative to weak incumbents, so the total increase in vote share for strong incumbents is 7.8 p.p. The remaining columns consider other values of z and S. In all the specifications but one the effects are statistically significant, and are always large in magnitude. The results are therefore consistent with the model: the stronger the incumbent party is, the more it benefits electorally from a fire in the last months before an election.

A caveat in interpreting these results is that there is no exogenous variation in the incumbent's vote share. Hence, it might be the case that the heterogeneity is driven by some omitted variable and not by the incumbent's vote share per se. In particular, we do find that municipalities with a strong incumbent (above the median) are smaller than those with a weak incumbent (average of 1,053 inhabitants versus 7,602). To assess whether this difference is driving the heterogeneity by the strength of the incumbent, we add population size as a control to the regressions—that is, we compare how strong and weak incumbents do after a fire, *in municipalities of the same size*. The results, displayed in Appendix Table A1, show that the heterogeneity by the incumbent's strength decreases slightly but remains large and significant.

5.2 Blind retrospection

This theory was proposed by Achen and Bartels (2004) and is extensively discussed in the recent book Achen and Bartels (2016). According to this theory, voters compare their well-being at the beginning and at the end of the term. If their well-being increased (decreased), they reward (punish) the incumbent. Voters are irrational and behave this way even if the change in their well-being was due to events that are outside the control of the incumbent.

We claim that it is hard to believe that such behavior can explain our findings. Given that fires are a negative or at least not-positive shocks, they should *reduce* the votes for the incumbent, and the estimated effect would accordingly be negative.

Might fires be a *positive* shock? For this theory to explain the effect that we find, fires would have to be a *positive* shock, that is, they would increase the well-being of voters. We can think of two main reasons why this could happen. One is that the affected municipality receives aid after the fire, and that this aid offsets the possible negative effects of the fire. Indeed, in the few papers that have found a positive effect of a natural disasters on the incumbent's vote share, aid has always been the channel (Bechtel and Hainmueller (2011), Chen (2013), Healy and Malhotra (2009)). Another possible reason is that the local government uses the fire to rezone the burnt land to urban land and that this generates a wealth effect through the increase in the value of the land. We now explore these two possibilities in turn.

The effect of aid. There are several reasons why aid is unlikely to explain our findings. First of all, aid in Spain is given out by the regional and national governments. Hence, if voters reward the incumbent for aid, it would be more natural to expect that voters reward regional and national governments after a fire, and not local governments, while we find that the opposite is true. To further explore the aid channel, we exploit micro data on aid approved by the national government after natural disasters.[20] We find three additional reasons why aid is not a plausible explanation for our results. First, aid is not very common: only 7.5% of municipalities that suffered an accidental wildfire received national aid. Second, aid takes time to arrive: on average, it is approved 200 days after a fire. This implies that many of the fires that are close to the election and benefit the incumbent have not had any aid approved by the election day. Third, this theory cannot explain the differential effect by time to election. In Appendix Table A2 we test whether municipalities that have a fire in the last year of the term receive more aid than those having a fire earlier in the term. The results show that, if anything, municipalities with a fire at the end of the term receive *less* aid. Therefore, aid cannot explain by itself why voters vote more for the incumbent when there is a fire towards the end of the term than when the fire is earlier.

Rezoning actions after a fire. Another way in which one might think that fires could be a positive shock is through land rezoning. In Spain, land is divided by the government into three

[20] The data come from *Protección Civil*, an institution within the Ministry of Domestic Affairs. It covers subsidies granted to municipalities in the wake of natural disasters, including wildfires, in the period 2006-2012. Unfortunately, there are no available data for regional aid.

categories: urban, developable, and rural. Building in rural land is in general prohibited. Hence, if local governments rezone rural land as developable after a fire, then this could increase the value of the land and generate a positive wealth effect.[21]

We can directly test this hypothesis in the data. To do so, we have downloaded data on the zoning of land (rural, developable, or urban) by year. The data come from the Spanish Land Registry Agency for the period 1994-2016. We consider the following regressions:

$$UrbanSurface_{it+j} - UrbanSurface_{it} = \alpha_{SM,pt} + \zeta_{SM} Fire_{SM,it} + \theta_{SM,it}, \tag{9}$$

for different values of j ($j \in 1, 2, 5$), where the variable *UrbanSurface* is defined as the log of the surface area of the municipality that is developable or urban. That is, we estimate if (the log of) the urban or developable surface area in the municipality increases 1, 2, or 5 years after a fire.[22] The results from this test are shown in Appendix Table A3. All the coefficients are close to zero and statistically insignificant, which provides evidence against the hypothesis that local governments systematically rezone the land status after accidental fires.[23]

The economic effect of fires. As a final test to assess the possibility that a fire is a positive shock, we estimate the effect on the economy of the affected municipality. We estimate:

$$UnemRate_{it+j} - UnemRate_{it} = \alpha_{SM,pt} + \zeta_{SM} Fire_{SM,it} + \theta_{SM,it}, \tag{10}$$

for different values of j ($j \in 1, 2, 5$). We also consider population size, instead of the unemployment rate, as the dependent variable. If fires are a positive shock for the affected municipality, then we expect a fire to reduce the unemployment rate and increase the population size. The results of these tests are shown in Appendix Table A4. Panel A (B) shows the results for unemployment rate (population size), for 1 year (columns 1 and 4), 2 years (columns 2 and 5) and 5 years (columns 3 and 6) after the fire. The results are close to zero and insignificant for all unemployment specifications, against the hypothesis that the economy benefits from a fire. For population size, most coefficients are also insignificant. The exception is the effect of fires burning at least 2% of the surface area of the municipality in the last six months before an election, which *decreases* population size by 4%. Although it is hard to conclude from this that fires are economically bad for the affected municipalities, the results do seem to rule out the possibility that suffering from a wildfire could turn out to be positive for the local economy.

5.3 "Rational updating"

In a recent paper, Ashworth, De Mesquita, and Friedenberg (2017) show that it may be rational for voters to change their voting behavior after a shock, even if the shock was outside of the incumbent's control. The intuition is that the shock can reveal the quality of the incumbent, either through the response given to the shock or through the shock revealing the quality of the prevention measures.

Consider the following example. There are two types of politicians, high quality and low quality. In any given municipality, a representative voter has to vote for either the incumbent or a challenger,

[21] The soil can also be devoted to common areas (e.g. roads) or be protected (e.g. natural parks). Our regression below can account also for rezoning of these areas, e.g. from protected to urban.

[22] The results are very similar if we use the log of the share of the municipality's surface area that is urban.

[23] In fact, this is not a surprising finding. Since 2006, it is prohibited by national law to rezone land during 30 years after a fire. Before 2006, regulation was at the regional level, and most of it prohibited it as well.

and the voter is uncertain about their quality. Suppose that 60% of incumbents are high quality, while only 30% of challengers are high quality (and these are the priors). Suppose that, if there is no fire during the term, then the voter does not learn anything about the quality of the incumbent (or the challenger). If there is a fire, then the voter will learn the true quality of the incumbent (and will learn nothing about the challenger). Then, in almost all municipalities with no fire, voters will follow their priors and think that the incumbent is more likely to be high quality than the challenger. Hence, almost all of the incumbents will be reelected. By contrast, in municipalities with a fire, voters learn the true quality of the incumbent—60% of the times will be high quality, and 40% will be low quality. Hence, only 60% of incumbents will be reelected. In this example, by revealing the true quality of incumbents, fires reduce the incumbents' vote shares.

This theory is therefore a clean way to rationalize some of the findings that previous work had attributed to voter irrationality. There are four reasons, however, why we argue that it cannot explain the entirety of our evidence.

First, we believe that the more reasonable assumptions of the Ashworth, De Mesquita, and Friedenberg (2017) model would lead to a *negative* effect of a fire on the incumbent's vote share. In their model, the direction of the effect depends on two key assumptions: whether the shock "reveals" or "mutes" the quality of the incumbent, and whether the incumbent is ahead or below the challenger. The shock reveals (mutes) the quality of the incumbent if the difference in the welfare of voters between being governed by a high- and a low-quality incumbent is higher (lower) with a shock than without a shock—that is, if the welfare of voters is more sensitive to the quality of the government when there is a shock. The incumbent is ahead (behind) the challenger if the probability that the politician is high quality is larger for the incumbent (challenger). In the example that we discussed above, we assumed that the shock (completely) revealed the quality of the incumbent, and that the incumbent was ahead of the challenger. Under these assumptions, the shock decreases the incumbent's vote share, as we saw. If either of the two assumptions is reversed, however, then the model will indeed predict that the shock increases the incumbent's vote share, as we find in our results. It is possible to come up with some stories in which that happens.[24] They are not, however, the most likely—it is more natural to think that politicians make more difference to the welfare of voters in times of crisis, and that incumbents are, on average, ahead of challengers, as they have already been elected for office, at least once.

Second, this mechanism cannot explain why only fires close to the election matter—the quality of the incumbent should be revealed (or muted) no matter when the fire happens. While adding myopia or forgetfulness to the model could explain why only fires close to the election matter, that extension would be unappealing, given that the point of the Ashworth, De Mesquita, and Friedenberg (2017)'s model is to rationalize the response of voters.

Third, as discussed in Section 2, most of the competences on prevention and extinction are at the regional and national levels. Although mayors also have some role in the management of the crises, especially as representative leaders of the municipality, there is no reason to think that the quality of regional or national governments should be revealed (or muted) less than that of local governments—if anything, the opposite should be true. Hence, if the effect is driven by a

[24] Ashworth, De Mesquita, and Friedenberg (2017) give the following case an example in which the shock mutes the true quality of the incumbent: "Suppose that good types are better at attracting investment. In normal times, good types will oversee better economic performance. But a natural disaster might stop investment, irrespective of the type of the incumbent. In this case, disasters mute the effect of type."

"revealing-the-quality" argument, it is not obvious why there is an effect on local elections but not on regional or national elections.

Fourth, for this model to explain why the effect is larger when the incumbent is stronger, we would need that, either a) if the positive effect is caused by the fire obscuring the quality of the incumbent, then the quality is more muted when the incumbent is stronger, or b) if the positive effect is caused by the challenger being ahead of the challenger, then the challenger is more ahead of the incumbent when the incumbent is stronger. It is not obvious why either of these two assumptions should hold.

5.4 Alternative mechanisms

Preferences over parties. One possibility is that fires temporarily change the partisan preferences of voters. For example, suppose that a fire makes voters more concerned about the environment. Then, left-wing parties might benefit in the next election. If most of the incumbents are left wing, then this can explain why incumbents win votes, on average.

To study this possible mechanism, we perform two tests. First, we analyze how the main parties fare after a fire, independently of whether they are the incumbent or not. Given that, during the sample period, Spain was an (imperfect) bipartisan system, we focus on the two main parties in Spain, the right-wing *Partido Popular* (PP) and the left-wing *Partido Socialista Obrero Español* (PSOE).[25]. To study this question, we run Equation (1), letting the outcome variable be the change in votes for the PP or the PSOE, instead of the change in votes for the incumbent. The results are shown in Panel A of Appendix Table A5. The first and fourth columns show the baseline results with the whole sample, for M=6 months and S=1% and S=2%, respectively. The second and fifth (third and sixth) columns show the effect of a fire on the vote shares for the PP (PSOE). No coefficient is statistically different from zero, even at the 10% level, indicating that neither party gains or loses votes, on average, after a fire.

Second, we test whether the effect of a fire on the incumbent's vote share differs by party. The results of this test are shown in Panel B of Appendix Table A5. As before, the first and fourth columns show the baseline results of the effect of a fire on the incumbent's vote share, for M=6 months and S=1% and S=2%, respectively. The second and fifth columns show the results when we restrict the sample to PP incumbents, and the third and sixth when we do so for PSOE incumbents.[26] The estimates are very similar and significant in all cases, indicating that both PP and PSOE incumbents gain votes after a fire.

Preferences over alignment. It could be argued that, after a fire, voters have stronger preferences for their local government to be aligned with the regional (or national) government. If most of the incumbents are aligned, then that could explain why they gain votes in the next election after a fire. To assess this possibility, we perform two tests that are parallel to the ones we carried out for the partisan preferences.

First, we estimate whether the party that is aligned with the regional (or national) government gains votes in the next election after the fire. The results of this test are shown in Appendix Table A6. The first and fourth columns show the baseline results of the effect of a fire on the incumbent's

[25] The PP obtained an average vote share of 40.4% in the municipalities with a 1% fire in the last 6 months before an election, and the PSOE, an average of 41.6%

[26] The PP was the incumbent in 17,259 out of the 46,877 observations in our dataset, while the PSOE was the incumbent in 15,903. In most of the remaining cases, the incumbent was some regional, local, or independent party.

vote share, for M=6 months and S=1 and S=2%, respectively. In the second and fifth (third and sixth) columns, we show the effect of a fire on the change in votes for the party that is aligned with the regional (national) government. The results show that regional and national incumbents do not systematically gain (or lose) votes after a fire, against the hypothesis that the effect is driven by the preferences of voters to align their local governments with other layers of governments.

Second, we test whether the effect of a fire on the incumbent's vote share differs for aligned and non-aligned parties. The results of this test are shown in Panel B of Appendix Table A6. When we restrict the sample to incumbents that are aligned with the regional party (columns (2) and (5)), the effect remains similar in magnitude to the baseline specification (columns (1) and (4)), which studies the effect on all incumbents. The same is true for incumbents that are aligned with the national government (columns (3) and (6)), although the point estimate loses significance for 1% fires. These results therefore indicate that the alignment status does not affect the reaction of voters to fires, as both aligned and non-aligned incumbents increase their vote share similarly after a fire.

6 Conclusion

We have shown that a large accidental fire in the last 9 months before a local election in Spain increases the incumbent's vote share by up to 8 p.p. Fires earlier in the term (farther from the next election) do not have an effect. We have also shown that fires before a regional or national election do not produce similar effects, and that stronger incumbents benefit more from a fire than weaker incumbents. We have argued that these effects are most consistent with a rally effect and formalized the mechanism in a simple model.

We conclude with a brief discussion and suggesting some avenues for future research. Our finding that a natural disaster increases the incumbent's vote share goes against most previous literature, which had found that these shocks usually generate negative effects. One possible reason for this divergence is that, unlike most previous research, not only do we study national elections but also local and regional ones. If our suggested mechanism is correct, a natural disaster makes voters willing to rally behind the leader of the affected area—the local government in our case. Hence, the findings of this paper imply that it is important that future research studies the electoral consequences of natural disasters on elections for different layers of government, who are likely to play different roles during the crisis. Similarly, given that our results cannot be fully explained by previous theories, we believe that it is also important that future research integrates behavioral responses (e.g., myopia or rally effects) into formal models of voter behavior.

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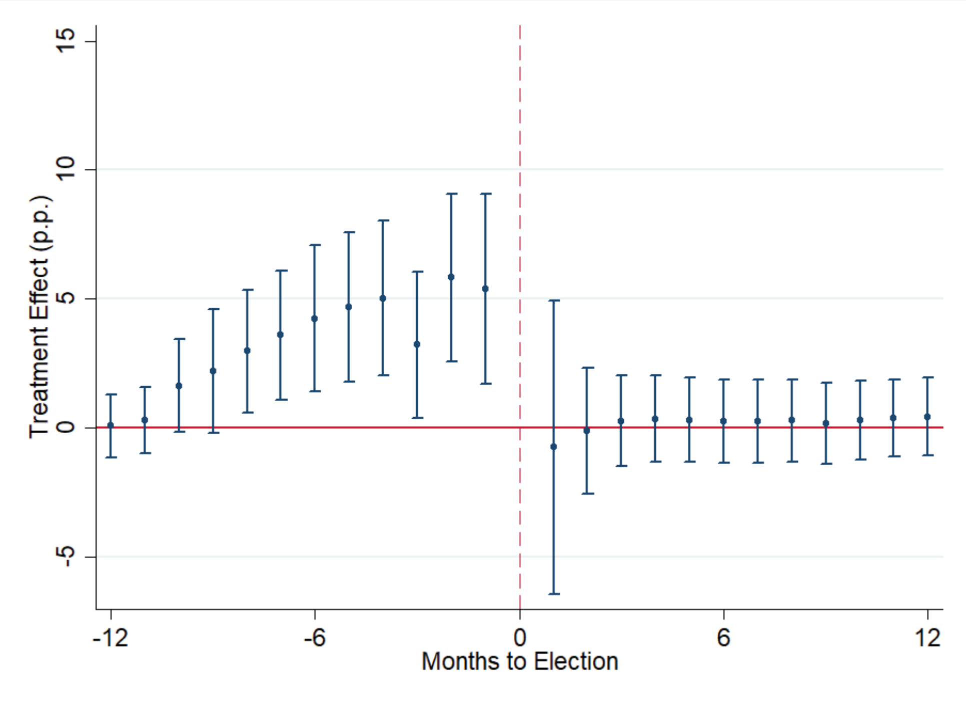
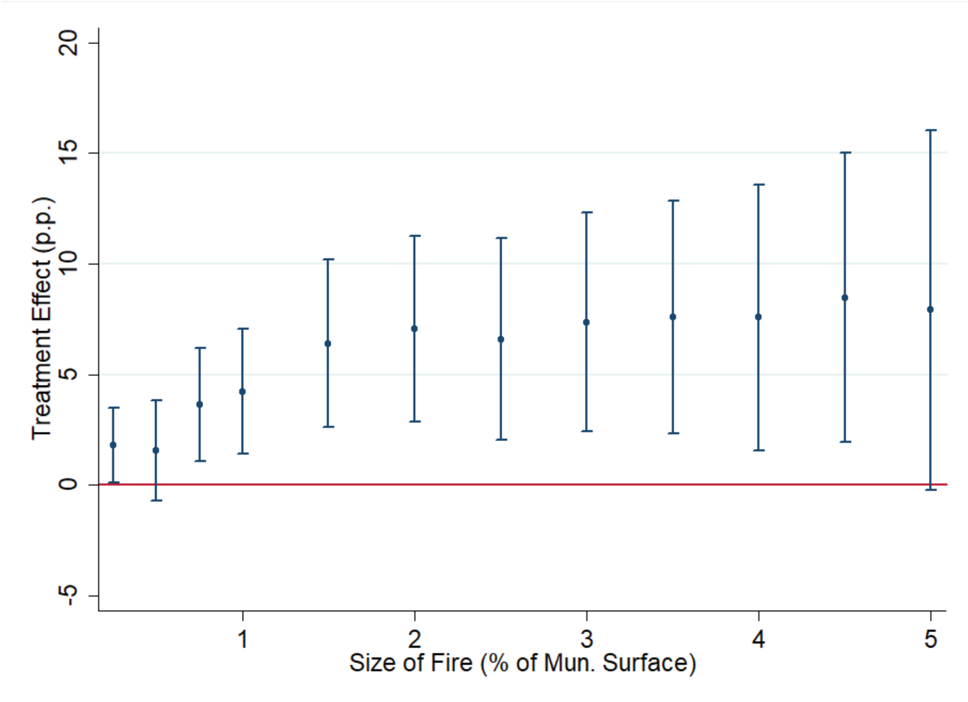
Figures

Figure 1: Effect of a Fire on the Incumbent's Vote Share, by Time to Election, Fires of Size S=1%



The figure shows the effect of a fire burning (at least) 1% of the municipality surface area, by time to a local election. The y-axis shows the point estimates and 95% confidence intervals for β_{1M}, obtained from $\Delta IncVoteShare_{it} = \alpha_{1M,pt} + \beta_{1M}Fire_{1M,it} + \epsilon_{1M,it}$, for different values of M (x-axis). The coefficients to the right of the vertical line are placebo tests that show the "effect" of fires that happen *after* the election. The standard errors are clustered by municipality.

Figure 2: Effect of a Fire on the Incumbent's Vote Share, by Size of the Fire



The figure shows the effect of a fire in the 6 months before a local election, by size of the fire. The y-axis shows the point estimates and 95% confidence intervals for β_{S6}, obtained from $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta Fire_{S6,it} + \epsilon_{S6,it}$, for different values of S (x-axis). The standard errors are clustered by municipality.

Tables

Table 1: Summary Statistics

Panel A: Summary Statistics

Variable/Sample	All	1% Fire at any time	1% Fire 6 m before local election
Population (inhab.)	5175	5945	5149
	(44993)	(76660)	(20391)
	[8,065]	[1,756]	[55]
Surface (ha.)	6244	6346	5999
	(9264)	(9157)	(6499)
	[8,065]	[1,756]	[55]
Votes Incumbent (%)	58.1	58.3	57.9
	(12.3)	(11.7)	(11.7)
	[8,065]	[1,756]	[55]
Unemployment (%)	4.1	4.2	4.2
	(2.1)	(2.0)	(1.4)
	[8,062]	[1,755]	[55]
Votes PP (%)	39.5	39.5	38.7
	(20.3)	(20.3)	(18.5)
	[7,651]	[1,691]	[54]
Votes PSOE (%)	36.9	37.9	39.6
	(16.4)	(15.9)	(16.6)
	[7,726]	[1,714]	[55]

The table shows the mean, the standard deviation (in parentheses), and the number of observations (in square brackets) of the indicated variables. The unit of observation is a municipality: for each municipality, we have first averaged the values of the variables across all the years in the sample.

Panel B: Number of Observations with $Fire_{SM,it} = 1$

Size/Months to Election	0-12	0-9	0-6	0-3	0-6	12-18	24-30	36-42
1%	665	153	58	41	58	87	96	69
2%	449	86	29	20	29	42	52	30
3%	354	63	23	15	23	31	17	17

The table shows the number of observations with a fire burning at least S% of the surface area of the municipality the last M months before an election. The unit of observation is a municipality-year.

Table 2: Effect of a Fire on the Incumbent's Vote Share (Local Elections)

Panel A: Effect by Time to Election

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,M}$	-0.0461	-0.0784	0.0638	2.189*	4.230***	3.210**
	(0.584)	(0.592)	(0.626)	(1.234)	(1.449)	(1.447)
Months to election	18	15	12	9	6	3
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	46877	46877	46877	46877	46877

Panel B: Effect by Size of the Fire

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{S,6}$	1.539	4.230***	7.069***	7.361***	7.577**	7.901*
	(1.155)	(1.449)	(2.140)	(2.516)	(3.061)	(4.150)
Size of the fire	.5%	1%	2%	3%	4%	5%
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	46877	46877	46877	46877	46877

Panel A shows the effect of an accidental fire burning (at least) 1% of the municipality surface area on the incumbent's vote share, by time to election. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{1M,pt} + \beta_{1M} Fire_{1M,it} + \epsilon_{1M,it}$, for different values of M. Standard errors, clustered by municipality, are in parentheses. Panel B shows the effect of a fire in the last 6 months before the election, by size of the fire. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta_{S6} Fire_{S6,it} + \epsilon_{S6,it}$, for different values of S. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 3: Effects on Regional and National Elections

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$
$Fire_{1,6}$	4.230***	0.737	0.261			
	(1.449)	(0.646)	(0.639)			
$Fire_{2,6}$				7.069***	0.471	1.163
				(2.140)	(0.728)	(1.102)
Elections	Local	Regional	National	Local	Regional	National
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	44364	56195	46877	44364	56195

The table shows the effect of an accidental fire burning (at least) 1% of the municipality surface area in the last 6 months before an election on the incumbent's vote share, by the type of election (local, regional, or national). Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta_{S6} Fire_{S6,it} + \epsilon_{S6,it}$, for $S = 1\%$ or $S = 2\%$. Standard errors, clustered by municipality, are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 4: Robustness: Effect of a 1% Fire, 6 Months to Election

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$
$Fire_{1,6}$	4.230***	3.888**	4.311***	4.636***	4.736***	4.087***
	(1.449)	(1.545)	(1.454)	(1.708)	(1.727)	(1.479)
α_{pt}	YES	YES			YES	
α_p			YES			
α_t			YES	YES		
α_i				YES	YES	
α_{prt}						YES
Controls		YES				
N	46877	34463	46877	46877	46877	37459

The table shows the effect of an accidental fire burning (at least) 1% of the municipality surface area in the last 6 months before a local election on the incumbent's vote share. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{1,6,pt} + \beta_{1,6}Fire_{1,6,it} + \epsilon_{1,6,it}$, for different combinations of fixed effects and controls (population size and unemployment rate). Standard errors, clustered by municipality, are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 5: Placebo Tests: "Effect" of a Fire on the Lagged Incumbent's Vote Share

Panel A: Effect by Time to Election

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,M}$	0.0507	-0.0194	0.113	-0.871	-0.801	0.0454
	(0.690)	(0.703)	(0.736)	(1.498)	(2.637)	(2.797)
Months to election	18	15	12	9	6	3
α_{pt}	YES	YES	YES	YES	YES	YES
N	33736	33736	33736	33736	33736	33736

Panel B: Effect by Size of the Fire

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{S,6}$	-1.180	-0.801	-3.283	-3.290	-3.498	-1.538
	(1.613)	(2.637)	(3.393)	(4.270)	(5.759)	(8.245)
Size of the fire	.5%	1%	2%	3%	4%	5%
α_{pt}	YES	YES	YES	YES	YES	YES
N	33736	33736	33736	33736	33736	33736

Panel A shows the "effect" of an accidental fire burning (at least) 1% of the municipality surface area, by time to election, on the on the incumbent's vote share in the previous election. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it-4} = \alpha_{1M,pt} + \beta_{1M}Fire_{1M,it} + \epsilon_{1M,it-4}$, for different values of M. Standard errors, clustered by municipality, are in parentheses. Panel B shows the effect of a fire in the last 6 months before the election, by size of the fire. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it-4} = \alpha_{S6,pt} + \beta_{S6}Fire_{S6,it} + \epsilon_{S6,it-4}$, for different values of S. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 6: Placebo Tests b: "Effect" of a Fire on Lagged Unemployment and Population Size

Panel A: Unemployment Rate

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	-0.0964	0.180	-0.265			
	(0.0999)	(0.147)	(0.200)			
$Fire_{2,6}$				-0.0946	0.231	-0.228
				(0.149)	(0.192)	(0.271)
Years before the election	1	2	5	1	2	5
α_{pt}	YES	YES	YES	YES	YES	YES
N	40287	32258	32210	40287	32258	32210

Panel B: Population Size

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	0.00601	0.0119	-0.0119			
	(0.00572)	(0.00920)	(0.0163)			
$Fire_{2,6}$				0.0144	0.0146	-0.00815
				(0.00953)	(0.0151)	(0.0283)
Years before the election	1	2	5	1	2	5
α_{pt}	YES	YES	YES	YES	YES	YES
N	56397	40315	48288	56397	40315	48288

Panel A shows the "effect" of an accidental fire burning (at least) 1% (or 2%, in the second row) of the municipality surface area, in the last 6 months before a local election, on the change in unemployment rate between the years indicated in the "years before the election" row and the election year. Each column is obtained from a separate regression, $UnemRate_{it} - UnemRate_{i,t-j} = \alpha_{S6,pt} + \zeta_{S6} Fire_{S6,it} + \theta_{SM,it}$, for $S = 1\%$ or $S = 2\%$, and for $j = 1$, $j = 2$, or $j = 5$, as indicated in the "Years before the election" row. Standard errors, clustered by municipality, are in parentheses. Panel B is analogous, for population size instead of unemployment rate. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 7: Alternative Specification: Differential Effect by Time to Election

Panel A: Effect by Time to Election

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,M}$	0.362	0.310	0.496	2.658**	4.637***	3.564**
	(0.728)	(0.731)	(0.750)	(1.285)	(1.482)	(1.478)
$Fire_{1,48}$	-0.427	-0.407	-0.455	-0.495	-0.431	-0.374
	(0.444)	(0.441)	(0.428)	(0.372)	(0.363)	(0.362)
Months to election	18	15	12	9	6	3
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	46877	46877	46877	46877	46877

Panel B: Effect by Size of the Fire

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{S,6}$	1.663	4.637***	7.371***	8.226***	8.546***	8.745**
	(1.186)	(1.482)	(2.190)	(2.570)	(3.111)	(4.197)
$Fire_{S,48}$	-0.136	-0.431	-0.310	-0.881*	-0.983*	-0.852
	(0.297)	(0.363)	(0.459)	(0.512)	(0.582)	(0.637)
Size of the fire	.5%	1%	2%	3%	4%	5%
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	46877	46877	46877	46877	46877

Panel A shows the effect of an accidental fire burning (at least) 1% of the municipality surface area on the incumbent's vote share, by time to election. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{1M,pt} + \beta_{1,1M} Fire_{1M,it} + \beta_{2,1M} Fire_{1,48,it} + \psi_{1M,it}$, for different values of M. Standard errors, clustered by municipality, are in parentheses. Panel B shows the effect of a fire in the last 6 months before the election, by size of the fire. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta_{1,S6} Fire_{S6,it} + \beta_{2,S6} Fire_{S48,it} + \psi_{S6,it}$, for different values of S. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 8: Effects by Strength of the Incumbent

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$	$\Delta VInc$
$Fire_{S,6}$	1.376	4.916	1.723	4.808**	-0.539	0.144
	(2.132)	(3.024)	(1.619)	(2.420)	(2.657)	(4.422)
$Fire_{S,6}$*$Strong_z$	6.447**	4.412	11.75***	9.972**	6.640**	9.366*
	(2.751)	(3.854)	(3.060)	(3.121)	(4.984)	(4.984)
Size of fire (S)	1%	2%	1%	2%	1%	2%
Strong (z)	> 50	> 50	> 75	> 75	> 25	> 25
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	46877	46877	46877	46877	46877

The table shows the effect of an accidental fire burning (at least) 1% (or 2%) of the municipality surface area in the last six months before a local election on the incumbent's vote share, by the strength of the incumbent. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta_{S6} Fire_{S6,it} + \beta_{S6} Strong_{it} + \beta_{S6} Fire_{S6,it} * Strong_{z,it} + \epsilon_{S6,it}$, for $S = 1\%$ or $S = 2\%$, as indicated in the "Size of fire" row, and for $z = 50$, $z = 75$, or $z = 25$, as indicated in the "Strong" row, where z indicates the percentile of the incumbent's vote share in the previous election. Standard errors, clustered by municipality, are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Online Appendices

Appendix A: Model Proofs

Proof of Proposition 1.

Proof. We start by deriving an expression for the effect of a fire on a given party's vote share. Then we will study the effect of a fire on the *incumbent's* vote share. In period 1, there is no fire, so $\gamma = 0$. There is an indifferent voter $\widetilde{\lambda} = -\epsilon$ such that all voters with $\lambda_i < \widetilde{\lambda}$ vote for party B and all voters with $\lambda_i > \widetilde{\lambda}$ vote for party A. Hence, the vote share for party A at $t = 1$ is given by:

$$V_{A1} = 1/2 + \epsilon_1,$$

and the probability that party A wins the election and becomes the incumbent is

$$P(V_{A1} > 1/2) = P(\epsilon > 0) = 1 - P(Z < \frac{1/2 - n_A}{\sigma}),$$

where a Z is a standard normal random variable.

Now consider period 2, and let us focus first on the case in which there is no fire ($fire = 0$). Given that, in this case, voters do not care about voting for the winner ($\gamma = 0$), everything is like in the first period. Hence, the vote share for party A at $t = 2$ when there is no fire is given by:

$$V_{A2|fire=0} = 1/2 + \epsilon_2, \tag{11}$$

and the probability that party A is the winner is

$$P(V_{A2} > 1/2|fire = 0) = P(\epsilon > 0|fire = 0) = P(\epsilon > 0) = 1 - P(Z < \frac{1/2 - n_A}{\sigma}), \tag{12}$$

Now consider $t = 2$ when there is a fire. Now the beliefs of voters on the strength of the parties matter because they do care about voting for the winner. We consider two cases: that voters do not anticipate the rally, and that they do.

Case 1. Voters do not anticipate the rally.

We study first the case in which voters do not anticipate the rally. That is, once a voter has observed the fire, i.e. $\gamma > 0$ in her utility function, but behave as if the rest of the voters will act as if $\gamma = 0$, not anticipating that other voters will also rally behind the winner. Hence, voters think, naively, that the vote shares will be given by Equation 11, and the probabilities of winning, by Equation 12.

For convenience, we define:

$$\rho \equiv P(V_{A2} < 1/2|fire = 1) = P(Z < \frac{1/2 - n_A}{\sigma}) \tag{13}$$

That is, ρ is the probability that party B will be the most voted in the election at $t = 2$ in case of fire, *as estimated by the voters.*

We now calculate the vote shares in case of fire. The indifferent voter will be given by the following expression:

$$\widetilde{\lambda} = -\epsilon_2 + \gamma(2\rho - 1).$$

Given that all voters with $\lambda_i < \widetilde{\lambda}$ vote for B and all voters with $\lambda_i > \widetilde{\lambda}$ vote for A, the vote share for party is given by:

$$V_{A2|fire=1} = 1/2 + \epsilon_2 - \gamma(2\rho - 1). \tag{14}$$

We can now compare the vote shares in the second period when there is fire and when there is no fire, given by Equations 14 and 11. The difference between the two equations is given by $-\gamma(2\rho-1)$. If $\rho > 1/2$, then $v_{A2|fire=1} < v_{A2|fire=0}$. That is, if voters believe that party B is more likely to win the election than party A ($\rho > 1/2$), then the fire benefits party B.

So far we have studied how a fire affects the vote share of a given party. We study now how a fire affects the vote share of the *incumbent* party.

If there is no fire, then the incumbent's vote share in the second-period election is:

$$\begin{aligned} E(V_{I2}|fire = 0) &= P(V_{A1} > 1/2)E(V_{A2}|fire = 0, V_{A1} > 1/2) \\ &\quad +P(V_{A1} < 1/2)(1 - E(V_{A2}|fire = 0, V_{A1} < 1/2)). \end{aligned}$$

The first term considers the case in which party A is the incumbent. This happens with probability $P(V_{A1} > 1/2)$. Similarly, the second term considers the case in which party B is the incumbent. Given that, when there is no fire, vote shares in the second period are independent of those in the first period, we can rewrite the previous expression as:

$$E(V_{I2}|fire = 0) = P(V_{A1} > 1/2)E(V_{A2}|fire = 0) + P(V_{A1} < 1/2)(1 - E(V_{A2}|fire = 0)).$$

Using Equation 11,

$$E(V_{I2}|fire = 0) = P(V_{A1} > 1/2)n_A + P(V_{A1} < 1/2)(1 - n_A). \tag{15}$$

If there is a fire, then

$$\begin{aligned} E(V_{I2}|fire = 1) = P(V_{A1} > 1/2)E(V_{A2}|fire = 1, V_{A1} > 1/2) \\ +P(V_{A1} < 1/2)(1 - E(V_{A2}|fire = 1, V_{A1} < 1/2)). \end{aligned}$$

Using Equation 14,

$$\begin{aligned} E(V_{I2}|fire = 1) = P(V_{A1} > 1/2)[n_A - \gamma(2\rho - 1)] \\ +P(V_{A1} < 1/2)[1 - n_A + \gamma(2\rho - 1). \end{aligned} \tag{16}$$

The difference between the expressions 16 and 15 is the expected effect of a fire on the votes of the incumbent:

$$\begin{aligned} E(\delta) \equiv E(V_{I2}|fire = 1) - E(V_{I2}|fire = 0) &= -\gamma P(V_{A1} > 1/2)(2\rho - 1) + \gamma P(V_{A1} < 1/2)(2\rho - 1) \\ &= \gamma(2\rho - 1)\big(P(V_{A1} < 1/2) - P(V_{A1} > 1/2)\big) \end{aligned}$$

But note that $\rho = P(V_{A1} < 1/2)$—that is, the probability that party B wins the second period when there is fire, as estimated by voters, is the same as the probability that party B wins the first period, because voters do not anticipate the rally. Hence,

$$E(\delta) = \gamma(2\rho - 1)^2 > 0,$$

that is, incumbents benefit, on average, from a fire.

Case 2. Voters do anticipate the rally.

Now voters are more sophisticated and predict that other voters may also rally after a fire. Hence, the estimated distribution of the vote shares in the second period is now given by:

$$\hat{\hat{V}}_{A2} \sim N(n_A - \gamma(2\tilde{\rho} - 1), \sigma^2)$$

where $\tilde{\rho}$ is the probability of party B winning, as estimated by voters, Hence,

$$\tilde{\rho} = P(Z < \frac{1/2 - n_A + \gamma(2\tilde{\rho} - 1)}{\sigma}). \tag{17}$$

Consider the case in which $n_A > 1/2$. The case for $n_A < 1/2$ is symmetric. The expected effect of a fire is now given by:

$$E(\tilde{\delta}) = \gamma(2\tilde{\rho} - 1)\big(P(V_{A1} < 1/2) - P(V_{A1} > 1/2)\big) \tag{18}$$

The sign of $E(\tilde{\delta})$ is given by the signs of the three terms of Equation 18. Obviously, $\gamma > 0$. With respect to the second term, note that, if $n_A > 0$, then $\rho < 1/2$. But then, there exists a solution to equation 17 such that $\tilde{\rho} < \rho$. (We cannot rule out that other solutions exist to this Equation—the equilibrium may not be unique.) Hence, $\tilde{\rho} < 1/2$, and the second term is in Equation 18 is negative. Finally, the third term is also negative if $n_A > 0$. Hence, $E(\tilde{\delta}) > 0$.

Proof of Proposition 2.

Proof. We consider the case in which voters do not anticipate the rally (the case in which they do is analogous). Consider the case in which $n_A > 1/2$. The case for $n_A < 1/2$ is symmetric.

We want to study how a fire increases the vote share of the incumbent party, *for any given* v_{I1}. This is given by this expression:

$$E(\tilde{\delta}|V_{I1} = v_{I1}) = -\gamma(2\tilde{\rho} - 1)\frac{f_A(v_{I1})}{f_I(v_{I1})} + \gamma(2\tilde{\rho} - 1)\frac{f_A(1 - v_{I1})}{f_I(v_{I1})}, \tag{19}$$

for $v_{I1} \geq 1/2$, where f_A be the density function of V_{A1}, and f_I the density of V_{I1}, $-\gamma(2\rho - 1)$ is the vote share gain of party A due to a fire, and $\gamma(2\rho - 1)$ is the vote share gain of party B. These two terms are weighted by the relative frequency of parties A and B being the incumbent conditional on the incumbent having obtained v_{I1} vote share. Rearranging,

$$E(\delta|V_{I1} = v_{I1}) = -\gamma(2\rho - 1)[\frac{f_A(v_{I1})}{f_I(v_{I1})} - \frac{f_A(1 - v_{I1})}{f_I(v_{I1})}] \tag{20}$$

Note that $f_I(v_{I1}) = f_A(v_{I1}) + f_A(1 - v_{I1})$—there are two ways an incumbent obtains a share v_{I1} of the votes: that party A obtains v_{I1}, or that party B obtains v_{I1}, which is the same as party A obtaining $1 - v_{I1}$. Hence,

$$E(\delta|V_{I1} = v_{I1}) = -\gamma(2\rho - 1)\frac{f_A(v_{I1}) - f_A(1 - v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})} \tag{21}$$

We need to show that this is increasing in v_{I1}. If $n_A > 1/2$, then $\rho < 1/2$, as we showed in the previous proof. Hence, $-\gamma(2\rho-1) > 0$. It remains to be shown that the last fraction is increasing in v_{I1}. Intuitively, we need to show that party A is more represented among incumbents that won the previous election by, for example, 70 to 30%, than among those that won 55 to 45%. Rearranging,

$$\frac{f_A(v_{I1}) - f_A(1 - v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})} = \frac{1 - \frac{f_A(1-v_{I1})}{f_A(v_{I1})}}{1 + \frac{f_A(1-v_{I1})}{f_A(v_{I1})}}. \tag{22}$$

This is increasing in v_{I1} if and only if $\frac{f_A(1-v_{I1})}{f_A(v_{I1})}$ is decreasing in v_{I1}. Given that V_{A1} is normal with mean n_A and variance σ^2[27],

$$\frac{f_A(1 - v_{I1})}{f_A(v_{I1})} = \frac{e^{\frac{-(1-v_{I1}-n_A)^2}{2\sigma^2}}}{e^{\frac{-(v_{I1}-n_A)^2}{2\sigma^2}}}, \tag{23}$$

and

$$\frac{\partial \frac{f_A(1-v_{I1})}{f_A(v_{I1})}}{\partial v_{I1}} = \frac{1}{\sigma^2} - 2\frac{n_A}{\sigma^2}, \tag{24}$$

which is negative for any $n_A > 1/2$.

Appendix B: An Alternative Model

Here we consider a model in which voters do not know the relative strength of parties, but rather have a prior, which they update with period 1 vote shares. We prove two propositions that are analogous to Propositions 1 and 2. The only difference is that the results now hold if the prior of voters is not too far from the true value of n_A. In fact, as voters have more an more information on the strength of parties, i.e. more realizations of the ϵ, the prior will converge to the true parameter, relaxing the conditions on the prior. In the limit, the case considered in here collapses to the one presented in the main text.

Preferences are like in the model in the main text. However, voters now know σ^2 but do not know n_A—they have a prior n^0_{prior} that is distributed as $n^0_{prior} \sim N(n^0_A, \sigma^{2,0})$. For simplicity, we assume $\sigma^{2,0} = \sigma^2$—this assumption does not affect any of the results.

[27] This proof is also valid for other distributions, in particular, a beta distribution.

Hence, the timing is now as follows:

1. Nature draws ϵ_1.

2. Voters vote ($t = 1$ election).

3. The party that wins the election (that is, obtains more than 1/2 vote share) forms government and becomes the incumbent.

4. Voters observe the vote shares and update their prior over n_A accordingly.

5. Nature draws $fire$ and ϵ_2.

7. Voters vote ($t = 2$ election).

Proposition 3. *There exists an equilibrium in which a fire increases the expected incumbent's vote share if ($n_A^0 \geq 1/2$ and $n_A > 1/2$), or if ($n_A^0 \leq 1/2$ and $n_A < 1/2$). If voters do not anticipate the rally, this equilibrium is unique.*

Proof. Period 1 and period 2 with no fire are as in the main text. Now consider $t = 2$ when there is a fire. Voters have observed v_{A1} and update their prior accordingly.[28] Their posterior's mean and variance are given by these expressions:

$$n_A^1(v_{A1}) = \frac{n_A^0 + (v_{A1})}{2}, \qquad (25)$$
$$\sigma^{2,1} = \sigma^2/2$$

With this information, voters estimate the probability that party A wins the election. We study first the case in which voters do not anticipate the rally.

Case 1. Voters do not anticipate the rally.

Given the posteriors,

$$\tilde{V}_{A2}|V_{A1} = v_{A1} \sim N(n_A^1(v_{A1}), \sigma^2 + \sigma^{2,1})$$

so the probability of party A winning, as estimated by the voter, is

$$\tilde{P}(V_{A2} > 1/2|fire = 1, V_{A1} = v_{A1}) = P(Z > \frac{1/2 - n_A^1(v_{A1})}{\sqrt{\sigma^2 + \sigma^{2,1}}}) = 1 - P(Z < \frac{1/2 - n_A^1(v_{A1})}{\sqrt{\sigma^2 + \sigma^{2,1}}}).$$

Plugging into Equation 25,

$$\rho(v_{A1}) \equiv \tilde{P}(V_{A2} < 1/2|fire = 1, V_{A1} = v_{A1}) = P(Z < \frac{1/2 - \frac{n_A^0 + v_{A1}}{2}}{\sqrt{(3/2)\sigma}}). \qquad (26)$$

Hence, the expression for ρ has changed with respect to the main text, as voters are uncertain about the true n_A (we keep the term ρ for simplicity, slightly abusing notation). Instead of a fixed number, ρ is now a function of v_{A1}.

Vote shares for parties are still given by Equations 11 and 14 and vote shares for the incumbent by Equations 15 and 16 (with ρ now given by 26).

[28] Note that observing v_{A1} is equivalent to observing ϵ_1. Theoretically, voters could also use the information from ϵ_2 to update their prior once more before the $t = 2$ election. This yields similar results to the ones we present here—in fact, the conditions on the priors are weaker under this alternative rule of updating, as the prior has less weight. We abstract from this for simplicity.

The expected effect of a fire on the votes of the incumbent is now given by:

$$E(\delta) \equiv E(V_{I2}|fire = 1) - E(V_{I2}|fire = 0) = -\gamma P(V_{A1} > 1/2)[E[(2\rho(v_{A1}) - 1)|V_{A1} > 1/2]$$
$$+\gamma P(V_{A1} < 1/2)[E[(2\rho(v_{A1}) - 1)|V_{A1} < 1/2]),$$

where we just have replaced ρ with its new expression.

Let $f(v)$ be the density of V_{A1}. Then,

$$E(\delta) = \gamma[\int_{v \le 1/2} [2\rho(v) - 1]f(v)dv - \int_{v>1/2}^{1} [2\rho(v) - 1]f(v)dv]. \quad (27)$$

Consider the case $n_A > 1/2$ (the other is symmetrical). Hence, by assumption of the Proposition, $n_A^0 \geq 1/2$.

Given that $\rho(v)$ is a monotonically decreasing function of v, $\rho(v) > \rho(1/2)$ in the first integral of 27, and $\rho(v) < \rho(1/2)$ in the second integral of 27. Hence,

$$E(\delta) \geq \gamma\Big[\int_{v \le 1/2} [2\rho(1/2) - 1]f(v)dv - \int_{v>1/2}^{1} [2\rho(1/2) - 1]f(v)dv\Big] \quad (28)$$

$$= \gamma[2\rho(1/2) - 1]\Big[\int_{v \le 1/2} f(v)dv - \int_{v>1/2}^{1} f(v)dv\Big] \quad (29)$$

Of course, $\gamma > 0$. Note that $\rho(1/2) < 1/2$ because $n_A^0 \geq 1/2$. Hence, the second term in 28 is negative. Finally, the third term is negative because $n_A > 1/2$. Hence, $E(\delta) > 0$.

Case 2. Voters do anticipate the rally.

The estimated vote share for party A in the second period is now given by:

$$\tilde{\rho}(v_{A1}) \equiv \tilde{P}(V_{A2} < 1/2|fire = 1, V_{A1} = v_{A1}) = P(Z < \frac{1/2 - \frac{n_A^0 + v_{A1}}{2} + \gamma(2\tilde{\rho}(v_{A1}) - 1)}{\sqrt{(3/2)\sigma}}). \quad (30)$$

This provides an equation for $\tilde{\rho}(v_{A1})$. We first prove that a solution exists. Let $\widehat{\rho}^{[0]}(v) = 0$ and for $n = 0, 1, \ldots$

$$\widehat{\rho}^{[n+1]}(v) = P(Z < \frac{1/2 - \frac{n_A^0 + v_{A1}}{2} + \gamma(2\widehat{\rho}^{[n]}(v) - 1)}{\sqrt{(3/2)\sigma}}). \quad (31)$$

Para each v fixed, by induction, the sequence of real numbers $\widehat{\rho}^{[n]}(v)$, $n = 0, 1, \ldots$, is monotonically increasing. Given that there is an upper bound of 1, this sequence has a limit, $\widehat{\rho}(v)$. Taking limits as $n \to \infty$ in 31, the limit $\widehat{\rho}(v)$ is a solution to 30. (We cannot rule out that other solutions exist.)

Once we have shown that there is a solution for $\tilde{\rho}(v_{A1})$, the expected effect of a fire on the incumbent's vote share is as in the no-anticipation case, given by Equation 27, with $\tilde{\rho}(v_{A1})$ instead of $\rho(v_{A1})$:

$$E(\tilde{\delta}) = \gamma\Big[\int_{v \le 1/2} [2\rho(v) - 1]f(v)dv - \int_{v>1/2}^{1} [2\rho(v) - 1]f(v)dv\Big]. \quad (32)$$

We now show that, as in the no-anticipation case, a) $\tilde{\rho}(v_{A1})$ is monotonically decreasing in v_{A1}, and b) that $\tilde{\rho}(1/2) < 1/2$.

a) For each n fixed, $\widehat{\rho}^{[n]}(v)$ is a monotonically decreasing function of v. This is by induction in n: for $n = 0$ the function $\widehat{\rho}^{[0]}(v) = 0$ is of course (weakly) decreasing and if we assume that $\widehat{\rho}^{[n]}(v)$ decreases as v increases, the same happens to $\widehat{\rho}^{[n+1]}(v)$, according to (31), given that increasing v decreases

$$\frac{1/2 - \frac{n^0+v}{2} + \gamma[2\widehat{\rho}^{[n]}(v) - 1]}{\sigma}.$$

Hence, as $n \to \infty$, the limit $\widehat{\rho}(v)$ is also a decreasing function.

b) For each n fixed, $\widehat{\rho}^{[n]}(1/2) \leq 1/2$. The proof is by induction, analogous the to the one in point a). In the limit when $n \to \infty$, also $\widehat{\rho}(1/2) \leq 1/2$.

With these two results, the proof that $E(\tilde{\delta}) > 0$ is identical to the one for $E(\delta) > 0$.

Proposition 4. *The effect of a fire on the incumbent's vote share at $t = 2$ is increasing in the incumbent's vote share at $t = 1$ if ($n_A^0 \geq 1/2$ and $n_A > 1/2$), or if ($n_A^0 \leq 1/2$ and $n_A < 1/2$).*

Proof. As in the main text, we consider the case in which voters do not anticipate the rally (the case in which they do is analogous). Consider the case in which $n_A > 1/2$. The case for $n_A < 1/2$ is symmetric.

We want to study how a fire increases the vote share of the incumbent party, *for any given* $v_{I1} \geq 1/2$. This is given by this expression:

$$E(\delta|V_{I1} = v_{I1}) = -\gamma(2\rho(v_{I1}) - 1)\frac{f_A(v_{I1})}{f_I(v_{I1})} + \gamma(2\rho(1 - v_{I1}) - 1)\frac{f_A(1 - v_{I1})}{f_I(v_{I1})} \tag{33}$$

where f_A be the density function of V_{A1}, and f_I the density of V_{I1}. As in the main text, we use the fact that $f_I(v_{I1}) = f_A(v_{I1}) + f_A(1 - v_{I1})$ to have:

$$E(\delta|V_{I1} = v_{I1}) = -\gamma(2\rho(v_{I1}) - 1)\frac{f_A(v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})} + \gamma(2\rho(1 - v_{I1}) - 1)\frac{f_A(1 - v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})} \tag{34}$$

Differentiating with respect to v_{I1},

$$\begin{aligned}
\frac{d}{dv_{I1}}E(\delta|v_{I1}) \quad = \quad & \left(\frac{d}{dv_{I1}}\Big(- \gamma[2\rho(v_{I1}) - 1]\Big)\right)\frac{f_A(v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})} \\
& -\gamma[2\rho(v_{I1}) - 1]\frac{d}{dv_{I1}}\frac{f_A(v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})} \\
& + \left(\frac{d}{dv_{I1}}\Big(\gamma[2\rho(1 - v_{I1}) - 1]\Big)\right)\frac{f_A(1 - v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})} \\
& +\gamma[2\rho(1 - v_{I1}) - 1]\frac{d}{dv_{I1}}\frac{f_A(1 - v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})},
\end{aligned}$$

Note that

$$\frac{d}{dv_{I1}}\frac{f_A(v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})} = -\frac{d}{dv_{I1}}\frac{f_A(1 - v_{I1})}{f_A(v_{I1}) + f_A(1 - v_{I1})},$$

so we can rewrite the last expression as follows:

$$\begin{aligned}\frac{d}{dv_{I1}}E(\delta|v_{I1}) \quad = \quad & \left(\frac{d}{dv_{I1}}\Big(-\gamma[2\rho(v_{I1})-1]\Big)\right)\frac{f_A(v_{I1})}{f_A(v_{I1})+f_A(1-v_{I1})} \\ & +\left(\frac{d}{dv_{I1}}\Big(\gamma[2\rho(1-v_{I1})-1]\Big)\right)\frac{f_A(1-v_{I1})}{f_A(v_{I1})+f_A(1-v_{I1})} \\ & +\gamma\Big(-[2\rho(v_{I1})-1]-[2\rho(1-v_{I1})-1]\Big) \\ & \times\frac{d}{dv_{I1}}\frac{f_A(v_{I1})}{f_A(v_{I1})+f_A(1-v_{I1})}.\end{aligned}$$

We need to show that this expression is positive.

- First term in the right-hand side. Given that $\rho(v_{I1})$ is decreasing in v_{I1}, $-\gamma[2\rho(v_{I1})-1]$ is increasing in v_{I1} and its derivative is positive. The fraction is also positive.

- Second term. $\rho(1-v_{I1})$ is increasing in v_{I1} and hence its derivative is positive. The fraction is also positive.

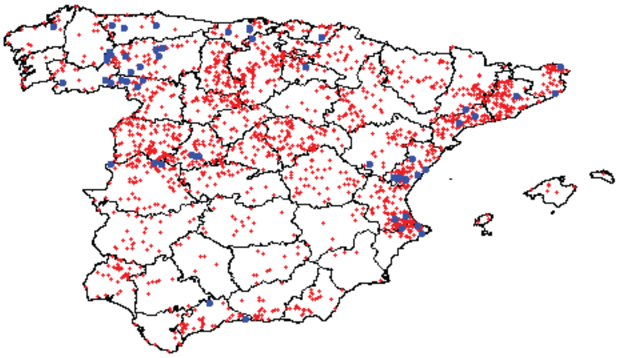
- Third term. The derivative is positive, as was proved in the main text. $-[2\rho(v_{I1})-1]$ is negative. We do not know the sign of $-[2\rho(1-v_{I1})-1]$ but in any case

$$-[2\rho(v_{I1})-1]-[2\rho(1-v_{I1})-1]\geq 0.$$

Hence, this term is also positive.

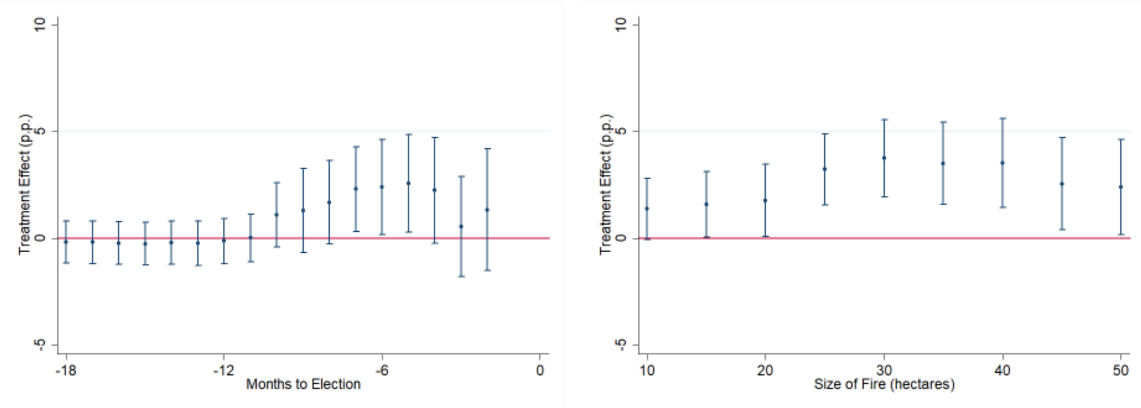
Appendix Figures

Figure A1: Map of Wildfires in Spain



Red dots: municipalities with (at least) one accidental fire larger than 1%, any time.
Blue dots: municipalities with (at least) one accidental fire larger than 1%, 6 months before an election.

Figure A2: Effect of a Fire on the Incumbent's Vote Share, *Absolute* Size of Fires

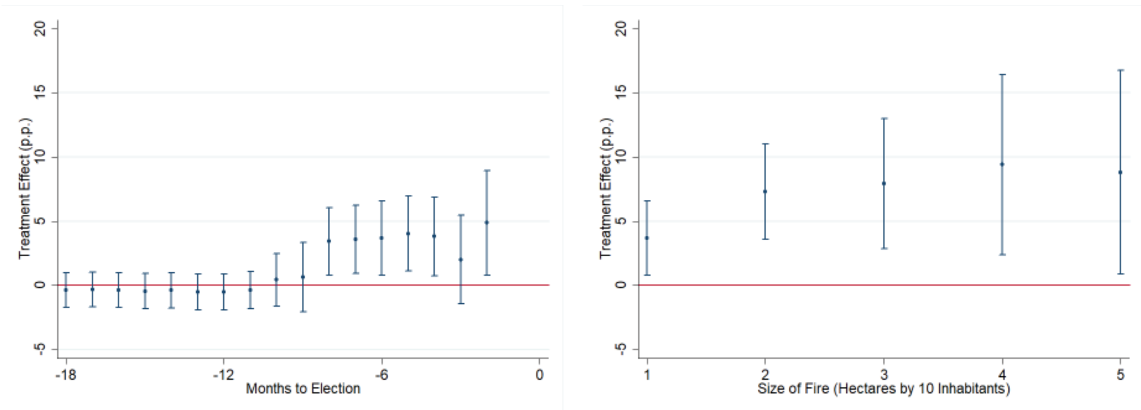


(a) By time to election

(b) By size of fire

Panel (a): The y-axis shows the point estimates and 95% confidence intervals for β_{M50}, obtained from $\Delta IncVoteShare_{it} = \alpha_{M50,pt} + \beta Fire_{M50,it} + \epsilon_{it}$, for different values of M (x-axis), where S is now measured in absolute (not per capita) hectares. Panel (b): The y-axis shows the point estimates and 95% confidence intervals for β_{S6}, obtained from $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta Fire_{S6,it} + \epsilon_{it}$, for different values of S (x-axis), where S is now measured in absolute (not per capita) hectares.

Figure A3: Effect of a Fire on the Incumbent's Vote Share, Size of Fires *Relative to Population*

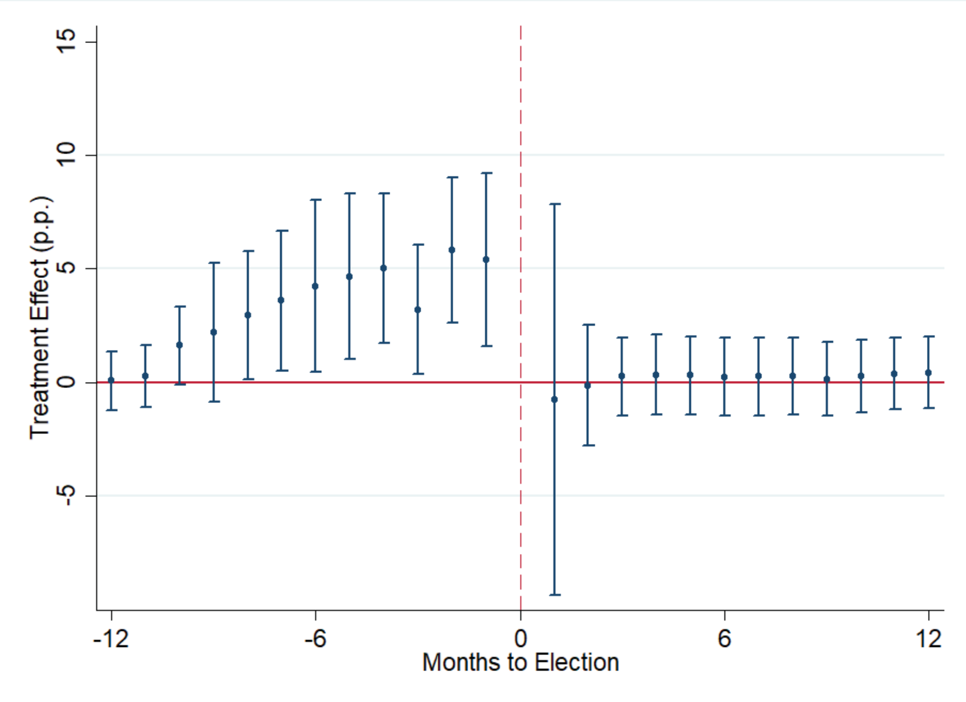


(a) By time to election

(b) By size of fire

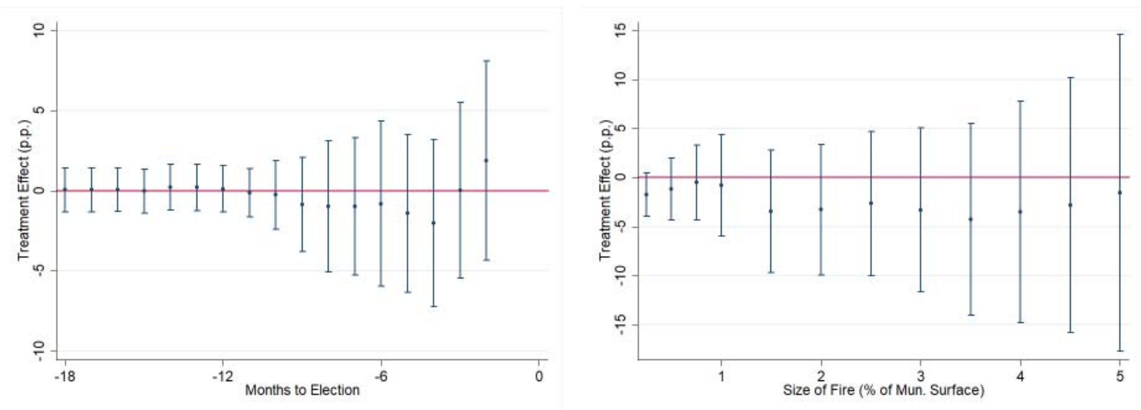
Panel (a): The y-axis shows the point estimates and 95% confidence intervals for β_{M1}, obtained from $\Delta IncVoteShare_{it} = \alpha_{M1,pt} + \beta Fire_{M1,it} + \epsilon_{it}$, for different values of M (x-axis), where S is now measured in hectares per population. Panel (b): The y-axis shows the point estimates and 95% confidence intervals for β_{S6}, obtained from $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta Fire_{S6,it} + \epsilon_{it}$, for different values of S (x-axis), where S is now measured in hectares per population.

Figure A4: Effect of a Fire on the Incumbent's Vote Share, by Time to Election, Fires of Size S=1% (Standard Errors Clustered by Province)



The figure shows the effect of a fire burning (at least) 1% of the municipality surface area, by time to a local election. The y-axis shows the point estimates and 95% confidence intervals for β_{1M}, obtained from $\Delta IncVoteShare_{it} = \alpha_{1M,pt} + \beta_{1M}Fire_{1M,it} + \epsilon_{1M,it}$, for different values of M (x-axis). The coefficients to the right of the vertical line are placebo tests that show the "effect" of fires that happen *after* the election. The standard errors are clustered by province.

Figure A5: Placebo Tests: "Effect" of a Fire on Lagged Incumbent's Vote Share



(a) By time to election

(b) By size of fire

Panel (a): The y-axis shows the point estimates and 95% confidence intervals for β_{M1}, obtained from $\Delta IncVoteShare_{it-4} = \alpha_{M1,pt} + \beta Fire_{M1,it} + \epsilon_{it-4}$, for different values of M (x-axis). Panel (b): The y-axis shows the point estimates and 95% confidence intervals for β_{S6}, obtained from $\Delta IncVoteShare_{it-4} = \alpha_{S6,pt} + \beta Fire_{S6,it} + \epsilon_{it-4}$, for different values of S (x-axis).

Appendix Tables

Table A1: Effects by Strength of the Incumbent, Controling for Population Size

	(1) $\Delta VInc$	(2) $\Delta VInc$	(3) $\Delta VInc$	(4) $\Delta VInc$	(5) $\Delta VInc$	(6) $\Delta VInc$
$Fire_{S,6}$	1.589	4.848	1.790	4.667*	-0.0762	0.711
	(2.145)	(3.031)	(1.640)	(2.438)	(2.752)	(4.654)
$Fire_{S,6}$*$Strong_z$	6.124**	4.188	11.73***	9.975**	6.068*	8.395
	(2.749)	(3.786)	(3.056)	(4.093)	(3.191)	(5.161)
Size of fire (S)	1%	2%	1%	2%	1%	2%
Strong (z)	> 50	> 50	> 75	> 75	> 25	> 25
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	46877	46877	46877	46877	46877

The table shows the effect of an accidental fire burning (at least) 1% (or 2%) of the municipality surface area in the last six months before a local election on the incumbent's vote share, by the strength of the incumbent. Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta_{S6}Fire_{S6,it} + \beta_{S6}Strong_{it} + \beta_{S6}Fire_{S6,it} * Strong_{z,it} + \zeta log(Population)_{it}\epsilon_{S6,it}$, for $S = 1\%$ or $S = 2\%$, as indicated in the "Size of fire" row, and for $z = 50$, $z = 75$, or $z = 25$, as indicated in the "Strong" row, where z indicates the percentile of the incumbent's vote share in the previous election. Standard errors, clustered by municipality, are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A2: National Aid Received by Election Year

	2006-2012			2006-2011		
	Aid Indicator	Total Aid	Aid per Hectare	Aid Indicator	Total Aid	Aid per Hectare
	(1)	(2)	(3)	(4)	(5)	(6)
Election Year	-0.068***	-0.628*	0.187	-0.033*	-1.168**	-0.604
	(0.019)	(0.369)	(0.826)	(0.018)	(0.490)	(0.933)
Constant	0.091***	8.627***	2.016***	0.055***	9.167***	2.807***
	(0.014)	(0.249)	(0.295)	(0.013)	(0.401)	(0.490)
N	586	44	44	441	20	20

The table shows the effect of being in a local election-year on the national aid received after a fire. The specification is the following $y_{it} = \alpha + \beta$ Election Year$_t + \epsilon_{it}$, the sample being composed of municipality-fires if the affected area was at least 1% of the municipality's surface area. y_{it} in columns 1 and 3 is a dummy taking value 1 if the municipality received national aid associated to the fire. In columns 2 and 4 the dependent variable is the log (real) aid received, while in columns 3 and 5 it is the log aid per hectare burnt. The covariate Election Year is a dummy taking value 1 if the fire was detected within a local election year and zero otherwise. Robust standard errors are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A3: Effect of a Fire on Land Rezoning

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	-0.00171	-0.0218	0.0115			
	(0.0145)	(0.0157)	(0.0281)			
$Fire_{2,6}$				0.00203	-0.0176	-0.00339
				(0.0227)	(0.0219)	(0.0346)
Years after the election	1	2	5	1	2	5
α_{pt}	YES	YES	YES	YES	YES	YES
N	37686	37686	37689	37686	37686	37689

The table shows the effect of an accidental fire burning (at least) 1% (or 2%, in the second row) of the municipality surface area in the last 6 months before a local election on the difference of the municipality surface area that is considered as "urban" or "developable" between the years indicated in the "years after the election" row and the election-year. Each column is obtained from a separate regression, $UrbanSurface_{it+j} - UrbanSurface_{it} = \alpha_{S6,pt} + \zeta_{S6} Fire_{S6,it} + \theta_{S6,it},$, for $S = 1\%$ or $S = 2\%$, and for $j = 1$, $j = 2$, or $j = 5$, as indicated in the "Years after the election" row. Standard errors, clustered by municipality, are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A4: Effect of a Fire on Unemployment and Population Size

Panel A: Effect on Unemployment Rate

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	-0.0290	-0.0836	0.107			
	(0.124)	(0.169)	(0.211)			
$Fire_{2,6}$				-0.0946	0.231	-0.228
				(0.149)	(0.192)	(0.271)
Years after the fire	1	2	5	1	2	5
α_{pt}	YES	YES	YES	YES	YES	YES
N	40043	32241	32223	40043	32241	32223

Panel B: Effect on Population Size

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	0.000454	-0.00448	-0.0154			
	(0.00484)	(0.00727)	(0.0115)			
$Fire_{2,6}$				0.000299	-0.00198	-0.0425***
				(0.00722)	(0.0113)	(0.0149)
Years after the fire	1	2	5	1	2	5
α_{pt}	YES	YES	YES	YES	YES	YES
N	56163	48357	48085	56163	48357	48085

Panel A shows the effect of an accidental fire burning (at least) 1% (or 2%, in the second row) of the municipality surface area in the last 6 months before a local election on the change in unemployment rate between the election year and the years indicated in the "years after the election" row. Each column is obtained from a separate regression, $UnemRate_{i,t+j} - UnemRate_{i,t} = \alpha_{S6,pt} + \zeta_{S6} Fire_{S6,it} + \theta_{S6,it}$, for $S = 1\%$ or $S = 2\%$, and for $j = 1$, $j = 2$, or $j = 5$, as indicated in the "Years after the election" row. Standard errors, clustered by municipality, are in parentheses. Panel B is analogous, for population size instead of unemployment rate. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A5: Effects by Party

Panel A: Effect of a Fire on Parties' Vote Shares

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	4.230***	1.663	1.503			
	(1.449)	(1.335)	(1.566)			
$Fire_{2,6}$				7.069***	1.470	-0.349
				(2.140)	(1.836)	(2.096)
Effect on	Incumbent	PP	PSOE	Incumbent	PP	PSOE
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	42958	42772	46877	42958	42772

Panel B: Effect of a Fire on the Incumbent's Vote Share by Party

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	4.230***	3.667**	4.183*			
	(1.449)	(1.786)	(2.316)			
$Fire_{2,6}$				7.069***	5.641***	7.504*
				(2.140)	(2.089)	(4.059)
Incumbent	All	PP	PSOE	All	PP	PSOE
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	17259	15903	46877	17259	15903

Panel A shows the effect of an accidental fire burning (at least) 1% (or 2%, on the second row) of the municipality surface area in the last six months before a local election on the incumbent's vote share (Columns 1 and 4), PP vote share (Columns 2 and 5) and PSOE vote share (Columns 3 and 6). Each column is obtained from a separate regression, $\Delta Outcome_{it} = \alpha_{S6,pt} + \beta_{S6} Fire_{S6,it} + \epsilon_{S6,it}$, where the outcome is the incumbent's vote share, the PP vote share, or the PSOE vote share. Panel B shows the effect of an accidental fire burning (at least) 1% (or 2%, on the second row) of the municipality surface area in the last six months before a local election on the incumbent's vote share, with the whole sample (Columns 1 and 4), only PP incumbents (Columns 2 and 5), and only PSOE incumbents (Columns 3 and 6). Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta_{S6} Fire_{S6,it} + \epsilon_{S6,it}$. Standard errors, clustered by municipality, are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table A6: Effects by Alignment

Panel A: Effect of a Fire on the Aligned Party's Vote Shares

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	4.230***	2.327	1.666			
	(1.449)	(1.565)	(1.444)			
$Fire_{2,6}$				7.069***	2.211	2.310
				(2.140)	(1.893)	(2.037)
Effect on	Inc.	Aligned w. reg. gov.	Aligned w. nat. gov.	Inc.	Aligned w. reg. gov.	Aligned w. nat. gov.
α_{pt}	YES	YES	YES	YES	YES	YES
N	46877	44849	43701	46877	44849	43701

Panel B: Effect of a Fire on the Incumbent's Vote Share by Alignment

	(1)	(2)	(3)	(4)	(5)	(6)
$Fire_{1,6}$	4.230***	3.707**	3.810			
	(1.449)	(1.566)	(2.749)			
$Fire_{2,6}$				7.069***	6.165***	8.179*
				(2.140)	(2.340)	(4.368)
Incumbent	All	Aligned w. reg. gov.	Aligned w. nat. gov.	All	Aligned w. reg. gov.	Aligned w. nat. gov.
YES	YES	YES	YES	YES	YES	
N	46877	24931	17734	46877	24931	17734

Panel A shows the effect of an accidental fire burning (at least) 1% (or 2%, on the second row) of the municipality surface area in the last six months before a local election on the incumbent's vote share (Columns 1 and 4), the party that is aligned with the regional government (Columns 2 and 5), and the party that is aligned with the national government (Columns 3 and 6). Each column is obtained from a separate regression, $\Delta Outcome_{it} = \alpha_{S6,pt} + \beta_{S6} Fire_{S6,it} + \epsilon_{S6,it}$, where the outcome is the incumbent's vote share, the party aligned with the regional government, or the party aligned with the national government. Panel B shows the effect of an accidental fire burning (at least) 1% (or 2%, on the second row) of the municipality surface area in the last six months before a local election on the incumbent's vote share, with the whole sample (Columns 1 and 4), only incumbents that are aligned with the regional government (Columns 2 and 5), and only incumbents that are aligned with the national government (Columns 3 and 6). Each column is obtained from a separate regression, $\Delta IncVoteShare_{it} = \alpha_{S6,pt} + \beta_{S6} Fire_{S6,it} + \epsilon_{S6,it}$. Standard errors, clustered by municipality, are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

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