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Natural Disasters and Government Turnover

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Abstract

Natural disasters have been linked to both violent conflict and, in some settings, poor economic growth, but do they also drive government parties out of office? We study government turnover in a global sample of more than 200 elections to the executive. Natural disasters are associated with more frequent turnover, but not in highly democratic countries. The effect of geophysical disasters is especially strong, and even stronger when endogeneity is addressed.

Keywords: natural disasters, elections
JEL-codes: Q54, P48, D72

1 Introduction

That natural disasters can affect electoral outcomes has been understood by practical politicians for a long time (Abney and Hill 1966), yet this remains an area where little comparative empirical work has been done. This paper investigates the electoral consequences of natural disasters. Natural disasters are found to have a positive effect on the probability that the party of the executive is voted out of office.

Why should natural disasters affect voting? In the literature on economic voting, the theoretical foundation regularly builds on the reward-punishment model in which an incumbent is assumed to be reelected when performance has been good, and not otherwise. This theory is typically borne out by the data (Lewis-Beck and Stegmaier 2000, Nadeau, Lewis-Beck, and Belénger 2012, Alesina, Carloni, and Lecce 2012).

The reward-punishment model has implications for what to expect in terms of voting behavior after a natural disaster. Natural disasters are caused by natural hazards but become actual disasters only where social, economic, and political factors allow it (Kahn 2004, Strömberg 2007, Toya and Skidmore 2007). The effects of natural disaster on economic growth is debated, with findings ranging from negative to positive, depending on sample and estimation method (Albala-Bertrand 1993, Noy 2009, Loayza et al. 2009, Cavallo and Noy 2010, Ahlerup 2013a).

Irrespective of the economic effect of natural disasters, it is plausible to assume that the fact that a natural disaster takes place at all is a signal of government incompetence in the eyes

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of the electorate, and a shock to the political system. Even a voter that did not blame the government for the hazardous event that triggered the natural disaster may hold it responsible for losses incurred and the quality of the relief effort. If so, we should observe a positive link between natural disasters and the turnover of governments.[1]

The study closest to the one presented in this paper is Quiroz Flores and Smith (2013). They explore whether natural disasters are linked to the tenure of individual leaders. The number of natural disasters is found to have a negative association with leader tenure in autocracies, but a positive one in democratic countries. Disaster related deaths, on the other hand, are negatively related to leader tenure in democracies, but not in autocracies. Their explanation is that democracies invest more in preventive measures, which limit the number of fatalities, since democratic leaders need to be supported by wider segments of the population. When people do die in democracies, leaders are punished.[2]

Cohen and Werker (2008) present a model on disaster prevention and discuss what determines the optimal level of investment from a government's perspective. Since disasters occur with some probability only, and then affects only parts of the country, governments, unlike households, will prefer palliative efforts (relief) to preventive effort. Further, the effective level of preparation is determined by averaging disaster risk over periods with and without disasters and over areas affected and not affected. A voter affected by a natural disaster is likely to find little comfort in the fact that preparations are on an efficient level on average. She may blame the incumbent administration for insufficient preparations.

A few studies have looked at presidential or mayoral elections in the USA. Abney and Hill (1966) study the aftermath of a hurricane in Louisiana, USA, in 1965, and its effect on a mayoral election in New Orleans. They find that the vote share of the incumbent mayor fell compared to the previous election, but that the magnitude of the fall was almost identical in areas affected and areas not affected by the resulting flood. Achen and Bartels (2004) find that voters punish the incumbent party in presidential elections in the USA for both droughts and wet spells. Arceneaux and Stein (2006) study what happened after a flood in Houston, USA, in 2001, and find that voters are willing to punish the mayor if they viewed the local government as responsible for (lack of) disaster preparation. Healy and Malhotra (2010) study voting in USA presidential elections 1952-2004, and find that incumbents are punished by voters for the economic damages caused by tornadoes.

In a study of elections in Colombia, Gallego (2012) argues that lethal floods and landslides, that resulted from the rainy season 2010-2011, benefited mayors belonging to the incumbent party. The mediating factor is clientelism, as there was an inflow of resources to affected areas that could be used for vote buying.

A more researched topic is the relationship between natural disasters and violent conflict. Natural disasters are typically found to be positively associated with violent conflict and social and political unrest (Olson and Drury 1997, Nel and Righarts 2008, Brancati 2007). It has been found that some natural disasters are followed by sentiments that constitute political motives

[1] Clark (2009) studies the effect of valence issues, which are issues on which everyone more or less agree, including the desirability of less crime, high growth, more honesty, competence, etc., and finds that they have a significant impact on party vote shares.

[2] While this interpretation is appealing, it still leaves open the question why disasters have a positive effect, rather than a zero effect, on tenure in democracies.

for rebellion, and a reasonable conjecture is that these also could trigger movements in the electorate. Examples include when governments are seen as passive in the face of disaster-induced deprivation, or that relief efforts, when such are undertaken, are seen as insufficient and discriminatory. Governments can be blamed for poor planning and lax enforcement of building codes, or of subjecting segments of the population to unjust forced relocation (OECD 2004, Kahl 2006, Schubert et al. 2007, Red Cross 2007).

There are also studies investigating the possible link to democratizing reforms. Brückner and Ciccone (2011) find that negative rainfall shocks, which may capture drought disasters, can create a window-of-opportunity that makes democratization more likely. Ahlerup (2013b) also finds a positive relationship, but only among countries with an intermediate regime type, and among countries that already are politically unstable and that receive humanitarian aid.

This paper employs a sample of all country-years between 1976 and 2007 with a competitive direct election of the executive to investigate if natural disasters are related to government turnover. We take number of steps to minimize the risk for invalid inference. Given the systematic differences in reported natural disaster across time and political system (Strömberg 2007), we are careful to always control for both unobserved heterogeneity and time trends. Our choice of natural resource indicator is made to limit endogeneity, and we use seismic data to instrument for geophysical disasters. We are the first to present evidence that natural disaster can drive the party of the executive out of office.

The rest of this paper is organized as follows. We discuss the data on government change and natural disasters in Section 2. The empirical framework and results are presented in Section 3. Section 4 concludes the paper.

2 Data

2.1 Government change

The Database on Political Institutions (Beck et al. 2001), contains information on when elections to the executive have taken place, the ideology of the party of the executive, and the degree of electoral competitiveness. We code our main dependent variable, *Government Change* as Alesina, Carloni, and Lecce (2012). *Government Change* is an indicator variable that takes the value 1 if and only if the ideology of the executive party changes from one year to the next. If the ideology does not change, it takes the value 0.

Alesina, Carloni, and Lecce (2012) note how this variable may underestimate change, as the executive (as individual) can be changed due to lack of popularity even if there is no change in the composition of the government. They also note that, on the other hand, an indicator of the change in president or prime minister, comparable to the end of a leader's tenure in Quiroz Flores and Smith (2013), may overestimate change, as there can be a routine change in prime minister in an otherwise stable government.

We follow Alesina, Carloni, and Lecce (2012) and include the following characteristics of the cabinet in our main specifications, all drawn from Beck et al. (2001). *Coalition* indicates that the government is formed by more than one political party. *Majoritarian* indicates whether the party of the executive controls all relevant houses. *Years in Office* indicates the number of years

the chief executive has been in office.

We focus on directly elected executives in countries where elections are competitive, in order to get as clean a signal of the voters' reactions as possible. Beck et al. (2001) provide an index for the degree of *Electoral Competitiveness* in executive elections. Our sample consists of all countries in which there was an election to an executive in a presidential system under competitive circumstances, which we take to be an *Electoral Competitiveness*-score of at least 6.

2.2 Natural disasters

We draw our indicators for natural disasters from the Emergency Events Database, EMDAT (2010), maintained by the Centre for Research on the Epidemiology of Disasters (CRED). For each disaster, the CRED includes as reliable information as possible on the number of people killed, the number of people affected (i.e., in need of direct assistance), and the estimated value of direct damages.[3] These direct losses are not good exogenous indicators of the strength of natural hazards. Instead, they are reflections of the varying vulnerability of human societies. Losses are ultimately determined by economic, political, and social factors (Kahn 2004, Strömberg 2007), wherefore it is problematic to use them as indicators in a study that attempt to assess the impact of natural disasters on some social, economic, or political outcome. A serious problem with this data is that there are systematic differences in reporting "across time, level of income, and political regimes" (Strömberg 2007:201). Additional problems include that data is often missing, and that continuous variables constructed from loss data are heavily skewed (Ahlerup 2013a).

We use the number of natural disaster events as our natural disaster indicator.[4] The main categories of natural disasters are *Biological*, *Climatological*, *Geophysical*, *Hydrological*, and *Meteorological*.[5] Our variable *Natural Disasters* refers to the sum of disasters in these categories.

Seismic activity is the ultimate natural force behind earthquakes and behind secondary event, such as tsunami, and can trigger volcanic eruptions and dry massmovements. Together, these form the category *Geophysical disasters*. To instrument for geophysical disasters, we draw data on the number of seismic events with a magnitude on Richter's magnitude scale of 6.5 or more from Allen et al. (2009). This variable is called *M6.5*. Seismic events with a magnitude of 6.5 can result in a quite severe disaster, even if also events with lower magnitude has led to reported

[3] To be included in the database, an event must meet at least one of the following criteria. There are 10 or more people are reported as killed, at least 100 people are reported as affected, a state of emergency is declared, or there is a call for international assistance.

[4] This has some important advantages (adapted from Ahlerup, 2013a), . First, the number of events is a less skewed variable than indicators of losses are. Second, the number of events is likely to be a less noisy indicator of the actual number of hazardous events caused by natural forces, than reported losses are of actual losses. Third, to the extent that political volatility co-determines disaster losses, we have less of an endogeneity problem if we instead include the count of the number of natural disasters. Fourth, we can use seismic data as an exogenous instrument to infer a causal link from geophysical disasters to government change. Fifth, even the most serious natural disasters typically have direct effects on a small fraction of the population. Therefore, it makes sense to view each natural disaster as an individual shock to the political system.

[5] Biological disasters include epidemics and insect infestations. Climatological disasters include instances of extreme temperature (cold waves, extreme winters, or heat waves), wildfires, and droughts. Geophysical disasters include earthquakes, tsunami, volcanic eruptions, dry mass movements (landslides, rockfall, debris flows, subsidences). Hydrological disasters include floods (flash floods, general floods, mudslides, storm surges, or coastal floods), and wet mass movements (avalanches). Meteorological disasters include storms (extratropical cyclones, winterstorms), local storms, and tropical cyclones.

geophysical natural disaster. A full description of all variables used in the paper, as well as their sources, can be found in the Appendix.

3 Empirical analysis

The sample consists of 58 countries between 1976 and 2007 in which there was an election to the executive, for a total of 212 observations. The ideology of the party of the executive changed in 34 percent of the observations. For reasons outline above, our focus lays on total number of all types of natural disasters, and on the number of geophysical disasters. On average, each country had 2.7 natural disasters any given year out of which 0.3 were geophysical, see Table I. The standard deviations show that there was a wide dispersion around the means. A natural disaster is reported in three out of four country-years, and a geophysical disaster in one out of six country-years.

The turn-over rate was higher among countries that experienced a geophysical disaster, 46 percent, than in countries that did not experience a geophysical disaster, 32 percent, and this drastic difference is statistically significant at the 10 percent level. Government change was marginally less frequent in countries that experienced at least one natural disaster (33.5 percent) than in countries that did not (35 percent), but the difference is not statistically significant.

[Table I about here]

The dependent variable is binary – either there was a change in the ideology in the party of the executive, or there was not. Models with a binary dependent are generally estimated either in a linear probability model (LPM) or in a non-linear model, such as Logit or Probit. The latter have advantages, such as forcing predicted probabilities to fall within the 0 to 1 range and giving marginal effects that vary over values on the explanatory variables. While non-linearity has an appeal, we have no *a priori* reason to expect that any of these non-linear forms are the correct one. Our choice of empirical model is further guided by our desire to control for unobserved heterogeneity and to use clustered standard errors, but also to be able to explicitly address endogeneity. Logit or Probit do not easily lend themselves to the inclusion of both fixed effects and instrument variables. In addition, marginal effects calculated from non-linear models with fixed effects have little meaning, so this particular general advantage of non-linear models is not relevant here. We therefore opt for the more transparent and versatile LPM framework in the bulk of the empirical analysis, but test whether the main results hold in non-linear models.

In the multivariate analysis we estimate variants of the following specification,

$$GovChange_{it} = \alpha + \beta_0 Natural\ Disasters_{it} + \mathbf{x}'_{it}\boldsymbol{\beta} + \nu_t + \mu_i + \epsilon_{it},$$

where *GovChange* is the change in ideology of the party of the executive from t to $t+1$ for country i, $Natural\ Disasters_{it}$ indicates the number of natural disasters during t, and $\mathbf{x}$ is a vector that includes *Polity2* (lagged once), *Coalition*, *Majoritarian*, *Years in Office*, *Log GDP per Capita* (lagged once), and *Economic Growth* from $t-1$ to t. ν_t represents time fixed effects

and ϵ_{it} is a general error term. Natural disasters are neither completely unpredictable nor truly random events, even if countries differ greatly in their natural vulnerability. In principle, LPM results could be driven only by between-country differences in disaster exposure and preparedness, rather than within-country variation in the number of natural disasters. To control for unobserved heterogeneity, we include country fixed-effects, μ_i.

Table II presents our main results. More natural disasters implies a higher probability of government change.[6] The result is the same in both LPM and Logit, see Columns 2 and 3.[7] The only other consistently significant variable is the level of democracy (*Polity2*), suggesting that more frequent turnover is a solid characteristic of more democratic countries. This finding is in line with Quiroz Flores and Smith (2013), who show that individual leaders are more likely to be replaced when there are more natural disasters.

All observations in the sample have an election to the executive. When we expand the sample to countries that do not have a directly elected executive, or where there was not an executive election, the coefficient for *Natural Disasters* no longer is significant (not reported). This indicates that what we find here is that the change in government is due to regular voting effects during election years, rather than through some other mechanism, such as a coup d'état.

The different categories of natural disasters are included separately in Columns 4 to 8. Government change is more likely after hydrological and geophysical disasters, but not after biological, hydrological, or meteorological disasters. An argument made in Ahlerup (2013b) is that these disaster categories differ in their degree of endogeneity to societal characteristics and in the seriousness of losses. Geophysical disasters are ultimately caused by tectonic forces beyond the control of even the most ambitious government. Hence, a potential explanation for the pattern in Table II is that disasters with a stronger exogenous component may have a stronger effect on the likelihood for government change. The pattern of losses is more complex, but there is no clear indication that the typical level of losses can explain the results in Table II.[8]

[Table II about here]

Is the effect of natural disasters the same in countries with weak and strong governments? One aspect of government strength that merits investigation is whether or not the government is formed by a coalition of parties. It is not clear *a priori* whether coalition governments are more likely to be voted out of office when a natural disaster strikes. The need for budget agreements that please parties with different agendas suggests that coalition governments may spend less on disaster prevention. Coalition governments could also be less decisive in their post-disaster actions due to internal disagreement. On the other hand, more parties in the government means

[6] All results for *Natural Disasters* in Tables II and III are robust to the exclusion of observations with many reported natural disasters (ten or more).

[7] The results are very similar when user use conditional Logit estimation with standard errors clustered by country.

[8] Climatological disasters typically affect a larger fraction of the population and are associated with more costly damages than other disasters. With the exception of biological disasters, such losses are lower in geophysical disasters than in any other type of disaster. The fraction of the population killed is, however, lower in Climatological and Geophysical disasters. See Table VII in Ahlerup (2013b).

that it is less clear who is responsible and who is to blame for lack of preparations or relief to affected individuals and regions.

We split the sample into one where the government is formed by a coalition of parties, and one where it is not, see Columns 1 and 2 of Table III. Natural disasters are less likely to be associated with government change in coalition governments. This is consistent with the idea that government change will be more likely when the burden of blame is more clear to voters.

Quiroz Flores and Smith (2013) find that individual leaders are less likely to be replaced after natural disasters in more democratic countries. To explore whether this is the case also for government parties, we construct an indicator for having a high *Polity2*-score (7 or higher), and include it interacted with *Natural Disasters* in Column 3. Government change is a less likely in democratic countries. The size of the coefficient for the interaction term almost matches that for *Natural Disasters*, implying that government change after natural disasters is something one may expect in countries with lower levels of democracy only.[9]

Direct losses in natural disasters are higher in poor countries, but neither the income level nor the level of economic growth decides if natural disasters result in a government being ousted or not. We have tested a wide range of different specifications, and this result seems quite robust.[10] This supports the idea that natural disasters can be seen as individual political shocks that can influence the probability for government change.

To investigate whether the actual ideology is affected, we create three variables, *Government Change to the Left/Center/Right*, that take the value 1 when the ideology of the executive party switches to the left, center, or right, respectively. We use these as alternative dependent variables in Columns 7 to 9 in Table III. Natural disasters are associated only with government changes to the right. Why this is the case merits further research.

[Table III about here]

There are good reasons to expect endogeneity to be an issue as hazardous natural events are more likely to become natural disasters in vulnerable environments. Factors such as a lack of democracy, excessively volatile (or stagnant) political environments, or low income levels, could affect voting patterns directly, or via other channels. We also have to consider that *Natural Disasters* is an imperfect indicator of relevant natural events due to over- or underreporting.

To circumvent the fundamental threat to identification from reversed causality, or simultaneity, we instrument for disaster events. The procedure involves first estimating

$$[Disaster\ Indicator]_{it} = \gamma_0 + \gamma_1 M6.5_{it} + \mathbf{x}'_{it}\boldsymbol{\beta} + \nu_t + \mu_i + \varepsilon_{it},$$

[9] We get the same result if we drop *Polity2* from the specification or if we set the cutoff for *Polity2* at 8 instead of 7. We also get the same result if we split the sample in two, one more democratic and one less democratic. Natural disasters is significant only in the latter sample. If we interact *Natural Disasters* and *Polity2* directly, the interaction term is not significant.

[10] We have interacted *Natural Disasters* with *Log GDP per Capita*, indicator variables for income levels higher than the mean, the median, or the 75th percentile, with *Economic Growth*, growth during the last 3 or 5 years, or with indicator variables for high or low growth. These interaction terms are never significant. Splitting the sample into countries with high or low income or growth never gives conclusive evidence that there is a difference in the probability for government change.

where [*Disaster Indicator*] is an indicator for geophysical disaster(s), and $M6.5_{it}$ captures seismic events. Seismic events cause earthquakes, tsunami, and dry massmovements, and may trigger volcanic eruptions. Together, they form the category geophysical disasters. Then, observed [*Disaster Indicator*] is replaced by predicted [*Disaster Indicator*] in a second stage,

$$GovChange_{it}^{IV} = \alpha + \beta_0 [\widehat{Disaster\ Indicator}]_{it} + \mathbf{x}'_{it}\boldsymbol{\beta} + \nu_t + \mu_i + \eta_{it}.$$

If the instruments are valid and informative, β_0 is consistently estimated.[11]

The results presented in Table IV confirm that natural disaster, here geophysical disasters, can have a causal effect on government turnover. One should be careful not to interpret this as evidence that there is a causal effect of all types of natural disasters. We need good instruments for other types of natural disasters in order to support such a claim.

For comparison, Column 1 repeats Column 8 of Table II, and Column 2 presents results from a Logit estimation.[12] Geophysical disasters are instrumented for in Column 3. The first stage works well and the second stage estimate is positive and significant at the 1 percent level. The estimated coefficient suggest that the true effect on the probability for government change is higher than what the standard LPM results implied.

[Table IV about here]

As placebo tests we replace *M6.5* with the number of seismic events during the year after or the year before. That this wipes out all significance from both first and second stages is reassuring – we are capturing that seismic events a certain year can cause geophysical natural disasters in that same year, and that this increases the probability that the party of the executive is voted out of office that particular year. To further test the instrument, we restrict the sample to countries that both experienced at least one seismic event and at least one geophysical disaster *any year* in the full 1976-2007 period. We also replace *Geophysical Disasters* with an indicator for experiencing at least one geophysical natural disaster. The overall results are confirmed.

4 Concluding Remarks

Natural disasters have recently attracted more attention also among social scientists, and have been found to be determinants of both economic growth and violent conflict. Less is known about whether they affect how citizens vote in competitive elections. Do they drive government parties out of office? This study finds that they do, but not in highly democratic countries. By employing seismic data as an instrument, it is established that the relatively strong impact of geophysical disasters is causal.

[11] For a general critique on the use of instruments, see Deaton (2010).

[12] There are 33 observations in the sample with at least one geophysical disaster. All result in Table IV are robust to excluding all countries with 3 or more geophysica disasters.

References

Abney, F.G. and Hill, L.B. (1966). Natural Disasters as a Political Variable: The Effect of a Hurricane on an Urban Election. *American Political Science Review*, 60(4): 974-981.

Achen, C. and Bartels, L. (2004). Blind Retrospection Electoral Response to Drought, Flu, and Shark Attacks. Working Paper, Princeton University.

Ahlerup, P. (2013a). Are Natural Disasters Good for Economic Growth? *mimeo*, University of Gothenburg.

Ahlerup, P. (2013b). Democratization in the Aftermath of Natural Disasters" *forthcoming* in "Globalisation and Development: Rethinking Interventions and Governance" (ed. A. Bigsten). Routledge.

Albala-Bertrand, J.M. (1993). *Political Economy of Large Natural Disasters: With Special Reference to Developing Countries*. Oxford: Clarendon Press.

Alesina, A., Carloni, D., and Lecce, G. (2012). The Electoral Consequences of Large Fiscal Adjustments. *mimeo*, Harvard University.

Allen, T.I., Marano, K., Earle, P.S., and Wald, D.J. (2009). PAGER-CAT: A composite earthquake catalog for calibrating global fatality models. *Seismological Research Letters*, 80(1):50-56.

Arceneaux, K. and Stein, R.M. (2006). Who is Held Responsible when Disaster Strikes? The Attribution of Responsibility for a Natural Disaster in an Urban Election. *Journal of Urban Affairs*, 28(1), 43-53.

Beck, T., G. Clarke, A. Groff, P. Keefer, and P. Walsh. 2001. New tools and new tests in comparative political economy: The database of political institutions. *World Bank Economic Review*, 15(1): 165-76.

Brancati, D. (2007). Political Aftershocks: The Impact of Earthquakes on Intrastate Conflict. *Journal of Conflict Resolution*, 51(5), 715-743.

Brückner, M., and Ciccone, A. (2011). Rain and the democratic window of opportunity. *Econometrica*, 79(3), 923–947.

Cavallo, E. and Noy, I. (2010). The Economics of Natural Disasters: A Survey. IDB Working Paper 124.

Clark, M. (2009). Valence and electoral outcomes in Western Europe, 1976–1998. *Electoral Studies*, 28: 111-122.

Cohen, C., and Werker, E.D. (2008). The Political Economy of 'Natural" Disasters'. *Journal of Conflict Resolution*, 52(6): 795-819.

Deaton, A. (2010). Instruments, Randomization, and Learning about Development. *Journal of Economic Literature*, 48:424-55.

EM-DAT (2010) The OFDA/CRED International Disaster Database, Université Catholique de Louvain, Brussels, Belgium. <Accessed 2010-09-21>.

Gallego, J. (2012). Natural Disasters and Clientelism: The Case of Floods and Landslides in Colombia. APSA 2012 Annual Meeting Paper.

Healy, A. and Malhotra, N. (2010). Random Events, Economic Losses, and Retrospective Voting: Implications for Democratic Competence. *Quarterly Journal of Political Science*, 2010, 5: 193–208

Heston, A., Summers, R., and Aten, B. (2009). Penn World Table Version 6.3, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Kahl, C. H. (2006). *States, Scarcity, and Civil Strife in the Developing World*. Princeton: Princeton University Press.

Kahn, M.E. (2004). The death toll from natural disasters: the role of income, geography, and institutions. *Review of Economics and Statistics*, 87(2):271-284.

Lewis-Beck, M. S., and Stegmaier, M. (2000). Economic Determinants of Electoral Outcomes. *Annual Review of Political Science*, 3:183–219

Loayza, N., Olaberría, E., Rigolini, J., and Christiaensen, L. (2009). Natural Disasters and Growth: Going Beyond the Averages. World Bank Policy Research Working Paper 4980.

Marshall, M.G. and Jaggers, K. (2002). Polity IV Project: Political Regime Characteristics and Transitions, 1800-2002, University of Maryland. <Accessed 2010-11-29>.

Nadeau, R. Lewis-Beck, M.S., and Belénger, É. (2012, forthcoming). Economics and Elections Revisited. *Comparative Political Studies*.

Nel, P. and Righarts, M. (2008). Natural Disasters and the Risk of Violent Civil Conflict. *International Studies Quarterly*, 52(1):159-185.

Noy, I. (2009). The macroeconomic consequences of disasters. *Journal of Development Economics*, 88:221–231.

OECD. (2004). *Large-Scale Disasters: Lessons Learned*. Paris: OECD.

Olson, R.S., and Drury, A.C. (1997). Un-therapeutic communities: a cross-national analysis of post-disaster political unrest. *International Journal of Mass Emergencies and Disasters*, 15, 221–238.

Quiroz Flores, A. and Smith, A. (2013, forthcoming). Leader Survival and Natural Disasters. *British Journal of Political Science*.

Red Cross (2007). *World Disaster Report*. Geneva: International Federation of the Red Cross/Red Crescent Society.

Schubert, R., Schellnhuber, H.J., and Buchmann, N. (2007). Climate Change as a Security Risk. London: Earthscan Publications.

Strömberg, D. (2007). Natural Disasters , Economic Development, and Humanitarian Aid. *Journal of Economic Perspectives*, 21(3):199-222.

Toya, H., and Skidmore, M. (2007). Economic Development and the impacts of natural disasters. *Economic Letters*, 94, 20-25.

Appendix

Variable Descriptions

Dependent variables

Government Change. Indicator variable that takes the value 1 if and only if the ideology of the executive's party changes from 1 January year t to 1 January year $t+1$. If the ideology is unchanged from t to $t+1$, the variable takes the value 0. Source: Beck et al. (2001).

Government Change to the Left. Indicator variable that takes the value 1 if and only if the ideology of the executive's party changes to Left from 1 January year t to 1 January year $t+1$. If the ideology is unchanged from t to $t+1$, the variable takes the value 0. Coded for countries in which the ideology of party of the executive 1 January year t is either Center or Right. Source: Beck et al. (2001).

Government Change to the Center. Indicator variable that takes the value 1 if and only if the ideology of the executive's party changes to Center from 1 January year t to 1 January year $t+1$. If the ideology is unchanged from t to $t+1$, the variable takes the value 0. Coded for countries in which the ideology of party of the executive 1 January year t is either Left or Right. Source: Beck et al. (2001).

Government Change to the Right. Indicator variable that takes the value 1 if and only if the ideology of the executive's party changes to Right from 1 January year t to 1 January year $t+1$. If the ideology is unchanged from t to $t+1$, the variable takes the value 0. Coded for countries in which the ideology of party of the executive 1 January year t is either Left or Center. Source: Beck et al. (2001).

Political and economic indicators

Coalition. Indicates that the government is formed by more than one political party. The variable takes the value 0 if only one government party is recorded, and 1 if more than one government party is recorded. Source: Beck et al. (2001).

Economic Growth. Annual growth rate of *Log GDP per capita* from year $t-1$ to t, in percent. Source. Heston et al. (2009).

Electoral Competitiveness. Executive index of electoral competitiveness. Source: Beck et al. (2001).

Highly Democratic. Observations with a (lagged) *Polity2*-score of 7 or more. Source: Marshall and Jaggers (2002).

Log GDP per capita. The natural log of real gross domestic product per capita, in year 2000 prices. This variable is lagged once when included in the specifications. Source. Heston et al. (2009).

Majoritarian. Takes the value 1 if and only if the party of the executive have an absolute majority in the houses that have lawmaking powers. If not, the variable takes the value 0. Source: Beck et al. (2001)

Polity2. The revised combined Polity-score. Possible range is from -10 to 10. This variable is lagged once when included in the specifications. Source: Marshall and Jaggers (2002).

Years in Office. The number of years the chief executive has been in office. The variable takes the value 1 for the year that follows the executive's election. Source: Beck et al. (2001).

Natural disaster indicators

Biological disasters. The total number of biological disasters (epidemics and insect infestations) reported. Source: EMDAT (2010).

Climatological disasters. The total number of climatological disasters (extreme temperatures, wildfire, and droughts) reported. Source: EMDAT (2010).

D[Geophysical Disaster≥1]. An indicator variable that takes the value 1 if and only if *Geophysical Disasters* is one or more, and 0 if there are zero *Geophysical Disasters.*

Geophysical disasters. The total number of geophysical natural disasters (earthquake, tsunami, volcanic eruptions, landslides, rock falls, debris flows, and subsidence) reported. Source: EMDAT (2010).

Hydrological disasters. The total number of hydrological natural disasters (flash floods, general flood, general floods, mudslides, storm surges, coastal floods, and avalanches) reported. Source: EMDAT (2010).

M6.5. Number of seismic events at time t with a Richter's scale magnitude$\geq$ 6.5. Source: Allen et al. (2009).

Meteorological disasters. The total number of meteorological disasters (storms and cyclones) reported. Source: EMDAT (2010).

Natural disasters. Number of any type of natural disaster (biological, climatological, hydrological, geophysical, and meteorological) reported. Source: EMDAT (2010).

Tables

TABLE I
DESCRIPTIVE STATISTICS

	N	Mean	St.Dev.	Min.	Median	Max
Dependent Variables:						
GovChange	212	0.340	0.475	0	0	1
GovChangeLeft	136	0.169	0.376	0	0	1
GovChangeCenter	117	0.068	0.253	0	0	1
GovChangeRight	136	0.140	0.348	0	0	1
Political and Economic Indicators:						
Coalition	212	0.363	0.482	0	0	1
Electoral Competitiveness	212	6.830	0.357	6	7	7
Majoritarian	212	0.547	0.499	0	1	1
Polity2	212	4.774	5.296	-8	7	10
Years in Office	212	7.297	6.337	1	5	38
Economic Growth	212	2.337	5.263	-17.895	2.037	39.597
Log GDP per capita	212	8.488	0.891	6.496	8.547	10.589
Disaster Indicators:						
Biological Disasters	212	0.245	0.672	0	0	4
Climatological Disasters	212	0.330	0.895	0	0	10
D[Geophysical Disasters≥1]	212	0.156	0.363	0	0	1
Geophysical Disasters	212	0.264	0.713	0	0	4
Hydrological Disasters	212	1.009	1.428	0	0	8
Meteorological Disaster	212	0.825	2.859	0	0	27
M65	212	0.255	0.696	0	0	5
Natural Disasters	212	2.675	4.318	0	1	32

TABLE II

ELECTORAL CONSEQUENCES OF NATURAL DISASTERS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Dependent Variable is GovChange				
Natural Disasters		0.032**	0.186*					
		(0.016)	(0.109)					
Biological Disasters				-0.039				
				(0.047)				
Climatological Disasters					0.082***			
					(0.029)			
Hydrological Disasters						-0.001		
						(0.033)		
Meteorological Disasters							0.022	
							(0.018)	
Geophysical Disasters								0.202***
								(0.068)
Polity2	0.030**	0.035***	0.335**	0.029**	0.030**	0.030**	0.032***	0.032***
	(0.012)	(0.011)	(0.160)	(0.012)	(0.012)	(0.012)	(0.012)	(0.010)
Coalition	-0.120	-0.123	-0.654	-0.120	-0.129	-0.120	-0.129	-0.069
	(0.098)	(0.096)	(0.615)	(0.098)	(0.095)	(0.098)	(0.098)	(0.093)
Majoritarian	-0.040	-0.025	0.051	-0.037	-0.046	-0.040	-0.032	-0.028
	(0.092)	(0.088)	(0.751)	(0.091)	(0.089)	(0.092)	(0.090)	(0.089)
Years in Office	0.009	0.010*	0.041	0.009	0.008	0.009	0.010*	0.009
	(0.006)	(0.005)	(0.117)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Log GDP per Capita	0.348*	0.302	-0.080	0.346*	0.302	0.349*	0.343*	0.400*
	(0.208)	(0.210)	(2.866)	(0.209)	(0.211)	(0.206)	(0.208)	(0.210)
Economic Growth	0.002	0.003	0.004	0.001	0.003	0.002	0.002	0.001
	(0.008)	(0.008)	(0.062)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Observations	212	212	128	212	212	212	212	212
Countries	58	58	29	58	58	58	58	58
R^2	0.05	0.08		0.05	0.07	0.05	0.06	0.11

Notes:

In parenthesis are standard errors, clustered by country and robust to heteroskedasticity in Columns 1, 2, and 4-8. Column 3 reports ordinary standard errors. *** / ** / * indicate p-values below 0.01 / 0.05 / 0.1. In Columns 1, 2, and 4-8 coefficients are efficient for arbitrary heteroskedasticity and clustering on country. Columns 1, 2, and 4-8 are estimated in linear probability models with GMM. Column 3 is estimated with Logit and reports estimated Logit coefficients. All specifications include country and year fixed effects. The sample period is 1976-2007. The full sample consists of all available country-years where an election to the executive was held in a presidential system with a high degree of electoral competetiveness (Electoral competetivenes$\geq$ 6).

TABLE III

MECHANISMS

Sample	(1) No Coal.	(2) Coal.	(3) Full	(4) Full	(5) Center/Right	(6) Left/Right	(7) Center/Left
Dependent Variable is:			*GovChange*		*GovChangeLeft*	*GovChangeCenter*	*GovChangeRight*
Natural Disasters	0.041**	-0.019	0.086***	0.013	0.011	0.005	0.030***
	(0.021)	(0.055)	(0.029)	(0.136)	(0.011)	(0.007)	(0.010)
Strong Democracy			0.084				
			(0.210)				
Natural Disasters ×			-0.060**				
Strong Democracy			(0.030)				
Natural Disasters ×				0.002			
Log GDP per Capita				(0.014)			
Polity2	0.011	0.018	0.036*	0.035***	-0.018	0.019*	0.049***
	(0.013)	(0.021)	(0.018)	(0.012)	(0.022)	(0.011)	(0.012)
Coalition			-0.105	-0.124	0.012	0.110	0.069
			(0.095)	(0.096)	(0.129)	(0.123)	(0.118)
Majoritarian	-0.183**	0.651	-0.037	-0.027	-0.222***	-0.037	0.100
	(0.077)	(0.440)	(0.088)	(0.088)	(0.077)	(0.068)	(0.101)
Years in Office	-0.007	-0.022	0.010*	0.010*	-0.015	0.012**	0.019***
	(0.009)	(0.023)	(0.006)	(0.006)	(0.011)	(0.006)	(0.007)
Log GDP per Capita	-0.018	-2.184	0.309	0.295	-0.392	0.375**	0.540**
	(0.268)	(1.417)	(0.218)	(0.217)	(0.295)	(0.184)	(0.218)
Economic Growth	-0.001	-0.006	0.004	0.003	0.007	0.002	-0.011
	(0.006)	(0.020)	(0.007)	(0.008)	(0.008)	(0.006)	(0.010)
Observations	118	60	212	212	129	110	129
Countries	33	21	58	58	32	29	32
R^2	0.12	0.24	0.10	0.08	0.08	0.12	0.17

Notes:

In parenthesis are standard errors, clustered by country and robust to heteroskedasticity. *** / ** / * indicate p-values below 0.01 / 0.05 / 0.1. Coefficients are efficient for arbitrary heteroskedasticity and clustering on country. All specifications include country and year fixed effects and are estimated in linear probability models with GMM. The sample period is 1976-2007. The full sample consists of all available country-years where an election to the executive was held in a presidential system with a high degree of electoral competetiveness (Electoral competetivenes$\geq$ 6). (No) Coal. are observations where there was (not) a coalition government. The sample in Column 5 consists of all observations in the full sample where the ideology of the party of the executive in the present period is either Center or Right. The sample in Column 6 consists of all observations in the full sample where the ideology of the party of the executive in the present period is either Left or Right. The sample in Column 7 consists of all observations in the full sample where the ideology of the party of the executive in the present period is either Center or Left.

TABLE IV

GEOPHYSICAL DISASTERS AND INSTRUMENTAL VARIABLES ESTIMATIONS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sample	Full	Full	Full	Full	Full	Q-Countries	Full	Full	Q-Countries
					Dependent Variable is GovChange				
Geophysical Disasters	0.202***	1.247**	0.318***	0.593	-2.786	0.344***			
	(0.068)	(0.575)	(0.096)	(0.627)	(5.946)	(0.102)			
D[Geophysical Disasters≥1]							0.293*	0.845***	0.816**
							(0.157)	(0.315)	(0.321)
Polity2	0.032***	0.244*	0.033***	0.036***	0.004	0.048***	0.030***	0.029***	0.042**
	(0.010)	(0.142)	(0.010)	(0.011)	(0.098)	(0.017)	(0.011)	(0.010)	(0.017)
Coalition	-0.069	-0.206	-0.039	0.030	-0.823	0.154	-0.067	0.032	0.281
	(0.093)	(0.665)	(0.096)	(0.206)	(1.413)	(0.136)	(0.095)	(0.115)	(0.183)
Majoritarian	-0.028	-0.167	-0.021	-0.006	-0.200	0.040	-0.028	-0.005	0.042
	(0.089)	(0.726)	(0.092)	(0.111)	(0.563)	(0.128)	(0.089)	(0.098)	(0.129)
Years in Office	0.009	0.007	0.009	0.009	0.006	-0.005	0.008	0.007	-0.009
	(0.006)	(0.112)	(0.006)	(0.007)	(0.032)	(0.023)	(0.006)	(0.007)	(0.028)
Log GDP per Capita	0.400*	1.642	0.430**	0.501*	-0.368	0.819**	0.350*	0.354	0.556
	(0.210)	(2.703)	(0.213)	(0.283)	(1.780)	(0.398)	(0.207)	(0.223)	(0.433)
Economic Growth	0.001	0.006	0.000	-0.001	0.016	-0.006	0.001	-0.001	-0.012
	(0.008)	(0.060)	(0.008)	(0.009)	(0.027)	(0.013)	(0.008)	(0.009)	(0.015)
					First Stage Results				
Endogenous Variable					*Geophysical Disasters*			*D[Geophysical Disasters≥1]*	
Exogenous Instrument			*M6.5*	Future *M6.5*	Lagged *M6.5*	*M6.5*		*M6.5*	*M6.5*
Estimate (Exog. Instrument)			0.538***	-0.128	0.036	0.601***		0.203***	0.253***
			(0.078)	(0.114)	(0.082)	(0.105)		(0.036)	(0.055)
Partial R^2 in first stage			0.353	0.021	0.001	0.351		0.185	0.222
F(Excluded Instrument)			47.56	1.25	0.19	32.87		32.18	20.83
Observations	212	128	212	212	212	116	212	212	116
Countries	58	29	58	58	58	25	58	58	25
R^2	0.11						0.08		

Notes:

In parenthesis are standard errors, clustered by country and robust to heteroskedasticity in Columns 1, 3-9. Column 2 reports ordinary standard errors. *** / ** / * indicate p-values below 0.01 / 0.05 / 0.1. Results in Columns 1, and 3-9 are estimated in linear probability models with GMM, and reporeted coefficients are efficient for arbitrary heteroskedasticity and clustering on country. Column 2 is estimated with Logit and reports estimated Logit coefficients. In Columns 3-6 and 8-9, the endogenous geophysical disaster indicators (see each column) are instrumented for with indicators of seismic events data (see each column). All other variables from the second stage are always included also in the first stage. All specifications include country and year fixed effects. The sample period is 1976-2007. The full sample consists of all available country-years where an election to the executive was held in a presidential system with a high degree of electoral competetiveness (*Electoral Competetiveness≥6*). Q-Countries means that only countries that experienced both at least one siesmic event of a magnitude 6.5 or greater and at least one geophysical disaster during the sample period are included in the sample.