Disaster Capitalism? Do Contract Intensive Economies Save Lives?†

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Abstract:

Why do some countries have a higher rate of death from natural disasters than others? Recent empirical work demonstrates no determinant of the rate of natural disasters across the globe. And yet, annual deaths from disaster tend to be negatively correlated with levels of economic development. Several recent studies find a relationship between natural disaster deaths and governance—but none have focused on the more informal institutional features that are part of a market economy. This paper fills this gap by exploring a hypothesis derived from theories associated with economic norms: as a nation's economy becomes more contract intensive, its mortality rate from natural disasters is likely to decrease. Data on the contract intensity of economies (CIE) is used to explore this relationship using time-series cross sectional data on natural disaster deaths between 1960 and 2000.

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Introduction

Why are natural disasters so deadly in some places but not in others? Recent research into this question is converging on a general set of influential variables. At the heart of much of this research sits the notion that institutions matter. Formal institutional arrangements that are more representative in nature have greater incentives to provide public goods that can include mitigation policies. Higher quality institutions, for example, those less susceptible to corruption, are more likely to foster both mitigation and recovery. Simply put, institutions structure incentives, and individuals respond to incentives.

But much of this literature is about the institutions that related most directly to governance. What about the institutions that structure the processes of exchange within a society? That is, what about economic institutions? The disaster-related literature here has been relatively silent. This paper offers an initial step toward filling that void.

One of the primary challenges to studying the relationship between the economic institutions of capitalism and disaster-related fatalities is measurement. This paper utilizes Mousseau's measure of contract intensive economies to capture both the formal and informal institutional relationships in economic exchange. Based on life insurance contracts within a country, this measure captures the extent to which a country is clientalist or contract intensive. In some ways this measure provides a way of adding a more explicitly economic component to the notion of social capital, which has long been and continues to be of great interest in disaster research, covering the role of informal institutions, norms and rules that structure so much of the way individuals and groups interact with and exchange with one another.

In what follows, I begin by reviewing the literature on the relationship between institutions and disaster-related fatalities. I link these insights to some of the thinking on clientalism, capitalism and economic norms—theories that underpin the CIE measure itself—and generate two opposed but plausible hypotheses about the relationship between CIE and disaster-related fatalities. The analysis of cross-national time series data between 1960 and 2000 provides preliminary evidence for the idea that national economies relying on contracts have generally lower natural disaster deaths than do countries that are relatively less contract intensive.

The Role of Institutions in the Politics of Disaster Mitigation

The recent literature on the politics of disaster mitigation, management, and recovery demonstrates that two broad aspects of formal institutions are important.[1] First, the broad institutional features embedded in particular regime types seem to have an effect on disaster-related mortality. The theorizing on democracy, for example, reveals several causal mechanisms. Compared to autocracies, democracies have institutionally based incentives to provide public goods to their citizens as larger selectorates make it more difficult for the leadership to use private goods in order to stay in power (Bueno de Mesquita et al. 2003). In addition, the political competition inherent in democracies ensures government responsiveness (Cohen and Werker 2008) and accountability (Besley and Burgess 2002). Thus, in democracies, we might expect to see a higher level of public goods provision on items such as disaster mitigation (Plümper and Neumayer 2009; Keefer, Neumayer, and Plumper 2011). In addition, Keefer et al. find evidence that across a spectrum of new to established democracies, those with more years of continuous competitive elections are more likely to be able to make credible commitments to citizens when it comes to providing public goods like the enforcement of building codes (2011, 1533).

Second, the quality of these formal institutions is also important in reducing disaster-related mortality (Escaleras, Anbarci, and Register 2007; Kahn 2005; Boettke et al. 2007). These studies explore institutional quality using a wide range of measures, from proxies such as ethnic fragmentation and income inequality (Kahn 2005) to measures of inequality from the World Bank and the International Country Risk Group (Kahn 2005; Escaleras, Anbarci, and Register 2007; Keefer, Neumayer, and Plumper 2011). Many of these studies have drilled

[1] In this paper, I rely on an understanding of *institutions* similar to the one used by Douglass North: "the humanly devised constraints that shape human interaction" (North 1990, 3). Ostrom (2009) and Kuran (2012) employ similar definitions, focusing on "prescriptions" and "regularities" respectively. Kuran points out that one of the advantages of such a definition is that it "encompasses consciously created social regularities" as well as "patterns that emerge as byproducts of other choices, such as procedural expectations based on history, customary contractual practices, and organizational norms" (2012, 7).

down and found that specific facets of institutional quality such as corruption and the rule of law are good predictors of the level of disaster-related mortality a country is likely to see in a given year.

These formal features notwithstanding, a number of recent studies focus on the informal institutional features that are fundamental to efficient market processes. Chamlee-Wright and Storr (2009) for example, show how the Mary Queen of Viet Nam Catholic Church provided important club goods that helped to alleviate some information problems associated with return and redevelopment in New Orleans following Hurricane Katrina. These goods included providing information to their Catholic community members about other members' well-being across a variety of evacuation locations and providing a community space for meeting and socialization (Chamlee-Wright and Storr 2009, 440). In strategic parlance, these goods helped individual community members to credibly commit to returning to New Orleans and coordinate their actions despite the difficulty inherent in the fact that the benefits from such a return were largely dependent on others (Chamlee-Wright and Storr 2009, 437).

More broadly, Chamlee-Wright places the informal institutions of "trust, reciprocity, authority, social sanctions, and habits of association" within the context of norms that influence the level of social capital in a society (2010, 42). These informal institutions assist in the conveyance of several important signals that facilitate social exchange in a way that alleviates the social coordination problem inherent in post-disaster recovery (2010, 55).

Contract Intensive Economies and Disaster Mitigation

One way to grapple with the importance of the informal institutions embedded in market processes is to turn to the literature on economic norms theory, which largely focuses on the differences between clientelist and contract-intensive economies. Using Polanyi's work (1957) on the reciprocal and familial bases of clientelist economies, Mousseau points out that on the other hand, "a capitalist economy is one that is contract intensive: when most citizens normally obtain their goods, services, and incomes by contracting with strangers located in a market" (2012, 472). Comparatively, this means that the interests of capitalist economies will tend toward greater emphasis on the rule of law, greater emphasis on individual freedom, and greater interest in the promotion of markets (Mousseau 2012, 472).

Each of these interests is likely to have some positive effect on the processes of disaster mitigation that are associated with a reduction in disaster-related fatalities. The literature on the relationship between the quality of institutions and disaster mitigation has emphasized the rule of law in particular (Kahn 2005). Specifically related to the focus on contract intensity here, the reliance on contracts—and by extension the deference given to property rights—can foster economic development (e.g., Easton and Walker 1997; Acemoglu and Johnson 2005), which can be important in crises (Coyne 2011) and has been shown to reduce fatalities at the time of disasters (Kahn 2005; Anbarci, Escaleras, and Register 2005). Individual freedom and the relative reliance on market processes have also been shown to foster disaster-related resilience (Boettke et al. 2007) particularly through their relative abilities to foster individual entrepreneurship (Sobel and Leeson 2006; Chamlee-Wright and Storr 2008).

Hypothesis 1: As a country's contract intensity increases, disaster-related fatalities are likely to decrease.

There are, however, at least two plausible paths to the opposite expectation that changes in contract intensity might be positively related to changes in disaster related fatalities. First, if one views clientelist economies as having their basis in reciprocal exchange, particularly among family and friends, these types of economies might be seen as having a high level of social capital relative to their capitalist counterparts. A wide range of research focuses on the relationship between social capital and its positive effects across the spectrum of disaster-related policymaking (e.g., Nakagawa and Shaw 2004; Adger et al. 2005; Aldrich 2011; Aldrich 2012; Kusumasari and Alam 2012). Among other studied effects, strong social capital can create extended networks that foster better recoveries (Wetterberg 2005) and provide information throughout the disaster management process (Aldrich 2012).[2] Each of

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[2] Despite the general trend in the literature, there are some cautionary notes. Szretzer (2002) is one of many to point out that social capital can theoretically have both costs and benefits. Aldrich (2011; 2012), for example, points out that high levels of social capital can have negative consequences for already-marginalized members of society in disaster recovery situations. Chamlee-Wright and Storr

these allows communities to overcome collective action problems (Krishna 2002) that are inherent in much of disaster-related policymaking given the varieties of public goods involved (Enia forthcoming).

Second, recent research has demonstrated that insurance—which is at the heart of the measure used in this paper (described below)—can have distorting effects on individual behavior around low-probability, high-impact events.[3] Kunreuther and Pauly, for example, point out that the process of purchasing insurance creates transaction costs around obtaining information about premiums and loss probabilities (2004, 5–6). If this logic holds, then it could be the case that the insurance reliance in contract intensive economies lowers mitigation efforts and contributing to a higher likelihood of disaster-related fatalities.

Hypothesis 2: As a country's contract intensity increases, disaster-related fatalities are likely to increase.

Data and Methodology

The data on disaster deaths come from EM-DAT, the International Disaster Database assembled at the Centre for Research on the Epidemiology of Disasters (CRED) at the *Université catholique de Louvain* in Brussels. For the purposes of its database, CRED defines a disaster as any event that fulfills at least one of the following four criteria: 1) ten or more people reported killed; 2) one hundred or more people reported affected; 3) a declaration of a state of emergency; 4) a call for international assistance.

The raw data in the EM-DAT database are event data, and each event is classified by type. For the purposes of this study, I focus on the natural disasters in the database. These data include five natural disaster subgroups: geophysical, meteorological, hydrological,

(2011) provide evidence that social capital plays a role in increased lobbying and rent seeking in post disaster situations.

[3] These are distorting effects above and beyond individuals' general inability to properly evaluate risk in these types of situations (Kahneman, Slovic, and Tversky 1982).

climatological, and biological.[4] For each event, EM-DAT includes a measure, *killed*, that captures "persons confirmed as dead and persons missing and presumed dead." ("EM-DAT: The OFDA/CRED International Disaster Database" 2013). Given the interest here in comparing the effects of country-year changes in contract-intensiveness (and other controls), I aggregate the event data into annual data for each country.

The sample includes 149 countries spanning the years 1960-2000.[5] During this time period, there is large range in the number of people killed. There are many country years with zero deaths due to natural disaster—an overrepresentation accounted for in the statistical methodology, explained below—and a small number of country-years with very large death tolls. Table 1 provides the average annual death toll for each of the countries in the sample, the highest and lowest death tolls for any country year in the range, and the average number of disaster events for any country year in the range. The dependent variable utilized in this analysis is the *log of the annual number of people killed by natural disaster* + *1*.

TABLE 1 ABOUT HERE

In addition to including a measure of deaths from disaster, the analysis also includes a measure of the number of disasters that occur within a given country year. Since the EM-DAT database contains disaster events with zero deaths, I assume that when a given country has no events during a particular year, it implies no disasters for that year. I include these country-years into the database, entering zeros for both the death count and the event count. The *total count of disasters* allows for the possibility of distinguishing between a country that has zero deaths because of zero events and a country that has zero deaths but one or more events.

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[4] "Geophysical" encompasses earthquakes, volcanos, and dry mass movements. "Meteorological" encompasses storms. "Hydrological" encompasses floods and wet mass movements. "Climatalogical" encompasses extreme temperature events, droughts, and wildfires. Finally, "Biological" encompasses epidemics, insect infestations, and animal stampedes. For more see the EM-DAT website: http://www.emdat.be/classification.

[5] Data on disaster events are available from 1900 to 2011. The sample under analysis in this paper is limited by the availability of the CIE data, which currently span 1960-2000.

The measure of *contract-intensive economy* is developed by Mousseau (2009; 2012) based on data from Beck and Webb (2003) on annually aggregated value (in constant US dollars) of life insurance contracts in force. Mousseau's CIE variable is the natural log of Beck and Webb's LIFEDEER variable +1. Several of the country year values are missing, and Mousseau imputes the values based on available data.[6] In total there are 5,117 country-year CIE observations. The minimum value is 0; the maximum is 8.34.

TABLE 2 ABOUT HERE

Other standard controls are included. *Population* is taken from the Penn World Tables (PWT) and controls for the notion that greater fatalities might be a result of simply having more people. In the model below it is transformed into its natural log. *Population density* captures the spatial distribution of the population and has been shown to have an effect on disaster fatalities (Haque 2003) and on the difficulty associated with recovery from disasters (Donner and Rodríguez 2008). The population density measure is the total PWT population divided by the country area in square kilometers as measured by the World Bank (The World Bank 2012).

To mitigate problems with multicollinearity, infant mortality rate is used as a proxy for economic development (Abouharb and Kimball 2007).[7] The formal institutions associated with democracy are measured using the Polity project's *polity2* variable, which is coded from -10 to 10 (Marshall, Gurr, and Jaggers 2010). Finally, recent research has shown a relationship between foreign aid and disaster mitigation strategies (e.g., Cohen and Werker 2008); thus, I include a measure of net official development assistance received in constant 2009 US dollars provided by the World Bank (The World Bank 2012).

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[6] The data and replication procedures are available on Michael Mousseau's website at http://portal.ku.edu.tr/~mmousseau/. In the codebook he specifies the measures used to impute the missing values and notes that his procedure produces imputed measures that correlate at 0.97 with the original CIE data.

[7] The CIE variable is correlated with standard measures of per capita GPD at .8277. The correlation between CIE and infant mortality rate is -.6963. All other correlations between the variables employed in the analysis fall below .63.

Figure 1 is a histogram that displays the occurrences of the dependent variable [log(1+death)]. Two aspects are evident that influence the statistical methodology employed here: First, the country-year deaths due to disaster are not normally distributed; they are heavily skewed. Second, the data appear to have an abundance of zeros. In fact, of the 5,117 country-years observations in the dataset 3,598 (70.3%) contain a zero for the annual death toll due to natural disasters. This is potentially problematic for the question analyzed in this paper. If a country has no deaths in a particular year, it could be due to the fact that it simply did not have a disaster event during the given year; however, it could also be the case that it did have one or more disasters during the year but these events resulted in zero deaths. In order to avoid biasing the sample, both types of data need to be included in the dataset. In order to distinguish between the two possible reasons for zero deaths and to account for the overrepresentation of zeros in the dependent variable, a zero inflated negative binomial regression is employed (ZINB).[8]

FIGURE 1 ABOUT HERE

The ZINB model makes the assumption that a zero outcome in the dependent variable might be due to two different processes described above. Hence it incorporates two different estimations to account for this. The first is a binary model, in this case a logit model to try to capture whether zeros in the dependent variable are due to "no event" or "events with no deaths." Here the dependent variable is 1 if no one died from a disaster in a given country-year. The probability φ_i is established by the logistic function:

$$\varphi_i = \frac{\exp(z_i'\gamma)}{1+\exp(z_i'\gamma)} \tag{1}$$

For each of the models reported here, I use the *total count of disasters* as the explanatory variable in the logit model.

[8] For examples of other analyses that employ ZINB to analyze disaster death data, see Kahn (2005), Raschky and Schwindt (2009), and Costa (2012).

The second part of the ZINB regression is a count model, here a negative binomial model, that looks at the expected death count as a result of the combination of both the "no event" and "events with no deaths." In this analysis, this model is estimated using a series of control variables that are defined above and discussed below given the results. The log likelihood function is:

$$
\begin{aligned}
L = & \sum_{\{i:y_i=0\}} \ln[\exp(z_i'\gamma) + (1+\alpha\exp(x_i'\beta))^{-\alpha^{-1}}] \\
& + \sum_{\{i:y_i>0\}} \sum_{j=0}^{y_i-1} \ln(j+\alpha^{-1}) \\
& + \sum_{\{i:y_i>0\}} \{-\ln(y_i!) - (y_i+\alpha^{-1})\ln(1+\alpha\exp(x_i'\beta)) + y_i\ln(\alpha) + y_i x_i'\beta\} \\
& - \sum_{i=1}^{N} \ln[1+\exp(z_i'\gamma)]
\end{aligned}
\qquad (2)
$$

Discussion of Results

Table 3 presents estimations from three different models of the relationship between contract-intensive economies and deaths from natural disasters. Model 1 begins with the baseline relationship controlling for population and infant mortality rate as a proxy for development. Models 2 and 3 begin to layer in some of the variables (discussed above), which have been shown elsewhere to have an effect on disaster-related fatalities. In all three models the total count of disasters is a statistically significant predictor of the occurrence of zero deaths in the zero-inflated logit portion of the regression. In addition, the Vuong test for each model indicates that the zero-inflated model used here is preferred to a negative binomial regression model.

TABLE 3 ABOUT HERE

In all three models, the estimated effects of the CIE variable are in the theorized direction—disaster related fatalities decrease as country's level of contract intensity increases—and they are statistically significant. More important, the variable appears to be substantively important in all three models. Model 1 predicts that if the other variables were held constant, a one unit increase in a country's CIE score leads to an expected decrease in the difference of logs of expected fatality counts of 0.0425. The estimation of model 2 results in roughly the same effects: a one unit increase in a country's CIE score leads to an expected decrease in the difference of logs of expected fatality counts of 0.0416. However, in model 3, which contains the most control variables, the substantive effects are even more pronounced. Holding the other variables, a one unit increase in a country's CIE score leads to an expected decrease in the difference of logs of expected fatality counts of 0.2699.

Among the control variables, infant mortality rate is statistically significant in models 1 and 2, but it is also positively related to the dependent variable. If infant mortality is indeed operating as a proxy for economic development in this analysis, then this result goes against previous research demonstrating that countries at higher levels of economic development have lower fatality rates. Several of the other control variables—democracy and population density—are also in the opposite direction from what is expected. These could be artifacts of the current number of observations (more below) or reflective of the fact that the relationship between the nominally independent variables (e.g., CIE and infant mortality rate) is cannibalizing some of the variables' explanatory power.[9]

While the results here are quite suggestive of the negative relationship implied in hypothesis 1, there are limitations to the current analysis that prevent one from completely rejecting hypothesis 2. In adding the additional control variables in model three, the number of observations drops to 129, only 71 of which are nonzero observations. In addition, the CIE data currently ends at 2000. However, in the past 12 years there have been a number of large-scale natural disasters (e.g., the 2003 Bam (Iran) earthquake, the 2004 Indian Ocean earthquake and tsunami, the 2005 Kashmir earthquake, the 2010 Haiti earthquake, and the 2011 Tōhoku (Japan) earthquake and tsunami). Given the numbers of fatalities in these events, future research with updated data is necessary.

[9] The relatively small number of observations in these models makes it difficult to make any definitive claims at this point. Ongoing analysis will include a number of robustness checks using different data.

Conclusions

The results here provide preliminary support for the hypothesis that contract intensiveness, as a specific component of capitalist economies, has a negative relationship to disaster fatalities. As a country's level of contract intensiveness increases, the likelihood of disaster-related fatalities decreases. While the data limitations necessitate caution in this conclusion, it does suggest the need for future research on this topic. To the extent that the market mechanisms of capitalist economies play a significantly positive role in mitigating the effects of large natural disasters, it is likely that those effects are channeled through both formal and informal institutional mechanisms.

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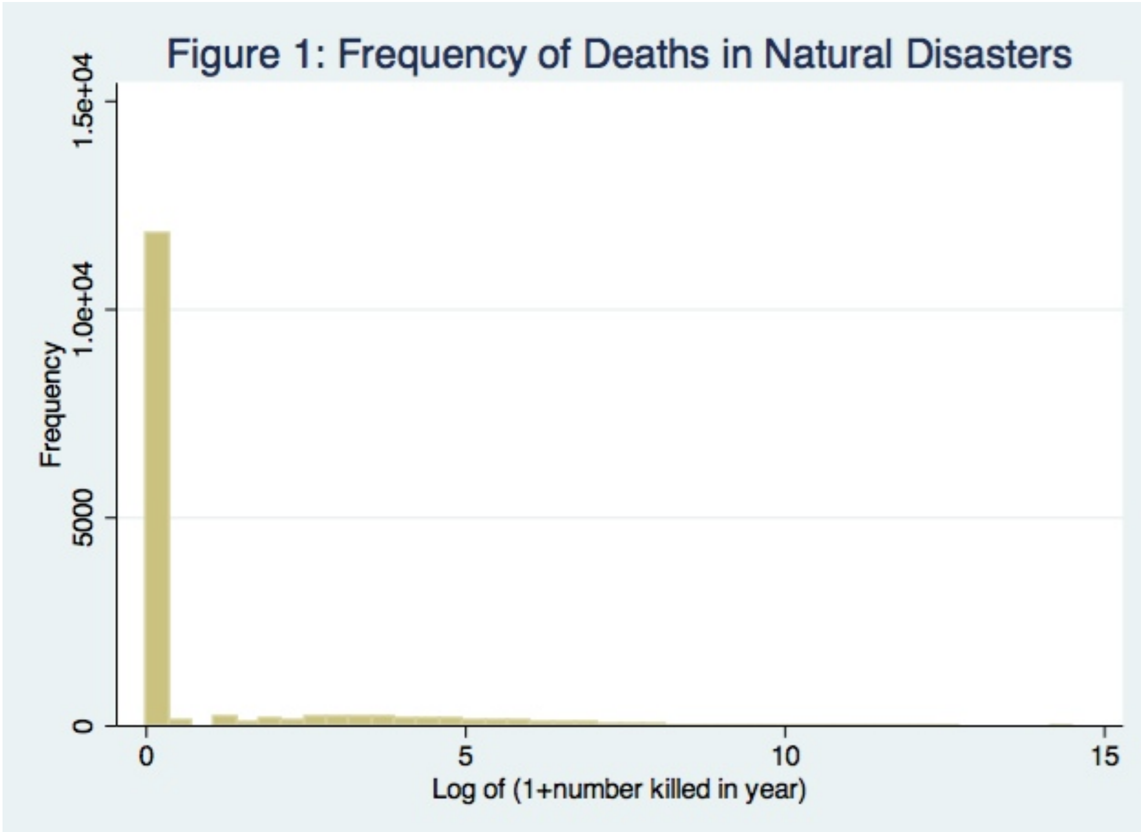
Figure 1: Frequency of Deaths in Natural Disasters
Frequency
1.5e+04
1.0e+04
5000
0
0
5
10
15
Log of (1+number killed in year)

TABLE 1: COUNTRIES AND NATURAL DISASTER FATALITIES, 1960-2010

Country	Avg. Annual Disasters	Avg. Annual Fatalities	Max. Fatalities	Min. Fatalities
Afghanistan	1.4	369.1	7,123.0	0.0
Albania	1.2	15.6	125.0	0.0
Algeria	1.5	142.3	2,635.0	0.0
Angola	5.0	59.0	59.0	59.0
Argentina	1.8	28.8	100.0	0.0
Armenia	1.2	0.8	4.0	0.0
Australia	4.2	19.5	90.0	0.0
Austria	0.7	3.9	53.0	0.0
Azerbaijan	1.5	10.0	42.0	0.0
Bahrain	1.0	0.0	0.0	0.0
Bangladesh	5.7	7,458.2	139,434.0	0.0
Belarus	1.0	1.4	5.0	0.0
Belgium	1.5	1.9	16.0	0.0
Benin	1.0	7.1	61.0	0.0
Bhutan	1.2	39.8	200.0	0.0
Bolivia	1.6	41.5	250.0	0.0
Bosnia-Hercegovenia	1.0	1.2	6.0	0.0
Botswana	1.0	3.9	20.0	0.0
Brazil	3.2	205.0	1,256.0	0.0
Bulgaria	1.2	4.7	20.0	0.0
Burkina Faso	1.0	4.4	22.0	0.0
Burundi	1.0	2.0	12.0	0.0
Cambodia	1.1	149.1	506.0	0.0
Cameroon	1.1	182.0	1,746.0	0.0
Canada	1.8	7.7	33.0	0.0
Central African Rep	1.2	0.9	7.0	0.0
Chad	1.1	10.8	54.0	0.0
Chile	1.8	310.1	6,570.0	0.0
China P Rep	10.8	11,441.6	242,000.0	0.0
Colombia	2.6	848.4	21,800.0	0.0
Comoros	1.0	0.0	0.0	0.0
Congo	1.0	22.3	154.0	0.0
Costa Rica	1.6	16.7	87.0	0.0
Cote d'Ivoire	1.0	4.7	28.0	0.0
Croatia	1.4	8.2	41.0	0.0
Cuba	1.5	77.8	1,750.0	0.0
Cyprus	1.1	8.4	52.0	0.0
Czech Rep	1.0	7.2	29.0	0.0
Denmark	1.2	1.7	9.0	0.0
Djibouti	1.0	18.1	145.0	0.0
Dominican Rep	1.2	113.9	1,432.0	0.0
Ecuador	1.7	275.4	5,102.0	0.0
Egypt	1.4	107.2	600.0	0.0
El Salvador	1.2	167.5	1,100.0	2.0
Eritrea	1.0	0.5	3.0	0.0
Estonia	1.0	0.0	0.0	0.0
Ethiopia	1.8	37.6	326.0	0.0
Finland	1.2	0.0	0.0	0.0

France	2.9	25.4	146.0	0.0
Gabon	1.0	0.0	0.0	0.0
Gambia The	1.0	10.6	53.0	0.0
Georgia	1.3	1.3	7.0	0.0
Germany	2.5	14.3	64.0	0.0
Ghana	1.0	21.3	145.0	0.0
Greece	1.8	64.2	1,048.0	0.0
Guatemala	1.6	1,170.3	23,000.0	0.0
Guinea	1.0	34.9	275.0	0.0
Guinea Bissau	1.0	0.6	3.0	0.0
Guyana	1.0	10.0	10.0	10.0
Haiti	1.9	133.7	1,122.0	0.0
Honduras	1.3	1,060.0	14,600.0	0.0
Hungary	1.4	50.4	300.0	0.0
Iceland	1.3	4.9	34.0	0.0
India	7.2	2,965.8	14,766.0	65.0
Indonesia	5.7	473.6	2,632.0	10.0
Iran Islam Rep	3.7	3,255.3	40,042.0	1.0
Iraq	1.0	3.3	20.0	0.0
Ireland	1.4	3.5	11.0	0.0
Israel	1.1	4.3	20.0	0.0
Italy	2.2	281.9	4,689.0	0.0
Jamaica	1.1	13.4	54.0	0.0
Japan	3.8	308.6	5,300.0	10.0
Jordan	1.2	30.6	259.0	0.0
Kazakhstan	1.1	17.4	112.0	0.0
Kenya	1.1	32.9	100.0	0.0
Korea Dem P Rep	1.3	71.4	315.0	0.0
Korea Rep	1.8	167.6	747.0	5.0
Kuwait	1.0	0.4	2.0	0.0
Kyrgyzstan	1.2	29.0	162.0	0.0
Lao P Dem Rep	1.2	27.8	300.0	0.0
Latvia	1.0	1.2	6.0	0.0
Lebanon	1.0	4.2	25.0	0.0
Lesotho	1.1	4.4	22.0	0.0
Liberia	1.0	7.0	46.0	0.0
Libyan Arab Jamah	1.0	0.0	0.0	0.0
Lithuania	1.2	6.7	34.0	0.0
Macedonia FRY	1.0	0.0	0.0	0.0
Madagascar	1.2	67.2	212.0	0.0
Malawi	1.2	41.6	472.0	0.0
Malaysia	1.4	40.4	320.0	0.0
Mali	1.1	5.4	17.0	0.0
Mauritania	1.2	0.6	4.0	0.0
Mauritius	1.1	1.5	9.0	0.0
Mexico	3.2	424.5	9,500.0	0.0
Moldova Rep	1.2	9.8	50.0	0.0
Mongolia	1.2	16.7	66.0	0.0
Morocco	1.6	21.0	60.0	0.0
Mozambique	1.6	128.2	832.0	0.0
Namibia	1.0	0.0	0.0	0.0
Nepal	1.7	249.2	1,076.0	20.0
Netherlands	1.5	1.6	20.0	0.0

New Zealand	1.8	3.0	53.0	0.0
Nicaragua	1.7	749.1	10,000.0	0.0
Niger	1.1	12.0	60.0	0.0
Nigeria	2.3	51.8	189.0	0.0
Norway	1.1	0.1	1.0	0.0
Oman	1.1	19.0	107.0	0.0
Pakistan	2.5	828.6	10,000.0	5.0
Panama	1.2	11.1	48.0	0.0
Papua New Guinea	1.6	168.0	2,182.0	0.0
Paraguay	1.1	11.9	76.0	0.0
Peru	2.2	2,078.7	66,826.0	0.0
Philippines	7.4	979.7	6,793.0	1.0
Poland	1.4	35.0	157.0	0.0
Portugal	1.2	44.1	462.0	0.0
Romania	1.9	161.6	1,641.0	0.0
Rwanda	1.0	6.9	48.0	0.0
Saudi Arabia	1.0	4.6	32.0	0.0
Senegal	1.1	15.6	187.0	0.0
Sierra Leone	1.0	12.3	60.0	0.0
Slovakia	1.0	12.4	54.0	0.0
Slovenia	1.0	0.0	0.0	0.0
Somalia	1.5	227.5	2,311.0	0.0
South Africa	1.9	64.8	515.0	0.0
Spain	2.1	88.6	519.0	0.0
Sri Lanka	1.6	71.3	750.0	0.0
Swaziland	1.0	8.8	53.0	0.0
Sweden	1.2	3.0	13.0	0.0
Switzerland	1.5	10.6	90.0	0.0
Syrian Arab Rep	1.0	0.0	0.0	0.0
Tajikistan	1.4	19.1	62.0	0.0
Tanzania Uni Rep	1.5	30.1	189.0	0.0
Thailand	2.4	146.6	769.0	0.0
Togo	1.1	0.4	3.0	0.0
Trinidad and Tobago	1.2	3.4	24.0	0.0
Tunisia	1.2	70.5	540.0	0.0
Turkey	2.2	988.2	17,982.0	0.0
Turkmenistan	1.0	1.8	11.0	0.0
Uganda	1.3	25.7	120.0	0.0
Ukraine	1.7	6.9	18.0	0.0
United Kingdom	2.0	22.7	140.0	0.0
United States	11.8	346.9	1,398.0	27.0
Uruguay	1.2	1.8	8.0	0.0
Uzbekistan	1.2	5.7	24.0	0.0
Venezuela	1.8	1,925.4	30,005.0	0.0
Viet Nam	3.1	757.3	7,400.0	0.0
Yemen	1.4	65.1	345.0	0.0
Zaire/Congo Dem Rep	1.0	22.0	147.0	0.0
Zambia	1.0	1.6	11.0	0.0
Total	2.4	572.7	242,000.0	0.0

TABLE 2: SUMMARY STATISTICS OF VARIABLES

Variable	Observations	Mean	Std. Dev.	Min.	Max
Disaster fatalities in year (log of kiy+1)	14757	.7591	1.7848	0	14.5097
Count of natural disasters in year	14757	.7493	2.0148	0	36
Population (log)	10730	8.1959	2.0610	1.9811	14.0945
Contract intensive economy	5117	2.1113	1.9384	0	8.3377
Infant mortality rate	3185	41.7530	43.5672	1.2	245
Population density	8648	.1162	.3486	.0006	6.4399
Polity score	8070	.1338	7.4976	-10	10
Official development assistance (real)	2002	4.73e+08	9.40e+08	-1.10e+09	2.47e+10

TABLE 3: DETERMINANTS OF ANNUAL NATIONAL DEATHS FROM NATURAL DISASTERS

	(1)	(2)	(3)
Total count of disasters	0.0162***	0.0158***	0.0389*
	(3.32)	(3.20)	(1.66)
Log population	0.2321***	0.2371***	0.3218***
	(12.75)	(12.45)	(4.05)
Contract-intensive economy	-0.0425***	-0.0416***	-0.2699***
	(3.12)	(3.03)	(2.63)
Infant mortality rate	0.0015*	0.0015*	-0.0020
	(1.85)	(1.81)	(0.77)
Average population density		-0.1249	-0.4370
		(0.76)	(0.84)
Democracy			0.0379**
			(2.39)
Net ODA Rec'd			-0.0000
			(1.34)
Constant	-1.1978***	-1.2422***	-1.7237**
	(6.08)	(6.15)	(2.32)
Zero-inflated logit model			
Total count of disasters	-0.9037***	-0.8853***	-0.7674**
	(12.83)	(12.45)	(2.44)
Constant	1.5886***	1.5503***	1.2285**
	(18.53)	(17.54)	(2.50)
Ln alpha	-26.8423	-19.1948	-16.6475
	(0.10)	(0.08)	(0.03)
Observations	1,817	1,757	129
Nonzero observations	1,250	1,199	71
Log likelihood function	-1,886.02	-1,845.03	-170.63
Vuong test statistic	2.57	3.11	3.62

Each column represents a separate estimate of the zero-inflated negative binomial regression (ZINB) model. The dependent variable is the log of the number of people killed+1 from a natural disaster in a country-year. The upper panel contains the estimates of the negative binomial regression. The lower panel of the table contains estimates from the second equation of the ZINB model, the logit model that estimates the probability that zero annual deaths is a function of not having a disaster. Standard errors are reported in parentheses beneath the coefficients. * $p<0.1$; ** $p<0.05$; *** $p<0.01$