Surviving Disasters

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September 1, 2010

Introduction

Acts of nature such as earthquakes, floods, and famines are deadly events that can kill many thousands of people. While occurrences of disasters are unavoidable, their impacts on society can be limited by appropriate policies. Unfortunately, these policies are not always pursued and political institutions strongly influence the lethality of natural events (Kahn 2005; Cavallo and Noy 2009). The same strength earthquake that takes the lives of hundreds of people in a democracy, might kill hundreds of thousands in an autocracy, as a comparison of the 2010 Chilean and the 2010 Haitian quakes illustrates. In this paper we argue the survival incentives of political leaders create the basis for the linkage between political institutions and the lethality of natural disasters.

Using data from the Emergency Events Database EM-DAT, we assess how the occurrence and lethality of natural disasters affect anti-government demonstrations and political survival. We find that in political systems, such as democracies, where leaders require mass support to retain office, the occurrence of disasters has little effect on either the level of anti-government demonstrations or on the survival of political leaders. However, leaders in these systems are highly sensitive to the level of casualties caused by these events: a large death toll increases the level of protest against the government and hastens leader removal. In contrast, we find that in more autocratic systems where leaders are beholden to only a small segment of the population, the lethality of disasters has no discernible effect on the level of protest or the survival of leaders, although the occurrence of mass disasters increases the rate at which autocratic leaders are removed from office. Given these incentives, office seeking politicians make more effort to prepare for and ameliorate the effects of natural disasters in a democratic than in an autocratic setting.

The paper proceeds as follows. The first section reviews the literature and motivates the theoretical and empirical analyses that follow. The second section uses selectorate theory (Bueno de Mesquita et al. 2003) to develop the link between disasters, political mobilization, and survival in office. The third part of the paper presents our hypotheses, which are then empirically tested. We

present three set of estimations in the fourth section of the article. First we estimate the effect of political institutions and economic conditions on the number of disaster related deaths. Second, we explore anti-government demonstrations as a function of disasters and disaster related casualties. Third, we investigate the effect of disasters and disaster related deaths on the survival of political leaders. We close with a summary of results and a discussion on future research.

1   Political Institutions and the Lethality of Disasters

There is huge variance in the lethality of natural disasters. In addition to the intensity of Mother Nature, economic and political forces systematically effect the lethality of disasters. Since Amartya Sen (1983, 1991) first argued that democracies experience less famines, research on the political economy of disasters has concentrated on the relationship between political institutions and extreme natural events. The consensus is that better institutions –broadly defined– reduce disaster related casualties (Cavallo and Noy 2009). In a seminal investigation of disaster deaths, Kahn (2005) demonstrates that nations with high-quality institutions, defined by level of democracy, income inequality, ethnic fragmentation, and good governance, suffer less deaths from natural events. This result is robust to different measures of institutional quality. Anbarci, Escaleras, and Register (2005) focus on a system's income inequality as a limit to the collective action necessary to "create and enforce of building codes, retrofit structures, or enact quake-sensitive zoning," among other relevant policies that minimize casualties. Although the authors do not study the role of government, the latter can clearly play an important part in either promoting collective action or implementing these policies, which have an significant public goods component. This is crucial in particular political systems. Stromberg (2007) finds that government effectiveness –determined by the quality of public services, infrastructure, and civil service– as well as level of democracy, are associated with less disaster related deaths. Raschky (2008) also shows that governmental stability and investment climate reduce the number of victims and economic losses. Toya and Skidmore (2007)

focus on the effect of higher educational attainment, greater openness, more complete financial systems and smaller government experience; countries with these characteristics experience fewer disaster related deaths. Escaleras, Anbarci, and Register (2007) find that public sector corruption is positively related to earthquake deaths, while Cohen and Werker (2008) argue that governments that derive utility from social welfare suffer less severe disasters.

One of the difficulties in studying disasters resides in finding comparable events –the European heatwave of 2004 cannot be easily compared with the strength of Hurricane Katrina in 2005 or with the floods in Pakistan in 2010. For this reason, a growing proportion of the literature on disasters has focused on earthquakes, as there are objective measures of their magnitude (Anbarci, Escaleras, and Register 2005; Kahn 2005; Escaleras, Anbarci, and Register 2007; Keefer, Neumayer, and Plumper 2010). Moreover, although earthquakes often take place along tectonic plates, national levels of income and political institutions vary along those plates, which makes them ideal subjects of study. These investigations also conclude that political incentives to provide public goods play an important role in minimizing earthquake related deaths. These studies have also contributed to the literature by exploring some of the dynamics of earthquakes and their effect on population. A significant proportion of large earthquakes takes place in isolated regions such as the Balleny Islands or in sparsely populated areas such as the Kuril Islands.[1] In order to account for this, scholars include measures of population density as well as the magnitude and depth of earthquakes (Anbarci, Escaleras, and Register 2005; Kahn 2005; Escaleras, Anbarci, and Register 2007; Keefer, Neumayer, and Plumper 2010). Consistent with earlier work, these analyses find that democracies experience fewer casualties than non-democracies.

Other studies focus on storms where wind speed records provide a measure of the magnitude of the disaster. Chen (2008, 2009) examines the 2004 hurricane season in Florida and finds that while hurricane wind measurements explain 49% of the variation in FEMA aid distribution, politics also plays an important role. Chen concludes that poor voters are significantly more responsive

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[1] http://earthquake.usgs.gov/earthquakes/eqarchives/year/byyear.php

to FEMA aid than wealthier voters (2008), and that core Republican voters are more electorally responsive to disaster aid than Democratic or moderate voters (2009).

The current gap in the literature is on the causal mechanism between institutions and disasters. The emphasis so far is on information and accountability. According to Sen (1991): "If governments were to be accountable to the public, through elections, free news reporting and uncensored public criticism, then they too would have good reasons to do their best to eradicate famine." Along the same lines, Besley and Burgess (2002) show that state governments in India are more responsive to disasters where people have access to information and where electoral accountability is greater. Information and news reporting have proven to be crucial in government response to natural disasters in the United States, as relief decisions are partly driven by news coverage of disasters (Platt 1999; Eisensee and Stromberg 2007). Accountability is perhaps more important, as citizens often assign some responsibility to leaders, as suggested by Achen and Bartels (2004), who "find that voters regularly punish governments for acts of God, including droughts, floods, and shark attacks." Nevertheless, Healy and Malhotra (2009) show that this is the case only for palliative spending, as voters tend to hold the incumbent presidential party accountable for disaster relief and not for disaster preparedness. Consequently, lack of accountability in disaster prevention leads to underinvestment in this area, which increases the likelihood of casualties (Cohen and Werker 2008).

Another relevant link between extreme natural events and politics resides on the strategic use of disasters (Brass 1986; Albala-Bertrand 1993). Cohen and Werker (2008) argue that governments spend less in politically weak or hostile regions. For instance, withholding food is a common political weapon. Robert Mugabe provoked international criticism in 2002 when he diverted food aid to its own supporters while ignoring opposition activists.[2] In a study of floods in Pakistan, Mustafa (2003) finds that relief cheques were distributed to political supporters and family members. In the United States, the president has unilateral control over the declaration of disasters, which allows

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[2]http://news.bbc.co.uk/2/hi/africa/2416633.stm

him to manipulate spending in strategic states (Sylves and Buzas 2007). Garrett and Sobel (2003), as well as Reeves (2009), find that electorally important states in the United States have a higher rate of disaster declaration. Leaders can also use disasters as an opportunity to show competence and improve electoral prospects (Abney and Hill 1966; Chen 2008, 2009; Reeves 2009; Healy and Malhotra 2009).

Corruption is an additional problem, both before a disaster (Escaleras, Anbarci, and Register 2007) and after it. Pelling (1999) argues that local elites can co-opt community leaders to maintain control over, and perhaps profit from, environmental rehabilitation projects. Congleton (2006) argues that emergency relief necessarily produces profits for contracting firms. According to this author "[L]ess than a week after Katrina made landfall, the Houston Chronicle reported that Halliburton had already received a half-billion-dollar contract for emergency repairs of navy facilities damaged by Katrina." Moreover, if countries expect to receive disaster aid, they might even underinvest in prevention and neglect a population so as to attract and steal aid (Cohen and Werker 2008; Raschky and Schwindt 2009).

Natural disasters have been shown to affect other political events, particularly civil conflict. On the one hand, disasters can fuel civil war by producing scarcity and competition (Brancati 2007) or more generally by transforming the motive, incentive, and opportunity for conflict (Nel and Righarts 2008; Salehyan 2008). However the evidence is mixed. Beardsley and McQuinn (2009) suggest the 2004 Tsunami in Indonesia and Sri Lanka help promote the resolution of conflicts. In contrast Miguel, Satyanath, and Sergenti (2004) find weather conditions can undermine economic conditions (or growth) and this increases the likelihood of civil war.

As the literature has established, political considerations influence policies relating to natural disasters. We contribute to the research agenda by providing a theoretical link between the lethality of disasters and political institutions through an examination of the survival incentives of individual political leaders. In the next section we use a selectorate theory based model to explain how

fatalities have differential survival effects under different institutional contexts. We then test these relationships and find that in systems where the leader is beholden to a large segment of the population, such as democracies, leaders face protest and removal should people be killed in disasters. For this reason, such leaders enact polices to ameliorate the effects of Mother Nature. In contrast, in more autocratic systems, the survival of leaders is much less sensitive to fatalities. With reduced accountability, non-democratic leaders do less to protect their citizens from disasters.

2   Selectorate Institutions, Policy Choice and Survival

While it is impossible for political leaders to prevent acts of God, an investment in preventative measures and palliative spending can mitigate the effects of such events. Our investigation into why some leaders choose to actively prevent disasters and provide assistance when they happen and other leaders are content to take little active role in avoiding deaths is based on the selectorate theory of political survival (Bueno de Mesquita et al. 2003) and, in particular, recent extensions of the theory which endogenize revolutions (Bueno de Mesquita and Smith 2009; Smith 2008).

Leaders face multiple threats to their survival. Leaders can be removed within the existing institutional rules if those upon whom they are dependent withdraw their support. Leaders can also be removed by revolutionary forces if the citizenry succeeds in coordinating and rises up as a mass movement. Such movements are typically motivated by the goal of institutional change as well as replacing the leader. If leaders want to survive in office, which we assume they do, then they adopt those policies that best reduce the threats to their tenure. Which policies best mitigate these threats depends upon the institutional setting.

Selectorate theory examines political institutions along two dimensions: the winning coalition (W) and the selectorate (S). The winning coalition is the set of essential supporters without whose support the leader would lose power. The selectorate is the set of people from which a leader

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forms her winning coalition. The size of the winning coalition and selectorate vary greatly and shape political incentives. In democratic systems, the selectorate is typically all adult citizens. The winning coalition is also large, with the exact size depending upon electoral rules. In elected monarchies or military juntas selectorates and winning coalitions are much smaller, typically being restricted to aristocrats and senior military figures. The winning coalition size is also typically only a small proportion of the citizenry in an autocratic system, although these systems often vary greatly in the size of the selectorate.

To survive in power a leader needs to ensure that each of her essential supporters prefer to retain her rather than back a political rival. The policies which most efficiently allow a leader to buy the loyalty of her winning coalition depends upon winning coalition size. When the coalition is small, so that the leader only needs to maintain the loyalty of a small number of supporters, she can most efficiently purchase their support through private goods. However, as coalition size grows rewarding supporters with private goods becomes much less effective as each person's share of government resources becomes smaller. Hence, as the number of people who must be rewarded grows, leaders increasingly rely on policies that provide a high proportion of public goods. Such policies simultaneously reward all coalition members (as well as everyone else). Of course all policies contain aspects of both private and public goods. For instance, in the context of disaster preparedness, the government could fund the training of rescue workers and firefighters and stockpile emergency supplies. Alternatively, they might pay bureaucrats bloated salaries and buy inappropriate or poorly serviced equipment from cronies. Both approaches generate some protection for the public against disasters and create private benefits for those who provide the service. However, these two approaches clearly differ in focus. Leaders in large coalition systems have political incentives to pursue the former public goods orientated set of policies that provide the citizens better insurance against disaster, while a small coalition leader better ensures her survival through policies with the latter private goods focus.[3]

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[3]Keefer, Neumayer, and Plumper's (2010) explanation of the impact of disasters also examines the incentive to

We treat a government's policy of insurance against natural disasters as a public good. Although the expectation of receiving assistance in the event of a disaster is a public good, the actual receipt of disaster relief is a private good for those who get it. Leaders might therefore want to be selective is providing assistance and investing in prevention. This effect strengthens rather than undermines the selectorate theory's predictions as to which types of governments provide disaster assistance. When the winning coalition is large it is likely that any substantial disaster affects members of the leader's winning coalition. As such, the leader wants to provide the public goods of disaster assistance and prevention because it is an efficient means to reward supporters. However, variation in the regional distribution of political support can lead to uneven disaster preparedness. For instance, a theme of Spike Lee's 2006 film "When the Levees Broke" about the impact of Hurricane Katrina in New Orleans in 2005 was that the poor neighborhoods primarily affected by the floods provided little support for the government. He argues the levees in these areas were inferior to those in more affluent areas where people were more likely to vote. Prevention can be uneven, as can post-disaster assistance. FEMA, the U.S. government agency in charge of disaster relief, as well as local and state governments received much criticism for their tardy and inadequate response to Katrina (Saad 2005; Sobel and Leeson 2006).

Regional differences in political support can cause some variance in disaster policy in large coalition systems. Yet, the scale of a winning coalition in a democracy makes it is hard for a leader to exclude a segment of the population from insurance against disasters without risking harm to a substantial number of supporters. As coalition size shrinks, however, it becomes increasingly easy for leaders to exclude large sections of the population from preventative measures and the expectation of assistance without jeopardizing the welfare of coalition members. Following Cyclone Nargis, which struck the Irrawaddy Delta in southern Burma in May 2008, the military regime not only failed to provide assistance to the hundreds of thousands affected, it also prevented domestic and international relief effects. Officially the storm killed 138,000 people, but others, such as

provide public goods.

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Larkin (2010), think the total was closer to a half million. Yet despite these huge casualty figures, President Than Shwe's key supporters were unaffected.

Political incentives determine disaster policy. Leaders beholden to large coalitions implement policy to prevent disasters and offer assistance when they happen. Such policies allow them to efficiently protect the welfare of the supporters upon whom they rely. In small coalition systems leaders do less to prepare for disasters. Such preparation is costly and does not target concentrated rewards to the small number of supporters upon whom the leader depends. While protecting the many might be normatively desirable, enriching the few is better politics in a small coalition system.

2.1 Survival Within the Selectorate Model

Political institutions help determine the ease of political survival. There is always a plentiful supply of political rivals who wish to come to power. Should members of the incumbent's coalition believe they would be better off under a rival's leadership then they defect and the incumbent is deposed. Small coalition systems, particularly in the presence of a large selectorate, make survival relatively easy; at least once leaders are well established. Although a potential rival might offer a member of the current coalition more rewards than they currently receive from the incumbent, the rival is inherently disadvantaged in the ability to credibly promise private goods in the future. Once established in power a new leader might, and often does, rearrange his coalition and replace some of those he needed to come to power—that is members of the former leader's coalition—with those whom he likes more or thinks will be more loyal. Hence supporters who defect to support a challenger risk losing access to future private goods when the new leader reorganizes his coalition. The incumbent leader does not suffer from this commitment problem. She has already had time to reorganize her coalition and base it around those with whom she has the greatest affinity. Members of her coalition can therefore expect to continue to be included in her coalition for as long as she

is leader. The challenger can not make such a commitment to continue to supply private goods.

The ability to credibly promise future private goods is the basis of the incumbency advantage. In large coalition systems it is relatively difficult to survive in office because private goods are relatively unimportant in such systems. In contrast, private goods provision is central to small coalition politics, so the ability of autocratic leaders to credibly promise future private goods makes their survival relatively easy, at least once they are established.

Leader survival shows a strong temporal dependency, particularly in small coalition systems. The longer a supporter expects to receive private goods from the leader and the more valuable these private goods are, the more loyal a supporter is likely to be. When challengers come to power they often reorganize their coalition. Hence supporters in a leader's initial coalition are mindful that they might well be replaced. Such supporters are not very loyal because they know the expected flow of private goods from the leaders could well be cut off. Yet, over time coalition loyalty grows. The longer a leader keeps a supporter and forgoes the opportunity to replace her, the more confident the supporter becomes that she will not be reorganized out of the coalition. Leader survival becomes easier over time since supporters become more certain of receiving future private goods. The effect of this time dependency varies with political institutions since coalition size determines the relative importance of private goods. In large coalition systems, private goods are relatively unimportant so over time there is little decline in the survival risk. In contrast, since private goods are more important in small coalition systems the increase in coalition loyalty over time makes it much easier for leaders to survive in office. Later, when we estimate leader survival, we account for these differences by using a parametric model in which the temporal dependence of the underlying hazard rate leaders face is a function of political institutions (Bueno de Mesquita and Smith 2010).

2.2 Revolution

Revolutions are attempts by those outside the winning coalition to replace the existing political institutions with more inclusive ones. The citizens have a greater incentive to rebel in small coalition systems than in large systems as the former provide few public goods. However, such autocratic systems make it difficult for the citizens to coordinate and depose the extant regime because communications and political freedoms are restricted. While someone might be prepared to join an anti-government protest in a neighboring town, they can not express their discontent if they don't know the protest is occurring or if there is no transport to get there. Natural disasters can serve as a coordinating device for citizens. Governments, particularly small coalition ones, are concerned that disasters act as a coordination device for citizens to protest.

On September 19, 1985, an 8.1 scale earthquake struck Mexico City. Officially, 9,500 individuals lost their lives on that day, but it is believed that the real death toll was closer to 20,000 people. Although Mexico City lies on a seismic region and is relatively familiar with earthquakes, the 1985 earthquake is particularly memorable for its magnitude and the governmental paralysis that forced citizens to carry out the rescue efforts. Indeed, as detailed by Preston and Dillon (2005), the local and federal governments stood out for their incapacity to organize prompt rescue efforts and provide shelter to the victims. These conditions forced students, house wives, teachers, and the unemployed to coordinate their own rescue efforts in order to save their neighbors and relatives—in an illustrative episode, opera singer Placido Domingo not only dug with his own hands in order to rescue his cousins from the ruins of a building in downtown Mexico City, but also coordinated international fund-raisers. One month after the earthquake, more than forty thousand people marched to the presidential residence in order to protest the lack of action exhibited by the government. Not since the late 1960s had Mexico witnessed such massive protests and the governments was forced to negotiate with the leaders of the movement. Although it took many years for the city to recover, a stronger and much better organized civil society emerged from the ruins of

the capital. Sectors of this organized society later on merged with the opposition, which was able to democratize the city in 1997 (until then, the Mayor of the city was appointed by the President) and replace the Institutional Revolutionary Party (PRI) in 2000, which had ruled Mexico for more than 70 years.

Disasters can facilitate coordination by concentrating those unhappy with the current system and giving them little to lose. For this reason disasters pose a potential problem to political leaders. In small coalition systems the people outside the coalition want to expand the coalition. While once organized into a mass movement they can potentially fulfill this goal, autocratic governments make assembly and coordination difficult, costly and risky. In an argument first advanced by Schelling (1978), Kuran and others conceptualize mass political movements as tipping points (Granovetter 1978; Kuran 1989; Lohmann 1994; Oliver et al. 1985; Ginkel and Smith 1999; Tilly 1978). If enough people participate then it is hard for the government to single them out for retaliation. Once events gain enough momentum disgruntled people readily join them. However, reaching this critical mass is difficult as the initial participants expose themselves to government retaliation. Unless there is a strong expectation that the protest will succeed, few people are willing to start them. Earthquakes and other disasters can serve as coordinating devices because they force together large numbers of people, which makes it easier to reach the critical mass. Disaster can also weaken the capacity of the state to monitor and punish. As was the case in Mexico City, earthquakes can concentrate disgruntled people and provide a focal point about which they can organize.

In small coalitions systems natural disasters can facilitate revolutionary movements. In order to coordinate relief efforts, when Hurricane Katrina stuck New Orleans the government ordered people to assemble at the Superbowl, a sports stadium. In a large coalition system, the government wants to assist the people. In contrast, before Cyclone Nargis struck Burma, the military junta made no effort to evacuate the people. Afterwards when survivors tried to make their way to larger towns and villages to seek assistance, they were prevented from doing so. Within a week

of the disaster the army started forcibly dispersing survivors from makeshift camps, schools and monasteries (Larkin 2010). By letting the people die in outlying areas the government forestalled the possibility of protest. Dead people cannot revolt.

The extent to which natural disasters serve as coordinating devices depends upon where they occur. Disasters which afflict the capital city or other densely populated urban areas are more likely to stimulate protest than disasters in rural or remote areas. In general small coalition systems are not geared towards disaster relief, but they are more likely to provide some assistance in the former locations than the later. Regrettably we can not test these distinctions in this paper as we do not have data on the geographical impact of disasters.

3   Predictions

Political institutions shape the choice of disaster policy and how disasters affect leader survival. In large coalition systems political competition is based upon the provision of public goods. Survival imperatives in small coalition systems dictate that leaders are better off retaining resources to buy off their small number of supporters than by providing effective public policy. Large coalition leaders spend more (and more effectively) to prevent and alleviate disasters than small coalition leaders. This leads to the first hypothesis we test.

H1: More people die in disasters in small coalition systems than in large coalition systems.

In large coalition systems politics focuses on the provision of public goods. Leaders who fail to effectively provide public goods are deposed. Protest against the government and the survival of leaders is driven by how well leaders protect people from disasters. Leaders cannot be expected to prevent acts of God, such as earthquakes, but the people evaluate them on how well they prepare for these events and how effectively they provide assistance. The survival of large coalition leaders depends upon how well they deal with disasters and not on the actual occurrence of the disasters.

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H2: In large coalition systems, in which the focus of political competition is the provision of public goods, an increase in the number of deaths from disasters leads to more anti-government demonstrations and decreased leader survival. However the occurrence of disasters should have a relatively little effect on protests and leader survival.

Private goods provisions dominate small coalition politics. Leaders more effectively buy the loyalty of their small number of supporters by retaining government resources to reward them rather than through the provision of effective public policy. Resources spent insuring the general public against disasters can not be given to supporters. Although supporters might be harmed by disasters, their relatively small number makes this unlikely and easy for the government to compensate them individually for their losses. Saving the masses from disasters does not promote survival. Although the quality of a leader's handling of a disaster is not especially salient in small coalition systems, the occurrence of disasters is. Disasters serve as a coordination device for the citizens to organize and protest against the government.

H3: In small coalition systems the occurrence of disasters causes an increase in anti-government demonstrations and a decline in leader survival. However, disaster related fatalities have little impact on leader survival and protest.

4 Data and Empirical Analysis

4.1 Data

We test the predicted relationships between disasters and politics. To do so we use data on the occurrence and impact of disasters, political institutions, anti-government protests, leader survival, and many control variables. Data about disasters are drawn from the Emergency Events Database

EM-DAT at the Centre for Research on the Epidemiology of Disasters (CRED).[4] This database contains information about the occurrence and characteristics of more than 16,000 disasters in the world since 1900. According to CRED, a disaster is a "situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance." For the EM-DAT database, an event is considered a *disaster event* if it caused the deaths of ten or more people, if a hundred or more people were affected, if an authority declared a state of emergency, or if there is a call for international assistance. When an event fulfills any of these criteria, it is recorded at three different levels: the disaster level, the country level, and the source level. In this framework, a unique identifier is assigned to each disaster, and each disaster can be associated to several countries affected by it. For instance, the December 2004 tsunami has a unique identifier, but it is recorded for 13 different countries. Disasters can be classified in groups, sub-groups, types, and sub-types. A classification is also made in terms of primary disasters that cause associated disasters. CRED also records the number of people killed, injured, left homeless, and affected by the disasters, as well as their economic damage in US dollars. The information about the occurrence and effect of a disaster is obtained from several sources, such as the United Nations as well as governmental and non-governmental agencies, among others. The reliability of the information produced by these sources is ranked by CRED, and in the majority of cases a disaster is included in the database only if two sources report the event in terms of casualties or people affected. Once an event is included in the database, it goes through an internal validation process, and once it is validated, it is made available to the public.

As argued before, the data can be organized by disaster group (e.g. hydrological, geophysical) or disaster type (e.g. earthquake, flood), and can be obtained by country or year. In the current empirical analysis we do not distinguish between types of disaster. The variable *Disasters* is the count of disasters that occur in a particular country in a year, while the variable *ln(Deaths)* is the natural logarithm of the count of disaster deaths plus one for all disasters in a particular country-

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[4]The database is available online at http:// www.emdat.be/

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year.

These data allow us to assess the occurrence of disasters and the impact of these disasters. Unfortunately the count of disasters alone cannot capture the power of natures punch. For instance, floods, extreme heat and earthquakes can all count as disasters. The lack of an objective measure of severity to compare these disasters is a serious limitation and has led some scholars to focus only on earthquakes for which the Richter scale offers a measure of intensity (Anbarci, Escaleras, and Register 2005; Kahn 2005; Escaleras, Anbarci, and Register 2007; Keefer, Neumayer, and Plumper 2010). Unfortunately, this drastically reduces the scope of any study and many nations are disaster prone even if they do not experience powerful earthquakes.[5] Given the absence of an objective measure with which to compare the intensity of disasters, we are stuck using counts of disasters.

To measure mass protests against the government we use a count of the number of anti-government demonstrations per year obtained from Arthur S. Banks's Cross National Time Series Data Archive (2001). Banks codes this variable as a peaceful public gathering of more than a hundred people to express discontent based upon media reports. We operationalize the *ln(AntiGov)* variable as natural logarithm of this count variable plus one. Data on leader survival are obtained from *Archigos*, a data base of political leaders collected by Goemans, Gleditsch, and Chiozza (2009). These data provide the dates for the entry and exit of political leaders and their age.

The selectorate institutions of winning coalition size (W) and selectorate size (S) are obtained from Bueno de Mesquita et al (2003). The estimate of the winning coalition (*W*) is a composite index based on institutional variables that reflect the openness of a political system. More specifically, the measurement of the winning coalition is a composite index of POLITY IV data on competitiveness of executive recruitment, openness of executive recruitment, and competitiveness

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[5]Exceptions are Raschky 2008, and Raschky and Schwindt 2009, who explore disasters losses using an empirical strategy similar to ours. Our focus, however, differs greatly. While they explore the effects of institutions and foreign aid on losses caused by disasters, we investigate the effect of disasters on leader survival.

of participation regime. The composition of the winning coalition also includes regime type as defined by Banks's Cross National Time Series Data Archive. Systems with small winning coalitions resemble autocracies, whereas systems with large winning coalitions are similar to democracies. The estimate of the selectorate (*S*) reflects the selectiveness of a country's legislature, which is a function of the breadth of the selectiveness of the members of each country's legislature and can be interpreted as a logarithmic scale of the magnitude of a polity's selectorate. This variable is also obtained from POLITY IV data. Both the size of the winning coalition and the selectorate have a minimum normalized value of 0, and a maximum of 1, and they are organized in intervals of .25 points.

Our analyses use a number of additional variables related to economic and demographic conditions. The *ln(GDPPC)* is the natural logarithm of per capita Gross Domestic Product in constant dollars. *Growth* is the annual change in *GDPPC*. The variable *ln(Population)* measures the number of people in a country. These variables are taken from the World Bank's World Development Indicators. All data and programs to replicate the analyses are available from the authors.

4.2   Deaths from Disasters

Consistent with existing studies, our analyses show that fewer people die in disasters in large coalition systems, such as democracies, than in small coalition systems. To represent this relationship more graphically, figure 1 shows the smoothed density of the number of disaster related deaths according to the size of the winning coalition.

Figure 1: Difference in Disaster Deaths by Institution
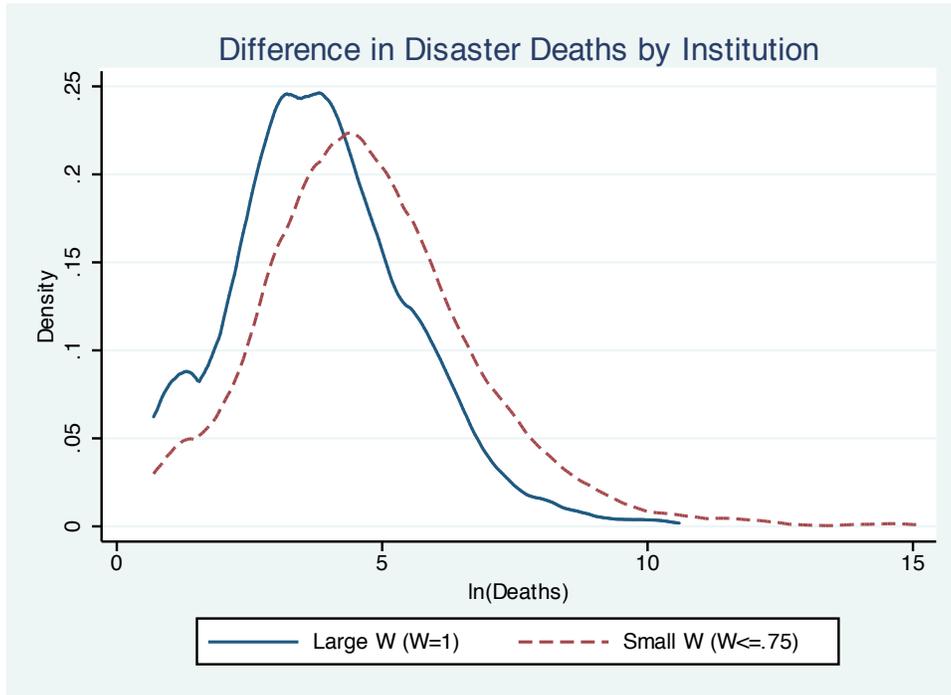
Clearly, there are significant differences in the mean and variance of these distributions. Countries with large winning coalitions have a smaller mean number of deaths and smaller variance around it. In contrast, countries with small winning coalitions have a larger mean number of deaths and a much larger variance.

As argued above, economic conditions also have a significant impact on the number of disaster related casualties. To control for this, table 1 presents the mean number of deaths caused by disasters according to the size of the winning coalition and the wealth of the country. Wealthy countries are defined as countries with a GDP per capita larger than the average GDP per capita.

Evidently, for countries with small coalitions, wealth significantly reduces the number of mean deaths. Since there are not many poor countries with large coalitions, it is difficult to make the same statement about the role of wealth across this type of systems. However, for all wealthy countries, it is clear larger coalitions are associated with a smaller number of deaths, as illustrated

Table 1: Deaths and Occurrences by Size of Winning Coalition and Income

Coalition Size	Statistic	Not Wealthy	Wealthy	
$W < 1$	Mean Deaths	1,318	260	
	Country-Years	2,781	1,153	
$W = 1$	Mean Deaths	52	124	
	Country-Years	71	1,152	

by the last column in table 1.

Motivated by these initial results, our first set of estimations explores the role of political institutions on the number of deaths caused by mass disasters. The unit of analysis for this set of models is the country-year. The data set includes information for 189 countries from 1900 to 2008. However, due to data restriction on other variables, in particular GDP, our sample for estimation will be smaller. Summary statistics are presented in table 2.

Table 2: Summary statistics

Variable	Mean	Std. Dev.	N
Coalition Size	0.478	0.321	14649
Selectorate Size	0.837	0.353	13741
Age	54.93	12.298	12662
Disasters	0.889	3.482	19149
ln(Deaths)	0.933	2.054	19149
ln(GDPPC)	7.429	1.548	6228
ln(Population)	15.31	2.019	7649
Growth	3.792	6.497	6224

Table 3 presents estimation results from a least squares regression of the natural logarithm of the number of deaths plus one per nation-year.[6] The number of deaths are determined by political institutions such as the size of the winning coalition, and by the number of disasters, GDP per capita, population, and their interactions with the size of the winning coalition. Model 1 uses region-year fixed effects, while model 2 uses country fixed effects. Standard errors robust to heteroskedasticity are below coefficients.

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[6]In order to control for a potential reporting bias, we performed the same analysis when there was at least one fatal disaster. The results are essentially the same.

Table 3: Dependent Variable: ln(Deaths)

	Model 1	Model 2
Coalition Size	-2.1547*	0.2477
	(1.255)	(3.288)
Disasters	0.1637***	0.2143*
	(0.044)	(0.113)
(Disasters)(Coalition Size)	-0.0801	-0.1503
	(0.049)	(0.131)
ln(GDPPC)	0.0320	-0.3873*
	(0.049)	(0.209)
ln(GDPPC)(Coalition Size)	-0.2152***	0.0703
	(0.059)	(0.153)
ln(Population)	0.5880***	2.2659***
	(0.064)	(0.328)
ln(Population)(Coalition Size)	0.2517***	0.0052
	(0.081)	(0.224)
Intercept	-7.9093***	-31.9753***
	(1.061)	(4.829)
N	5157	5157
FE	321 reg-years	150 countries

Unit: Country-Year.

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

The estimates are consistent with the results produced by the literature on the effect of institutions on disaster related casualties and they show support for our theory, particularly hypothesis one (Sen 1983, 1991; Besley and Burgess 2002; Anbarci, Escaleras, and Register 2005; Kahn 2005; Escaleras, Anbarci, and Register 2007; Stromberg 2007; Toya and Skidmore 2007; Cohen and Werker 2008; Raschky 2008; Cavallo and Noy 2009; Keefer, Neumayer, and Plumper 2010). In model 1 the negative coefficient estimate on coalition size and the interaction of coalition size and wealth indicate that large coalition systems experience few deaths and convert society resources into better protection against disaster than do small coalition systems. The positive (but insignificant) parameter estimate in model 1 on the wealth variable indicates that small coalition systems do not successfully use increased societal resources to reduce the risk its citizens face from natural disasters. This is consistent with the theorys predictions that large coalition leaders spend available resources on public goods while small coalition leaders retain such resources for their coalition rather than protect their citizens.

Model 2 replicates the analysis including a fixed effect for each nation. Unfortunately, since there is relatively little institutional variation within nations, the estimates show a less significant pattern. This is a common problem when variables when variables are relatively invariant with the fixed effect grouping (Beck and Katz 2001; Green, Kim, and Yoon 2001; King 2001). As a robustness test we ran Plumper and Troeger's procedure (2007) which accounts for the lack of temporal change within the fixed effect units, and obtained similar results to those reported in model 1. Institutions affect the number of casualties from natural disasters. Our next set of analyses delves into the reasons for these institutionally induced differences by testing how the occurrence and impact of disasters affects public protests and leader survival.

4.3 Anti-Government Protests and Disasters

We now turn to an examination of anti-government protests. In large coalition systems leaders impose few restrictions on free speech and the right of assembly. Protests thus provide an easy means whereby the citizens of democracies can express their dissatisfaction with government performance. Joining a protest in a small coalition system is a much more risky endeavor. Leaders in such nations restrict the right of assembly and those who protest often risk arrest, imprisonment or torture. Compared to the citizens in large coalition systems, the citizens in small coalitions have much greater cause to protest but the costs and the risks of dissent are much higher. We argue disasters affect protests in different ways across political systems. In large coalition systems we expect that the occurrence of disasters has little effect on protests. However, the people will protest if the government performs poorly—that is, it lets a lot of people die. In contrast, in small coalition systems, the occurrence of protests is restricted by the ability of citizens to coordinate and organize rather than satisfaction with the government. Disasters facilitate coordination, for example, by concentrating disgruntled people in camps and potentially diminishing the government's repressive capacity. We predict that in small coalition systems it is the occurrence of disasters that is more important in predicting protests that the government's handling of the crisis (measured as number of deaths).

We test these predictions in table 4. The dependent variable is the natural logarithm of the number of protest plus one, *ln(Anti-Gov)*. There is strong temporal dependence in the number of protests with a high level of protests in one year being a strong predictor of protests in the following year, as demonstrated by the highly significant parameter estimate on the lagged dependent variable. The models in table 4 include variables for political institutions, the number of disasters in a year, *Disasters*, and the number of disaster related deaths, *ln(Deaths)*. The models also include controls for GDP per capita, economic growth, and population and the interactions of these variables with size of the winning coalition, *W*. Models 3 and 4 include region-year fixed effects,

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while models 5 and 6 have country specific fixed effects.[7]

The models also include the lagged values of disasters and disaster deaths. These lagged terms are included as well as the contemporaneous variables because, as the Mexico city earthquake illustrated, it can often take time for protest to take place and propagate. The need for lags is particularly pertinent if a disaster occurs late in the year. Models 3 and 5 examine a single year lag, while models 4 and 6 include disasters and deaths in two previous years. As mentioned before, the models in table 4 also contain all the disaster and death variables interacted with coalition size, W. Since coalition size is coded between 0 and 1, the impact of death and disasters on the level of protest in the smallest coalition systems is given by the non-interacted coefficient estimates. In large coalition systems the impact of disasters and deaths is given by the sum of the non-interacted and the interacted coefficient estimates.

In small coalition systems the occurrence of disasters leads to an increase in the level of protest. Consider, for example, model 4. The coefficient estimates for disasters, lagged disasters and double lagged disasters are .0201, -.0172 and .0198, respectively. The first and last of these estimates are significant at the 5% level, while the estimate on the one year lag is significant at the 10% level. Rather than examine these coefficients separately, it is more sensible to consider them as a group and perform a joint hypothesis test. Suppose, that a nation experiences an extra disaster in the current and each of the two previous years. This equates to approximately a 2.3% increase in the number of anti-government protests. A joint hypotheses that the sum of the coefficient estimates is zero ($H_0 : Disasters_{t,i} + Disasters_{t-1,i} + Disasters_{t-2,i} = 0$) shows that we can reject the null at the .0001 level. Table 4 is annotated to show this joint hypothesis test. Table 5 presents these tests for all models in table 4.

In small coalition systems the occurrence of disasters leads to increased anti-government protest. In contrast, the occurrence of disasters has no appreciable affect on the occurrence of protest in

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[7]Replication of these analyses using count models produces similar substantive results.

Table 4: Dependent Variable: ln(Anti-Government Demonstrations)

	Model 3	Model 4	Model 5	Model 6
L.(ln)AntiGov	0.3245***	0.3198***	0.2166***	0.2079***
	(0.014)	(0.014)	(0.014)	(0.014)
Coalition Size	-0.4147	-0.3179	0.8003	0.9657*
	(0.334)	(0.343)	(0.506)	(0.521)
Disasters	0.0266***	0.0201**	0.0322***	0.0240***
	(0.008)	(0.009)	(0.008)	(0.008)
L.Disasters	-0.0080	-0.0172*	0.0049	-0.0048
	(0.009)	(0.010)	(0.008)	(0.009)
L2.Disasters		0.0198**		0.0249***
		(0.009)		(0.009)
(Disasters)(Coalition Size)	-0.0247**	-0.0150	-0.0382***	-0.0263**
	(0.011)	(0.012)	(0.011)	(0.012)
L.(Disasters)(Coalition Size)	0.0039	0.0198	-0.0197*	-0.0008
	(0.012)	(0.014)	(0.011)	(0.013)
L2.(Disasters)(Coalition Size)		-0.0321**		-0.0424***
		(0.013)		(0.012)
ln(Deaths)	-0.0005	0.0016	-0.0081	-0.0057
	(0.008)	(0.008)	(0.008)	(0.008)
L.ln(Deaths)	-0.0006	0.0031	-0.0106	-0.0066
	(0.008)	(0.008)	(0.008)	(0.008)
L2.ln(Deaths)		-0.0127		-0.0210***
		(0.008)		(0.008)
ln(Deaths)(Coalition Size)	0.0086	0.0041	0.0165	0.0121
	(0.012)	(0.012)	(0.012)	(0.012)
L.ln(Deaths)(Coalition Size)	0.0145	0.0070	0.0276**	0.0196*
	(0.012)	(0.012)	(0.012)	(0.012)
L2.ln(Deaths)(Coalition Size)		0.0254**		0.0334***
		(0.012)		(0.012)
ln(GDPPC)	0.0575***	0.0571***	0.0318	0.0305
	(0.013)	(0.014)	(0.033)	(0.033)
ln(GDPPC)(Coalition Size)	-0.0654***	-0.0621***	-0.0881***	-0.0868***
	(0.016)	(0.016)	(0.028)	(0.028)
ln(Population)	0.0187	0.0236	0.1495***	0.1771***
	(0.014)	(0.014)	(0.034)	(0.036)
ln(Population)(Coalition Size)	0.0542***	0.0457**	-0.0130	-0.0257
	(0.021)	(0.022)	(0.030)	(0.031)
Growth	-0.0025	-0.0023	-0.0020	-0.0016
	(0.002)	(0.002)	(0.002)	(0.002)
(Growth)(Coalition Size)	-0.0037	-0.0050	-0.0052	-0.0065
	(0.004)	(0.004)	(0.004)	(0.004)
Intercept	-0.5489**	-0.6171**	-2.3688***	-2.7749***
	(0.247)	(0.253)	(0.546)	(0.573)
N	4854	4769	4854	4769
FE	300 reg-years	300 reg-years	148 countries	148 countries

Annotations (Model 3, Disasters + L.Disasters): H_0: Sum=0 P-value= .000 (+)

Annotations (Model 4, Disasters + L.Disasters + L2.Disasters): H_0: Sum=0 P-value= .155 (-)

Annotations (Model 3, ln(Deaths) + L.ln(Deaths)): H_0: Sum=0 P-value= .475 (-)

Annotations (Model 4, ln(Deaths) + L.ln(Deaths) + L2.ln(Deaths)): H_0: Sum=0 P-value= .001 (+)

Unit: Country-Year.

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

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large coalition systems. When W=1, the largest coalition size in Bueno de Mesquita et al. (2003) measure, the effect of disasters is the sum of the disaster coefficients and their interactions with W, which in the case of model 4 is an insignificant -.0044. The analysis suggests that while disasters increase protest in small coalition systems they have no significant effect on the level of protest in large coalition systems.

When large numbers of people die in disasters, this is an indication that the government has done a poor job at preparing for and responding to disasters. In large coalition systems such poor performance results in a significant increase in the level of protest. Yet, in small coalition systems the level of disaster related fatalities has no significant effect on protest. When W=0, the sum of the coefficient estimates on the current and two lagged death variables is negative, suggesting deaths actually reduce protests. However, the joint hypothesis test indicates that this sum is indistinguishable from zero. In contrast, in large coalition systems an increase in the level of disaster fatalities leads to increased protest. The sum of the three deaths coefficient estimates and their interactions with W is 0.0284, which in a joint hypothesis test is significant at the .001 level.

As predicted, the relationship between disasters and anti-government protests is highly dependent on political institutions. In small winning coalitions the occurrence of disasters leads to increased protest, but the number of disaster related deaths has no significant effect. Exactly the opposite pattern arises in large coalition systems where it is the level of fatalities and not the occurrence of disasters which affects the level of protest. Although we only described this pattern in detail for model 4, it is repeated across the board. Table 5 shows the analogous joint hypotheses tests to those discussed above for the other models in table 4. Table 5 also shows whether the sum of coefficients is positive or negative.

Evidently, the occurrence of disasters significantly affects protest in small coalition systems and fatalities significantly affect protest in large coalition system. As we shall see, this is a pattern

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Table 5: Anti-Government Demonstrations Joint Hypotheses

Model	Sum Covariates=0	P-Value (W=0)	P-Value (W=1)
Model 3	Disasters	0.0001 (+)	0.4815 (-)
	Deaths	0.9109 (-)	0.0043 (+)
Model 4	Disasters	0.0000 (+)	0.1552 (-)
	Deaths	0.4754 (-)	0.0011 (+)
Model 5	Disasters	0.0000 (+)	0.0000 (-)
	Deaths	0.0588 (-)	0.0015 (+)
Model 6	Disasters	0.0000 (+)	0.0000 (-)
	Deaths	0.0039 (-)	0.0006 (+)

that is repeated in the analyses of leader survival.

4.4   Leader Survival and Disasters

We explore the effect of disasters and disaster related deaths on leaders' tenure in office while controlling for population size, per capita income, economic growth, and the interaction of these terms with coalition size. The unit of analysis is the leader-year. Although the *Archigos* database has information on about 3,020 leaders from 1800 to 2008, the inclusion of economic indicators reduces the sample to the years 1961-2004. For the sample used in estimation (1075 leaders), median survival time is 2.71 years with a standard error of .170 years and a 95% confidence interval of [2.39, 3.01] years. Table 6 presents Weibull survival models where positive coefficients represent an increase in the hazard rate, while negative coefficients represent an increase in the time a leader can expect to remain in office. Standard errors clustered on the leader are presented below coefficients.[8]

The analyses in table 6 use a Weibull parametric model in which the shape parameter is modeled as a function of coalition size (Box-Steffensmeier and Zorn 2001). Most hazard analyses in political science use the semi-parametric Cox proportionate hazard model. It is therefore important

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[8]In the analysis presented we consider all leader depositions independent of cause. We repeated these analyses treating leaders who died in office, retired due to ill health, or were deposed by foreign powers as censored observations and obtained similar substantive results.

Table 6: Dependent Variable: Leaders' Years in Office

	Model 7	Model 8
Coalition Size	-0.5991	-0.9015
	(1.709)	(1.732)
Selectorate Size	-0.9045***	-0.8869***
	(0.175)	(0.176)
Age	0.0452***	0.0446***
	(0.008)	(0.008)
(Age)(Coalition Size)	-0.0429***	-0.0417***
	(0.011)	(0.011)
Disasters	-0.0065	-0.0098
	(0.039)	(0.042)
L. Disasters	0.0548	0.0337
	(0.039)	(0.040)
L2. Disasters		0.0263
		(0.035)
(Disasters)(Coalition Size)	0.0063	0.0026
	(0.051)	(0.055)
L.(Disasters)(Coalition Size)	-0.0762	-0.0725
	(0.051)	(0.053)
L2.(Disasters)(Coalition Size)		-0.0012
		(0.047)
ln(Deaths)	0.0115	-0.0009
	(0.040)	(0.041)
L. ln(Deaths)	0.0208	0.0256
	(0.039)	(0.039)
L2. ln(Deaths)		0.0291
		(0.038)
ln(Deaths)(Coalition Size)	0.0367	0.0424
	(0.055)	(0.057)
L. ln(Deaths)(Coalition Size)	0.0558	0.0566
	(0.055)	(0.055)
L2. ln(Deaths)(Coalition Size)		0.0040
		(0.053)
ln(GDPPC)	-0.0747	-0.0872
	(0.069)	(0.070)
ln(GDPPC)(Coalition Size)	0.2034**	0.2344***
	(0.088)	(0.089)
ln(Population)	-0.1338*	-0.1619**
	(0.076)	(0.078)
ln(Population)(Coalition Size)	0.0945	0.0872
	(0.108)	(0.110)
Growth	-0.0316***	-0.0324***
	(0.009)	(0.009)
(Growth)(Coalition Size)	0.0172	0.0360**
	(0.016)	(0.017)
Intercept	-0.4782	0.0408
	(1.218)	(1.249)
ln(p)		
Coalition Size	0.5065***	0.5028***
	(0.089)	(0.089)
Intercept	-0.4983***	-0.4900***
	(0.069)	(0.069)
N	5586	5448
Subjects	1075	1055
LogLikelihood	-1.61e+03	-1.54e+03

Model 7 Disasters block: H_0: Sum=0 P-value= .000 (+)

Model 8 Disasters block: H_0: Sum=0 P-value= .055 (-)

Model 7 ln(Deaths) block: H_0: Sum=0 P-value= .292 (+)

Model 8 ln(Deaths) block: H_0: Sum=0 P-value= .000 (+)

Unit: Leader-Year.

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

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to explain why the Weibull model is a more appropriate choice in this setting. The Cox model assumes some underlying (and unestimated) baseline hazard and assesses how independent variables affect the survival risk relative to this baseline. Such an approach relies on the assumption that all units have the same underlying hazard rate. Unfortunately, selectorate theory explicitly predicts that leader survival violates this assumption.

As discussed above, the incumbency advantage in selectorate theory arises because long established leaders can commit to retain their coalition members and reward them with private goods in the future. In contrast, when a challenger comes to power he learns who his preferred supporters are and rearranges his coalition accordingly. As this learning and reorganization process takes place, a leader's ability to promise future private goods grows. Private goods are relatively more important in buying political loyalty in small coalition systems than in large ones. Hence the incumbency advantage grows more over time in small coalition systems than large coalition systems. In particular, selectorate theory predicts that over time the hazard a small coalition leader faces declines more rapidly than for a large coalition leader.

The Weibull model assumes that at time t, the hazard a leader faces is $h(t) = \lambda p(\lambda t)^{p-1}$, where $\lambda = \exp(X\beta)$ represents the exponentiated linear influence of covariates. The shape parameter p affects how this hazard changes over time. Selectorate theory suggests that p is smaller in small coalition systems than in large ones. Models 7 and 8 estimate the shape parameter $\ln(p)$ as a function of W. For a large coalition system where $W = 1$, the shape paramater p is indistinguishable from 1, suggesting the risk of leader removal is relatively constant over time. In contrast the risk of removal for a small coalition leader declines rapidly overtime. The time dependence of the hazard rate for small and large coalition leaders is best seen graphically, as shown in figure 2, which presents the hazard rate of leaders according to model 8. The solid line represents the hazard rate for a large coalition leader while the line with long dashes and dots shows the corresponding hazard rate for small coalition leaders.

Figure 2: Hazard Rate by Institution (Model 8)
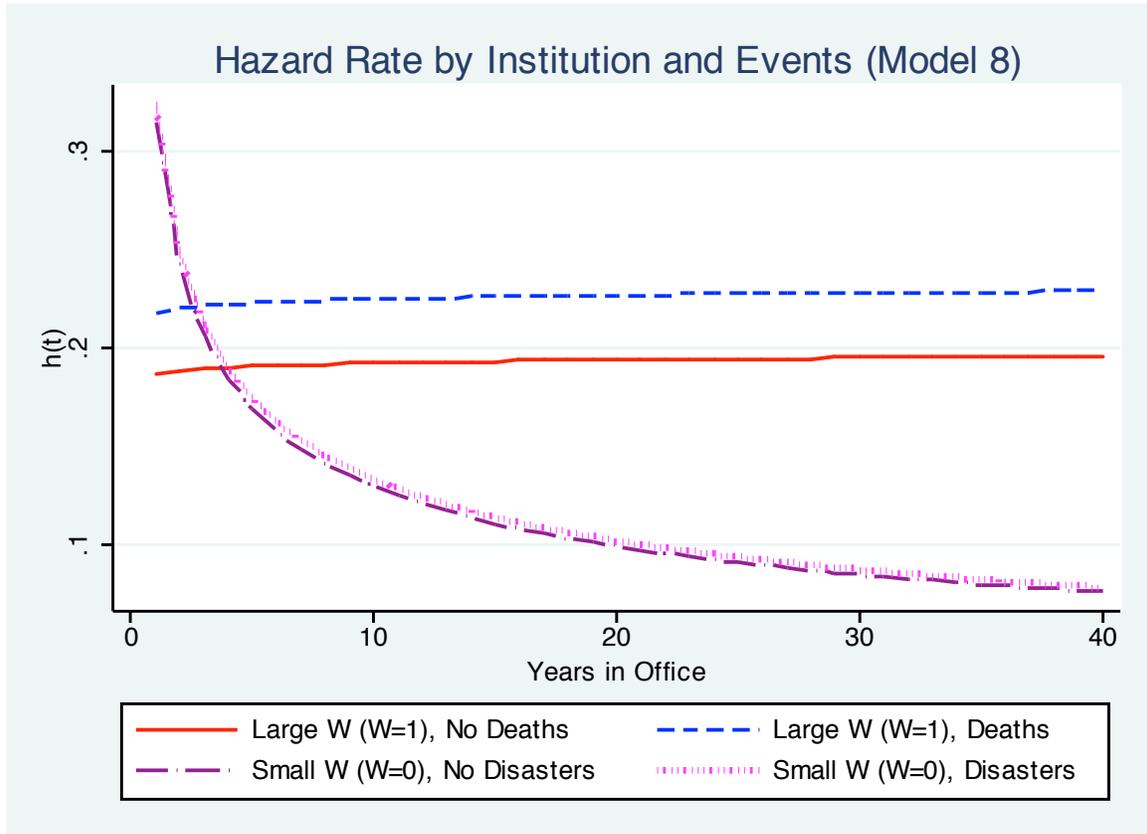
Clearly, the hazard rate for leaders in small coalition systems presents negative duration dependence, which indicates that the rate at which these leaders are deposed decreases over time. In contrast, leaders in large coalition systems have a constant hazard rate, which suggests that the probability of deposition does not depend heavily on time. This is consistent with earlier results on leader survival (Bueno de Mesquita et al. 2003; Bueno de Mesquita and Smith 2009 and 2010).

Although coalition size strongly alters the shape of the hazard rate over time, it has no direct significant effect on the scale parameter in the hazard analysis. Initially small coalition leaders are less secure than large coalition leaders. It is only over time that their incumbency advantage grows. As predicted, selectorate size increases time in office. As the pool of potential supporters increases, coalition members are less ready to defect, as evidence by the significant negative estimate for the

selectorate size coefficient.

Age is an important determinant of the risk leaders face in small coalition systems, but not in large ones. The incumbency advantage of small coalition leaders lies in their ability to promise future private goods. Once leaders are sickly and dying their coalition members become less loyal because they know the flow of private rewards will terminate with the leader's death. As leaders age in small coalition systems they become less secure in office. This is shown by the significant positive coefficient on leader age. In large coalition systems, the effect of age is insignificant (i.e. the sum of $(Age) + (Age)$(Coalition Size) is indistinguishable from zero), as we might expect since the provision of private goods is relatively unimportant in these system.

We now turn to the central question of the effects of disasters on leader survival. The pattern is very similar to that seen for protests. In small coalition systems the occurrence of disasters jeopardizes a leader's hold on office, but the number of disaster related deaths has no statistically discernible effect. In large coalition systems the occurrence of disasters does not affect a leader's tenure but the number of fatalities does. Again we examine joint hypothesis tests. In model 8, for W=0 the sum of the coefficients for the number of disasters in the current and two previous years is 0.0502, which is statistically significant. This suggests that an additional disaster striking in three consecutive years increases the hazard rate of leaders in small coalition systems by about 5%. This small, but significant, difference is shown graphically in figure 2. The line with long dashes and dots shows the corresponding hazard rate for small coalition leaders when there are no disasters. The dotted line shows the increased hazard faced by a small coalition leader whose country experiences a disaster. In a large coalition system, the occurrence of disasters does no affect tenure: the aggregate effect of an additional disaster striking in three consecutive years in large coalition systems is -.0208, which is statistically insignificant at the 5% level. This indicates that the occurrence of disasters has no significant effect on the survival of leaders in large coalition systems.

Disasters affect small coalition leader survival, but disaster related deaths do not. While for small coalition leaders the sum of the coefficient estimates for *ln(Deaths)* and its two lagged values is 0.0538, a joint hypothesis test reveals that this is indistinguishable from zero. Disaster related fatalities matter in large coalition systems. Model 8 indicates that sum of the death related coefficients for a large coalition leader is 0.1567, which is highly significant in a joint hypothesis test. This indicates that an order of magnitude change in deaths over the current and previous two years increases the hazard rate of a large coalition leader by about 17%. This is shown in figure 2. The solid line represents the hazard rate for a large coalition leader when there are no disaster deaths. The line with short dashes represents the increased hazard faced by a large coalition leader whose country experiences disaster related casualties.

In short, in small coalition systems leader survival is reduced by the occurrence of disasters, but not by the number of disaster related deaths. In large coalition systems this pattern is reversed: leaders are sensitive to disaster related fatalities but not to disasters themselves. These trends are replicated for model 7. Table 7 summarizes the joint hypothesis tests for the survival analyses. Table 7 also shows whether the sum of coefficients is positive or negative.

Table 7: Leader Survival Joint Hypotheses

Model	Sum Covariates=0	P-Value (W=0)	P-Value (W=1)
Model 7	Disasters	0.0007 (+)	0.0279 (-)
	Deaths	0.4730 (+)	0.0000 (+)
Model 8	Disasters	0.00072 (+)	0.0555 (-)
	Deaths	0.292 (+)	0.0000 (+)

As was the case with demonstrations, the analysis shows that small coalitions leaders are sensitive to the occurrence of disasters but their survival is unaffected by disaster-related fatalities. The opposite is true in large coalitions: leader survival is highly sensitive to casualties, but the occurrence of disasters weakly enhances their survival. As Abney and Hill (1966), Chen (2008 and 2009), Healy and Malhotra (2009), and Reeves (2009) have shown in the US, leaders can benefit from the opportunity to disperse benefits and demonstrate competence in the aftermath of disasters.

5 Conclusion

Consistent with prior work and many anecdotal accounts, our analyses show that fewer people die from disasters in large coalition systems, such as democracies, than in more autocratic small coalition systems. We contend that these differences results from how political institutions shape survival incentives for political leaders. Using selectorate theory as a model of political competition, we examine the incentives of political leaders to insure their citizens against disasters.

In large coalition systems leaders need to retain the support of a large portion of the population. This incentivizes them to use public goods as a reward mechanism. In the context of disasters this means taking steps to avoid them and minimizing their impact when they happen. Given the large scale of their support base, it is difficult for leaders to exclude segments of the population from insurance against disasters without excluding members of their coalition. For this reason leaders invest in preventative and palliative measures to minimize the impact of disaster. Leaders can not be expected to prevents acts of God, but they are judged on their handling of these events.

In small coalition systems, the incentive for leaders to protect the citizens from disasters is much less than in a large coalition systems. Preparing for disasters and providing assistance in their aftermath consumes resources. Leaders better enhance their survival by retaining these resources to buy the loyalty of their small coalition of supporters. Humanitarian assistance is not good politics: focusing on the welfare of the essential few in the coalition and ignoring the suffering of the masses is the efficient means of buying political support in a small coalition system. Yet, disasters can undermine a leader's tenure in office as they can serve as coordinating devices for protest movements. It is not a leader's poor handling of a crisis that gets her in trouble, but rather that disasters often concentrate displaced people and enhance the ability of the disenfranchised to organize. This is particularly the case when the disaster strikes the capital or other urban center, although we do not have sufficient geographical information on the impact of disasters to test this hypothesis.

These predictions are supported in empirical tests. In large coalition systems the occurrence of disasters has little effect on the level of protest or leader survival in large coalition systems. However, as predicted, leaders are sensitive to the number of fatalities. In small coalition systems, the pattern of leader survival is reversed. The occurrence of disasters increases protest and reduces leader survival, but the lethality of these events has no significant effect. Political motivations and not humanitarian concerns drive governments' responses to disasters.

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