Expecting the Unexpected: Disaster Risks and Conflict

Muhammet A. Bas
Department of Government
Harvard University

Elena V. McLean
Department of Political Science
University at Buffalo, SUNY

Abstract

This study examines the effect of rational expectations regarding future natural disasters on conflict. We argue that anticipated disasters can make conflict more likely. This relationship emerges because expected future disasters could imply resource shocks that shift the relative power balance and generate commitment problems among groups even before any disasters take place. Our approach represents a significant shift of focus from previous research, which investigates the effect of actual disasters, and ignores rational expectations regarding future events. We use a game-theoretic model to highlight the commitment problem that emerges in the presence of anticipated disasters and the resulting increase in conflict likelihood. We then discuss and apply an empirical strategy enabling us to disentangle effects of disaster events from effects of disaster proneness. Our results indicate that greater disaster risks are indeed associated with higher likelihoods of intra- and inter-state conflict.

Word Count: 9,509

Do natural disasters have a pacifying effect on international relations and domestic politics, or do environmental shocks fuel discord and violence? These questions are certainly not new, and their relevance stretches far beyond recent history to significant events in the distant past, such as the rapid rise and expansion of the Mongol empire under Genghis Khan's rule. While established accounts for years focused on droughts and scarcities as the cause of the expansion, an alternative explanation has recently established that the wave of Genghis Khan's conquests did not take place because the Mongols were forced to migrate due to severe droughts (Fagan, 2008). Quite on the contrary, that was the time of mild temperatures and abundant rainfall (Pederson et al., 2014). According to this account, the Mongols took advantage of the favorable conditions, which lasted for fifteen years and allowed the cavalry force to increase the number and quality of their horses – the means of transportation critical to the Mongols' successful military attacks. Hence, the conventional wisdom that this conflict episode can be linked to natural disasters and their costs must be rejected, since new evidence indicates that Genghis Khan's conquests took place during the spell between droughts.

This paper provides a theoretical framework to shed new light on cases like the Mongols' military expansion and to answer the broad questions regarding the relationship between disasters and conflict. Specifically, we conceptualize natural disasters as a form of resource shocks that affect groups' future capabilities, and emphasize rational expectations that vulnerable groups form about potential future disasters. We argue that when anticipated, such shocks can generate a commitment problem before their arrival, which has been linked to an increased likelihood of inter-group conflict (Fearon, 1995; Powell, 2006; Bas and Coe, 2012). Commitment problems represent one reason why peaceful bargaining fails and costly conflict ensues among rational groups. When applied to natural disasters, the logic of commitment problems suggests that, if disaster costs are expected to shift the relative power balance in a given country or among states in a region in favor of the groups that are less likely to be af-

fected by disasters, populations that reside in more disaster-prone areas could anticipate that they will become relatively weaker in the future. This expectation may make it preferable for the vulnerable groups to attack with the goal of taking over resources and territory of other groups, or possibly eliminating them altogether in competition for scarce resources before such disasters occur. Following this logic, Genghis Khan's decision to initiate his conquests can be at least partly attributed to the anticipated return of droughts and scarcities that threatened to weaken Mongol tribes' military capabilities relative to their level under more favorable weather conditions. Genghis Khan benefited from this temporary favorable shift in his military capabilities and took advantage of it by extending his control over vast stretches of land. His successful conquests allowed him to prevent a reversal in the Mongols' military capabilities upon the return of drought conditions. More broadly, this approach suggests that disaster proneness should be positively associated with conflict, and empirical analyses of the link between disasters and conflict should take such expectations into account.

Beyond elucidating the disaster-conflict link in individual cases, our study broadly contributes to a long-standing debate: despite decades of scientific debates, scholars have failed to reach a consensus on the nature of the relationship between disasters and conflict. Some studies show that environmental shocks lead to conflict initiation and/or escalation (Drury and Olson, 1998; Kahl, 1998; Reuveny, 2002; Brancati, 2007; Nel and Righarts, 2008). Others disagree and argue that disasters can, in fact, consolidate societies and offer opportunities for ending conflict (Quarantelli and Dynes, 1976; Kelman and Koukis, 2000; Evin, 2004). A third strand of literature, however, questions the relationship between disasters and conflict by pointing out that environmental shocks are likely to encourage people to find solutions to resource shortages through advancements in technology and efficiency. This would suggest that disasters may not influence conflict propensity at all (Deudney, 1990; Levy, 1995; Simon, 1996; Salehyan, 2008).

Our contribution to this research is to draw attention to the role that expectations play in the relationship between disasters and conflict. Previous studies that have reached different conclusions mainly consider the short- or long-term impacts of *actual* disasters, which are implicitly treated as isolated individual events that do not appear to trigger any learning in the affected populations. In other words, these studies assume that populations only *react* to environmental shocks, but do not form or act upon expectations regarding the likelihood of future disasters, regardless of the frequency of such shocks in the past. We argue that people in fact form such expectations, and under certain conditions, decision-makers can *proactively* take preemptive measures based on the expectations. Therefore, anticipation of future environmental shocks should be considered an important potential determinant of conflict behavior.

This blind spot is particularly notable, given that other areas of research have long recognized the importance of rational expectations. Decades of monetary policy research include the public's rational expectations about price levels as a significant factor in explaining policy outcomes (Sargent and Wallace, 1975; Barro, 1976). Scholars of American politics have identified voters' expectations about future levels of business conditions in the country as an important determinant of voters' approval of the president (MacKuen, Erikson and Stimson, 1992; Erikson, MacKuen and Stimson, 2000). Studies of financial markets also find that financial actors' expectations regarding the government's fall or the new government's policies drives their behavior, one example of which is speculative attacks (Leblang and Bernhard, 2000; Leblang, 2002). Likewise, in this paper we aim to address the oversight in the study of natural disasters and conflict by investigating the influence of rational expectations about future events and about the consequences of these events for relations between different domestic groups or states.

To test our theoretical expectations, we first conduct Monte Carlo analyses to identify an

appropriate empirical strategy for disentangling the effect of disaster expectations from that of actual disasters, which leads us to focus on the effect of disaster risks in years without disaster events. We then conduct two sets of empirical tests: one relies on replication data from two extant studies of intrastate conflict, while the other uses Militarized Interstate Disputes (MIDs) data on interstate conflict. Our empirical findings provide evidence supportive of the hypothesized positive relationship between anticipated natural disasters and conflict.

Environment and Conflict: An Ongoing Debate

Existing studies investigating the effect of disasters on conflict have drawn diverging conclusions. A number of studies suggest that natural disasters may have a pacifying effect domestically and internationally. When disasters strike, they may reduce the likelihood of conflict by serving as a focal point for cooperation in the aftermath of an environmental shock and reducing the relevance of other potential sources of conflict (Kelman and Koukis, 2000; Quarantelli and Dynes, 1976; Evin, 2004). In addition, natural disasters can damage the capacity of countries or subnational groups to engage in conflict. Moreover, reduced military capacity, as well as demand for disaster relief, may increase the government's willingness to settle ongoing civil conflicts (Kreutz, 2012).

At the same time, there is an equally large amount of research indicating that environmental shocks may have the opposite effect. Disasters, especially sudden and severe, appear to increase the likelihood or intensity of conflict because they reduce economic resources available to the affected population and negatively affect economic development (Miguel, Satyanath and Sergenti, 2004) and destroy the government's ability to provide public goods to the population and to suppress violence. Resulting shortages of scarce resources and hence deprivations in the affected population can then trigger violence either domestically

or at the international level as affected groups seek to get access to territories with resources that could make up for the disaster-related losses (Homer-Dixon, 1994, 2001; Kahl, 1998; Reuveny, 2002; Brancati, 2007; Nel and Righarts, 2008; Gleditsch, 1998). Intrastate and interstate conflict may also become more likely because environmental shocks can alter the relative size of fighting costs and expected benefits of fighting: costly conflict can become an attractive option if a population struck by a natural disaster faces the trade-off between peaceful starvation and fighting to gain new territory, which induces risk-acceptant behavior by the group. Similarly, exogenous shocks to resources could lower the opportunity cost of conflict and make conflict a more attractive option (Chassang and i Miquel, 2009).

Some scholars disagree with the assessment that natural disasters are linked to conflict and report non-findings in their investigations of the relationship between environmental shocks and conflict likelihood (Theisen, Holtermann and Buhaug, 2011; Nardulli, Peyton and Bajjalieh, 2015). One of the criticisms of existing research is that it overlooks the possibility that scarcities of resources generated by natural disasters may force affected people to use the remaining resources more efficiently. In addition, disaster-prone societies may seek to adapt by improving their policies and technology in response to environmental shocks, thereby reducing or eliminating deprivations in the aftermath of disasters (Simon, 1996). These adaptation and mitigation mechanisms may undermine the hypothesized relationship between natural disasters and conflict. Therefore, the causal link between environmental shocks and conflict is likely to be more complex than many studies acknowledge and depend on intervening political and socioeconomic factors (Bernauer, Bohmelt and Koubi, 2012).

Disaster Risks as a Determinant of Conflict

As our brief research overview suggests, despite disagreements over the impact of indi-

vidual disaster events, these studies share one assumption. The impact of a disaster is to be expected and measured in the aftermath of this disaster, either in the near term or in the long run. Hence, conflict behavior is mostly reactive in that actors respond to actual disaster losses. One critical effect that the literature appears to overlook is the effect of disasters on rational actors' expectations.[1] The populations of areas that frequently experience environmental shocks should learn that such shocks occur with regularity and, hence, are likely to take place in the future. Once disaster expectations are formed, they must enter the decision-making processes when it comes to interactions among groups or states. In other words, if a group fears that it will lose its bargaining power as a result of a future disaster and will have to settle for a smaller share of resources, the group may proactively initiate conflict.[2]

The game theoretical model, presented below, summarizes this argument formally, while

[1]Numerous examples of decision-makers' reactions to disaster events highlight the anticipation of future disasters. After Hurricane Sandy that affected the northeastern region of the United States, for instance, New York City Mayor Bloomberg pointed out that he anticipated even more severe environmental shocks in the future, as he introduced a plan to prepare New York City for future disasters: "As bad as Sandy was, future storms could be even worse... In fact, because of rising temperatures and sea levels, even a storm that's not as large as Sandy could, down the road, be even more destructive." (Bagley and Gallucci, 2013).

[2]Vulnerable groups may also seek to pursue disaster preparedness strategies. In fact, countries attempt to coordinate such efforts at the international level – through the UN Office for Disaster Risk Reduction, which was created in 1999 to provide support for the implementation of the International Strategy for Disaster Reduction. However, the most recent Global Assessment Report on Disaster Risk Reductions indicates that countries severely underinvest in these programs (www.preventionweb.net/gar).

here we discuss the assumptions and intuition behind it. We start with the observation that natural disasters often reduce the availability of resources in the country or region where such disasters occur. An important outcome of such a shock occurs when one country or group experiences larger disaster-related losses relative to others: the result is a relative shift in groups' capabilities. This relative shift has similar implications at the international and subnational levels. Although disaster relief may mitigate this effect, previous studies indicate that (actual or perceived) inequitable allocation of such assistance could nullify pacifying effects of assistance. For instance, governments may choose to reallocate remaining resources and forego relief efforts if the groups that are not affected by disasters have more influence over their governments' policies. Similarly, one of the countries in the affected region may conclude that international humanitarian aid does not provide an adequate compensation for its diminished capabilities. Note, however, that we do not view actual damage and economic losses associated with disaster events that have already taken place as the main mechanism that incentivizes groups in disaster-prone areas to take action. We view individuals and groups as forward-looking rational actors who form expectations about the likelihood of environmental shocks. These actors will then decide on the best course of action when a dispute arises, which may involve conflict, given their expectations about the future. From this perspective, environmental shocks matter because they affect actors' expectations of future natural disasters and this, in turn, influences their decision-making regarding conflict initiation.

We focus on a commitment problem generated by these rational calculations: if one group feels that future environmental shocks will significantly diminish its capabilities and weaken its position relative to others, the threatened group may initiate conflict against its future potential opponents while it is still in a relatively strong position. This is because the groups that expect to get relatively stronger after disasters in the future cannot credibly commit to not using their future strength against their weakening rivals to acquire more resources.

The implication of this argument is that groups may not wait until an actual disaster strikes to initiate conflict. Our argument suggests that disaster costs do not need to materialize before groups can preemptively mobilize for political violence, even though disasters can also provide opportunities for such mobilization (Nel and Righarts, 2008).

Similarly, we expect disaster-prone regions of the world to experience more inter-state conflict. Even though countries may prefer to settle on some allocation of scarce resources peacefully to avoid paying the costs of fighting, the country that is expected to become relatively stronger due to environmental shocks cannot credibly commit to upholding this resource allocation when the power balance shifts in its favor. Knowing this, the country whose power will weaken in the future as a result of environmental shocks has an incentive to take advantage of its current stronger position. This means that the weakening country will prefer to initiate conflict in the present to seize control of more resources or eliminate its opponent altogether, rather than wait for its power to wane and its opponent to become more powerful in the future. Therefore, areas that tend to experience more frequent environmental shocks should, on average, experience more conflict, all else being equal.

A Model of Disaster Expectations and Conflict

We formalize our argument by developing a simple game theoretical model. The model allows us to elucidate the causal mechanism that links expectations about future disasters to conflict. Consider the interaction between two groups in a region, A_1 and A_2, which bargain over the division of an infinite flow of benefits, represented by the unit interval [0,1]. The groups may represent two countries, or ethnic groups residing in the same country, and our conclusions regarding conflict behavior apply to inter-state, as well as intra-state, conflicts. The benefits that A_1 and A_2 bargain over could represent, for instance, physical resources, the control of government, or territory. Assume that in each discrete time period, A_1 makes

a take it or leave it offer to A_2 to divide that period's benefits. If A_2 accepts the offer, the division is implemented immediately. If A_2 rejects, war ensues, which is modeled as a costly, game ending lottery. The military capabilities of each group are represented by m_1 and m_2, respectively, with $m_i > 0$. A_1 wins the war with probability $p = \frac{m_1}{m_1+m_2}$, and loses with $1-p = \frac{m_2}{m_1+m_2}$. The winner receives all the benefits in the present and all future periods; the loser receives nothing. Each player also pays a per period war cost of c_1 and c_2, respectively, in every period.[3]

To incorporate the possibility of future disasters, suppose that in period 2, a disaster hits the region with probability α. Suppose that the disaster affects the two groups unequally. Without loss of generality, assume that A_1 and A_2's capabilities decrease permanently with the remaining percentages represented by λ_1 and λ_2, respectively, where $\lambda_1 > \lambda_2$, and $\lambda_i \in [0, 1]$. This assumption can be thought of as A_1 living in a less disaster prone area compared to A_2, or if within the same country, A_1 controlling the government and thereby having easier access to disaster relief funds, or A_1 using international disaster relief to prioritize their own supporters. For instance, a region in the southern Philippines, which is populated by minority Muslim groups, experienced disproportionate damage from natural disasters, such as storms and floods. The economic impact of the disasters, including a significant number of displaced people and destroyed infrastructure, has weakened the region relative to the central government, which likely affected the region's struggle for autonomy.[4] Another example illustrates the situation when the government shifts disaster assistance towards areas populated by its supporters. Amnesty International found evidence of ethnic discrimination in the aftermath of the 2015 earthquake in Nepal. The government not only provided less relief to these groups, including the Janajati, but also denied access to UK helicopters that

[3]We assume that $0 \leq c_1 \leq p$ and $0 \leq c_2 \leq 1 - p_d$, as defined below.

[4]For more information, see `http://www.trust.org/spotlight/Philippines-Mindanao-conflict/?tab=briefing`.

attempted to deliver aid to these communities.[5]

Thus, when a disaster takes place, the balance of power between the two groups shifts in favor of A_1 from p to $p_d = \frac{\lambda_1 m_1}{\lambda_1 m_1 + \lambda_2 m_2} > p$, since $\lambda_1 > \lambda_2$. Suppose that, for simplicity of exposition, no future disasters take place from period 3 and onwards.[6] This parameterization captures both disasters' severity and their unequal effects on the two groups. For minor disasters, for instance, both λ_1 and λ_2 are close to 1. For major disasters with significant asymmetric effects on the two groups, $\frac{\lambda_2}{\lambda_1}$ becomes smaller, until it approaches zero in extreme cases.

We assume that the groups' utilities are linear in present benefits, i.e., for any share of x_i, $U_i(x_i) = x_i$. A_1's share represents settlements, i.e., x represents A_1 and A_2 receiving $(x, 1-x)$, respectively. The players discount future by $\delta \in [0, 1)$. We assume that all the exogenous parameters of the game and actor preferences are common knowledge.

Since this is a game of complete information, we focus on Subgame Perfect Equilibria (SPE). Below, we first show that the subgame in period 2, when a disaster may hit, has a unique equilibrium in which no war occurs. We then show the equilibrium behavior in the first period when no disasters have yet taken place, and specify the conditions for war occurrence. The appendix provides proofs of all propositions.

Proposition 1. *If a disaster hits in period 2, the two sides immediately reach a permanent settlement at $x = p_d + c_2$. If no disaster takes place, the groups immediately agree to $x = p + c_2$ in period 2 and all future periods. No war occurs in this or any future periods.*

[5] The report is available at https://www.amnesty.org/en/documents/ASA31/1753/2015/en/.

[6] We focus on this setup for simplicity of exposition. Relaxing this assumption by allowing disasters to take place in any period with some probability would not change the substantive results presented below.

Intuitively, since a disaster can only strike in period 2, no future shifts in the balance of power is possible in period 3 or later. Thus, whether or not a disaster occurs in round 2, the players find a settlement that they both prefer to a costly war. When a disaster hits, the settlement favors A_1 more, as this group becomes relatively stronger in the disaster aftermath. Moreover, the more severe the disaster's impact is for A_2, the better A_1 expects to do in peaceful bargaining for the rest of the game.

Proposition 2. *In period 1, if $\delta\alpha(p_d - p) > (1-\delta)(p + c_2)$, there is war. Otherwise, the two sides reach a peaceful settlement.*

In this scenario, war results due to a commitment problem. Both A_1 and A_2 are aware that if a disaster strikes in the future, A_1 will become relatively stronger, and as Proposition 1 shows, bargaining in all future rounds will reflect this shift in the balance of power and A_1 will receive a larger share of benefits in every subsequent round. A_1 cannot credibly commit to not using this future advantage in bargaining, and A_2 needs to be compensated in period 1 for the future adverse shift in capabilities. If there is a feasible settlement in period 1 that compensates A_2, war is avoided and peace prevails. The largest compensation A_1 can offer in period 1 is to concede the whole stake in period 1 to A_2. If this is not sufficient to satisfy A_2, war results, which is represented by the inequality condition in Proposition 2.

War is more likely if a disaster is more likely (α is high), disaster impact is more severe, and A_2 suffers from the disaster disproportionately more than the other group ($\frac{\lambda_1}{\lambda_2}$ increases, and hence $p_d - p$ increases). Moreover, note that war occurs under these conditions in the absence of an actual disaster. A disaster can hit in period 2 or not, but the fear of its substantial and unequal impact in the event that the disaster does occur can create commitment problems and increase incentives for conflict earlier on.

Hypothesis 1: The likelihood of natural disasters increases the probability of

intra-state conflict.

Hypothesis 2: The likelihood of natural disasters increases the probability of inter-state conflict.

Note that our approach can explain the mixed findings in the conflict literature regarding the effects of natural disasters. If environmental shocks are anticipated and groups fight due to this expectation, conflict does not need to follow actual shocks. Rational expectations of future disasters, combined with the fact that many large-scale disasters are sufficiently rare, suggests that extant studies may suffer from a critical oversight. If expectations of environmental shocks affect conflict behavior, then it may be more appropriate to analyze the impact of disaster proneness, rather than actual disasters, on conflict likelihood. Therefore, in the empirical section, we use global data on disaster propensity to investigate the effects of disaster proneness on intra- and inter-state conflict.

Empirical Analysis

In this section, we conduct statistical tests to investigate the impact of disaster risks on conflict propensity and report empirical results that show evidence of such an impact. We first conduct a Monte Carlo analysis to determine which empirical strategy offers a more appropriate test for our hypotheses, given that actual disasters and disaster risks are not entirely independent of one another. We then evaluate our first hypothesis using replication data from two previous models of civil conflict and our hazard variables: Brancati (2007) and Slettebak (2012). The following set of results tests our second hypothesis and gauges the effect of disaster hazards on onset of interstate conflict. Together, our empirical models yield robust support for our main theoretical expectation. Specifically, our tests show that

countries that are exposed to higher levels of environmental risks are more likely to experience inter- and intra-state conflict.

Monte Carlo Analyses on Empirical Strategy

In testing our hypotheses linking susceptibility to natural disasters and conflict, we need to differentiate between the effect of disaster likelihood and potential effects of actual disaster events. Disaster events and a variable measuring susceptibility to such events are likely correlated, as the latter is directly related to the data generating process for the former. Thus, simply replacing our susceptibility measures with disaster variables in existing studies on conflict might be misleading as any estimated effect could be due to the existing correlation between the two variables.

To explore various empirical strategies in testing the hypothesized relationship, we conducted a Monte Carlo analysis. In our analyses of sample sizes ranging from 200 to 10,000, we focus on three hypothetical scenarios: (i) only actual disasters matter and susceptibility is irrelevant for conflict in the data generating process; (ii) both susceptibility and actual events matter; and (iii) only susceptibility matters. In each scenario, we compare the performance of three empirical strategies in recovering the underlying relationship in the data generating process: (a) Including both a variable measuring disaster events and a variable on susceptibility in the regression model; (b) just including a susceptibility measure; (c) focusing only on years that did not experience disaster events, and only including a susceptibility measure.

Our results are summarized in Table 1 in Appendix.[7] Overall, we find that strategy (c)

[7]Appendix includes a more detailed description of the MC analysis and the estimation processes.

that selects on the independent variable and focuses on no-disaster years and includes only the susceptibility measure in the analysis provides a better approach in terms of a lower false positive rate compared other approaches. In other words, if no relationship exists in the data generating process between disaster risks and conflict, approach (c) is the least likely to find one. Moreover, it provides a more conservative test, as its' false negative rate is slightly higher than the other two approaches. In other words, it is harder to report a significant coefficient with this approach as it is slightly biased in favor of the null hypothesis of no relationship. Thus, informed by these results, we test our hypotheses by replicating two existing analyses linking disasters and intra-state conflict while only focusing on years that did not experience a disaster. We then move on to inter-state level, and analyze the link between inter-state conflict initiation and disaster risks by focusing on dyad-years that did not experience any disaster events.

Operationalization of Disaster Risks

To test our hypothesis, we first construct various measures of disaster susceptibility. We use data on the likelihood of natural disasters available from the Socioeconomic Data and Applications Center (SEDAC).[8] SEDAC provides information on six categories of natural hazards: floods, cyclones, droughts, volcanoes, earthquakes, and landslides. The data sets record the relative likelihood and distribution over time of these disasters.[9] For each type of disaster, the data sets provide a frequency metric ranging from 0 to 10 for each 2.5 minute grid-cell over the globe, with higher scores representing locations that are at a higher risk for that specific disaster. To capture the overall propensity of experiencing different disasters, we also construct a measure of the average disaster risk by taking the mean of the six hazard

[8] http://sedac.ciesin.columbia.edu/

[9] Dilley et al. (2005).

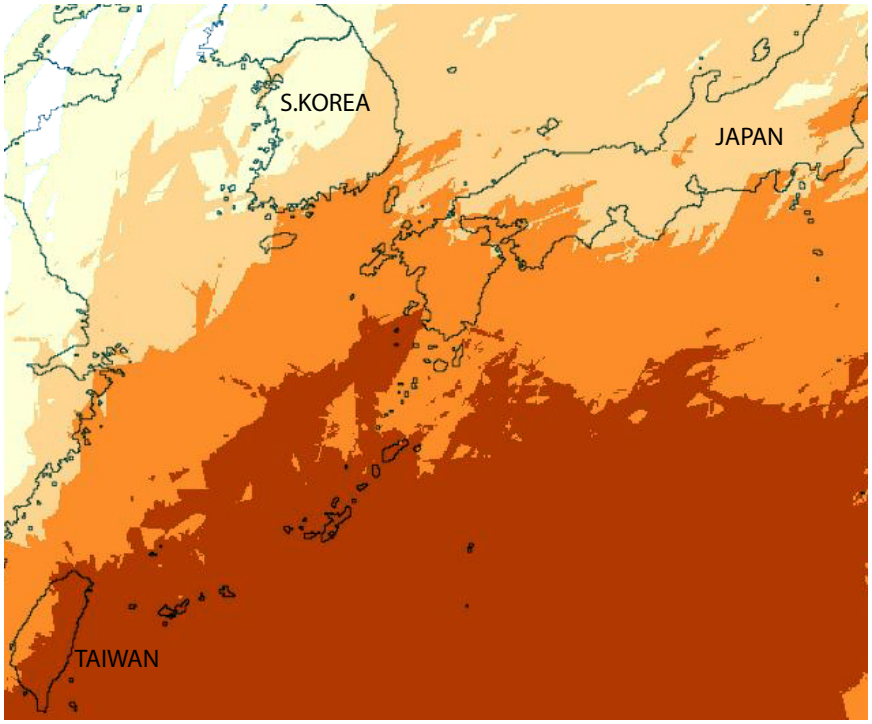


Figure 1: Cyclone Hazard Frequency Distribution Map of East Asia (from SEDAC)

scores for a given country.

To get a better sense of our disaster risk measures, consider the cyclone hazard. Figure 1 gives a snapshot of SEDAC's Cyclone Hazard Frequency Distribution map over part of East Asia. Darker colors in this map represent areas that are estimated to experience more cyclone force wind speeds based on decades of storm observations. Based on this map over the globe, SEDAC has generated an ordinal 10-scale cyclone risk score that is detailed down to each 2.5 minute grid cell. Japan, for instance, has more than 20,000 such cells, and each grid cell receives a cyclone risk score. Our *Cyclone hazard* measure averages over all such cells to come up with an overall score of around 9.48 for Japan. Similarly, South Korea has a score of 7.61, while North Korea has 4.98, and Taiwan has 10.

Disaster Risks and Intrastate Conflict

We first examine the effect of disaster susceptibility on intrastate conflict. Given that studies in this area arrive at diverging conclusions, we turn to two studies that represent this divergence. On the one hand, Brancati (2007) argues that disasters (specifically, earthquakes) increase the likelihood of conflict due to resulting resource scarcities. On the other hand, Slettebak (2012) demonstrates that disasters (specifically, climate-related disasters) have the opposite effect – i.e., they make intrastate conflict less likely, possibly due to greater societal cohesion in the disaster aftermath. These studies, then, provide a valuable opportunity to incorporate measures of disaster risks into replication models of intrastate conflict using data from the original studies. While the researchers' conclusions on the link between disasters and conflict are in stark opposition, we find patterns that are fully consistent with our theoretical expectations in both datasets: disaster risks increase the likelihood of intrastate conflict.

Note that in the replication analyses reported in the manuscript, we report results based on samples of no-disaster observations for each study, and only our hazard variables are included. This corresponds to the third scenario of our MC analyses, which focuses on years without disasters and incorporates disaster susceptibility. Additional results, such as models with actual disasters and disaster risks as explanatory variables, are available in the appendix.

The first study that we rely on for a model of intrastate conflict onset is Brancati (2007). The theoretical argument that informs the empirical tests is based on the deprivation framework: earthquakes, a natural disaster type that is characterized by a sudden onset and is arguably least dependent on human activities, generate resource shortages. These negative resource shocks, in turn, lead to competition for remaining resources and, hence, conflict. To test the hypothesis linking earthquakes to conflict, Brancati (2007) uses data on earth-

quake observations recorded in the U.S. Geological Survey during the period between 1975 and 2002. The dependent variable is operationalized in several ways. First, the number of intrastate conflicts that occur in a given month and are categorized as instances of intrastate violence is counted based on the Integrated Data for Events Analysis (IDEA) dataset (Bond et al., 2003). The second variable, antiregime rebellion, relies on data from the Minorities at Risk dataset (CIDCM, 2005) and indicates a conflict between dominant and minority groups in a state. Finally, the researcher uses the Fearon and Laitin (2003) dataset on civil wars to construct a binary measure of whether a civil war has taken place in a state in a given year. The empirical tests show that, as expected, earthquakes are positively and significantly associated with intrastate violence and conflict, regardless of the measure used.

We use the replication data for the specification in Model 1 in Brancati's Table 1 to conduct our own test on the sample of observations without earthquakes. Models B1 and B2 of Table 1 replicate that specification, which is based on a negative binomial analysis with conflict count as the dependent variable. We also replicate a robustness check using a negative binomial model with fixed effects; these results are reported as Models B3 and B4 of Table 1.[10] Note that Models B1 and B3 include the average disaster hazard, which is then replaced with six individual hazard measures in Models B2 and B4. We find that, as expected, the average hazard has a positive and statistically significant effect on conflict count, regardless of the method. Similarly, earthquake and flood risks increase the number of conflicts in both models, and the result reaches statistical significance at conventional levels. In addition, cyclone and drought hazards have the same positive effect in the fixed effects model.

To illustrate the substantive effect of our findings, we replicate Figure 3 from Brancati

[10]The robustness check is not reported in Brancati (2007), but is included in the article's replication materials.

(2007), which illustrates the effect of earthquakes on the likelihood of observing zero conflict events.[11] We then generate a graph based on Model B2 of Table 1. This graph shows that the earthquake hazard has a comparable substantive effect on the probability of no conflict – i.e., earthquake risks increase conflict propensity (hence, Prob(Conflict=0) decreases) even in the years without actual earthquakes.

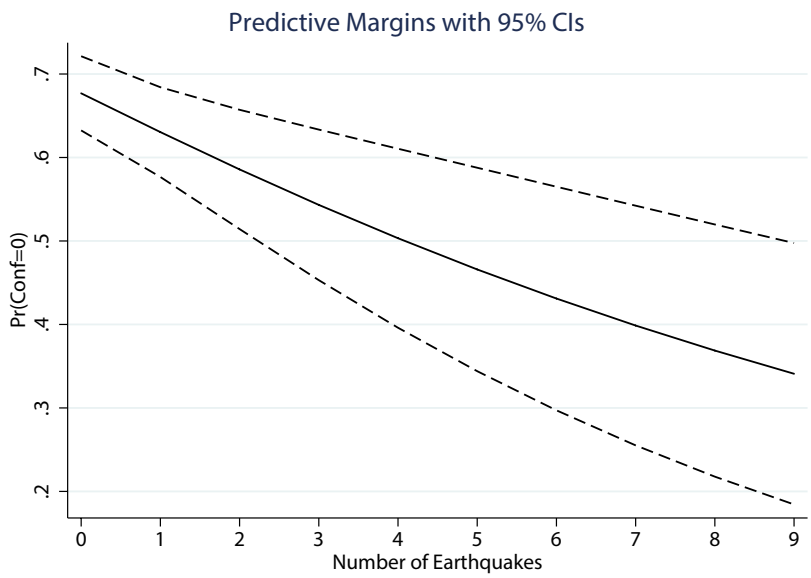
Table 1: Intrastate Conflict Events (Replication of Brancati (2007); no-disaster years)

	Neg. Binom		**FE Neg. Binom**	
	B1	**B2**	**B3**	**B4**
Average hazard	0.144*	-	0.121*	-
	(0.068)		(0.016)	
Cyclone hazard	-	-0.026	-	0.051*
		(0.052)		(0.010)
Drought hazard	-	0.049	-	0.028*
		(0.033)		(0.007)
Earthquake hazard	-	0.164*	-	0.137*
		(0.062)		(0.018)
Flood hazard	-	0.069*	-	0.099*
		(0.030)		(0.007)
Landslide hazard	-	-0.084	-	-0.200*
		(0.063)		(0.015)
Volcano hazard	-	-0.208	-	-0.205*
		(0.207)		(0.050)
Conflict events (lag)	0.091*	0.088*	0.015*	0.014*
	(0.009)	(0.009)	(0.000)	(0.000)
Observations	23,809	23,809	21,601	23,559

* $p < 0.05$

Note: replication of Model 1 in Brancati's Table 1 and a robustness check with fixed effects.

[11] All other variables are fixed at their means.



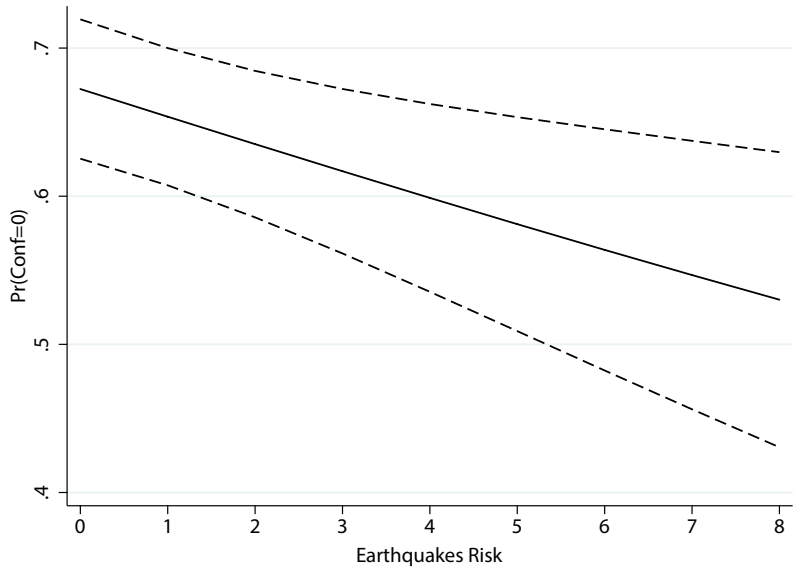


Figure 2: Earthquake Hazard (bottom), Earthquake Events (top, from Brancati) and Conflict

The second study, i.e., Slettebak (2012), builds on sociological accounts of disaster behavior and argues that emergencies, such as natural disasters, are more likely to generate the sense of unity, than discord, among affected people. Given this, disasters should reduce the likelihood of conflict. To test these expectations, the researcher uses information on actual disasters from the EM-DAT database, unlike Brancati (2007). Another difference is that the theoretical and empirical focus is on disasters potentially related to climate change, such as floods, storms, heat waves, droughts, and wet landslides, rather than earthquakes. This results in a total of 7,833 disasters for the period 1946 – 2008. The conflict onset data come from the UCDP/PRIO Armed Conflict Dataset (Gleditsch et al., 2002; Strand, 2006). The researcher also adds other variables that are based on the civil war model developed by Fearon and Laitin (2003). Empirical analyses show that a count of disaster events has no significant relationship with conflict onset, while a binary climatic disaster variable has a significant negative effect on conflict likelihood. For individual disasters, the study finds no evidence of a statistically significant effect for all disaster types, except droughts. Again, this disaster variable has a negative and significant relationship with conflict onset, confirming the researcher's expectation.

As in our previous analysis, we focus on years without disaster events to isolate the effect of our disaster risk variables. Table 2 reports our results that replicate the specification of Model 3 in Slettebak's Table 2. The two models in Table 2 show results of logit analyses, which use conflict onset as the dependent variable.[12] While the average disaster hazard has the expected positive association with conflict onset, it fails to reach statistical significance,

[12]Note that all models in the table using Slettebak's data include control variables as in the original article: logged GDP, logged population size, rough terrain, noncontiguous state, new state, recent instability, ethnic and religious fractionalization, and mixed regime. These controls are not reported here due to the table size, but are included in the appendix, along with replications of other models.

as Model S1 indicates. However, when we include individual hazard variables in Model S2 of this table, we find that four out of six hazard variables have positive coefficients, and two of those reach statistical significance – i.e., coefficients on the drought and volcano variables.

Table 2: Civil Conflict (Replication of Slettebak (2012); no-disaster years)

	Logit	
	S1	**S2**
Average hazard	0.084	-
	(0.091)	
Cyclone hazard	-	-0.127
		(0.084)
Drought hazard	-	0.111*
		(0.047)
Earthquake hazard	-	-0.098
		(0.137)
Flood hazard	-	0.013
		(0.050)
Landslide hazard	-	0.037
		(0.104)
Volcano hazard	-	0.448*
		(0.223)
Conflict previous year	-0.399	-0.469
	(0.453)	(0.417)
Observations	3,591	3,591

* $p < 0.05$

Note: replication of Model 3 in Slettebak's Table 2.

What are the substantive effects of these two variables? To assess this, we focus on an example case, a hypothetical new state in 2006, while all the other explanatory variables in the model assume their median values. In this scenario, an increase in the drought hazard variable from the sample minimum (0) to maximum (9) results in a significantly higher

probability of conflict onset: the predicted probability goes up by .187 (.025, .379) from its baseline value of .225.[13] Similarly, if we change the volcano hazard variable from its sample minimum (0) to maximum (3.45), the predicted probability of conflict onset rises from .27 to .56 – this represents a statistically significant difference of .29 (.002, .59).

We can also compare these predicted values to the effects of actual disaster events in Slettebak's analysis. We rely on Slettebak's model that utilizes a dichotomous climate-related disaster variable, which captures events, such as droughts, storms or floods, and calculate its substantive effects in the same example case as before.[14] We find that an occurrence of such a disaster event reduces the likelihood of conflict by .046 from the baseline value of .192. Similarly, when we use the specification with different disaster types, reported in Model 5 of the same table from Slettebak (2012), and increase the number of observed droughts from its sample minimum (0) to maximum (3), the predicted probability of conflict onset declines by .110 from the baseline probability of .153. A comparison of these changes in predicted probabilities to the substantive effects for our hazard variables suggests that disaster risks have comparable, and possibly stronger, effects on the likelihood of conflict onset in years without actual disasters. Together with the results based on replications of Brancati (2007)'s models, this empirical evidence lends robust support for the hypothesized positive relationship between disaster expectations and intrastate conflict.

Disaster Risks and Interstate Conflict Onset

In this section, we investigate the effect of disaster risks on states' conflict behavior. The unit of analysis is non-directed dyad years. We report specifications with politically relevant dyads

[13]The 95% confidence interval for the first difference is reported in parentheses.

[14]This is Model 4 in Table 2 in Slettebak (2012).

as well as all possible dyads in the international system after 1945.[15] As in our replication analyses, we focus on observations in which neither of the states in the dyad experienced any disaster event in that year to isolate the effect of disaster risks.[16] For specifications with politically relevant dyads, our sample size is 6,380, while all dyads specifications have the sample size of 116,714.

The dependent variable in this analysis is *Conflict initiation*, which is a binary measure that takes the value of 1 when a dyad experiences a dispute involving use of force (maximum hostility level of 4 or above), as specified in the Militarized Interstate Disputes (MID) data set (Palmer et al., 2015; Ghosn and Bennett, 2003). As in our replication analyses, the main independent variables represent the susceptibility of each state to various disasters (cyclones, droughts, earthquakes, floods, landslides and volcanoes). Due to the dyadic unit of observation, we convert each risk variable to indicate the average risk for a given dyad. We also use an *Average hazard* variable, which averages over the six risk variables for the dyad.

Our models incorporate several control variables that previous studies identify as determinants of conflict onset. First, we include *Relative capabilities* in the dyad, defined as $\frac{\max(C_1,C_2)}{C_1+C_2}$, where C_i represent states' CINC scores (Singer, Bremer and Stuckey, 1972). *Relative capabilities* captures how balanced the dyad is and ranges from 0 to 0.5. Extant

[15]We focus on this period due to better reliability and coverage of disaster events data. That being said, results are substantively similar if we use earlier cutoff points.

[16]To identify observations without disasters for this analysis, we use information on actual disaster events from EM-DAT (Guha-Sapir, Below and Hoyois, 2015). While selecting on the independent variable in this way does not bias results, the supplementary appendix reports specifications with all dyads, including those that experienced disasters. Those specifications include disaster event counts as control variables. The results on the effect of disaster risks on conflict remain substantively the same.

research differs over whether power balance is more peaceful or power preponderance is more conducive to peace (Bremer, 1992).

Contiguity is a geographical proximity measure ranging from 1 for land contiguous states to 6 for states that are separated by more than 400 miles of water. Geographical proximity has been proposed one of the significant determinants of conflict onset (Vasquez, 2009). More proximate states may be more likely to fight due to reduced costs of conflict and the increasing chance of disputed stakes between the two states, implying a negative regression coefficient.

Joint democracy is a dichotomous variable taking the value of 1 when both states in the dyad have Polity scores 6 or above, and 0 otherwise. Consistently with the vast democratic peace literature, we expect a positive coefficient for this variable (Russett and Oneal, 2000). *Alliance* is an ordinal measure, which captures the existence and strength of an alliance between the two states in the dyad, ranging from defense pact (the value of 1) and neutrality (2) to entente (3) and no agreement (4). We expect that stronger alliance ties would be associated with less conflict, indicating a negative regression coefficient.

Following Thompson (2001), *Rivalry* captures the existence of persistent conflicts of interest between the two states, which has been argued to increase the risk of conflict, implying a positive coefficient. Finally, we account for duration dependence by including *Peace years* polynomials in the analysis (Carter and Signorino, 2010).

Due to the binary dependent variable of conflict initiation, we estimate logistic regression models with standard errors clustered at the dyad level. The results presented in Table 3 offer strong support for our hypothesis linking disaster risks to inter-state conflict. Consistent with our theoretical expectation, in Models M2 and M4 that use the average hazard measure for all six disasters, the risk variable has a significant positive coefficient in both politically relevant and all dyads specifications. These findings indicate that areas susceptible

to disasters are more likely to experience conflict onset in years without disasters. When we focus on individual disaster variables in Models M1 and M3, the drought and flood hazard variables have positive and significant coefficients in both politically relevant and all dyad specifications. In the latter specification, the coefficient on *Earthquake hazard* is also positive and statistically significant. The only significant exception to the overall pattern is *Landslide hazard*: the coefficient on this variable is negative and significant in the specification with all dyads. Finally, the coefficients on the cyclone and volcano hazard variables are not significant at conventional levels. Among the control variables, *Contiguity*, *Rivalry* and *Alliance* achieve significance and are in line with theoretical expectations.

What are the substantive effects of disaster risks on conflict onset? Based on Model M2, Figure 3 plots the predicted probability of conflict initiation when the *Average hazard* variable takes values from the 0th to 95th percentiles (calculated by 5 percentile increments), while holding all other regressors at their mean values among the rival dyads. In each percentile value, there is a predicted positive effect that is significantly different from zero. Moreover, with each percentile increment, predicted probabilities show an increasing pattern. For instance, the effect of increasing disaster risks from the minimum sample value to its maximum results in an increase in conflict probability by .15 (from .038 to .191), with a confidence interval of (.07, .28) around this first difference. If, instead, the variable's theoretical maximum is used for this calculation, the resulting first difference from the baseline probability value of .038 to .719 is around .68, with a 95% confidence interval of (.30, .92).

Next, we focus on Model M1 and calculate substantive effects for individual disaster risk variables that have statistically significant coefficients. As in the above analysis, we fix the regressors to their mean values among rival dyads. For such an observation, the effect of increasing the *Drought hazard* measure from its sample minimum to maximum results in a .154 increase in the probability of conflict from the baseline probability of .036 - to .189.

Table 3: Interstate Conflict and Disaster Risks, Dyads with No Disasters, post-1945

	Pol. Rel. Dyads		**All Dyads**	
	M1	**M2**	**M3**	**M4**
Average hazard	-	0.214*	-	0.130*
		(0.053)		(0.048)
Cyclone hazard	0.041	-	0.028	-
	(0.038)		(0.034)	
Drought hazard	0.119*	-	0.116*	-
	(0.031)		(0.028)	
Earthquake hazard	0.150	-	0.264*	-
	(0.090)		(0.094)	
Flood hazard	0.089*	-	0.074*	-
	(0.027)		(0.025)	
Landslide hazard	-0.140	-	-0.259*	-
	(0.091)		(0.097)	
Volcano hazard	-0.179	-	-0.225	-
	(0.171)		(0.180)	
Relative cap.	-0.671	-0.576	-0.808	-0.721
	(0.939)	(0.970)	(0.676)	(0.720)
Contiguity	-0.412*	-0.442*	-0.781*	-0.809*
	(0.091)	(0.093)	(0.047)	(0.052)
Joint democ.	-0.494	-0.796	-0.339	-0.634
	(0.481)	(0.494)	(0.373)	(0.390)
Rivalry	1.382*	1.330*	1.456*	1.522*
	(0.243)	(0.234)	(0.234)	(0.243)
Alliance	0.049	0.164*	0.036	0.156*
	(0.072)	(0.076)	(0.069)	(0.072)
Peace years	-0.280*	-0.288*	-0.297*	-0.293*
	(0.042)	(0.042)	(0.037)	(0.036)
Peace years sq.	0.009*	0.009*	0.011*	0.010*
	(0.002)	(0.002)	(0.002)	(0.002)
Peace years cb.	-0.000*	-0.000*	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	6,380	6,380	116,714	116,714

* $p < 0.05$

Note: years with no disaster events involving the countries in the dyad.

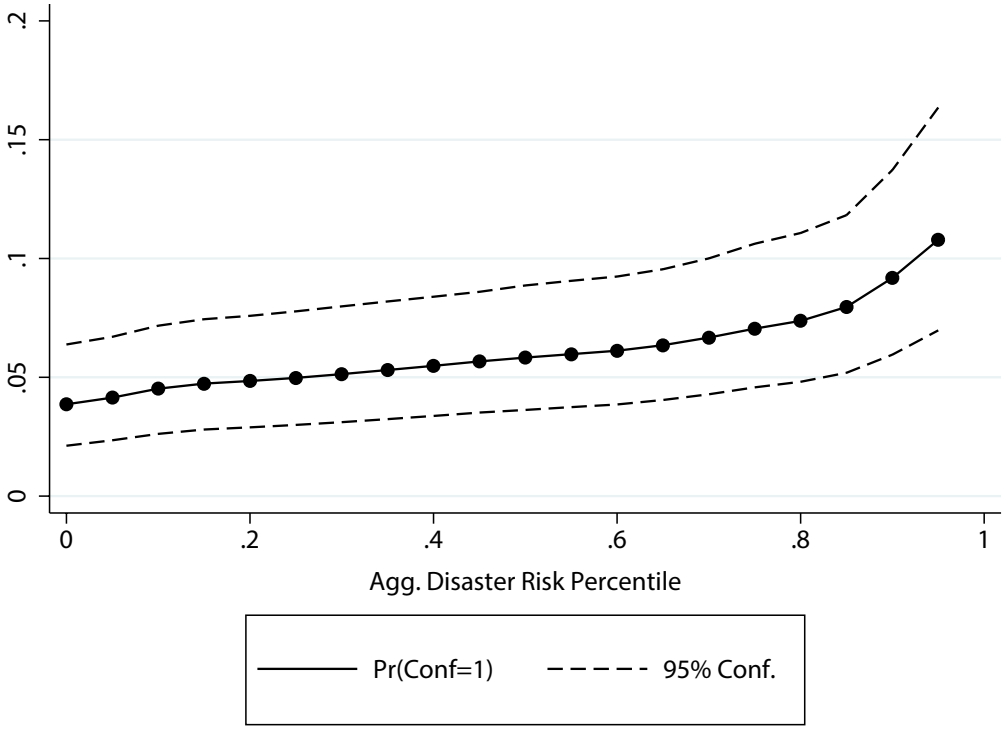


Figure 3: Disaster Risks and Inter-state Conflict

The confidence interval for this first difference is (.06, .281). If the theoretical minimum and maximum values are used instead, the estimated increase in probability jumps to .260 with a confidence interval of (.090, .476). Similarly, for *Flood hazard*, increasing the susceptibility from the sample minimum to maximum results in a .12 (.033, .236) increase in the probability of conflict initiation (.150 for the theoretical range, with a confidence interval from .038 to .296).

In sum, with few exceptions, disaster susceptibility is a significant determinant of interstate conflict onset. Its effect, which we argue is due to actors' rational expectations about future disasters and the resulting commitment problems, is distinct from any effects of actual disasters. Equally important is the sizeable substantive effect of disaster risks on conflict.

Conclusions

This paper presents a theoretical argument that links anticipated natural disasters and conflict. We view conflict onset as a bargaining failure, which results from a commitment problem between rational groups residing in disaster-prone regions. Specifically, we argue that expected future disasters could imply resource shocks that shift the relative power balance, and groups that anticipate being weakened in the future could initiate conflict even before any disasters take place. Our empirical analyses provide evidence of the expected positive relationship between disaster susceptibility and conflict likelihood. This finding emerges from models of intrastate conflict, as well as in interstate conflict analyses. Therefore, our study suggests that the literature on disasters and conflict should take into account disaster susceptibility as a determinant of conflict.

Our results linking rational expectations of future environmental shocks to conflict initiation suggest that some conflicts, which do not appear to be directly caused by natural

disasters, may in fact be shaped by disaster expectations. Consider the case of the Sandinista revolution in Nicaragua. Earthquakes and volcanic eruptions are significant environmental threats in Nicaragua, and Managua, the capital of the country, experienced about a dozen of major earthquakes since 1844, including destructive events of 1931, 1968 and 1972. The Somoza government's response to the 1972 earthquake, in particular, helped to consolidate the anti-government movement led by the Sandinista National Liberation Front (FSLN), founded in 1961 to oppose the government. Instead of providing much-needed assistance to the affected people, the government took advantage of international relief funds to benefit itself and its supporters (Drury and Olson, 1998; de Boer and Sanders, 2005). Government actions highlighted the growing gap in the allocation of resources in the society: while the government and its allies became more affluent and powerful, other groups in the population saw their share of benefits shrinking. In 1979, after years of protests and fighting, the Sandinista troops overthrew the government and succeeded in imposing a new revolutionary regime in the country, which allowed to re-allocate domestic resources in favor of the groups that suffered under the Somoza government. While the emergence of the FSLN and the government overthrow do not correlate well with actual disaster events in the country, our framework suggests that expected future disasters and the likely government response to such events could have triggered a change in rational expectations about future capabilities for the opposition, and could have contributed to the conflict.

In addition to indicating the need to revisit explanations of conflict in disaster-prone areas, our research has important implications for policy adoption and implementation in the area of disaster preparedness and mitigation. In particular, climate scholars have identified an increasing trend in the number of adverse weather events as a result of global warming. Our results suggest that more severe and frequent disasters associated with environmental changes will likely increase the frequency of inter- and intra-state conflicts initiated by populations that can expect to bear the brunt of these shocks. Moreover, when we include

an interaction between the disaster risk variables with a time trend, our preliminary test suggests that the magnitude of the effect of disaster risks increases over time. If global warming will lead to sudden changes in the natural environment, as the most recent IPCC report indicates, we should see an increase in the likelihood of extreme and sudden disasters, such as severe heat waves, floods and droughts. Once people in particularly vulnerable regions update their expectations to reflect the changing climate patterns, our results suggest that domestic and international conflict is likely to follow, even in periods without actual disasters.

To address this challenge highlighted in our study, governments should consider allocating more resources to areas that suffer from frequent environmental shocks. Such assistance should come in the form of disaster preparedness and mitigation programs, rather than post-disaster relief alone. This assistance is important not only for helping these areas to rebuild immediately after disasters, but also for changing the population's expectations about the government disaster policies and resource allocation in the future. In addition, a greater degree of local control over disaster relief programs may also mitigate commitment problems. For donor countries and international organizations, such as UN, humanitarian aid and international relief efforts can make a significant contribution to shifting affected populations' expectations in years without actual disaster events. If aid agencies and donor countries succeed in developing expectations of effective and equitable humanitarian assistance if a disaster does occur, conflict due to commitment problems should become less likely because individuals in these disaster-prone areas will believe that such relief efforts will deliver sufficient aid to compensate costs generated by disasters. This, in turn, would mitigate any decline in these groups' or countries' bargaining power in negotiations over resource allocation, thereby alleviating the conditions leading to the emergence of a commitment problem.

References

Bagley, Katherine and Maria Gallucci. 2013. "Is NYC's Climate Plan Enough to Win the Race Against Rising Seas?". Accessed Online: 2016-02-25.

URL: *http://insideclimatenews.org/news/20130620/nycs-climate-plan-enough-win-race-against-rising-seas*

Barro, Robert J. 1976. "Rational expectations and the role of monetary policy." *Journal of Monetary Economics* 2(1):1 – 32.

Bas, Muhammet A. and Andrew J. Coe. 2012. "Arms Diffusion and War." *Journal of Conflict Resolution* 56(4):651–674.

Bernauer, Thomas, Tobias Bohmelt and Vally Koubi. 2012. "Environmental changes and violent conflict." *Environmental Research Letters* 7(1):1–8.

Bond, Doug, Joe Bond, Churl Oh, J. Craig Jenkins and Charles Lewis Taylor. 2003. "Integrated Data for Events Analysis (IDEA): An Event Typology for Automated Events Data Development." *Journal of Peace Research* 40(6):733–745.

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

Bremer, Stuart A. 1992. "Dangerous Dyads Conditions Affecting the Likelihood of Interstate War, 1816-1965." *Journal of Conflict Resolution* 36(2):309–341.

Carter, David B. and Curtis S. Signorino. 2010. "Back to the Future: Modeling Time Dependence in Binary Data." *Political Analysis* 18(3):271–292.

Chassang, Sylvain and Gerard Padro i Miquel. 2009. "Economic Shocks and Civil War." *Quarterly Journal of Political Science* 4(3):211–228.

CIDCM. 2005. "Minorities at Risk Project.". College Park, Maryland: Center for International Development and Conflict Management.
URL: *http://www.cidcm.umd.edu/mar/*

de Boer, Jelle Zeilinga and Donald Theodore Sanders. 2005. *Earthquakes in Human History: The Far-Reaching Effects of Seismic Disruptions.* Princeton, NJ: Princeton University Press.

Deudney, Daniel. 1990. "The Case Against Linking Environmental Degradation and National Security." *Millennium* 19(3):461–476.

Dilley, Maxx, Robert Chen, Uwe Deichmann, Arthur Lerner-Lam and Margaret Arnold. 2005. *Natural Disaster Hotspots: A Global Risk Analysis.* Disaster Risk Management Series World Bank.

Drury, A. Cooper and Richard Stuart Olson. 1998. "Disasters and Political Unrest: An Empirical Investigation." *Journal of Contingencies and Crisis Management* 6(3):153–161.

Erikson, Robert S., Michael B. MacKuen and James A. Stimson. 2000. "Bankers or peasants revisited:: economic expectations and presidential approval." *Electoral Studies* 19(2–3):295 – 312.

Evin, Ahmet O. 2004. "Changing Greek Perspectives on Turkey: An Assessment of the post-Earthquake Rapprochement." *Turkish Studies* 5(1):4–20.

Fagan, Brian M. 2008. *The great warming: climate change and the rise and fall of civilizations.* New York: Bloomsbury Press.

Fearon, James D. 1995. "Rationalist explanations for war." *International Organization* 49(03):379–414.

Fearon, James D. and David Laitin. 2003. "Ethnicity, Insurgency, and Civil War." *American Political Science Review* 97:75–90.

Ghosn, Faten and Scott Bennett. 2003. "Codebook for the Dyadic Militarized Interstate Incident Data, Version 3.10.".
URL: *http://correlatesofwar.org*

Gleditsch, Nils Petter. 1998. "Armed Conflict and the Environment: A Critique of the Literature." *Journal of Peace Research* 35(3):381–400.

Gleditsch, Nils Petter, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg and Havard Strand. 2002. "Armed Conflict 1946-2001: A New Dataset." 39(5):615–637.

Guha-Sapir, Debarati, Regina Below and Philippe Hoyois. 2015. "EM-DAT: The OFDA/CRED International Disaster Database.".
URL: *www.emdat.be*

Homer-Dixon, Thomas F. 1994. "Environmental Scarcities and Violent Conflict: Evidence from Cases." *International Security* 19(1):5–40.

Homer-Dixon, Thomas F. 2001. *Environment, Scarcity and Violence*. Princeton, NJ: Princeton University Press.

Kahl, Colin H. 1998. "Population Growth, Environmental Degradation, and State-Sponsored Violence: The Case of Kenya, 1991-93." *International Security* 23(2):80–119.

Kelman, Ilan and Theo Koukis. 2000. "Disaster Diplomacy: Special Issue." *Cambridge Review of International Affairs* 14(1):214–294.

Kreutz, Joakim. 2012. "From Tremors to Talks: Do Natural Disasters Produce Ripe Moments for Resolving Separatist Conflicts?." *International Interactions* 38(4):482–502.

Leblang, David A. 2002. "The Political Economy of Speculative Attacks in the Developing World." *International Studies Quarterly* 46(1):69–91.

Leblang, David and William Bernhard. 2000. "The Politics of Speculative Attacks in Industrial Democracies." *International Organization* 54:291–324.

Levy, Marc A. 1995. "Is the Environment a National Security Issue?" *International Security* 20(2):35–62.

MacKuen, Michael B., Robert S. Erikson and James A. Stimson. 1992. "Peasants or Bankers? The American Electorate and the U.S. Economy." *American Political Science Review* 86:597–611.

Miguel, Edward, Shanker Satyanath and Ernest Sergenti. 2004. "Economic Shocks and Civil Conflict: An Instrumental Variables Approach." *Journal of Political Economy* 112(4):725–753.

Nardulli, Peter F., Buddy Peyton and Joseph Bajjalieh. 2015. "Climate Change and Civil Unrest: The Impact of Rapid-onset Disasters." *Journal of Conflict Resolution* 59(2):310–335.

Nel, Philip and Marjolein Righarts. 2008. "Natural Disasters and the Risk of Violent Civil Conflict." *International Studies Quarterly* 52(1):159–185.

Palmer, Glenn, Vito D'Orazio, Michael Kenwick and Matthew Lane. 2015. "The MID4 Dataset, 2002-2010: Procedures, Coding Rules and Description." *Conflict Management and Peace Science* 32(2):222–242.

Pederson, Neil, Amy E. Hessl, Nachin Baatarbileg, Kevin J. Anchukaitis and Nicola Di Cosmo. 2014. "Pluvials, droughts, the Mongol Empire, and modern Mongolia." *Pro-*

ceedings of the National Academy of Sciences of the United States of America 111(12):4375 – 4379.

Powell, Robert. 2006. "War as a Commitment Problem." *International Organization* 60:169–203.

Quarantelli, E. L. and R. R. Dynes. 1976. "Community Conflict: Its Absence and Its Presence in National Disasters." *Mass Emergencies* 1:139–152.

Reuveny, Rafael. 2002. "Economic Growth, Environmental Scarcity, and Conflict." *Global Environmental Politics* 2(1):83–110.

Russett, Bruce M and John R Oneal. 2000. *Triangulating Peace: Democracy, Interdependence, and International Organizations*. Norton.

Salehyan, Idean. 2008. "From Climate Change to Conflict? No Consensus Yet." *Journal of Peace Research* 45(3):315–326.

Sargent, Thomas J. and Neil Wallace. 1975. ""Rational" Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule." *Journal of Political Economy* 83(2):241–254.

Simon, Julian L. 1996. *The Ultimate Resource II*. Princeton, NJ: Princeton University Press.

Singer, J. David, Stuart Bremer and John Stuckey. 1972. Capability Distribution, Uncertainty, and Major Power War, 1820–1965. In *Peace, War, and Numbers*, ed. Bruce Russett. Sage pp. 19–48.

Slettebak, Rune T. 2012. "Dont Blame the Weather! Climate-Related Natural Disasters and Civil Conflict." *Journal of Peace Research* 49(1):163–176.

Strand, Havard. 2006. "Onset of Armed Conflict: A New List for the Period 1946-2004, with Applications." Working Paper.

URL: *https://www.prio.org/Data/Armed-Conflict/Onset-and-Duration-of-Intrastate-Conflict/Onset-Data/*

Theisen, Ole Magnus, Helge Holtermann and Halvard Buhaug. 2011. "Climate Wars?: Assessing the Claim That Drought Breeds Conflict." *International Security* 36(3):79–106.

Thompson, William R. 2001. "Identifying Rivals and Rivalries in World Politics." *International Studies Quarterly* pp. 557–586.

Vasquez, John A. 2009. *The War Puzzle Revisited*. Cambridge University Press.