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Leader Survival and Natural Disasters

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Analyses of the occurrence of natural disasters show that in large coalition systems, such as democracies, their occurrence has little effect on protest or leader survival. However, if large numbers of people die in these disasters, more protests occur and leader survival diminishes. In contrast, for leaders in small coalition systems, the occurrence of disasters increases protests and reduces tenure, but the level of fatalities has little effect. The anticipation of these potential political effects accounts for why many more people die in disasters in small coalition systems than in large coalition systems.

Natural disasters such as earthquakes, floods and famines are deadly events that can kill many thousands of people. While politicians cannot stop disasters from happening, they can do much to mitigate their impact on society by choosing appropriate policies. Unfortunately, these policies are not always pursued.[1] Extant research shows that political institutions play a major role in policy choice and in determining the death toll from natural disasters. We offer a political survival explanation for these results by examining how disasters and their death tolls affect the occurrence of anti-government protests and the (political) survival of leaders.

We use data from the Emergency Events Database EM-DAT to assess how the number of disasters and the number of people killed in these disasters affect anti-government demonstrations and political survival. Using a selectorate theory-based analysis, we found striking differences in the political ramifications of disasters across different political systems.[2] In political systems such as democracies, in which leaders require mass support to stay in office, the occurrence of disasters has little effect on either the level of anti-government demonstrations or the survival of political leaders. However, consistent with predictions that leaders in large coalition systems are accountable for good public policy, we found that democratic leaders are highly sensitive to the level of casualties caused by these events. In large coalition systems, a large death toll increases the level of protest against the government and hastens leader removal.

In autocratic systems this pattern is reversed. Since small coalition leaders stay in power by providing their cronies with private goods, the provision of effective public goods is much less important to their survival. Our analyses bare these predictions out. In autocratic small coalition systems, the death toll from natural disasters has little discernible effect on the level of protest or the survival of leaders. Accountability for good policy is relatively unimportant in such systems. Yet disasters are not without consequences; they often lead to

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[1] Matthew Kahn, 'The Death Toll from Natural Disasters: The Role of Income Geography and Institutions', *Review of Economics and Statistics*, 87 (2005), 271–84; Eduardo Cavallo and Ilan Noy, *The Economics of Natural Disasters: A Survey* (Washington, D.C.: Inter-American Development Bank, 2009); World Bank, *Natural Hazards, UnNatural Disasters: The Economics of Effective Prevention* (Washington, D.C.: World Bank Publications, 2010).

[2] Bruce Bueno de Mesquita, Alastair Smith, Randolph M. Siverson and James D. Morrow, *The Logic of Political Survival* (Cambridge, Mass.: MIT Press, 2003).

the concentration of disgruntled people into camps, which lowers the cost of coordinating protests. Disasters can also damage the state's repressive capacity. These factors mean that although casualties have relatively little effect in small coalition systems, the occurrence of disasters in such systems can be destabilizing, leading to protest and possible leader replacement. The incentives implied by these results help explain why democratic leaders make more effort than autocrats to prepare for and ameliorate the effects of natural disasters.

POLITICAL INSTITUTIONS AND DISASTERS

There is huge variance in the number of people killed by natural disasters. The severity of a storm or earthquake is obviously partially responsible, but economic and political factors also systematically affect the extent to which disasters harm society. Since Amartya Sen first argued that democracies experience fewer famines, research on the political economy of disasters has concentrated on the relationship between political institutions and extreme natural events.[3] The consensus is that better institutions – broadly defined – reduce disaster-related casualties.[4] In a seminal investigation of disaster deaths, Kahn demonstrated that nations with high-quality institutions – defined by level of democracy, income inequality, ethnic fragmentation and good governance – suffer fewer deaths from natural events.[5] This result is robust to different measures of institutional quality. Anbarci, Escaleras and Register focused 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.[6] Although Anbarci, Escaleras and Register do not study the role of government, it can clearly play an important part in either promoting collective action or implementing such policies, which have a significant public goods component. Stromberg found that government effectiveness – determined by the quality of public services, infrastructure and civil service – and level of democracy are associated with fewer disaster-related deaths.[7] Raschky also showed that government stability and investment climate reduce the number of victims and economic losses.[8] Toya and Skidmore focused on the effect of higher educational attainment, greater openness, more complete financial systems and smaller government; countries with these characteristics experience fewer disaster-related deaths.[9] Escaleras, Anbarci and Register found that public sector corruption was positively related to earthquake deaths, while Cohen and Werker argued that governments that derive utility from social welfare suffer less severe disasters.[10]

[3] Amartya Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation* (Oxford: Oxford University Press, 1983); Amartya Sen, 'Public Action to Remedy Hunger', *Interdisciplinary Science Reviews*, 16 (1991), 324–36.

[4] Cavallo and Noy, *The Economics of Natural Disasters*.

[5] Kahn, 'The Death Toll from Natural Disasters', pp. 271–84.

[6] Nejat Anbarci, Monica Escaleras and Charles A. Register, 'Earthquake Fatalities: The Interaction of Nature and Political Economy', *Journal of Public Economics*, 89 (2005), 1907–33.

[7] David Stromberg, 'Natural Disasters, Economic Development, and Humanitarian Aid', *Journal of Economic Perspectives*, 21 (2007), 199–222.

[8] Paul A. Raschky, 'Institutions and the Losses from Natural Disasters', *Natural Hazards and Earth System Sciences*, 8 (2008), 627–34.

[9] Hideki Toya and Mark Skidmore, 'Economic Development and the Impacts of Natural Disasters', *Economics Letters*, 94 (2007), 20–5.

[10] Monica Escaleras, Nejat Anbarci and Charles A. Register, 'Public Sector Corruption and Major Earthquakes: A Potentially Deadly Interaction', *Public Choice*, 132 (2007), 209–30; Charles Cohen and Eric D. Werker, 'The Political Economy of ''Natural'' Disasters', *Journal of Conflict Resolution*, 52 (2008),

One of the difficulties of 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. Therefore, a growing proportion of the literature on disasters has focused on earthquakes, as there are objective measures of their magnitude.[11] 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 concluded 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 effects on population density. Since 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, scholars include measures of population density as well as the magnitude and depth of earthquakes.[12] Consistent with earlier work, these analyses found that democracies experience fewer casualties than non-democracies. The key question is why.

Information and accountability have been highlighted as key mechanisms in determining government responses to disasters. According to Sen, '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.'[13] Likewise, Besley and Burgess showed that state governments in India are more responsive to disasters in areas where people have access to information and where electoral accountability is greater.[14] Information and news reporting have proven to be crucial in government responses to natural disasters in the United States, as relief decisions are partly driven by news coverage of disasters.[15] Accountability is also important, as citizens often assign some responsibility to leaders, as suggested by Achen and Bartels, who 'find that voters regularly punish governments for acts of God, including droughts, floods, and shark attacks'.[16] Both Malhotra and Kuo, as well as Gasper and Reeves, also found that members of the American electorate punish elected officials for natural disasters at the local, state and federal levels.[17]

(F'note continued)

795–819. For a comprehensive review of the literature on the political economy of disasters, see Richard Stuart Olson and Vincent T. Gawronski, 'From Disaster Event to Political Crisis: A "5C+A" Framework for Analysis', *International Studies Perspectives*, 11 (2010), 205–21.

[11] Anbarci, Escaleras and Register, 'Earthquake Fatalities', pp. 1907–33; Kahn, 'The Death Toll from Natural Disasters', pp. 271–84; Escaleras, Anbarci and Register, 'Public Sector Corruption and Major Earthquakes: A Potentially Deadly Interaction', p. 209–30; Philip Keefer, Eric Neumayer and Thomas Plümper, *Earthquake Propensity and the Politics of Mortality Prevention* (Washington D.C.: World Bank, Policy Research Working Paper 5182, 2010).

[12] Anbarci, Escaleras and Register, 'Earthquake Fatalities', pp. 1907–33; Kahn, 'The Death Toll from Natural Disasters', p. 271–84; Escaleras, Anbarci and Register, 'Public Sector Corruption and Major Earthquakes: A Potentially Deadly Interaction', p. 209–30; Keefer, Neumayer and Plümper, *Earthquake Propensity and the Politics of Mortality Prevention*.

[13] Sen, 'Public Action to Remedy Hunger', p. 324–36.

[14] Timothy Besley and Robin Burgess, 'The Political Economy of Government Responsiveness: Theory and Evidence from India', *Quarterly Journal of Economics*, 117 (2002), 1415–51.

[15] Platt Rutherford, *Disasters and Democracy: The Politics of Extreme Natural Events* (Washington D.C.: Island Press, 1999); Thomas Eisensee and David Stromberg, 'News Droughts, News Floods, and U.S. Disaster Relief', *Quarterly Journal of Economics*, 122 (2007), 693–728.

[16] Christopher H. Achen and Larry M. Bartels, *Blind Retrospection Electoral Responses to Drought Flu and Shark Attacks* (Princeton NJ: Mimeo, Princeton University, 2004).

[17] Neil Malhotra and Alexander G. Kuo, 'Emotions as Moderators of Information Cue Use Citizen Attitudes Toward Hurricane Katrina', *American Politics Research*, 37 (2009), 301–26; John T. Gasper and

On the other hand, disasters also provide an opportunity for leaders to demonstrate their competence and improve their electoral prospects.[18] Olson and Gawronski argue that, depending on leaders' specific response to a disaster, it can have positive or negative effects for the government in question.[19]

Political leaders are not above using disasters strategically to further their own political goals.[20] In a study of floods in Pakistan, Mustafa found that relief cheques were distributed to political supporters and family members.[21] Pelling argues that local elites can co-opt community leaders to maintain control over, and perhaps profit from, environmental rehabilitation projects.[22] Firms contracted to undertake disaster relief are also often politically connected.[23] In the United States, the president has unilateral control over the declaration of disasters, which allows him to manipulate spending in strategic states.[24] Garrett and Sobel, as well as Reeves, found that electorally important states in the United States have a higher rate of disaster declaration.[25] Within states, the distribution of disaster aid is also politically driven, as Chen's analyses of hurricanes in Florida show.[26] Cohen and Werker argue that governments spend less in politically weak or hostile regions, and that nations expecting to receiving disaster aid can exacerbate the problem by underinvesting in preparations or neglecting a population in order to attract (and steal) aid.[27] On numerous occasions, governments have actually used famines as political weapons.[28]

(F'note continued)

Andrew Reeves, 'Make it Rain? Retrospection and the Attentive Electorate in the Context of Natural Disasters', *American Journal of Political Science*, 55 (2011), 340–55.

[18] F. Glenn Abney and Larry B. Hill, 'Natural Disasters as a Political Variable: The Effect of a Hurricane on an Urban Election', *American Political Science Review*, 60 (1966), 974–81; Jowei Chen, *Are Poor Voters Easier to Buy Off with Money? A Natural Experiment from the 2004 Florida Hurricane Season* (Ann Arbor: University of Michigan, 2008); Jowei Chen, *When Do Government Benefits Influence Voters' Behavior? The Effect of FEMA Disaster Awards on US Presidential Votes* (Ann Arbor: University of Michigan, 2009); Andrew Healy and Neil Malhotra, 'Random Events Economic Losses and Retrospective Voting: Implications for Democratic Competence', *Quarterly Journal of Political Science* 5 (2010), p. 193–208; Andrew Reeves, 'Political Disaster Unilateral Powers Electoral Incentives and Presidential Disaster Declarations', *Journal of Politics*, 73 (2011), 1–10.

[19] Olson and Gawronski, 'From Disaster Event to Political Crisis: A "5C+A" Framework for Analysis', p. 205–21.

[20] Paul Brass, 'The Political Uses of Crisis: The Bihar Famine of 1966–1967', *Journal of Asian Studies*, 45 (1986), 245–67; J. M. Albala-Bertrand, *Political Economy of Large Natural Disasters* (Oxford UK: Clarendon, 1993).

[21] Daanish Mustafa, 'Reinforcing Vulnerability? Disaster Relief Recovery and Response to the 2001 Flood in Rawalpindi, Pakistan', *Environmental Hazards*, 5 (2003), 71–82.

[22] Mark Pelling, 'The Political Ecology of Food Hazard in Urban Guyana', *Geoforum*, 30 (1999), 249–61.

[23] Roger D. Congleton, 'The Story of Katrina: New Orleans and the Political Economy of Catastrophe', *Public Choice*, 127 (2006), 5–30.

[24] Richard Sylves and Zoltan I. Buzas, 'Presidential Disaster Declaration Decisions, 1953–2003: What Influences Odds of Approval?', *State and Local Government Review*, 39 (2007), 3–15.

[25] Thomas A. Garrett and Russell S. Sobel, 'The Political Economy of FEMA Disaster Payments', *Economic Inquiry*, 41 (2003), 496–509; Reeves, 'Political Disaster Unilateral Powers Electoral Incentives and Presidential Disaster Declarations', p. 1–10.

[26] Chen, *Are Poor Voters Easier to Buy Off with Money?*; Chen, *When Do Government Benefits Influence Voters' Behavior*?

[27] Cohen and Werker, 'The Political Economy of "Natural" Disasters', pp. 795–819; Raschky and Schwindt, *Aid Natural Disasters and the Samaritan's Dilemma*.

[28] Michael H. Glantz, 'Nine Fallacies of Natural Disaster: The Case of the Sahel', *Climatic Change*, 1 (1977), 69–84; Edmond J. Keller, 'Drought War and the Politics of Famine in Ethiopia and Eritrea', *Journal of Modern African Studies*, 30 (1992), 609–24.

Natural disasters also affect other political events. For instance, a number of studies have found relationships between natural disasters and civil war.[29] Our study is within this genre. However rather than civil war, we examine how disasters affect political protest and leader survival. The key result is that democratic leaders are highly sensitive to disaster-related causalities, while autocrats are not. Given this result, it is perhaps not surprising that democratic leaders do a better job of protecting people from disaster than autocrats.

SELECTORATE INSTITUTIONS, POLICY CHOICE AND SURVIVAL

Leaders cannot stop earthquakes and extreme weather conditions, but investing in preventative and palliative measures can mitigate the effects of such events. Using selectorate theory and, in particular, recent extensions of the theory that endogenize revolutions, we examine the political incentives to mitigate the impact of disasters.[30]

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 that the leader relies on to maintain power. The selectorate is the set of people from which a leader forms her winning coalition. The sizes of winning coalitions and selectorates 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 on electoral rules. In elected monarchies or military juntas, selectorates and winning coalitions are much smaller, and are typically restricted to aristocrats and senior military figures. The winning coalition is also typically only a small proportion of the citizenry in an autocratic system, although these systems often vary greatly in the size of their selectorates.

To stay in power, a leader needs to ensure that each of her essential supporters prefers to retain her rather than back a political rival. The policies that most efficiently allow a leader to buy the loyalty of her winning coalition depend on the size of the winning coalition. When the coalition is small, the leader only needs to maintain the loyalty of a small number of supporters, so she can most efficiently purchase their support by supplying them with 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 that must be rewarded grows, leaders increasingly rely on policies that provide a high proportion of public goods; this approach simultaneously rewards 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

[29] Kyle Beardsley and Brian McQuinn, 'Rebel Groups as Predatory Organizations: The Political Effects of the 2004 Tsunami in Indonesia and Sri Lanka', *Journal of Conflict Resolution*, 53 (2009), 624–45; Dawn Brancati, 'Political Aftershocks: The Impact of Earthquakes on Intrastate Conflict', *Journal of Conflict Resolution*, 51 (2007), 715–43; Edward Miguel, Shanker Satyanath and Ernest Sergenti, 'Economic Shocks and Civil Conflict: An Instrumental Variables Approach', *Journal of Political Economy*, 112 (2004), 725–53; Philip Nel and Marjolein Righarts, 'Natural Disasters and the Risk of Violent Civil Conflict', *International Studies Quarterly*, 52 (2008), 159–85; Idean Salehyan, 'From Climate Change to Conflict? No Consensus Yet', *Journal of Peace Research*, 45 (2008), 315–26; Mariya Y. Omelicheva, 'Natural Disasters: Triggers of Political Instability?', *International Interactions*, 37 (2011), 441–65.

[30] Bruce Bueno de Mesquita, Alastair Smith, Randolph M. Siverson and James D. Morrow, *The Logic of Political Survival*; Bruce Bueno de Mesquita and Alastair Smith, 'Political Survival and Endogenous Institutional Change', *Comparative Political Studies*, 42 (2009), 167–97; Alastair Smith, 'The Perils of Unearned Income', *Journal of Politics*, 70 (2008), 780–93.

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, they clearly differ in focus. Leaders in large coalition systems have political incentives to pursue a public goods-orientated set of policies that better insulates citizens from disasters, while a small coalition leader is better protected by policies with a private goods focus.

Of course a government's ability to insulate its population from natural disasters is not a perfect public good, and leaders might selectively provide assistance and prevention. Yet the extent to which leaders can discriminate between people depends on the size of their winning coalition. When the coalition is very small, leaders could allow large areas to flood, for instance, without jeopardizing the welfare of their cronies. However as a leader's essential supporters become more numerous, insulating them from disasters becomes more difficult without widescale prevention and relief programs. In large coalition systems, policy competence – that is, the ability to deliver public goods – determines political survival. Democratic leaders are motivated to protect and assist the people because they cannot afford to appear incompetent. This is not to say that relief is evenly distributed in democracies. As Chen shows, storm intensity accounts for only about 49 per cent of the variance in disaster relief in Florida hurricanes; much of the rest depends on political alignment and electoral turnout.[31] However, leaders beholden to large swathes of the population cannot afford to appear incapable of protecting the people or their supporters will defect to someone who can. Political incentives determine disaster policy.

Survival Within the Selectorate Model

Political institutions determine the ease of political survival. There is always a plentiful supply of political rivals that wishes to come to power. If members of the incumbent's coalition believe they would be better off under a rival's leadership, they can defect and depose the incumbent. Small coalition systems, particularly in the presence of a large selectorate, make survival relatively easy, at least once a leader is 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 her ability to credibly promise private goods in the future. Once established in power a new leader might, and often does, rearrange her coalition and replace some members of the former leader's coalition with those she 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 her coalition. An incumbent leader does not suffer from this commitment problem, because she has already reorganized her coalition around those with whom she has the greatest affinity. Coalition members can therefore expect to be included for as long as she is leader.

In small coalition systems in which private goods are particularly prominent, a leader's ability to commit to providing future private goods endows her with an incumbency advantage once she is well established in office. While there is also an incumbency advantage in democracies, the incumbent's advantage is not as strong because private goods are relatively less important in large coalition systems.

[31] Chen, *Are Poor Voters Easier to Buy Off with Money?*; Chen, *When Do Government Benefits Influence Voters' Behavior*?

Protests and Revolution

Revolutions are attempts by those outside the winning coalition to replace the existing political institutions with more inclusive ones and are often preceded by mass protests. Citizens have a greater incentive to protest in small coalition systems than in large coalition systems, as the former provide few public goods. However, such autocratic systems make it difficult for 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 neighbouring town, they can not express their discontent if they do not know the protest is taking place or if there is no transport to get there. Natural disasters can serve as a coordinating device for citizens, and governments, particularly small coalition ones, fear they may provide a rally point for protest.

Disasters can facilitate coordination by concentrating those who are unhappy with the current system and have little to lose, and thus pose a potential problem to political leaders. In small coalition systems the people outside the coalition want to expand it. While citizens can potentially reach this goal once they are organized into a mass movement, autocratic governments make assembly and coordination difficult, costly and risky. In an argument first advanced by Schelling, Kuran and others conceptualize mass political movements as tipping points:[32] if enough people participate, then it is hard for the government to single them out for retaliation. Once events gain sufficient 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 protests will succeed, few people are willing to initiate 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 state's capacity to monitor and punish.

Since natural disasters can facilitate revolutionary movements in small coalition systems, leaders in such systems often try to prevent people from congregating. For instance when Cyclone Nargis struck Burma in 2008, the military junta made no effort to evacuate the people. Afterwards, survivors were prevented from seeking assistance in larger towns and villages. Within a week of the disaster the army started forcibly dispersing survivors from makeshift camps, schools and monasteries.[33] By letting 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 on where they occur. Disasters that afflict the capital city or other densely populated urban areas are more likely to stimulate protest than those in rural or remote areas. In general small

[32] Thomas C. Schelling, *Micromotives and Macrobehavior* (New York: W.W. Norton and Co., 1978); Mark Granovetter, 'Threshold Models of Collective Behavior', *American Journal of Sociology*, 83 (1978), 1420–43; Timur Kuran, 'Sparks and Prairie Fires: A Theory of Unanticipated Political Revolution', *Public Choice*, 61 (1989), 41–74; Suzanne Lohmann, 'The Dynamics of Informational Cascades: The Monday Demonstrations in Leipzig East Germany 1989–91', *World Politics*, 47 (1994), 42–101; Pamela Oliver, Gerald Marwell and Ruy Teixeira, 'A Theory of the Critical Mass: Interdependence Group Heterogeneity and the Production of Collective Action', *American Journal of Sociology*, 94 (1985), 502–34; John Ginkel and Alastair Smith, 'So You Say You Want a Revolution: A Game Theoretic Explanation of Revolution in Repressive Regimes', *Journal of Conflict Resolution*, 43 (1999), 291–316; Charles Tilly, *From Mobilization to Revolution* (Reading, Mass.: Addison-Wesley, 1978).

[33] Emma Larkin, *Everything is Broken: A Tale of Catastrophe in Burma* (London: Penguin Press, 2010).

coalition systems are not geared towards disaster relief, but they are more likely to provide some assistance in urban areas than in remote areas. In China, the government only half-heartedly assisted the remote province of Qinghai after an earthquake in 2010 and suffered few political consequences for its inaction. But when an earthquake hit Sichuan in 2008, the Chinese government – wary of protest in this politically and economically powerful centre – undertook relief operations that won the approval of much of the international community.

PREDICTIONS

Political institutions shape disaster policies and how disasters affect leader survival. In large coalition systems, political competition is based on the provision of public goods. Small coalition leaders can more efficiently maintain power by buying 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 contrast leads to our first hypothesis.

HYPOTHESIS 1: 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. Protests against the government and the survival of leaders are driven in part by how well leaders protect people from disasters. Leaders cannot be expected to prevent earthquakes and extremes of weather, 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 in this context depends on how well they deal with disasters, not on their actual occurrence.

HYPOTHESIS 2: 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.

HYPOTHESIS 3: In large coalition systems, the occurrence of disasters should have a relatively small effect on protests and leader survival.

Private goods provision dominates small coalition politics. Leaders more effectively buy the loyalty of their small number of supporters by retaining government resources to reward them rather than by providing effective public policy. Resources spent insuring the general public against disasters cannot be given to supporters. Although supporters might be harmed by disasters, their relatively small number makes this unlikely, and it is easy for the government to compensate them individually for their losses. Saving the masses from disasters does not promote leader 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 because they serve as a coordination device for citizens to organize and protest against the government.

HYPOTHESIS 4: In small coalition systems, disaster-related fatalities have little impact on leader survival and protest.

HYPOTHESIS 5: In small coalition systems, the occurrence of disasters causes an increase in anti-government demonstrations and a decline in leader survival.

DATA AND EMPIRICAL ANALYSIS

Data

We tested the predicted relationships between disasters and politics using data on the occurrence and impact of disasters, political institutions, anti-government protests, leader survival and many control variables. Data about disasters were drawn from the Emergency Events Database EM-DAT at the Centre for Research on the Epidemiology of Disasters (CRED).[34] This database contains information about the occurrence and characteristics of more than 16,000 disasters around 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 100 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: disaster level, country level and source level. In this framework, a unique identifier is assigned to each disaster, and each disaster can be associated with several countries affected by it. For instance, the December 2004 tsunami has a unique identifier, but it is recorded for thirteen different countries. Disasters can be classified into groups, subgroups, types and subtypes. There is also a classification for primary disasters that caused associated disasters. CRED also records the number of people killed, injured, left homeless and affected by the disasters, as well as the economic damage of disasters in US dollars. 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. CRED ranks the reliability of the information produced by these sources, 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 is made available to the public once it is validated.

The first part of our study focuses on the variable *ln(Deaths)*, which is the natural logarithm of the count of disaster deaths plus one for all disasters in a particular country-year, and the variable *Disasters*, which is the count of disasters that takes place in a particular country in a year. Unfortunately the EM-DAT database is still susceptible to reporting biases, as some nations are much more likely to report events than others.[35] In addition, the *Disasters* variable cannot distinguish between the scale of different disasters. Such concerns have lead some scholars to focus on earthquakes, for which the Richter scale offers an objective measure of intensity.[36] Other studies use alternative measures of disaster magnitudes. For example, Chen explores the effect of storm intensity on disaster relief,[37] while Healy and Malhotra use the Fujita scale to examine the effect of economic losses from tornadoes on electoral outcomes.[38]

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

[35] D. D. Hargitt Guha-Sapir and P. Hoyois, *Thirty Years of Natural Disasters 1974–2003: The Numbers* (Louvain-la-Neuve, Belgium: Presses Universitaires de Louvain, 2004).

[36] Anbarci, Escaleras and Register, 'Earthquake Fatalities', pp. 1907–33; Kahn, 'The Death Toll from Natural Disasters', pp. 271–84; Escaleras, Anbarci and Register, 'Public Sector Corruption and Major Earthquakes: A Potentially Deadly Interaction', p. 209–30; Keefer, Neumayer and Plümper, *Earthquake Propensity and the Politics of Mortality Prevention*.

[37] Chen, *Are Poor Voters Easier to Buy Off with Money?*; Chen, *When Do Government Benefits Influence Voters' Behavior*?

[38] Healy and Neil Malhotra, 'Random Events Economic Losses and Retrospective Voting', pp. 193–208.

However it is important to recognize that this fix for one form of measurement error introduces another type of measurement error. A focus on earthquakes, for instance, provides an objective measure of the magnitude of disasters for a small subset of natural disasters. Yet considering only earthquakes implicitly gives the magnitude of all other forms of disasters a value of zero. Hence unless one believes that earthquakes generate political fallout but storms do not, then an exclusive focus on earthquakes must be seen as a different trade-off in dealing with noisy, poorly measured data rather than as a fix. Reassuringly, we obtain similar results when we examine only earthquakes.

To measure mass protests against the government we used a count of the number of anti-government demonstrations per year obtained from Arthur S. Banks's Cross National Time Series Data Archive.[39] Banks codes this variable as a peaceful public gathering of more than 100 people to express discontent based upon media reports. We operationalize this variable as both a simple count of the number of protests (*AntiGov*) and as the natural logarithm of this count variable plus one (*ln(AntiGov)*). Data on leader survival are obtained from *Archigos*, a database of political leaders collected by Goemans, Gleditsch and Chiozza[40] that provides 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.[41] The estimate of 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 a regime's competitiveness of executive recruitment, openness of executive recruitment and competitiveness of participation. 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 W and S have a minimum normalized value of 0, and a maximum of 1. As a practical matter the democracies of Western Europe are all classified as having the largest coalition size ($W = 1$). The next category of coalition size ($W = 0.75$) includes emerging democracies such as Indonesia and the Philippines. The smallest coalition systems ($W = 0$) are generally military regimes such as Pakistan following Musharraf's coup in 1999. Middle Eastern monarchies, such as Saudi Arabia and Kuwait, are generally coded as $W = 0.25$.

Measuring political institutions is a contentious topic. Much of the discipline has focused on differentiating democracies from other political systems. An advantage of selectorate theory is that it allows comparisons both within and across democracies and non-democracies. Of course this is not the only approach to classifying non-democratic regimes. Geddes, for instance, examines whether autocracies are military, personalist or single-party in nature. Yet her typology does not directly relate to the theoretical ideas developed here.[42]

[39] Available at http://www.databanksinternational.com/53.html.

[40] H. E. Goemans, Kristian Skrede Gleditsch and Giacomo Chiozza, 'Introducing *Archigos*: A Data Set of Political Leaders', *Journal of Peace Research*, 46 (2009), 269–83.

[41] Bruce Bueno de Mesquita, Alastair Smith, Randolph M. Siverson and James D. Morrow, *The Logic of Political Survival*.

[42] Barbara Geddes, *Paradigms and Sand Castles: Theory Building and Research Design in Comparative Politics* (Ann Arbor: University of Michigan Press, 2003).

TABLE 1 *Summary Statistics*

Variable	Mean	Std. dev.	*N*
ln(Deaths)	2.087	2.562	5,157
Anti-government demonstrations	0.572	1.921	5,069
ln(Anti-government demonstrations)	0.243	0.518	5,069
W	0.612	0.309	5,157
S	0.877	0.316	5,118
Disasters	2.408	5.832	5,157
ln(GDP per capita)	7.395	1.561	5,157
Economic growth	3.894	6.208	5,047
ln(Total population)	15.94	1.535	5,157
Leader age	56.891	11.257	5,003

All measures have practical limitations, and assessing selectorate institutions is no exception. Clarke and Stone and Morrow et al. debate, for instance, the close correlation between measures of selectorate institutions and Polity IV's measure of democracy.[43] Given these concerns, in the Appendix we replicate all results replacing measures of *W* with Polity's −10 to +10 measure of democracy-autocracy rescaled between 0 and 1, a variable we label *Demaut*. These analyses produce similar results. However given the theoretical focus on selectorate theory, we focus on the impact of *W* on disasters and their political consequences.

Our analyses also 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 (GDP) in constant dollars. *Growth* is the annual change in *GDPPC*. The variable *ln(Population)* measures a country's population.[44] 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. Table 1 presents summary statistics for the key variables.

Deaths from Disasters

Consistent with existing studies, our analyses showed that fewer people die in disasters in large coalition systems, such as democracies, than in small coalition systems. Figure 1 shows the smoothed density plot of the number of disaster-related deaths in each nation-year according to the size of the winning coalition.

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 a smaller variance around this number, while countries with small winning coalitions have a larger mean number of deaths and a much larger variance.

Motivated by these initial results, our first set of estimations explored the role of political institutions on the number of deaths caused by disasters. The unit of analysis for

[43] Kevin A. Clarke and Randall Stone, 'Democracy and the Logic of Political Survival', *American Political Science Review*, 102 (2008), 387–92; James D. Morrow, Bruce Bueno de Mesquita, Randolph M. Siverson and Alastair Smith, 'Retesting Selectorate Theory: Separating the Effects of W from Other Elements of Democracy', *American Political Science Review*, 102 (2008), 393–400; Monty G. Marshall, 2011 *Polity IV Project, Dataset User's Manual*, available at http://wwwsystemicpeaceorg/inscr/p4manualv2010pdf.

[44] In our ideal specification, we would like to use population density for each disaster. Since we explore all types of disasters by country-year, we have not found the general equivalent of an earthquake's epicenter; national population density is not a feasible alternative because there is high variance in population density within countries. However, our ongoing study of the effects of earthquakes addresses this issue.

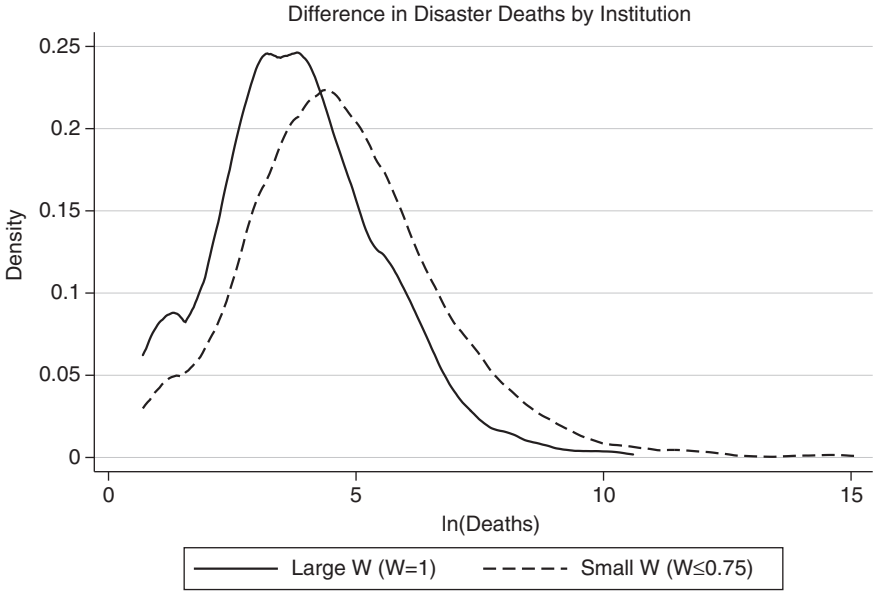

Fig. 1. Difference in disaster deaths by institution

this set of models is the country-year. The dataset includes information on nations from 1900–2008. However, due to data restrictions on other variables, GDP in particular, our sample for estimation will be smaller.

Table 2 presents estimates from a least squares regression of the natural logarithm of the number of deaths plus one per nation-year.[45] Political institutions, the number of disasters, GDP per capita, population and their interactions with the size of the winning coalition influence the number of disaster-related fatalities. Model 1 uses region-year fixed effects, while Model 2 uses country fixed effects.[46] As with all analyses, we report robust standard errors clustered by either nation or region-year.

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 Hypothesis 1.[47]

[45] 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. It is important to note that most empirical analyses of disasters use a linear model to explore disaster-related casualties. Nevertheless, to address potential concerns about the distribution of casualties, we estimated the same specifications using count models; our analyses using these models also produce similar results.

[46] The regions are given by the Correlates of War Project: Western Hemisphere, Europe, Africa, Middle East, Asia, and Oceania.

[47] Sen, 'Public Action to Remedy Hunger', p. 324–36; Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation*; Besley and Burgess, 'The Political Economy of Government Responsiveness', pp. 1415–51; Anbarci, Escaleras and Register, 'Earthquake Fatalities', pp. 1907–33; Kahn, 'The Death Toll from Natural Disasters', pp. 271–84; Escaleras, Anbarci and Register, 'Public Sector Corruption and Major Earthquakes', pp. 209–30; Stromberg, 'Natural Disasters, Economic Development, and Humanitarian Aid', pp. 199–222; Toya and Skidmore, 'Economic Development and the Impacts of Natural Disasters', pp. 20–5; Cohen and Werker, 'The Political Economy of "Natural" Disasters', pp. 795–819; Raschky, 'Institutions and the Losses from Natural Disasters', pp. 627–34; Cavallo and Noy, *The Economics of Natural Disasters*; Keefer, Neumayer and Plümper, *Earthquake Propensity and the Politics of Mortality Prevention*.

TABLE 2 *Dependent Variable: ln(Deaths)*

	Model 1	Model 2
W	−2.1547*	0.2477
	(1.255)	(3.288)
Disasters	0.1637†	0.2143*
	(0.044)	(0.113)
(Disasters)(W)	−0.0801	−0.1503
	(0.049)	(0.131)
ln(GDPPC)	0.0320	−0.3873*
	(0.049)	(0.209)
ln(GDPPC)(W)	−0.2152†	0.0703
	(0.059)	(0.153)
ln(Population)	0.5880†	2.2659†
	(0.064)	(0.328)
ln(Population)(W)	0.2517†	0.0052
	(0.081)	(0.224)
Intercept	−7.9093†	−31.9753†
	(1.061)	(4.829)
N	5,157	5,157
FE	321 reg-years	150 countries

Unit: country-year.
*$p < 0.10$, †$p < 0.01$.

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 that such systems convert societal resources into better protection against disasters 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 citizens' risk from natural disasters. This finding is consistent with the theory's predictions that large coalition leaders spend available resources on public goods while small coalition leaders retain such resources for their coalition rather than protecting their citizens. Although not shown, a similar pattern observed in the analysis is repeated without fixed effects: wealth reduces disaster-related deaths in large, but not small, winning coalition systems.

Model 2 replicates the analysis using a fixed effect for each nation. Unfortunately, since there is relatively little institutional variation between nations, the estimates show a less significant pattern, which is a common problem when variables are relatively invariant within the fixed-effect grouping.[48] As a robustness test we ran Plümper and Troeger's fixed-effect vector decomposition procedure, which accounts for the lack of temporal change within the fixed-effect units, and obtained similar results to those reported in Model 1:[49] institutions

[48] Neal Beck and Jonathan Katz, 'Throwing Out the Baby with the Bath Water: A Comment on Green, Kim, and Yoon', *International Organization*, 55 (2001), 487–95; Donald P. Green, Soo Yeon Kim and David H. Yoon, 'Dirty Pool', *International Organization*, 55 (2001), 441–68; Gary King, 'Proper Nouns and Methodological Propriety: Pooling Dyads in International Relations Data', *International Organization*, 55 (2001), 497–507.

[49] Thomas Plümper and Vera E. Troeger, 'Efficient Estimation of Time-Invariant and Rarely Changing Variables in Finite Sample Panel Analyses with Unit Fixed Effects', *Political Analysis*, 15 (2007), 124–39.

affect the number of casualties from natural disasters. Our next analyses delved into the reasons for these institutionally induced differences by testing how the occurrence and impact of disasters affect public protests and leader survival. The negative coefficient estimate on the interaction of coalition size and wealth indicates that large coalition systems experience few deaths, and that such systems also convert societal resources into better protection against disasters.

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 for citizens of democracies to 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 citizens in large coalition systems, citizens in small coalition systems have much greater cause to protest, but the costs and risks of dissent are much higher. We argue that disasters affect protests in different ways across political systems. In large coalition systems we expect that the occurrence of disasters will have little effect on protests. However, the people will protest if the government performs poorly – that is, if it lets a lot of people die. In contrast, the occurrence of protests in small coalition systems is restricted by citizens' ability to coordinate and organize rather than by their 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, the occurrence of disasters is more important in predicting protests than the government's handling of the crisis.

These predictions are borne out by the analyses in Table 3. In Models 3 through 6, the dependent variable is the natural logarithm of the number of protests plus one, *ln(Anti-Gov)*. Models 7 and 8 examine a direct count of the number of protests. Model 7 is a fixed-effects negative binomial count model. The data exhibit a large number of cases in which there are no protests recorded. To adjust for this skew, Model 8 estimates a zero inflated negative binomial count model.[50] In this framework a first equation determines whether any count is observed, and then the negative binomial is used for the positive outcomes. In the model shown we included only coalition size in this first equation. The regression and count models approaches yield similar results.

There is strong temporal dependence in the number of protests; a high level of protests in one year is 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 3 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 the size of the winning coalition, *W*. Models 3 and 4 include region-year fixed effects, while Models 5, 6, 7 and 8 have country-specific fixed effects. We report robust standard errors clustered by either nation or region-year.

Models 4 and 6 include lagged values of disasters and disaster deaths. These lagged terms are included as well as the contemporaneous variables because it can often take time for protests to take place and propagate. The need for lags is particularly pertinent if

[50] William Greene, *Econometric Analysis* (New Jersey: Prentice Hall, 2003).

TABLE 3 *Dependent Variable: Anti-Government Demonstrations*

	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
L.(ln)AntiGov	0.3252‡	0.3245‡	0.2198‡	0.2166‡		
	(0.023)	(0.024)	(0.027)	(0.026)		
L.AntiGov					0.0967‡	0.0910‡
					(0.022)	(0.024)
W	−0.5468	−0.4147	0.7014	0.8003	7.9600‡	7.4215‡
	(0.362)	(0.389)	(0.577)	(0.611)	(2.785)	(2.875)
Disasters	0.0196†	0.0266†	0.0342‡	0.0322‡	0.0495†	0.0515†
	(0.008)	(0.012)	(0.010)	(0.011)	(0.022)	(0.021)
(Disasters)(W)	−0.0208*	−0.0247	−0.0504‡	−0.0382†	−0.0766†	−0.0798†
	(0.011)	(0.016)	(0.018)	(0.016)	(0.035)	(0.034)
L.Disasters		−0.0080		0.0049		
		(0.011)		(0.013)		
L.(Disasters)(W)		0.0039		−0.0197		
		(0.014)		(0.016)		
ln(Deaths)	−0.0002	−0.0005	−0.0100	−0.0081	0.0425	0.0415
	(0.008)	(0.009)	(0.009)	(0.008)	(0.042)	(0.042)
ln(Deaths)(W)	0.0120	0.0086	0.0227*	0.0165	−0.0353	−0.0346
	(0.013)	(0.014)	(0.013)	(0.012)	(0.058)	(0.058)
L.ln(Deaths)		−0.0006		−0.0106		
		(0.009)		(0.008)		
L.ln(Deaths)(W)		0.0145		0.0276†		
		(0.013)		(0.012)		
GDPPC	0.0572‡	0.0575‡	0.0194	0.0318	0.0883	0.0649
	(0.013)	(0.013)	(0.034)	(0.034)	(0.203)	(0.208)
(GDPPC)(W)	−0.0669‡	−0.0654‡	−0.0845‡	−0.0881‡	−0.6479‡	−0.6405‡
	(0.016)	(0.016)	(0.031)	(0.031)	(0.156)	(0.158)
ln(Population)	0.0170	0.0187	0.1518‡	0.1495‡	1.4871‡	1.4876‡
	(0.014)	(0.016)	(0.043)	(0.045)	(0.244)	(0.245)
ln(Population)(W)	0.0638‡	0.0542†	−0.0067	−0.0130	−0.2077	−0.1867
	(0.022)	(0.024)	(0.038)	(0.040)	(0.172)	(0.175)
Growth	−0.0035*	−0.0025	−0.0026	−0.0020	−0.0541†	−0.0558†
	(0.002)	(0.002)	(0.002)	(0.002)	(0.024)	(0.026)
(Growth)(W)	−0.0016	−0.0037	−0.0036	−0.0052	0.0239	0.0262
	(0.004)	(0.004)	(0.004)	(0.005)	(0.036)	(0.039)

TABLE 3 *(Continued)*

	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Intercept	−0.5161†	−0.5489*	−2.3267‡	−2.3688‡	−25.5528‡	−25.1849‡
	(0.262)	(0.280)	(0.665)	(0.700)	(4.009)	(4.033)
Inflation equation						
W						−1.7191‡
						(0.531)
Intercept						−1.5849*
						(0.858)
ln(alpha)					0.4581***	0.3146*
					(0.101)	(0.161)
N	4,918	4,854	4,918	4,854	4,918	4,918
FE	300 reg-years	300 reg-years	149 countries	148 countries	149 countries	149 countries

Unit: country-year.
*$p < 0.10$; †$p < 0.05$; ‡$p < 0.01$.

a disaster occurs late in the year. As mentioned before, the models in Table 3 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 deaths 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 interacted coefficient estimates.

In small coalition systems, the occurrence of disasters leads to an increase in the level of protest. For example, in Model 3 the coefficient estimate for disasters is a significant 0.0196, which implies that in the most autocratic systems the occurrence of disasters leads to increased protest. Model 4, which examines effects in both the current and previous periods, yields the same substantive conclusion. Although the coefficient estimate for lagged disasters is statistically insignificant, a joint hypothesis test that the sum of the disaster and lagged disaster coefficients is different from zero is highly significant. Thus in autocracy, each additional disaster increases the level of protest by about 2 per cent.

The occurrence of disasters has no significant effect on the level of protest in democracies. In the analysis the largest coalition systems are coded as $W = 1$. To evaluate the effect of disasters in these systems we need to examine the coefficient estimates on both the disasters variable and its interaction with W. In Model 3, the sum of these coefficients is $0.0196 - 0.0208 = -0.0012$, which is statistically indistinguishable from zero. In the Appendix we provide tables with hypotheses tests for the sum of coefficients in each of the models in Tables 3 and 4. An examination of the sum of estimated coefficients for the disasters variables and their interaction with W in the other models leads to the same substantive conclusion: disasters produce a small but statistically significant increase in the likelihood of protest in small coalition systems but have no discernible effect in democracies.

When large numbers of people die in disasters, this is an indication that the government has done a poor job of preparing for and responding to a natural disaster. 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. For instance, the coefficient estimate for deaths in Model 3 is an insignificant -0.0002. Likewise in Model 4, a joint hypothesis test on the deaths variable and the lagged deaths variable is indistinguishable from zero. In small coalition systems, the number of deaths appears to have little impact on the level of protest. Protest in the wake of a large number of disaster-related deaths is more likely in democracies. Assessing the impact of disaster deaths for large coalition systems requires summing the deaths variable and its interaction with W. In Model 3 this sum equals 0.0118, which is significant at the 5 per cent level in a one-tailed test. A similar effect is seen in Models 4, 5 and 6. Deaths have no effect on the level of protest in autocracies, but lead to an increase in protest in democracies; a result that is statistically significant at the 1 per cent level. However, the effects of disaster-related fatalities estimated in the count models (7 and 8) are statistically indistinguishable from zero.

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. In large coalition systems, the level of fatalities – not the occurrence of disasters – affects the level of protest. This pattern repeats in analyses of leader survival.[51]

[51] As a robustness check, we included variables indicating the occurrence and intensity of civil war (UCDP/PRIO Armed Conflict Dataset: Nils Petter Gleditsch, Peter Wallensteen, Mikael Eriksson,

Leader Survival and Disasters

We explore the effect of disasters and disaster-related deaths on leaders' tenures in office while controlling for population size, per capita income, economic growth, leader age 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 1800–2008, the inclusion of economic indicators reduces the sample to the years 1961–2004. For the estimation sample (1,111 leaders), median survival time is 2.6 years with a standard error of 0.16 years and a 95 per cent confidence interval of [2.30, 2.93] years. Table 4 presents survival models. Positive coefficients represent an increase in the hazard rate. Standard errors clustered on the leader are presented below coefficients.

Table 4 contains two forms of survival analysis. Models 9 and 10 are Cox proportional hazard models. Models 11 and 12 use a Weibull parametric method in which the shape parameter, ρ, is modelled as a function of coalition size. Each of the models supports the same substantive conclusion. In small coalition systems, the occurrence of disasters leads to an increased risk of leader removal. The number of deaths caused by these disasters has no statistically significant effect on leader survival in small coalition systems. The pattern is different for large coalition leaders. Their survival is greatly endangered by disaster-related deaths, but the actual occurrence of disasters appears to help them retain office. We start by examining the coefficient estimates in the models. We then turn to technical issues relating to the temporal dependence of the results and explain why we present multiple estimation approaches.

Institutions affect the survival of leaders directly, and also by conditioning the effect of other variables. Models 9–12 each contain coalition (W) and selectorate (S) size. As predicted by selectorate theory, leaders survive longer when they form a coalition from a large pool of potential supporters. The significant negative coefficient estimate on the S variable supports this prediction. The impact of coalition size is more nuanced. The coefficient estimates on W are insignificant, but W significantly modifies the impact of other variables. For instance, the parameter estimate on age is positive in each model, indicating that old autocrats are at a greater risk of deposition than young autocrats. Age is a less important factor in democratic leader survival. The coefficient estimate on the age variable interacted with W is significant and negative. For democratic leaders, the impact of age on survival is given by the sum of the age variable and its interaction with W (0.0062 in Model 9). Democratic leaders are much less sensitive to age than autocrats, which illustrates a common pattern throughout the analyses; coalition size modifies the impact of other variables. For instance, the significant negative coefficient estimate of the growth variable and the positive estimate on growth interacted with W indicate that economic growth helps autocrats remain in office more than democrats.

Disasters affect leader tenure. The positive significant coefficient estimates on the disasters variable in Models 9 and 11 indicate that the occurrence of a disaster will jeopardize a small coalition leader's hold on office. Models 10 and 12 examine the effect of disasters in both the current and previous years. Joint hypothesis tests of the effects across these two years show that disasters increase the risk to autocrats. In contrast, disasters – at least low casualty ones – lower the risk of deposition in large coalition systems. Across the four models, the

(F'note continued)

Margareta Sollenberg and Hovard Strand, 'Armed Conflict 1946–2001: A New Dataset', *Journal of Peace Research*, 39 (2002), 615–37. The results remained similar.

TABLE 4 *Dependent Variable: Tenure in Office*

	Model 9	Model 10	Model 11	Model 12
W	−0.0760	0.4599	−0.8875	−0.5991
	(1.696)	(1.767)	(1.644)	(1.709)
S	−1.0410‡	−1.0503‡	−0.9114‡	−0.9045‡
	(0.161)	(0.171)	(0.165)	(0.175)
Age	0.0382‡	0.0378‡	0.0455‡	0.0452‡
	(0.009)	(0.009)	(0.008)	(0.008)
(Age)(W)	−0.0320‡	−0.0297†	−0.0451‡	−0.0429‡
	(0.012)	(0.012)	(0.011)	(0.011)
Disasters	0.0386†	−0.0038	0.0400‡	−0.0065
	(0.016)	(0.042)	(0.014)	(0.039)
(Disasters)(W)	−0.0531†	0.0039	−0.0546†	0.0063
	(0.023)	(0.056)	(0.022)	(0.051)
L.Disasters		0.0489		0.0548
		(0.042)		(0.039)
L.(Disasters)(W)		−0.0706		−0.0762
		(0.055)		(0.051)
ln(Deaths)	0.0082	0.0097	0.0086	0.0115
	(0.037)	(0.041)	(0.036)	(0.040)
ln(Deaths)(W)	0.0637	0.0371	0.0627	0.0367
	(0.050)	(0.056)	(0.050)	(0.055)
L.ln(Deaths)		0.0173		0.0208
		(0.040)		(0.039)
L.ln(Deaths)(W)		0.0669		0.0558
		(0.056)		(0.055)
GDPPC	−0.1040	−0.0792	−0.0986	−0.0747
	(0.071)	(0.073)	(0.068)	(0.069)
(GDPPC)(W)	0.1865†	0.1891†	0.1962†	0.2034†
	(0.088)	(0.090)	(0.086)	(0.088)
ln(Population)	−0.0920	−0.0977	−0.1196*	−0.1338*
	(0.077)	(0.082)	(0.072)	(0.076)
ln(Population)(W)	0.0874	0.0416	0.1272	0.0945
	(0.104)	(0.111)	(0.101)	(0.108)
Growth	−0.0408‡	−0.0427‡	−0.0295‡	−0.0316‡
	(0.008)	(0.008)	(0.009)	(0.009)
(Growth)(W)	0.0390†	0.0329†	0.0229	0.0172
	(0.016)	(0.015)	(0.017)	(0.016)
Intercept			−0.4592	−0.4782
			(1.171)	(1.218)
Ancillary parameter				
W			0.5192‡	0.5065‡
			(0.085)	(0.089)
Intercept			−0.5160‡	−0.4983‡
			(0.064)	(0.069)
N	5,729	5,586	5,729	5,586
Subjects	1111	1075	1111	1075
LogLikelihood	−6.19e+03	−5.88e+03	−1.71e+03	−1.61e+03

Unit: leader-year.
*$p < 0.10$; †$p < 0.05$; ‡$p < 0.01$.

sum of the estimates of the disasters variables and their interaction with W is negative and generally statistically significant. Disasters help democratic leaders stay in power, but imperil autocrats. This result for democracies is consistent with prior evidence. Abney and Hill, Chen, Healy and Malhotra, and Reeves have shown that US leaders can benefit from the opportunity to disperse benefits and demonstrate competence in the aftermath of disasters;[52] Olson and Gawronski also found evidence in favour of this hypothesis in their analysis of several case studies around the world.[53] The story is reversed when it comes to evaluating disaster-related fatalities. The small statistically insignificant coefficient estimate on the deaths variable indicates that small coalition leaders are relatively immune to disaster-related deaths. However the estimates of the interactions between W and the deaths variables are larger, and joint hypothesis tests show that increased deaths impose a statistically significant threat to the tenure of large coalition leaders.

Figure 2 illustrates the substantive effects of disasters and deaths on the rate of leader removal. The graph plots estimates of the hazard rate leaders face under different conditions. The hazard rate at any point in time is the rate at which leaders are deposed, and is conditional upon having survived to at least that point in time. The upper panel in Figure 2 reflects the risks autocrats face ($W = 0$), while the lower panel plots the risks for democratic leaders ($W = 1$). The estimates are constructed under the premise that $S = 1$, leaders are aged 55 years, and per capita income and national size are that of the average democracy, around $11,000 and 10 million people. The graphs plot the estimated hazard calculated from Model 9 over ten years under different disaster contingencies. The solid line in each panel assumes that no disasters occur. The dashed line plots the hazard if a nation experiences five natural disasters and no casualties. Five disasters represents approximately the 90th percentile in terms of the number of disasters per nation-year. The final dot-dash line plots the hazard a leader faces if his or her nation suffers 10,000 casualties and five natural disasters. Ten thousand is a high casualty figure that occurs in about only 1 per cent of cases, even less in democracies (0.21 per cent).

The most obvious difference between the two panels of Figure 2 is that large coalition leaders face a much higher risk of deposition than autocrats. A comparison of the solid and dashed lines shows that the occurrence of five disasters increases the risk for autocrats by about 20 per cent and decreases a democratic leader's deposition risk by about 7 per cent. Disasters help democratic leaders stay in office, but only if they prevent people from dying. Democratic leaders are highly susceptible to casualties. Figure 2 demonstrates that the estimated hazard for leader removal nearly doubles if 10,000 people die in a democracy. In contrast, fatalities hardly matter in autocracies: the dash-dotted line reflecting high casualties is virtually indistinguishable from the zero casualty disasters case shown by the dashed line. Although the effects are only plotted for Model 9, the other models in Table 4 show similar substantive effects.

The occurrence of disasters imperils autocrats and helps democratic leaders stay in office. Democratic leaders are highly sensitive to disaster-related fatalities. Each of the models in Table 4 supports this conclusion. We offer two forms of hazard analysis due to

[52] Abney and Hill, 'Natural Disasters as a Political Variable', pp. 974–81; Chen, *Are Poor Voters Easier to Buy Off with Money?*; Chen, *When Do Government Benefits Influence Voters' Behavior?*; Healy and Neil Malhotra, 'Random Events Economic Losses and Retrospective Voting', pp. 193–208; Reeves, 'Political Disaster Unilateral Powers Electoral Incentives and Presidential Disaster Declarations', pp. 1–10.

[53] Olson and Gawronski, 'From Disaster Event to Political Crisis: A "5C+A" Framework for Analysis', pp. 205–21.

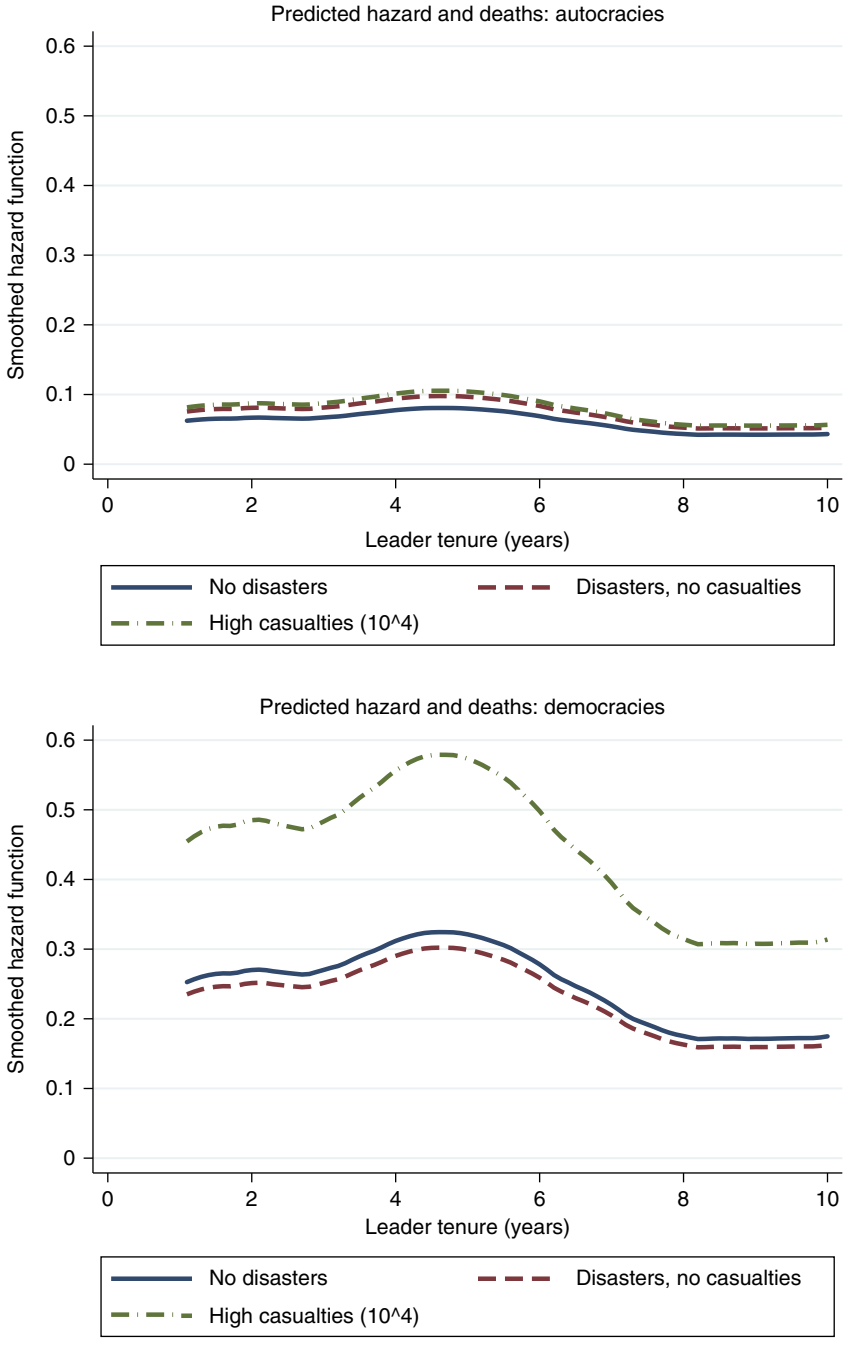

Fig. 2. Leader survival

concerns about the proportionality assumption. The Cox proportional hazard model, which is the work horse of survival analysis in the social sciences, assumes some common underlying hazard $h_0(t)$. The exogenous variables modify the hazard, so at time t leaders

face the hazard $h(t) = h_0(t)e^{X\beta}$, where $X\beta$ reflects the standard set of covariates and coefficients. Unfortunately, selectorate theory suggests how the underlying hazard varies over time depends on institutions. In particular, small coalition leaders face a high initial risk that declines over time, while large coalition leaders face a more constant threat to their tenure. Hence theory suggests that the proportionality assumption of the Cox model is violated; this conclusion is supported by statistical tests. A standard test of the proportionality assumption is to generate residuals and correlate them with the logarithm of time.[54] These tests find significant correlations in our data between the residuals associated with covariates and time; the proportionality assumption is violated. What is more, the pattern observed in these tests is consistent with that predicted by selectorate theory. For instance, the residuals associated with the deaths variable are positively correlated with time, while the residuals associated with the interaction of deaths and W are negatively correlated with time. Further, if the analyses are performed on each size of institution separately, then non-proportionality ceases to be a problem.

The non-proportional hazard model is a standard fix when the proportionality assumption is invalid. This approach interacts variables that fail the proportionality test with the logarithm of time and re-estimates the Cox model with these interaction variables added. Unfortunately, with the inclusion of many time interactions, convergence becomes an issue. Some models will converge if the number of interactions is restricted. Further, although Licht proposes useful graphical methods, examining the substantive impact of variables in non-proportional models is difficult.[55] Therefore we instead used a parametric approach that allows the hazard rate to vary differently according to institutions, as it is theoretically expected to do. In particular we follow the approach of Bueno de Mesquita et al. and Bueno de Mesquita and Smith, and model the hazard rate as a Weibull model with the ancillary parameter, which controls how the hazard varies over time, modelled as a function of W.[56]

The Weibull model assumes that the hazard a leader faces at time t is $h(t) = \lambda(\lambda t)^{p-1}$, where $\lambda = \exp(X\beta)$. 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 11 and 12 estimate the shape parameter $\ln(p)$ as a function of W. For a large coalition system in which $W = 1$, the shape parameter p is indistinguishable from 1, suggesting that the risk of leader removal is relatively constant over time. In contrast, the risk of removal for a small coalition leader presents negative duration dependence, which indicates that the rate at which these leaders are deposed decreases over time.

Central to our analysis, irrespective of whether we look at Cox models, non-proportional models (discussed, but not shown here) or parametric models, the results with respect to disasters are similar. Small coalition 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 leader survival.

[54] See Janet M. Box-Steffensmeier and Bradford S. Jones, *Event History Modeling. A Guide for Social Scientists* (Cambridge: Cambridge University Press, 2004), chapter 8 for detail.

[55] Amanda Licht, *Change Comes With Time: Interpreting Non-proportional Hazards in Event History Analyses* (Iowa City: Working Paper, Department of Political Science, University of Iowa, 2008).

[56] Bruce Bueno de Mesquita, Alastair Smith, Randolph M. Siverson and James D. Morrow, *The Logic of Political Survival*; Bruce Bruce Bueno de Mesquita and Alastair Smith, 'Leader Survival Revolutions and the Nature of Government Finance', *American Journal of Political Science*, 54 (2010), 936–50.

The analyses suggest powerful incentives for leaders. Depending on the institutional setting, leaders should undertake very different levels of disaster preparedness and remediation when disasters strike. If people die in disasters then democratic leaders are likely to lose their jobs. It is therefore small wonder that they experience relatively few casualties. The tenure of autocrats is less endangered by casualties. Given fewer incentives to protect the people, it is perhaps not surprising that they do a worse job.

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 result from how political institutions shape survival incentives for political leaders. Using selectorate theory as a model of political competition, we examined 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 both preventative and palliative measures to minimize the impact of disasters. Leaders cannot be expected to prevent natural disasters, but they are judged on how they handle them if they occur.

In small coalition systems the incentive for leaders to protect citizens from disasters is much less than in large coalition systems. Preparing for disasters and providing assistance in their aftermath consumes resources. Leaders more effectively 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 most efficient means of securing 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 him or her into trouble, but rather that disasters often concentrate displaced people and enhance the ability of the disenfranchised to organize. As we explore in ongoing research, this is particularly the case when a disaster strikes the capital or other urban centre.

These predictions are supported by empirical tests. In large coalition systems the occurrence of disasters has little effect on the level of protest or leader survival. 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, not humanitarian concerns, drive governments' responses to disasters.