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Natural Disasters, Economic Development, and Humanitarian Aid

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Natural disasters are one of the major problems facing humankind. Between 1980 and 2004, two million people were reported killed and five billion people cumulatively affected by around 7,000 natural disasters, according to the dataset maintained by the Centre for Research on the Epidemiology of Disasters (CRED) at University of Louvain (Belgium). The economic costs are considerable and rising. The direct economic damage from natural disasters between 1980–2004 is estimated at around $1 trillion.

Of course, the damage caused by natural disasters has been discussed for centuries. For example, in 1755 an earthquake devastated Lisbon, which was then Europe's fourth-largest city. At the first quake, fissures five meters wide appeared in the city center. The waves of the subsequent tsunami engulfed the harbor and downtown. Fires raged for days in areas unaffected by the tsunami. An estimated 60,000 people were killed, out of a Lisbon population of 275,000. In a letter to Voltaire dated August 18, 1756, Jean-Jacques Rousseau notes that while the earthquake was an act of nature, previous acts of men, like housing construction and urban residence patterns, set the stage for the high death toll. Rousseau (as cited by Dynes, 1999, from Masters and Kelly, 1990) wrote: "Without departing from your subject of Lisbon, admit, for example, that nature did not construct twenty thousand houses of six to seven stories there, and that if the inhabitants of this great city had been more equally spread out and more lightly lodged, the damage would have been much less and perhaps of no account."

Following Rousseau's line of thought, disaster risk analysts (for example, Coburn, Spence, and Pomonis, 1994; Mileti, 1999) distinguish three factors contributing to a disaster: the triggering *natural hazard event* (such as the earthquake

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striking in the Atlantic Ocean outside Portugal); the *population exposed* to the event (such as the 275,000 citizens of Lisbon); and the *vulnerability* of that population (higher for the people in seven-story buildings). Distinguishing these factors will prove useful in discussing how the effects of natural disasters evolve over time and across countries.

The Lisbon earthquake was the first natural disaster in which the state accepted the responsibility for emergency response and reconstruction (Dynes, 1999). Lisbon suffered no epidemics of disease and was already being rebuilt within less than a year. The new downtown of Lisbon was designed to resist subsequent earthquakes. A possible explanation for the rapid and appropriate response is that Portugal was relatively wealthy at the time and that important structural and political changes were moving Portugal toward more modern economic and political institutional forms (Dynes, 1999).

The general point is that societal factors affect the impact of disasters. Today, disaster fatalities are, on average, higher in low-income countries and nondemocratic countries. There could be many reasons for this; for example, perhaps low-income countries are more exposed to natural hazards, or perhaps fatalities in nondemocratic countries are higher only because these countries are also poor. Below we will try to sort out how societal factors, such as economic and political development, are related to the impact of disasters.

Rousseau mentions another important point in his letter, which is that whether an event is elevated to social discussion and considered a disaster depends on who is affected. He wrote: "You might have wished . . . that the quake had occurred in the middle of a wilderness rather than in Lisbon. . . . But we do not speak of them, because they do not cause any harm to the Gentlemen of the cities, the only men of whom we take account." Concerns continue today that the decision about what to call a disaster and how much relief to provide depends on who is suffering. For example, international relief may neglect disasters in countries that are culturally and geographically distant from the major donors and may favor high-profile emergencies at the expense of more invisible suffering far from the media or the political spotlight.

This paper starts by describing the incidence of natural disasters, where they strike, and their development over time. It then discusses how societal factors act to protect people from or expose them to natural hazards. The final section discusses the determinants and targets of international aid to disaster victims.

Where Do Disasters Occur and Have They Increased Over Time?

This section discusses where natural disasters strike in geographic terms and whether they have increased over time. I primarily use data from the Emergency Events Database (EM-DAT), maintained by the Centre for Research on the Epide-

Table 1
Global Humanitarian Consequences of Natural Disasters, 1980–2004

Disaster type	*Number*	*Number killed (thousands)*	*Number affected (millions)*
Drought	510	559	1,590
Wind storm	1,813	264	537
Wave/surge	28	229	2
Earthquake	621	215	78
Flood	2,102	171	2,490
Extreme temperature	237	68	11
Volcano	109	25	3
Slides	358	19	6
Wildfires	250	1	4
Total	**6,028**	**1,551**	**4,710**

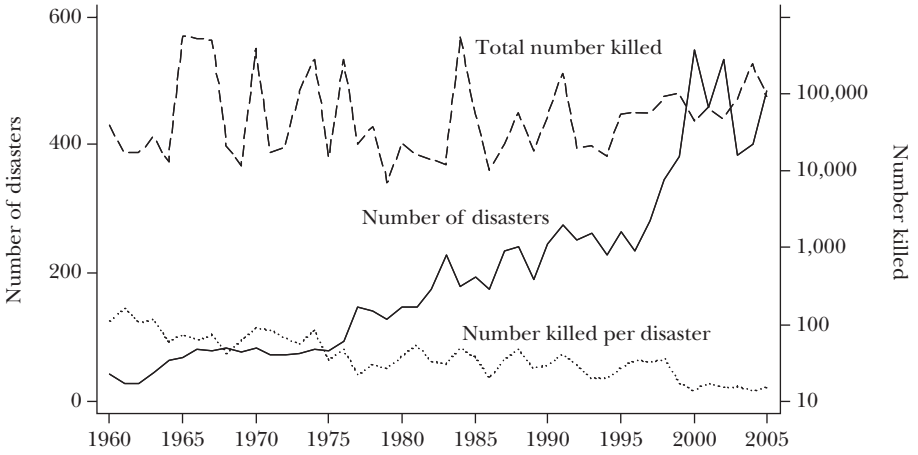
miology of Disasters (CRED) at the University of Louvain (Belgium).[1] Natural disasters occur when extreme natural phenomena like earthquakes, floods, or storms cause loss of lives, human suffering, or extensive damage to property. An event qualifies as a disaster in the CRED database if at least one of the following criteria is fulfilled: 10 or more people are reported killed; 100 or more people are reported affected, injured, and/or homeless; the government declares a state of emergency; or the government requests international assistance.

We limit the discussion to natural disasters caused by geophysical events, such as volcanoes and earthquakes, or hydro-meteorological events, such as floods, winds, and landslides. Between 1980 and 2004, 6,028 natural disasters of these types occurred, causing around 1.5 million deaths and affecting 4.7 billion individuals, as summarized in Table 1. Droughts have been the most deadly disaster, followed by windstorms and wave surges (tsunamis), while floods have affected the largest number of people. We do not discuss epidemics, insect infestations, and famines—although these are also contained in the CRED data.

One general concern is that reporting (and misreporting) of disasters varies systematically across time, levels of income, and political regimes. Reporting of small disasters is probably more complete in later years and in more developed countries. Closed undemocratic societies may also underreport natural disasters. For example, China reported an average of less than one disaster per year over the period 1960–1979 (under Mao Zedong and Hua Guofeng) and never reported less than six disasters per year after 1980 (with Deng Xiaoping taking over as de facto leader). These systematic reporting differences make it hard to estimate how economic development and political regime affect disaster causualties. Despite these problems, the CRED database is the best one available, and we discuss it keeping these problems in mind.

[1] There exist two other global sources on natural disasters maintained by private insurance companies, namely Sigma from Swiss Re and NatCat from Munich Re. However, these are not in the public domain.

Figure 1
Number and Magnitude of Disasters, 1960–2005



Although the total number of disasters reported worldwide has been rapidly increasing, the number of killed has not (except in Africa). The yearly numbers of disasters are plotted in Figure 1, together with their total and average magnitudes. Since 1960, the number of disasters has, on average, increased by around 5 percent per year and the number of affected by 4 percent. However, the number of killed has only increased by an insignificant 0.1 percent per year. In other words, the average magnitude of the reported disasters has fallen.

What explains the growth in the number of natural disasters? More frequent extreme weather events may explain part of the increase in droughts, floods, and storms. According to the Intergovernmental Panel on Climate Change (2007), there is likely to have been an increase in heavy precipitation events and, in some regions, increases in tropical cyclone activity and extreme weather events causing droughts in the period 1970–2000.

More complete reporting may also be driving this increase. Although, the number of earthquakes that hit populated areas has not increased since 1970 (Peduzzi, 2005), the numbers of reported earthquakes display the same 5 percent yearly increase from 1960–2004 as do disasters in general. The reason may be that the propensity to report earthquakes has increased roughly at this rate. Over the periods 1970–79, 1980–92, and 1993–2003, the EM-DAT reported, respectively, 11, 25, and 31 percent of the earthquakes that hit populated areas (Peduzzi, 2005). Over the same three time periods, the average reported number of earthquakes per year in EM-DAT was 10, 23, and 27.

Population growth may also turn more natural hazard events into disasters, by exposing more people. To get a rough estimate of the importance of this factor, I regressed the number of disasters in each country and each year from 1960 to 2004 on the country's population, allowing a separate population coefficient for India and China, and only including country and year fixed effects. The population

Table 2
Regional Humanitarian Consequences of Natural Disasters, 1980–2004

	Number of disasters	*Killed (thousands)*	*Affected (millions)*	*Killed per 100,000*	*Affected per 100,000*
Africa	861	581	324	2.61	1,453
Asia	2,352	726	4,210	0.74	4,303
Americas	1,626	131	125	0.59	564
Europe	863	110	37	0.60	206
Oceania	324	4	19	0.46	2,363

Notes: The first three columns show the total number of disasters, number killed, number affected over the period 1980–2004. The last two columns divide those numbers by the population in 2006 in 100,000s.

coefficients are highly significant and imply that an increased population of ten million is associated with an average increase in the number of disasters by 0.9 outside of China and India, and 0.3 in these two countries. Between 1960 and 2000, population grew by 1.2 billion in India and China, and 1.8 billion in the remaining countries in our sample. The associated increase in the number of disasters is around 190, which is around half of the total actual increase shown in Figure 1.

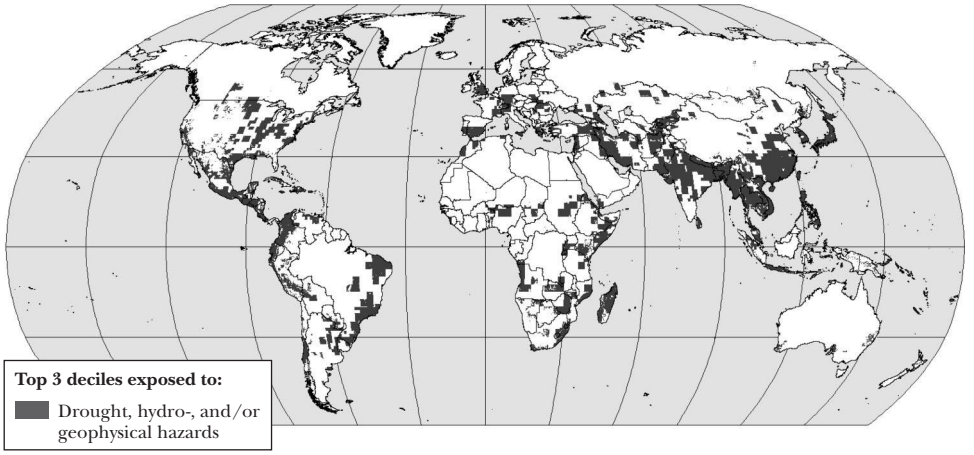
Given that extreme weather events have become more frequent, world population has doubled, and disaster reporting has become more complete, why is it that the total death toll has not increased? To get an idea of what can explain the falling per capita vulnerability, we now turn to the geographic distribution of natural disasters.

Comparing continents, Asia has the most disasters, fatalities, and people affected, as shown in Table 2. This finding is not surprising since Asia contains over 60 percent of the world population and one-third of the world land mass. In relation to the population, the death rate is highest in Africa, and the share of the population affected was highest in Asia.

To look more closely at the geographical distribution of disasters, it is useful to study acts of nature and acts of men separately. Starting with acts of nature, global data has been compiled by Dilley, Maxx, Chen, Deichmann, Lerner-Lam, and Arnold (2005); for most types of events, the data gathered covers the period 1980–2000. This data covers just the triggering natural phenomena: 1,600 storm tracks; 4,000 cases of volcanic activity categorized as moderate or above; earthquakes of magnitude 4.5 or higher on the Richter scale; drought events when the magnitude of monthly precipitation was less than or equal to 50 percent of its long-term median value for three or more consecutive months; data on flood events; and data on landslide risk based on soil moisture, precipitation, seismicity, and temperature.

The global distribution of natural hazards is displayed in Figure 2 on a latitude–longitude grid, whose boxes are 2.5 by 2.5 minutes (5 by 5 kilometers at the equator). The graph shows areas in the top three risk deciles of exposure to earthquakes, volcanoes, drought, floods, storms, or landslides. Floods, storms, and landslides

Figure 2
Geographic Distribution of Natural Hazard Events, 1980–2000



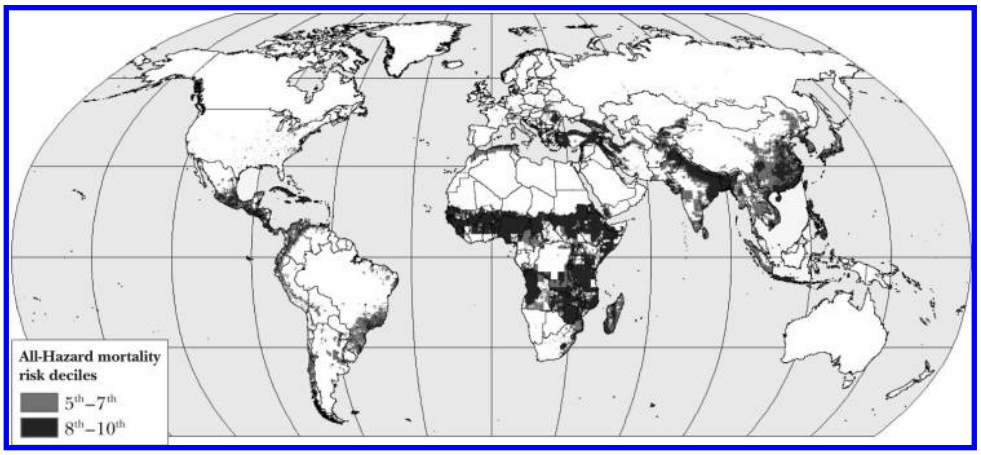
Note: Computed by Dilley, Chen, Deichmann, Lerner-Lam, and Arnold (2005) for grid cells of 2.5 by 2.5 minutes (5 by 5 kilometers at the equator). The graph shows the grid cells that are in the top three deciles of exposure to droughts or hydro- or geophysical hazards.

strongly affect eastern coastal regions of the major continents and the interior regions of North and South America, Europe, and Asia. Earthquakes and volcanoes cluster along fault boundaries with mountainous terrain. In the Americas, such a boundary stretches from the western coast of the United States through Central America and the western coast of South America. In Eurasia, one such boundary stretches from southern Europe, through Turkey, Iran, and central Asia, all the way to southwest China and Nepal. It then turns southeast through the waters outside Indonesia and then northeast, passing New Zealand, the Philippines, Taiwan, and Japan. Drought is more widely dispersed, affecting parts of Africa, the Middle East, India, and Southeast Asia, as well as Brazil and the interior regions of North America.

Interestingly, no apparent relation exists between economic development and exposure to natural hazards. High-income areas in Europe, North America, and Japan are as highly exposed to natural hazards as are low-income areas in Africa and Asia. This impression will be confirmed when we look at the numbers below.

The historical pattern of fatalities is very different. Figure 3 shows estimated mortality risks, computed by allocating regional mortalities from 1980 to 2000 by disaster type to smaller geographical units using data on population and frequency of natural hazard events. Mortality risks are clearly lower in countries with developed economies. The United States is noteworthy in that more than one-third of its population lives in hazard-prone areas but only 1 percent of its land area ranks high in mortality risk (Dilley et al., 2005). In contrast, many people have died from natural disasters in central Africa, without being highly exposed to natural hazards. This pattern suggests that high-income countries have been able to protect themselves

Figure 3
Geographic Distribution of Mortality Risk from Natural Hazards, Based on Events 1980–2000



Note: Computed by Dilley, Chen, Deichmann, Lerner-Lam, and Arnold (2005) for grid cells of 2.5 by 2.5 minutes (5 by 5 kilometers at the equator). The graph shows the grid cells that are in the top three and five deciles of the risk distribution.

against fatalities from natural disasters. The next section will investigate this pattern in more detail.

What Characterizes Countries Vulnerable to Disasters?

High-income countries face a lower mortality risk from natural hazards, for obvious reasons. High-income societies can better afford measures to limit the effects of natural disasters. Buildings can be constructed of stronger and more durable materials. Houses can have raised platforms to better withstand floods. Agricultural areas can be irrigated to reduce losses during droughts. Warning systems for certain natural disasters, such as hurricanes, can save lives (Sheets and Williams, 2001). After a disaster strikes, measures such as bringing in medical care and food as well as mass evacuations can limit the negative consequences of the disaster.

Since the government typically handles many of these measures, disasters may be less severe in countries with efficient and accountable governments. Government efficacy is positively related to having firm civil liberties and a free press (Isham, Kaufmann, and Pritchett, 1997). In a comparison across states within India, Besley and Burgess (2002) found that calamity relief has been more responsive to needs in states where more people read newspapers. For this reason, it is easy to believe that disasters are less severe in those countries that are more democratic, having a free press, as forcefully argued by Sen (1990).

Table 3
Comparing High- and Low-Income Countries

Country income category	*Number of disasters*	*Population (million)*	*Exposed pop. (million)*	*Killed in disasters*	*GDP per capita*	*Democracy index*
High-income	1,476	828	440	75,425	23,021	9.5
Low-income	1,533	869	496	907,810	1,345	3.2

Note: The first and the fourth columns contain the numbers of natural disasters and number killed, respectively, over the period 1980–2004. The other columns contain characteristics in 1996. "Exposed pop." is the population share in each country that live in areas in the top three deciles of risk exposure to volcanic activity, earthquakes, storms, floods, landslides, or droughts—multiplied by the population in the country and summed over the countries in the income group. The "Democracy index" is the population-weighted average POLITY IV Democracy index.

Economic inequality may also increase vulnerability, because inequality increases the share of the very poor and this group is particularly vulnerable (Chou, Huang, Lee, Tsai, Chen, and Chang, 2004). Poor individuals typically have a worse initial health status, live in lower-quality housing, more frequently live in areas facing disaster risk, have lower savings and less insurance, and have poorer access to alternative food supply routes. In addition, economic inequality may reflect a society or a political system that is ill-equipped to make a collective effort to limit the consequences of natural hazards (Kahn, 2005; Anbarci, Escaleras, and Register, 2005).

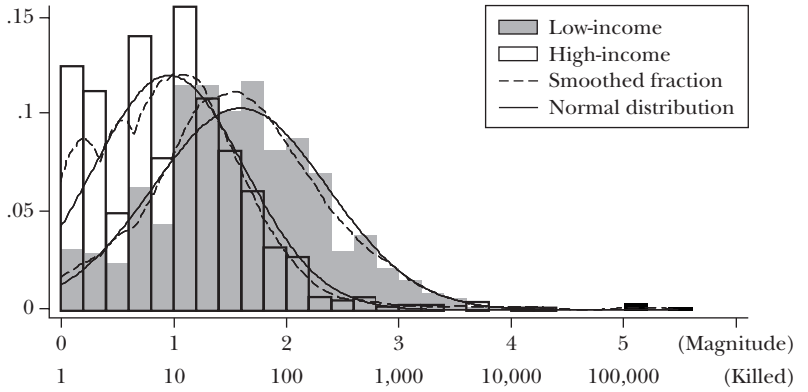
A small but growing body of work in economics has investigated these hypotheses. We discuss the results and provide some empirical evidence using the EM-DAT data merged with data on country characteristics. We will focus on disaster fatalities, since there are fewer issues in measuring the number of people killed than the number affected or economic losses.

Starting at the widest perspective, the one-third of the world's population that lives in low-income countries suffers almost two-thirds of all fatalities from disasters (using the World Bank's official analytical classification of high-, middle- and low-income countries in 2006).[2] In other words, disaster-related deaths per capita are four times higher in this group of countries than elsewhere. It is instructive to compare just the groups of high- and low-income countries. These are roughly comparable in terms the number of disasters 1980–2000, population size, and populations exposed to high disaster risk. However, the high-income countries suffered an order of magnitude fewer fatalities than did low-income countries, as shown in Table 3.

How much of the 90 percent lower fatalities in high-income countries can be explained by reduced vulnerability related to development? There could be many reasons for the different findings for high- and low-income countries: perhaps different

[2] World Bank list of economies (July 2006) available at ⟨http://siteresources.worldbank.org/datastatistics/resources/class.xls⟩.

Figure 4
Fraction of Disasters by Magnitude for Low- and High-Income Countries, 1980–2004



types of disasters strike in rich and poor countries; perhaps reporting is different; or perhaps other factors drive both development and disaster-related deaths. It could also be that the difference in fatalities appears by chance. The difference is completely dominated by a few large disasters. Total fatalities would, in fact, have been higher in high-income countries had the two largest disasters struck there. (The four most deadly natural disasters in our data 1980–2004 are: the 1984 droughts in Ethiopia and Sudan, killing 300,000 and 150,000; the 2004 Indian Ocean Tsunami, killing 230,000; and the 1991 cyclone in Bangladesh, killing 140,000. All of these struck low-income countries, except the 2004 tsunami that affected mainly middle-income countries.)

To assess the systematic differences, we use a linear regression to analyze the determinants of the magnitude of the disaster measured in terms of the base-ten logarithm of the number killed. Following Richardson (1960), a disaster that kills one person has a magnitude of 0, one that kills ten has a magnitude of 1 in terms of number killed, and one that kills a million has a magnitude of 6. Analyzing magnitudes limits the influence of extreme observations. Figure 4 shows the distributions of disaster magnitudes in the two income groups. For example, disasters of magnitudes between 1 and 1.2 (numbers of killed between 10 and $10^{1.2}=16$) were the most frequent in high-income countries, as 15 percent were of this kind. In high-income countries, the whole disaster distribution is skewed towards smaller magnitudes. This pattern indicates that the very large disasters are much less likely in high-income countries.

Note that regressions on disaster magnitudes implicitly assume that the effects on fatalities are proportional, independent of disaster size; for example, an increase in income of 1 percent is associated with 0.4 percent fewer fatalities, whether the disaster kills 100 or 10,000 people. This assumption is what enables us to draw inferences on total fatalities, dominated by the large disasters, after observing mainly small and medium-sized disasters.

We will analyze the 3,200 natural disasters (approximately) that occurred in

1980–2004 striking in countries and years for which we have background data. Again, the dependent variable is the disaster magnitude. Our key independent variables are various economic and political country-specific variables potentially related to vulnerability to natural hazards. I will call these "vulnerability factors." To measure income, I use the income categories by the World Bank presented above and real GDP per capita from the World Penn Tables.[3] I use two variables as proxies for government effectiveness and accountability. The first is the government effectiveness index produced by the World Bank (Kaufmann, Kraay, and Mastruzzi, 2006). This broad, survey-based index aims at measuring the quality of public services, infrastructure, and civil service. For each country, I use the 1996–2004 average of this index. The next row is a yearly democracy index produced by the POLITY IV (2004) project at the University of Maryland. The index is on a zero-to-ten scale, and measures the competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive. I use this index divided by ten so that the range is between zero and one. To measure inequality, I use the country's average Gini coefficient 1980–2004, as reported by the UN-WIDER World Income Inequality Database.

To account for differences in the triggering natural hazard events and the populations exposed, a set of controls is included in all regressions. This includes dummy variables for type of disaster, the country population in levels and logs, and the share of each country's population that was exposed to high risk of natural hazards in 1980–2000. Of course, one would have liked to control more carefully for the severity and the number of people affected by each particular disaster. Peduzzi, Dao, and Herold (2005) have assembled this type of data, although it is not yet publicly available. To control for other continent-specific and common time-varying factors, continent and year dummy variables are included.

To simplify the exposition, I will sometimes refer to the estimates as "effects," although they may not measure causal effects. For example, societies that have high per capita incomes or that experience economic growth are likely to be different from poor, stagnant countries in a multitude of ways that are hard to measure and are likely to affect disaster deaths. We cannot hope to control for all these factors. It is important at least to correct the standard errors for the presence of these unobserved factors, which is done by clustering by country.

How large is the total systematic difference in fatalities between high- and low-income countries? In Table 4, column 1, I regress the disaster magnitudes on only the indicators for middle-income and low-income countries and the controls. The left-out category is high-income countries, so these coefficients can be interpreted relative to high-income countries. The estimates suggest around 70 percent lower fatalities in high- than low-income countries from disasters of the same type striking on the same continent in the same year, controlling for country population and population shares exposed to high natural hazard risk. (The table shows that,

[3] And I use the Laspeyres index, as reported in Heston, Summer, and Aten (2002).

Table 4
Characteristics of Countries with Severe Natural Disasters

	Killed (log_{10})	*Killed* (log_{10})	*Killed* (log_{10})
Middle-income country	0.29		
	(0.06)***		
Low-income country	0.51		
	(0.08)***		
Real GDP per capita (log_{10})		−0.21	−0.43
		(0.09)**	(0.18)**
Government effectiveness		−0.13	
		(0.04)***	
Democracy index		0.14	0.12
		(0.06)**	(0.06)*
Gini coefficient		0.30	
		(0.26)	
Observations	3262	3137	4064
R-squared	0.25	0.26	0.31

Notes: Results from ordinary least squares regressions. The unit of observation is a natural disaster in the CRED database. The dependent variable is log_{10}(killed). All regressions include year-, continent-, and disaster type fixed effects, and control for the log and level of population, and the share of the country's population living in areas exposed to high natural disaster risk. Column 3 also includes country fixed effects. Robust standard errors, clustered by country, in parentheses.
* significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

with the controls, the average disaster is about half a magnitude lower in high-income countries than low-income countries, implying that high-income countries have 30 percent of the fatalities of low-income countries, as $10^{-0.5} = 0.3$.)

We now explore whether democracies are better at dealing with disasters. Sen (1990) argues this, comparing the democratic India with China. Interestingly, the Chinese government is more effective by the World Bank measures. Which of these factors—democracy or effectiveness—is more important for disaster fatalities? The specification in column 2 includes all the vulnerability factors discussed above, but drops the middle- and low-income indicators and instead uses the (base-ten log of) real per capita GDP to capture the economic status of countries. Income is still negatively related to disaster deaths. Strikingly, countries with more effective government suffer fewer fatalities while more democratic countries suffer more. This finding lends little support to Sen's argument. However, the benefits of democracy may appear as government effectiveness. Once government effectiveness is controlled for, the remaining positive effect of democracy may just reflect more complete reporting of fatalities. Consistent with this idea, the democracy index is insignificant when government effectiveness is removed from the regression (result not shown).

I find little evidence that more unequal countries experience more disaster-related deaths. The estimated Gini-coefficient is not significant. I also tried other proxies for inequality, such as the income share of the poorest quintile (from UN-WIDER), but these were not systematically related to disaster magnitudes

either. In contrast, both Kahn (2005) and Anbarci, Escaleras, and Register (2005) find that the Gini coefficient is positively correlated with disaster-related deaths, controlling for income. Interestingly, Anbarci, Escalera, and Register also find that the earthquake preparedness of countries, as judged by three international agencies, is negatively correlated with the Gini coefficient (although this finding is just a simple correlation). Thus, the evidence regarding the Gini-coefficient and disaster effects is mixed.

The third column investigates whether changes in disaster magnitudes within a country over time are related to changes in the potential vulnerability factors. By including country-dummy variables, we effectively control for all differences between countries that are constant over time, such as geographical location and most of the systematic natural hazard risk. Consequently, only time-varying country-level variables, such as income and democracy, can now be included. To get more statistical power, the sample period is expanded to 1960. The coefficient implies an elasticity of disaster-related deaths to GDP per capita of −0.43. Kahn (2005) finds a similar elasticity for earthquake fatalities. To compare this to the earlier estimates, an increase in per capita GDP from the average income among low-income ($1,300) countries to that of high- and low-income countries ($23,000) is associated with a decrease in disaster fatalities of around 70 percent, as $(23{,}000/1{,}300)^{-0.43} = 0.3$. The democracy index is also positively correlated with disaster magnitude over time, although not significantly so.

Recall that, despite population growth, total disaster-related deaths showed no trend between 1960 and 2004. How much larger would disaster fatalities have been, absent development? In an average country, GDP per capita increased 2.4 times between 1960 and 2000. An estimated elasticity of −0.4 implies that the current number of disaster-related deaths would be around 30 percent higher, absent economic development ($2.4^{-0.4} = 0.7$). However, this estimate assumes that all countries had the same average development.

Taking into account growth and disaster death rates in individual countries, disaster deaths are only 20 percent lower than they would have been absent development. The reason is the weak development in Africa. Some African countries with many disaster-related deaths, notably Sudan and Mozambique, experienced zero or negative economic growth from the 1960s to 2000. Summing the effects across all African countries, the expected number of people killed in natural disasters in Africa is the same evaluated at the levels of income in 1960 and in 2000. Europe and Asia, on the other hand, would have had an estimated 30 percent more disaster-related fatalities absent development. The high levels of growth in China, Indonesia, and India account for much of the estimated reduction of fatalities in Asia, somewhat balanced by the poor development in Bangladesh. The estimated reduction is around 10 percent in the Americas.

I will now briefly discuss three remaining potentially important issues: misreporting; the effect of disasters on the economy; and whether the variance of disaster magnitudes differs between high- and low-income countries. Starting with the last issue, we may underestimate the effect of income by just looking at average disaster

magnitudes and not the full distribution. Total fatalities are dominated by extreme disasters, and these are less likely if disaster magnitudes have less variance. High-income countries do seem to have a lower variance, as shown in Figure 4. The difference in estimated variance between high- and low-income countries implies an additional 25 percent reduction of fatalities in high-income countries (under the assumption that the errors are normally distributed). Note also that the variance in disaster magnitudes is higher for some types of disasters, like droughts.

Another concern is that low-income countries may report fewer disasters and, in particular, fewer small disasters. The average disaster magnitude in low-income countries would then be larger in the data than in reality, making reported disaster magnitude more negatively related to income. Hence, our estimated −0.4 elasticity of deaths per disaster with respect to income could be an overestimate. However, the underreporting would also make the total number of reported disaster-related deaths in low-income countries smaller than in reality. This would lead us to underestimate the effect of income on total disaster deaths. In a pure cross-country regression, I estimated the elasticity of total disaster-related deaths from 1980 to 2004 to average GDP per capita to be −0.5 and statistically significant.

We have discussed how economic development affects natural disasters, but natural disasters also affect the economy. In theory, the impact of natural disasters on GDP is unclear. The disaster may provide a positive contribution to measured GDP as reconstruction efforts are part of GDP while the direct losses of human and physical capital are not. On the other hand, the loss of productive capital may reduce GDP. Growth in real incomes is not significantly different in years when disasters strike than in an average year. This result was confirmed in our data after running a regression of the percentage change in real GDP per capita on a dummy variable indicating disaster years, including year and country fixed effects. For other studies of this relationship, see Albala-Bertrand (1993), Chavériat (2000), and Rasmussen (2004).

Looking forward, there is clearly scope to improve on the types of estimates made in this section. Data at finer geographical and temporal levels already exist for natural hazards as well as for demographic and economic variables. These could be used to identify more convincingly the relationship between, for example, income and disaster vulnerability. Developing joint statistical models of the triggering natural phenomena (for example, weather and geological events) and disaster effects would be a useful improvement to the "top three risk-deciles"–data used in this paper. It may also prove a fruitful way to better understand the crucial statistics of very large disasters.

Disaster Relief

Most victims of natural disasters live in low-income countries, with limited resources to mitigate the effects of such disasters. Consequently, international relief

from richer countries could play a key role. Given the large humanitarian stakes, it is essential that relief be given where it can do most good. However, some suspect that disaster relief favors high-profile emergencies at the expense of more invisible suffering far from the media or the political spotlight. Other suspicions are that disaster relief favors disaster victims in countries that have historical ties or lie close to the large donors, or that it favors countries that are important from a foreign policy or economic perspective. This section will discuss these motives and some empirical evidence.

Who Gives Relief, Who Receives Relief, and How Much?

The two main sources of international disaster relief data are the Development Assistance Committee (DAC) of the OECD and the Financial Tracking System (FTS) of the UN Office for the Coordination of Humanitarian Affairs. The DAC reports annual spending on emergency aid by donor–recipient country pair. This data is reasonably comprehensive, but includes emergencies other than natural disasters. The FTS is more specific; it records how much international relief was provided to individual natural disasters. But the FTS data is far from comprehensive, since reporting is voluntary. For this reason, we will mainly use the DAC data and restrict the attention to years when natural disasters struck.

According to the Development Assistance Committee data, net disbursements on emergency and distress relief over 1995–2004 were around $4.6 billion per year (in constant 2004 dollars). A few donors supplied most of this aid; in fact, eleven countries provided 90 percent. The United States has been the largest donor by far, accounting for around a third of all relief. However, European countries as a group account for 57 percent of the funds. Among them, the largest donors are the Netherlands, the United Kingdom, Sweden, Norway, Germany, and France, each contributing 6–9 percent. Other large donor countries have been Canada, Japan, and Australia. The bulk of the relief has been given to Africa (40 percent), Asia (35 percent), and Europe (19 percent).

We will not analyze relief from private individuals through organizations such as the Red Cross, OXFAM, UNICEF, and the Bill and Melinda Gates Foundation, since this is not contained in the Development Assistance Committee data. Private individuals contributed 10 percent of the total relief funds to natural disasters over 2000–2004, based on records of the Financial Tracking Service of the United Nations.

Why Do Countries Provide Disaster Relief?

In July 2001, heavy rains caused floods in Poland, killing approximately 30 people and affecting 15,000. This disaster was met by international relief efforts totaling around $15 million, as reported by the FTS. In that same year, a flood in Thailand killed 100 people and affected 450,000, while one in Angola killed 50 and affected 40,000 people, and another in Brazil killed 50 and affected 2,200. Here are the corresponding relief efforts: Thailand received $25,000; Angola, $75,000; and Brazil, $230,000.

Can the reasons countries provide disaster relief help explain such divergent responses? Private donations are probably based on humanitarian motivations for the most part, and this motive is certainly the most stressed in official guidelines for relief. The humanitarian motive is to provide relief where it would do most good, in terms of saving lives and reducing human suffering. Arguably, this motivation would drive relief to larger disasters in low-income countries, although such an outcome is not completely obvious, because low-income countries may have poor infrastructure and more prevalent corruption limiting the effectiveness of relief (see the discussion in Collier and Dollar, 2002).

However, people must be aware of a disaster in order to help, and so disasters in the media spotlight may get more relief. Donor government officials may also react more swiftly to disasters reported in the media.

Donor countries may also provide relief with an eye to their own economic or geostrategic political interest (for example, Alesina and Dollar, 2000, and the references therein). Large disasters may destabilize governments. Aid to friendly governments could help these stay in power; withholding aid from not-so-friendly governments could destabilize them (Drury, Olson, and Van Belle, 2005). Disaster relief may also be used to protect investments in foreign countries, driving relief towards countries where the donors have large economic stakes.

People may be more moved by the suffering of those close by—geographically or culturally—and media coverage also may focus more on these disasters. Geostrategic and economic interests are likely to be more important in countries geographically close to donors or in countries where donors have historical or cultural ties. We will investigate the role of geographical distance, common colonial past, common language, bilateral trade flows, and similar voting patterns in the United Nations in predicting aid flows. This approach is very much in line with research on general aid flows, as in Alesina and Dollar (2000).

Disaster Severity and News

Given that the United States is the largest single donor, I will focus here on relief provided by the USAID's Office of Foreign Disaster Assistance (OFDA) between 1968 and 2002. The OFDA is generally the first U.S. agency to be on the scene of a disaster, and it also influences other relief efforts. For example, the largest U.S. disaster relief program, under the Office of Food for Peace, requires an OFDA disaster declaration to trigger some of its disaster assistance. Although the OFDA only contributes around 20 percent of total U.S. disaster relief, each dollar spent by the OFDA on a particular disaster was, on average, matched by four dollars from other U.S. agencies in the fiscal year 2002.

The OFDA relief decisions respond strongly to fatalities. The OFDA provided relief to 11 percent of the disasters with less than 100 fatalities, to 30 percent of the disasters with fatalities ranging from 100 to 1000, and to 60 percent of the disasters with more than 1,000 fatalities. These large differences partly arise from other factors correlated with many deaths. Table 5 presents these results in a regression framework. In the first column, the dependent variable is a dummy variable for

Table 5
Disaster Relief, Need, and News

	Whether U.S. OFDA provided relief?	*Whether U.S. OFDA provided relief?*	*DAC donor country provided relief?*
Killed ($\log_{10}$)	0.10	0.02	0.05
	(0.01)***	(0.04)	(0.01)***
Affected ($\log_{10}$)	0.06	0.04	0.014
	(0.01)***	(0.01)***	(0.004)***
Real GDP per capita ($\log_{10}$)	−0.08	−0.23	−0.29
	(0.03)***	(0.07)***	(0.02)***
Disaster in the news	0.09	0.76	0.04
	(0.02)***	(0.32)**	(0.02)***
Type of regression	OLS	IV	OLS
Observations	4755	4755	17837
R-squared	0.32		0.27

Notes: Results from ordinary least squares (OLS) regressions, except column 2, which shows an instrumental variable (IV) regression where news coverage has been instrumented by whether there was a concurrent Olympic game. The dependent variable in the first two columns is a dummy variable indicating whether the U.S. Office of Foreign Disaster Assistance (OFDA) provided relief to an individual disaster. In the third column, the dependent variable indicates whether each Development Assistance Committee (DAC) donor country provided emergency aid to a potential recipient country in a year in which a disaster struck. All regressions include year fixed effects and control for the logarithm of population. The first two columns also include fixed effects for the continent, the disaster type, and the month of the disaster. The third column includes a donor fixed effect. Robust standard errors, clustered by recipient country in parentheses.
* significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

whether OFDA provided relief for a given disaster. The explanatory variables are the number killed; the number affected; the real per capita GDP of the country; and whether the disaster was in the news. The "news" variable measures whether a disaster was covered by one of the major U.S. television networks: ABC, CBS, NBC, or CNN. For example, Dan Rather covered the flood in Poland 2001 on the CBS evening news, but no network covered the flood in Angola. The coefficients in the regression suggest that an increase in fatalities by a factor of ten is associated with an increase in the probability of receiving relief by 10 percent. Around 29 percent of the disasters in the news received relief, as compared to 13 percent among those that were not covered. Taking into account factors such as the number of killed and affected, disasters covered by U.S. network news are 9 percent more likely to get relief than other similar disasters.

However, this simple regression is clearly insufficient to show that the media affects disaster relief. For example, it could be the case that both media coverage of natural disasters and disaster relief efforts are focused on more severe disasters, as measured in some way that we are unable to account for by the reported number of killed and affected. News coverage could also be affected by the geographic or cultural closeness between the recipient country and the primarily Western donors.

To investigate further the extent to which news coverage influences disaster

relief, Eisensee and Strömberg (2007) use the availability of other newsworthy material as an instrument for whether or not the disaster was in the news. In other words, they are asking whether a natural disaster is less likely to receive relief because news about this disaster was crowded out by news about, for example, the Olympics, or the O. J. Simpson trial. Thus, the first stage of the estimation process uses, as the dependent variable, whether the natural disaster was covered by the news media and, as the instrumental explanatory variable, measures of the amount of competing news material. Then the coefficients from this regression are used to calculate an estimate of media coverage of natural disasters, which is then plugged into the original regression. The second column shows the results from this type of estimation, using whether there was a concurrent set of Olympic Games as instrument. The significant coefficient on news coverage indicates that news coverage of natural disasters does have a causal effect on relief efforts. The estimated coefficient is larger than the ordinary least squares estimate.

Moreover, the news effect biases relief towards disasters that are more newsworthy, in the journalistic sense of the word. Earthquakes and volcanoes are more often covered by the news than equally severe disasters of other types. For example, Eisensee and Strömberg (2007) estimate that for every person that dies in a volcano disaster, over 2,000 people must die in a drought to receive the same expected news coverage. Similarly, disasters in Europe or the Americas are more covered than similar disasters in Asia, Africa, and the Pacific. This coverage induces a relief bias favoring the disasters that appear more in the news for reasons unrelated to severity.

The third column of Table 5 analyzes relief from a much larger set of donors. This column uses data from the Development Assistance Committee (DAC) covering the ten years 1995–2004, for 23 donor countries. This relief data is merged with information on 143 potential recipient countries that experienced at least one natural disaster during these ten years according to the CRED. The regression only includes years when natural disasters struck, in order to reduce the problem that this data also covers emergency relief given in complex emergencies like civil wars. The dependent variable in this column indicates whether a DAC-donor provided relief to a potential recipient country in a particular year (for example, the United States provided relief to Thailand in 2001). Here, we control for the total number of killed and affected in all natural disasters in that country in that year (for example, the seven natural disasters in Thailand in 2001 killed a total of 222 people and affected 470,000). This larger group of donors is more likely to give relief the larger is the disaster and the poorer is the potential recipient country, and if the disaster is in the news.

Donor–Recipient Relations

Data on bilateral emergency aid can be used to investigate the effects of donor–recipient relations, as measured by factors like colonial ties and distance. In effect, we can compare relief from different donors: for example, how much the

United States and France gave to Thailand and Poland, respectively, in 2001. The aid flows are converted into constant 2004 dollars.

Starting with the effect of colonial ties, the former colonial powers are easily identified by the number of countries with which donors ever had colonial ties.[4] The donors with most colonial ties are the United Kingdom (ties to 35 percent of the recipients), France (19 percent), Spain (11 percent), Turkey (7 percent), and Germany and Portugal (4 percent). The majority of the recipient countries have colonial ties with just one donor, although some have ties with more than one country. Notably, Palau and the Federal States of Micronesia have ties to four donors. Colonial ties are completely lacking for 36 states, notably China, Iran, Thailand, and a set of states around the Caspian and Black Seas. The spending patterns appear very different for the old colonial powers. France, Spain, Portugal, and Turkey clearly give more to their former colonies. For example, 40 percent of the former Spanish colonies receive Spanish relief as compared to 10 percent of the other countries in an average year. Other former colonial powers show no such preference, notably the larger donor countries like Germany and the United Kingdom.

Simple comparisons like these are open to alternative interpretations. For example, former colonies of some countries might be faring worse and need more relief. To analyze this more carefully, we regress emergency relief on some possible determinants. The unit of observation is donor country by potential recipient country by year. Only years when recipient countries were struck by natural disasters are included in the sample. We include a dummy variable for each recipient-year pair, thus accounting for all factors constant for a recipient country in a given year. The results are shown in Table 6. The first column has as the dependent variable whether a donor provided relief, the second has (the natural logarithm of) the amount of relief provided in those years when any relief was provided, and the third has (the natural logarithm of the) share of each donor's spending.[5]

Colonial history is clearly important. Having a common colonial history increases the probability of getting relief by 8 percentage points (estimated coefficient 0.08 in the table). If the donor is located in Latin Europe (France, Spain, Portugal, and Italy), the probability increases an additional 10 percentage points. These numbers are very large, given that the average donor only gives relief to 20 percent of the recipient countries. At that level, an increase of 18 percentage points roughly doubles the chance of getting relief. Colonial history is also of importance for the amount of relief, when relief is provided. This is 46 percent higher for countries with colonial ties, and three times higher for countries with colonial ties to Latin Europe (with spending in logs, a coefficient of 0.38 on

[4] From the dataset dist_cepii, provided by the Centre d'Etudes Prospectives et d'Informations Internationales.

[5] Here we assume that, conditional on positive amounts of aid being given, the conditional expectation of the log amount is linear. The estimated coefficients do not change significantly if both equations are estimated jointly using a Heckman selection model.

Table 6
Disaster Relief and Donor–Recipient Relations

	Is relief provided?	*Amount relief provided ($\log_e$), when relief is provided*	*Share provided ($\log_e$)*
Colony	0.08	0.38	0.66
	(0.03)***	(0.18)**	(0.16)***
Latin European colony	0.10	0.66	0.66
	(0.05)**	(0.27)**	(0.24)***
Common language	0.02	0.38	0.22
	(0.02)	(0.15)**	(0.09)**
Geographic distance	−0.11	−0.79	−1.13
	(0.05)**	(0.38)**	(0.23)***
Trade value ($\log_{10}$)	0.08	0.24	
	(0.01)***	(0.10)**	
UN friend	−0.26	1.20	
	(0.11)**	(0.62)*	
Observations	15819	4155	22910
R-squared	0.40	0.55	0.45

Notes: Results from ordinary least squares regressions. The dependent variables are the following: first column, whether a donor country provided relief to a recipient country struck by a natural disaster that year; second column, the logarithm of the amount provided, when relief was provided; third column, the logarithm of the share of all relief provided by that donor + 0.00001. All regressions include donor and recipient-year fixed effects. Robust standard errors, clustered by recipient country, in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

colonial ties implies that relief from the donor is increased by a factor $e^{0.38} = 1.46$ and so is 46 percent higher for colonies). Including both the increased chance of getting relief and the increased amount when relief is given, former colonies of Latin European countries can expect expenditures almost four times as high from their former colonial power than other aid recipients.

Donors also give more to countries with a common language. The dummy variable "common language" indicates that at least 9 percent of the populations in both countries speak a common language. For example, Canada has a common language with 46 percent of the recipient countries, where French or English is spoken by at least 9 percent of the population. The estimates in Table 6 imply that having a common language does not significantly affect whether aid is given. However, when relief is provided, the amount given is around 46 percent higher ($e^{0.38}$=1.46).

More distant countries are less likely to receive relief. The variable "geographic distance" contains the distance between the capitals of the donor and the recipient country. The unit is half the circumference of the earth, so a measurement of 1 means that the country is at the other side of the earth (roughly 20,000 km). The estimated coefficients imply that a country on the other side of the earth is 11 percent less likely to receive relief than a country at distance zero. To place this estimate in perspective, recall that the estimated probability of receiving relief increases by 5 percent when fatalities increase by a factor of ten. Combined, the estimates imply that to have the

same chance of receiving relief, a country at the other side of the earth must have 160 times as many fatalities as a country at zero distance, all else equal. A country on the other side of the earth also gets 45 percent as much relief when relief is provided ($e^{-.79} = .45$). The total effect is that a country on the other side of the earth gets one-third of the funds of a country at distance zero.

To investigate the hypothesis that economic interest motives may drive disaster relief, we include the variable "trade value," which is the (base-ten logarithm of the) bilateral trade flow between the donor and the recipient. (The data is provided by UN Comtrade.) Disaster relief is clearly increasing in the importance of the trade partner. The estimates imply that as trade flows increase by a factor of ten, the chance of receiving relief increases by 8 percent and the amount of relief increases by 27 percent ($e^{0.24} = 1.27$).

This evidence that economic donor interests affect relief is suggestive, but far from conclusive. The problem is that trade and aid would be positively related even if economic interests played no role for relief. The two are driven by similar factors, such as geographic and cultural closeness. For example, the measures of distance, common language, and colonial relationships that we have used to explain aid are standard in tests of the "gravity model" of trade (for example, Glick and Rose, 2002). We cannot control for all factors driving both trade and aid, and part of the positive relation between the two is due to this.

Finally, we investigate whether foreign policy motives drive relief to friendly governments. This test requires a measure of government friendliness. A simple proxy is whether the donor has a formal alliance with the country, which is tracked in the Correlates of War Formal Interstate Alliance Data Set (Gibler and Sarkees, 2003, v3.03). Another proxy is the similarity between the donor's and the recipient's voting pattern in the United Nations (Gartzke, 2006).

We find little evidence that these measures of government friendliness are of importance for disaster relief. Table 6 shows the effect of similar voting patterns in the United Nations. A recipient with similar voting patterns to a donor is less likely to receive relief from that donor, and the effect on the amount is positive, although only significant at the 10 percent level. The net effect is not significant. Using the number of alliances instead of voting patterns yields similar results. Other studies, notably Alesina and Dollar (2000) and Drury, Olson, and Van Belle (2005) have found aid to be positively related to these measures of government friendliness. The difference in results might be a reflection of our sample period being post–Cold War.

Which Countries Lose Out?

Which countries are likely to get less relief, given the same need? Aggregating across donors, the estimated effect of distance, colonial ties, and common language on total relief funds is shown for continents and a selection of countries in Table 7.

The first column contains the average distance in kilometers to the donors, weighted by each donor's share of relief expenditures. The second column shows how much this distance is decreased because of colonial ties. Having a colonial tie

Table 7
Average Aid-Dollar Distance (km), and Implied Effect on Relief

Continents	*Geographic distance*	*Colony*	*Latin European colony*	*Common language*	*Generalized distance*	*Implied effect on relief*
Europe	3,728	−386	0	−191	3,295	1.86
America	8,767	−548	−299	−713	4,576	1.60
Africa	7,180	−582	−283	−680	5,865	1.54
Asia	7,236	−328	−86	−244	7,381	1.37
Pacific	14,029	−815	−173	−816	10,967	1.00
Countries						
Algeria	4,296	−677	−681	−628	2,309	2.57
Poland	3,873	−700	0	0	3,173	2.52
Lebanon	5,798	−677	−681	−2,299	2,141	2.48
Anguilla	5,717	−955	0	−1,869	2,893	2.26
Gambia	6,049	−955	0	−1,869	3,225	2.24
China	8,729	0	0	0	8,729	1.50
Brazil	8,734	−12	−12	−4	8,706	1.47
Swaziland	10,758	−955	0	0	9,803	1.41
East Timor	13,310	−12	−12	0	13,286	1.03
Tonga	14,245	−955	0	0	13,290	1.00

Note: The first column shows the average distance a relief dollar would have to travel, if it was sent from the donor country's capital to the recipient country's capital. The second column shows the reduction in distance that would produce the same expected increase in relief as having colonial ties to the donor. The following two columns show analogous numbers for "Latin European colony" and "common language." The generalized distance is the sum of geographic and cultural distance. The final column shows the implied effect on relief. This column is computed by predicting the share of each donor's budget going to a recipient country (from column 3 of Table 6), multiplying this by the size of the donor's budget, and aggregating across donors.

has the same effect on expected aid flows as moving the country 12,000 kilometers closer to the donor (based on estimates from Table 6, column 3). However, most countries only have a colonial relationship to one country. For example, East Timor and Brazil are former Portuguese colonies. Portugal is a minor donor, only contributing 0.1 percent of the aid funds. The colonial tie only decreases the distance to these Portuguese funds, and when weighted in this way, the average aid-dollar distance only falls by 12 kilometers (as shown near the bottom of the second column). In contrast, Tonga has a colonial relationship with the United Kingdom, which provides 8 percent of the relief funds. This decreases its average distance to the aid dollar by 955 kilometers. The columns for a Latin European colony and common language are constructed in an analogous fashion.

Aggregating across donors, language is more important than colonial status, since language connects the recipient to multiple donors. For example, Lebanon has language ties to both English- and French-speaking donors, which move Lebanon over 2,000 kilometers closer to the average aid dollar.

The last column reports the estimated effect on relief. This column is computed by predicting the share of each donor's budget going to a recipient country (from column 3 of Table 6), multiplying this by the size of the donor's budget, and aggregating across donors.

The differences are large. Compared to disasters in Europe, the estimates imply that this general donor–recipient distance reduces funds to Asian disasters by 36 percent, to African disasters by 21 percent, and to American disasters by 16 percent.

The individual middle- and low-income countries "closest" to the large donors are located in Eastern Europe (notably states from former Yugoslavia, the Baltic states, Poland, and the Czech Republic) and states in the Middle East and northern Africa (Lebanon, Jordan, Egypt, Algeria, and Morocco) and islands in the Caribbean (Anguilla, St. Kitts and Nevis, and Montserrat). For example, Lebanon lies geographically close to the large European donors, has colonial ties to France, and language ties to both French- and English-speaking donors. Note that generalized distance reduces relief less to Poland than to Lebanon, even though the average distance to the aid-dollar is longer. Relief decreases more than proportionally to distance, which means that it is important to have a few large donors very close.

At the other end, we find islands in the South Pacific, such as Tonga, Tuvalu, and the Solomon Islands, to be most distant from the important donors. Another group at this end of the spectrum includes remote former Portuguese colonies, notably East Timor. These countries generally lack language ties to the major donors, and, as mentioned, their colonial ties are less valuable because Portugal is a very minor donor. The estimated effect of donor distance makes disasters in Poland receive 2.5 times more than similar disasters in East Timor. Other former Portuguese colonies, such as Angola, Brazil, and Mozambique, are also far from the average aid-dollar. A third group far from the large donors are Asian countries without colonial ties, such as China, Nepal, Bhutan, and Thailand.

What is the cost of these differences in relief in terms of human lives or suffering? To my knowledge, there are no estimates of the net effect of moving relief funds from one disaster to another. It is straightforward to study the kinds of relief given: how much cash spent per capita, amount of blankets, food, and clean water provided. However, it is harder to estimate their effects: to what extent did relief save lives or improve health and nutrition? The underlying problem is that provision of relief depends on these outcomes. For example, comparing mortality rates between victims that have received relief and those who have not will obviously not do, because relief was presumably given to those victims still alive whose health was most endangered. From a technical point of view, randomized field experiments would be desirable, but in the context of disaster relief, such an approach is impractical. Seeking natural experiments where relief provision differs for reasons unrelated to health status might be a way forward.

Conclusions

Although the extreme natural phenomena causing natural disasters are not more severe in developing countries, their consequences are. Significantly more people are affected and killed in disasters striking low- or middle-income countries, taking into account the type of disaster and the population at risk. Our estimates imply that fatalities would have been around 20 percent higher today, absent economic growth since 1960. This average hides strong regional differences, with considerably larger fatality reductions in Europe and Asia, and no reductions in Africa. Looking forward, the present strong growth rates in China and India hold promise of further reductions in the toll from natural disasters. These two countries hold more than one-third of the world population and three-quarters of all people affected by disasters over the period 1980 to 2004.

International relief for natural disasters does increase with the severity of the disaster, as measured by the number of killed and affected, and also rises when the income of the affected country is lower. However, relief is also driven by factors other than need. News coverage appears to drive disaster relief. Donors also give more to countries that lie closer, and with which they share a common language and colonial ties. These effects are sizeable. For example, to have the same chance of receiving relief from a particular donor, a country at the other side of the earth must have 160 times as many fatalities as a country at zero distance from that donor. A country without colonial ties must have 50 times as many fatalities to have the same chance of receiving relief as a former colony. For this reason, countries that lie far away from the major donors are systematically disfavored when it comes to disaster relief. Aggregated across donors, the estimated combined effects of distance, colonial ties, and common language imply that a disaster in Poland or Algeria is expected to receive around 2.5 times as much relief as a similar disaster in East Timor or Tonga.

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