Symposium: Advances in the Study of the Economics of Terrorism

Exploiting the Chaos: Terrorist Target Choice Following Natural Disasters

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This article explores the differences between transnational and domestic terrorism, further differentiating by private versus government targets, to estimate the effect of exogenous catastrophic shocks on a country's level of domestic and transnational terrorism. The empirical analysis uses detailed data on terrorism, natural disasters, and other relevant controls for 176 countries from 1970–2007 to illuminate several key disparities in a postdisaster target choice of terrorists. The results indicate that natural disasters incite both transnational and domestic terrorism; however, evidence is found for dissimilar motivations between the two. While both types of terrorism increase after disasters, transnational attacks against the government increase immediately following the disaster, suggesting an impetus to exploit weakened "hard" targets during the chaos. Conversely, domestic terrorism against the government takes longer to manifest, suggesting a period of time for which the public recovers and assesses the government's response.

JEL Classification: D74, H56, Q54, C23

1. Introduction

As the police force is busy in rescue and relief work for flood affectees, militants tried to take advantage of the situation to attack Peshawar.
Liaqat Ali Khan, Police Chief, Peshawar, Pakistan (Crilly and Nelson 2010)

We are not going to allow them to take advantage or exploit this natural disaster, [the outcome] depends on how effective and quick the response is. That is why it is so important that the international assistance comes immediately… If we fail, it could undermine the hard-won gains made by the government in our difficult and painful war against terrorism.
Shah Mahmood Qureshi, Pakistan Foreign Minister (Varner 2010)
What we are facing… calls for generous souls and brave men to take serious and prompt action to provide relief for their Muslim brothers in Pakistan.
Osama Bin Laden, tape released circa (2010)

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Beginning in late July 2010, monsoon rains inundated Pakistan, affecting an estimated 20 million people (Singapore Red Cross 2010). In the aftermath, the Pakistani government sought additional U.S. monies and supplies in order to bolster relief capacity over concern that a growing number of militant groups were rushing into the inundated areas to exert influence (DeYoung 2010). Media reports suggested that terrorist groups had been quick to seize upon the event in order to procure popular support by providing relief supplies (Porges 2010; Witte 2010). At the same time, reports also indicated these groups were engaging in a surge of attacks against police stations, other aid agencies, and civilians while the government was distracted by relief efforts (Hasan 2010; Shakir 2010; Waraich 2010). By providing relief aid to affected areas while simultaneously carrying out attacks, the terrorist groups sought to exploit the disaster to their advantage.

As witnessed in Pakistan, natural disasters present opportunities that terrorist groups can exploit in order to bolster their legitimacy at the expense of the government. By pursuing relief efforts in cases where government measures are inadequate or disorganized, terrorists may seek to gain support from the disaster-afflicted population. It is important to note that this phenomenon is by no means limited to the case of Pakistan. In addition to the 2010 flooding in Pakistan, evidence of this sort of posturing has been reported after a number of disasters, for example, in the aftermath of the 2004 Sumatra earthquake and tsunami. The 2004 tsunami was devastating for the small Republic of Maldives, with total damages estimated at 62% of the gross domestic product (GDP) (World Bank, Asian Development Bank, and United Nations System 2005). In 2004, the Idara Khidmat-e-Khalq (IKK), a charitable front of Lashkhar-e-Tayyiba (LeT), sent members to the Maldives under a humanitarian mission to aid tsunami victims. Reports indicated that the group led the way for LeT's activities in the Maldives, focusing on recruitment (US Department of State 2006; Roul 2010). It was not long after the tsunami that the Maldives suffered its first recorded transnational terrorist attack when a bomb exploded in a recreational park killing two Britons, eight Chinese, and two Japanese citizens (Global Terrorism Database 2007; Sherwell and Leapman 2007). In 2009, an article in the Asia Times Online declared that, following the tsunami, "scores of Maldivian boys were recruited through the IKK to be sent to seminaries in Pakistan" (Ramachandran 2009).

In the Maldives, groups associated with transnational terrorist organizations moved in a concerted effort to establish a presence following the disaster. While the anecdotal evidence in the Maldives does not constitute a causal relationship between natural disasters and transnational terrorism, it does establish grounds for exploring this association empirically. In fact, ex-ante there might be reasons to believe that disasters may only be affecting domestic terrorism. As governments carry the responsibility for ensuring the safety of their populations, it often falls on the state to provide or organize relief after a disaster. Dissatisfaction with the amount and relative share of relief could exacerbate pre-existing divisions and strife. Additionally, the existing literature has noted that disasters tend to disproportionately affect marginalized or disempowered groups (Albala-Bertrand 1993; Mustafa 1998; Bolin 2007; Cohen and Werker 2008). If the relative differences in disaster exposure manifest along these divisions, then domestic grievances could be triggered or intensified after a disaster.

While this logic leads to a clear basis for domestic terrorism following disasters, the characteristics of a disaster and subsequent recovery lead to possible motives for transnational terrorism. Influxes of foreign relief could be perceived by terrorist groups as an effort by foreigners to exploit the disaster for influence. Transnational attacks could occur as the result of domestic or transnational groups attacking foreign nationals in order to combat this sort of

influence. Though not considered to be terrorism, after the devastating earthquake in Haiti in 2010, there were multiple accounts of protesters hurling rocks and Molotov cocktails at treatment centers out of fear that foreign aid workers had been the source of the cholera outbreak (Associated Press 2010). As another possibility, weakened governments focused on providing disaster relief could present a target of opportunity for terrorist groups. As seen in the Maldives and Pakistan, transnational terrorist groups may *want* to influence the disaster-stricken nation. The attacks perpetrated by foreign terrorist organizations could be directly related to the efforts to damage the legitimacy of the government and establish a support base within a weakened population. As focus turns toward disaster response and recovery, the reduction in stability diminishes the risks for operating in previously stable nations through the deterioration of established borders and defenses.

Related to the possible variations between transnational and domestic terrorism following a natural disaster are the potential disparities between disasters' effects on the targets of terror. In particular, as domestic terrorist attacks could be driven by dissatisfaction over government response, attacks might be concentrated against government targets following a disaster. Grievances against a state's response to a disaster may take time to build as the adequacies and inadequacies of the government's relief efforts are realized; thus, domestic attacks against a regime could foment over time rather than occur immediately after the disaster. Alternatively, transnational groups may want to act quickly to exploit the chaos surrounding a disaster, as they perceive a disaster as an opportunity to attack a distracted regime and then transition to other less fortified targets afterwards. Similarly, if terrorism results from attacks *against* foreigners, the concentration of transnational terrorist activity might be most evident in the immediate relief period when these foreign workers are present.

Research on the links between disasters and terrorism is markedly recent. Berrebi and Ostwald (2011) demonstrated a clear link between the severity of natural disasters, as measured by disaster deaths, and subsequent increases in terrorism within a country. The study's findings were robust across many other measures of both terrorism and disasters for both incidence and severity. While the knowledge of this link is valuable in its own right, the findings expose many other related areas that beg further empirical investigation. This study seeks to advance this research into the relationships between disasters, terrorism, and the transference of terrorism along multiple fronts. First, by partitioning between domestic and transnational terrorism, the research assesses whether the impacts of disasters differ between these terrorism categories. Second, by differentiating by the primary targets of terrorism the research explores the underlying motives of this phenomenon.

The results show statistically significant, positive effects of natural disasters on both domestic and transnational terrorism. Analysis of the target type indicated that natural disaster fatalities were statistically associated with increased attacks against private entities in both the current and lagged year for both domestic and transnational terrorism; however, attacks against the government appeared to manifest differently between domestic and transnational terrorism. In particular, the effects of natural disasters on transnational terrorism against the government were observed in the immediate year of the disaster, whereas a period of two years was needed before effects were observed on domestic terrorism targeting the government. This bolsters the evidence that the observed effects of natural disasters on terrorist activity are through a combination of increased dissatisfaction with a government and a perception of an exploitable weakness. It also highlights possible differences in the impetus for attacks between domestic and transnational terrorism.

2. Data

Data for this study was gathered and integrated from a wide variety of sources. For data on transnational and domestic terrorism, this analysis uses Enders, Sandler, and Gaibulloev's (2011) recalibrated version of the Global Terrorism Database (GTD) from the National Consortium for the Study of Terrorism and Responses to Terrorism (START 2010a). Data on natural disasters were derived from the Center for Research on the Epidemiology of Disasters (CRED), Emergency Events Database (CRED 2010a). Demographic and economic characteristics as well as civil liberties and political rights were acquired from the World Bank's (2010) World Development Indicators and Freedom House's (2010) Freedom in the World Reports.

The unit of observation was the individual country year. Base specifications contained data on 176 countries[1] between 1970 and 2007. Final specifications displayed smaller numbers of countries and years as a result of missing demographic measures and absence of terrorism. The most complete set using all covariates consisted of 145 countries and 4000 individual country-year observations. The smallest set was observed for transnational attacks against a government and contained 117 countries and 3326 individual county-year observations. It was vital to control for demographic factors, as their influence potentially affects both disaster outcomes and terrorist activity; however, while the absence of countries with missing demographic measures deserves consideration, the results remained statistically significant and similar in size regardless of their inclusion. Additionally, as the focus of the research is primarily on countries where terrorism occurs or is likely to occur, the exclusion of states without reported events of terrorism was not a concern.

Terrorism Data

Within the empirical terrorism literature, the study of differences between domestic and transnational terrorism remains nascent. Anecdotally, there is evidence that transnational terrorism arises out of related but special circumstances as compared to domestic terrorism (Addison and Murshed 2005). Much of the lacuna in empirical research has been blamed on a lack of consistently tracked data that distinguishes between these types over a broad range of countries. While there have been some empirical studies that have focused along these lines for particular areas of the world (Jongman 1992), until recently there have not been data available on a global scale to distinguish between these two types.

Berrebi and Ostwald (2011) utilized terrorism data from the Global Terrorism Database (2007) from the National Consortium for the Study of Terrorism and Responses to Terrorism (START), which includes data on both transnational and domestic terrorism; however, it does not distinguish between the two types. The GTD contains information on target type, weapons used, date of attack, number of casualties, and location. The data are obtained primarily from contemporary news articles and other news sources. The GTD refrains from establishing a single definition of terrorism and, instead, includes coded criteria covering a broad set of

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[1] While the base specifications in Tables 2 and 3 contain 168 and 163 countries, respectively, the total coverage of countries between the two tables was 176 attributable to some countries not reporting any transnational terrorism and others not reporting any domestic terrorism.

definitions for terrorism. For an event to be included in the database, it must first meet the three following base criteria (START 2010b):

(i)   The incident had to be intentional—the result of a conscious calculation on the part of the perpetrator.

(ii) It had to entail some level of violence or threat of violence—includes damage to property.

(iii) The perpetrators of the incidents had to be subnational actors—does not include acts of state terrorism.

In order to further understand terrorism phenomena in circumstances where the two types might have differing impacts, Enders, Sandler, and Gaibulloev (2011) established a method of decomposing the data within the GTD into transnational and domestic terrorist incidents as well as recalibrating the GTD to account for discrepancies in the data set.[2] Using their methodology, transnational attacks are defined as those attacks in which victims, targets, perpetrators, or venues differ in nationality. Additionally, an incident is categorized as transnational if the terrorist(s) transit international borders or target international organizations or peacekeepers. Domestic terrorist incidents are those in which all of those factors share the same nationality. They further restricted their data to require three additional criteria be present for an incident to be included, further narrowing the acceptable set to approximately 66,000 terrorist incidents:

(i)   The act had to be aimed at attaining a political, economic, religious, or social goal. Exclusive pursuit of profit does not satisfy this criterion.

(ii) There had to be evidence of an intention to coerce, intimidate, or convey some other message to a larger audience (or audiences) than the immediate victims.

(iii) The action had to be outside the context of legitimate warfare activities.

Additionally, cases labeled as "doubted" were removed. These include incidents involving insurgency or guerilla warfare, internecine conflict, mass murder, and criminal acts. This cleaned and decomposed version of the GTD is the data set used for this study's investigation of natural disasters' influence on terrorism.[3]

Distinctions between targets were maintained in order to assess whether natural disasters had any influence on target choice. Brandt and Sandler (2010) first explored the differences between government and private targets for terrorism. In particular, they distinguished four target types: private parties, officials, military, and business. The GTD uses a wide range of categories for target entities. In total, target types are broken down into 22 distinct categories.

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[2] The GTD was modified in 1998 from contemporaneous collection to collection, retrospectively, at the end of each year; therefore, it is possible that the observed drop in attacks after 1998 could be attributed partially to the differences in data collection. In addition, the data set contains a discontinuity in 1993; however, totals were available for that year. As this study used data aggregated at the year interval, this was not a concern. To alleviate these concerns, year fixed-effects are included in the entire analysis, which can control for discrepancies where errors or methods have proportionate effects on all incidents over a year. As a precaution, the analysis was rerun using the recalibration methods developed by Enders, Sandler, and Gaibulloev (2011) to address these issues. No significant differences in the results were apparent. This was not surprising as the recalibration techniques adjusted all incidents for certain periods proportionately.

[3] Incidents where the terrorism type was categorized as "unknown" were not included in the analysis of effects on transnational versus domestic terrorism; however, they are included in the analysis of total terrorist incidence and terrorist incidence partitioned by target type.

To ensure that an adequate number of events were included for statistical tests, the decision was made to aggregate some of the groups together to form two groups: government and private. Government incidents consist of attacks against government entities (diplomatic and general) and the military. The categories falling under the government group are government (general), police, military, and government (diplomatic). Private targets consist of attacks against businesses, abortion-related entities, airports and airlines, education centers and schools, food or water, journalists and media, maritime-civilian, nongovernment organizations, private citizens and property, religious figures and institutions, tourists, transportation, and utilities.[4]

Disaster Data

The Emergency Events Database (EM-DAT) contains records of over 17,000 disaster events from 1900 until the present. The data were acquired from a variety of resources including United Nations (UN) agencies, nongovernmental organizations, insurance companies, research institutes, and press agencies. Reports from UN agencies, governments, and the Red Cross and Red Crescent Societies (CRED 2010b) were given priority. Natural disasters are categorized into several groups: geophysical, meteorological, hydrological, climatologic, and biological. In order to be included within the database, an event must have met at least one of the following criteria (CRED 2010b):

(i)   10 or more people killed;
(ii)   100 or more people affected;
(iii)   declaration of a state of emergency; or
(iv)   call for international assistance.

Only natural disasters are used in this analysis as the frequency and effects of other disaster types—such as industrial or technological accidents—are likely to depend on government factors and conditions that might be endogenous to terrorism. The natural disaster types included are drought, earthquake, flood, mass movement dry, mass movement wet, storm (hurricanes, typhoons, etc.), volcano, and wildfire. Deaths caused by natural disasters are used as the proxy for a disaster's severity. The data were culled to match the year range available from our terrorism data set.

Demographic Data

Data were obtained from the World Bank's (2010) World Development Indicators on a range of demographic and economic characteristics. These included log population size, population growth, percentage of population in an urban environment, log GDP per capita in constant 2000 U.S. dollars, gross government final consumption expenditures as a percentage of GDP (GFCE), foreign direct investment as a percentage of GDP, and Development Assistance Committee (DAC) country inflows as a percentage of GDP. The choice of indicators was based primarily on previous literature exploring the social, political, and economic contexts

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[4] Attacks with targets designated as "other" or "unknown" were not included in the analysis of target types because of the relatively few number of these events; however, they were included in all other analyses.

that influence terrorism activity and disaster effects and secondly on the availability and consistency of collection.

Population is included as it is an important factor in disaster and terrorism risk assessments (Berrebi and Lakdawalla 2007). Urban population as a percentage of population and population growth were added as controls to reflect theories of social disorganization and strain but also because urbanization and growth can influence the susceptibility to and consequences of disasters (Kandel 1992; Albala-Bertrand 2000; Robison, Crenshaw, and Jenkins 2006). GDP per capita, while not a direct measure of disaster recovery capability, is considered a good proxy for a state's ability to mitigate and recover from the effects of a disaster. It proxies for a variety of other development indicators and has been used in studies of conflict as an all-inclusive approximation of a country's level of development (Hegre and Sambanis 2006; Nel and Righarts 2008). Foreign direct investment as a percentage of GDP is used as an approximate measure of globalization as well as investment risk and development potential. The level of foreign investment and DAC country inflows might be expected to correlate with both natural disasters and terrorism, thus they are particularly important covariates to control for. Government final consumption expenditures are used as a measure of the degree of government involvement in providing goods and services to satisfy the direct needs of a population (Robison, Crenshaw, and Jenkins 2006). Finally, indicators for political rights and civil liberties are included (Freedom House 2010). Political rights reflect freedom of political participation and elections that are competitive. The civil liberties indicator measures the level of freedoms of speech, press, and association, which have been shown important in terrorism research (Krueger and Malecková 2003; Krueger and Laitin 2008).

In Table 1, we see that each year, countries suffer an average of 341 deaths from disasters. Within the terrorism measures, there is significant variation between the average number of transnational incidents and domestic incidents. In particular, the average number of domestic incidents per country year is more than four times larger than the average number of transnational incidents. Additionally, about a third of all domestic and transnational attacks are carried out against the government. The variation between these types and targets might manipulate the channels through which natural disasters influence terrorism. As a percentage, transnational terrorism encompassed 19% of all terrorist attacks (6% directed against government targets, 13% directed against private targets), whereas domestic terrorism comprised 81% of all terrorist attacks (29% against government targets, 52% against private targets).

3. Methodology

The relationship between natural disasters and terrorism is assessed by estimating the model,

$$terrorism_{i,t} = f\left(disaster_{i,t-j}, demographic_{i,t}, year_t, country_i\right), \qquad (1)$$

where terrorism$_{i,t}$ is terrorism incidence, transnational terrorism incidence, domestic terrorism incidence, attacks against a government and military, attacks against private citizens or private entities, domestic terrorist attacks against a government or military, domestic terrorist attacks against private citizens or private entities, transnational attacks against a government and

Table 1. Summary Statistics

Variable	N	Mean	SD	Min	Max	Median	P5	P95
Terrorism measures								
Attack incidence	6336	9.6	41	0	727	0	0	43
Domestic attack incidence	6336	7	32.8	0	673	0	0	32
Transnational attack incidence	6336	1.7	6.2	0	135	0	0	8
Attacks targeting gov	6336	3.2	13.9	0	262	0	0	13
Attacks targeting private	6336	6.3	28	0	485	0	0	29
Domestic attacks targeting gov	6336	2.5	12.1	0	233	0	0	11
Domestic attacks targeting private	6336	4.5	22.1	0	453	0	0	20
Transnational attacks targeting gov	6336	0.5	2.3	0	66	0	0	3
Transnational attacks targeting private	6336	1.1	4.4	0	128	0	0	6
Disaster measures								
Disaster deaths	6336	341.1	6332.5	0	300,000	0	0	287
Demographic measures								
GDP per capita	5212	6013.2	9008.4	62.2	72,296	1778.6	175.7	24,973.1
GFCE (% of GDP)	4967	16.1	6.9	1.4	76.2	15.3	7.2	28.2
Foreign direct investment (% of GDP)	4718	3.6	18.8	−82.9	564.9	1.1	−0.2	10.9
DAC inflows (% of GDP)	4924	4	6.9	−0.8	115.8	1	0	16.5
Population size	6190	3.00E+07	1.10E+08	18166	1.30E+09	6.50E+06	199,098	1.00E+08
Population growth	6186	1.8	1.5	−35.9	19	1.9	−0.3	3.7
Urban population (% of total population)	6210	49.8	24.4	2.7	100	50.1	12.4	90.5
Civil liberties and political freedoms	5484	8.1	4.1	2	14	8	2	14

military, or transnational attacks against private citizens or private entities in country i, year t; disaster$_{it-j}$ is deaths from natural disaster in country i, year $t - j$, where j ranges from 0 to 2 (i.e., current as well as two lagged years); demographic$_{i,t}$ is log population size, population growth, urban population (% of total population), log GDP per capita (constant 2000 USD), general government final consumption expenditure GFCE (% of GDP), DAC inflows (% of GDP), and political rights and civil liberties in country i, year t; and year$_t$, country$_i$ is year and country fixed-effects.

As terrorism incidence is a count, it is most appropriate to use panel estimators appropriate for count data. This analysis follows Berrebi and Ostwald (2011) and utilizes the Poisson quasi-maximum likelihood estimator (QMLE). Importantly, this estimator does not require that the conditional distribution of the dependent variable be Poisson distributed. It generates consistent estimates under a relatively weak assumption that only the conditional mean be correctly specified (Wooldridge 1999). Often a concern when implementing a Poisson model is the prospect of over/underdispersion in the data, as its existence can miscalculate the standard errors. Tests of terrorism incidence indicated this possibility. Notably, the Poisson QMLE makes few assumptions regarding the distribution of the variance,[5] and the quasi-maximum likelihood framework preserves consistency even in cases of over/underdispersion. Because of this, the analysis is able to incorporate fully robust standard errors (Wooldridge 1999, 2002; Simcoe 2007).[6] The negative binomial model is another possible specification for addressing overdispersion; however, it involves more restrictive assumptions related to the conditional distribution of the dependent variable. The analysis continues with the Poisson QMLE as, in this context, the consistent estimates from this estimator are deemed more valuable than the possible efficiency gains of the negative binomial model. As a robustness check, the analysis tests the negative binomial specification along with other alternatives. Finally, country and year fixed-effects are incorporated to control for time-invariant, country-specific factors and global trends.

Fixed-Effects Poisson QMLE

The conditional probability density function for the panel Poisson model is given as

$$f(terrorism_{i,t}|\mathbf{x}_{i,t}, country_i) = \frac{\exp(-\mu_{i,t})\mu_{i,t}^{terrorism_{i,t}}}{terrorism_{i,t}!}, \tag{2}$$

where the conditional mean[7] of terrorism with country specific fixed-effects is

$$\mu_{i,t} = E[terrorism_{i,t}|\mathbf{x}_{i,t}, country_i] = country_i \cdot \exp(\mathbf{x}_{i,t}\boldsymbol{\beta}) \tag{3}$$

and

$$\mathbf{x}_{i,t}\boldsymbol{\beta} = disaster_{i,t-j} \cdot \alpha + demographic_{i,t} \cdot \varphi + year_t \cdot \lambda. \tag{4}$$

The chosen specification uses both country and year fixed-effects. This assuages many of the concerns for potential omitted variable bias. By including country fixed-effects, the model

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[5] This is aside from the standard regularity conditions.

[6] Standard errors are robust to clustering, over/underdispersion, arbitrary heteroscedasticity, and arbitrary serial correlation (Wooldridge 1999).

[7] The exponential function was chosen for its clear interpretation and convenient computational and predictive properties. Wooldridge mentions it as the most common conditional mean in applications (Wooldridge 2002).

controls for all country-specific variables that are time invariant. Nations that are in geographic areas more susceptible to catastrophes may experience a higher incidence of terrorism attributable to location irrespective of the timing of natural disasters. Terrorism studies have shown significant relationships between terrorism and elevation, tropical climate, and land area (Abadie 2006). Geographic location and the physical characteristics of countries have generally remained constant over the 37-year period of observation, and country fixed-effects control for these and any other time-invariant factors. Along with country fixed-effects, year fixed-effects are included to control for the average global effects of specific periods. They alleviate bias from overall trends and events that occurred in a specific year, which might have influenced the average global level of transnational or domestic terrorism and/or natural disasters. For example, one might expect various worldwide trends in domestic or transnational terrorism during the era of communism or the period of the Global War on Terror.

As stated earlier, the recalibrated GTD, as derived in Enders, Sandler, and Gaibulloev (2011), allows the analysis to differentiate along the lines of transnational and domestic terrorism. It is then possible to test for differential effects of disasters by employing each of these types individually as the dependent variable in the model. Furthermore, the data distinguishes between attacks by target allowing for an assessment of the choice of targets postdisaster.

4. Empirical Results

In Table 2, domestic terrorist attack incidence is used as the dependent variable. The first lag of natural disasters is statistically significant. The Poisson model and choice of conditional mean allows a simplified interpretation of the coefficients as $100 \times \beta_j$ is the semielasticity of $E[y|\mathbf{x}]$ with respect to x_j. Small changes in our covariates can be interpreted approximately as fixed percentage changes in the expected value of the terrorism measure (Wooldridge 2002). In model 4, this translates to the interpretation that an increase of 25,000 disaster deaths is associated with a 23.5% increase in terrorism in the subsequent year. Effects are also seen in the current period; however, they are not as robust as the effect sizes observed in the year after. In the other covariates, we see that foreign direct investment and our measure of civil liberties are negatively associated with terrorism in the current year, whereas population size, GDP per capita, and GFCE are positively associated with terrorism.

In Table 3, the analysis shifts to transnational incidents. While the results share many similarities in terms of size and significance to the results for domestic terrorism, there are a few key differences to point out. First, while effects are again seen in the first lag of disaster deaths, they are equally concentrated and statistically significant in the year of the disaster with no statistically significant effect for the second lag. Additionally, for domestic terrorism, the statistical significance of current year disaster effects was mixed. This could indicate that terrorist attacks are driven by different motivations between these categories of terrorism. While these results are not enough to definitively substantiate this possibility, disparities in the effects indicate further areas to explore. Furthermore, the results confirm that natural disaster

Table 2. Natural Disaster Deaths and Domestic Terrorism Incidence

Models	(1)	(2)	(3)	(4)
Domestic Terrorist Attack Incidence	b/se	b/se	b/se	b/se
# Deaths from disaster / 25K	**0.131****	**0.195***	0.149	**0.186****
	(0.064)	**(0.105)**	(0.093)	**(0.086)**
# Deaths from disaster	**0.134****	**0.245*****	**0.207*****	**0.240*****
$(t-1)$/25K	**(0.054)**	**(0.094)**	**(0.063)**	**(0.050)**
# Deaths from disaster	**0.140**	**0.310****	**0.279*****	**0.282*****
$(t-2)$/25K	**(0.092)**	**(0.136)**	**(0.100)**	**(0.087)**
Log GDP per capita		0.392	1.061*	1.267**
		(0.637)	(0.591)	(0.530)
GFCE (% of GDP)		0.039	0.049**	0.042**
		(0.024)	(0.020)	(0.021)
FDI (% of GDP)		−0.108**	−0.110**	−0.096*
		(0.051)	(0.053)	(0.052)
Net DAC flows (% of GDP)		0.009	0.015	0.031
		(0.027)	(0.029)	(0.021)
Log population size			6.045***	5.691***
			(1.674)	(1.624)
Population growth			−0.084	−0.054
			(0.133)	(0.129)
Population urban			−0.014	0.002
(% of total population)			(0.034)	(0.032)
Civil liberties				−0.111**
				(0.056)
Year effects	**Yes**	**Yes**	**Yes**	**Yes**
Fixed effects (country)	**Yes**	**Yes**	**Yes**	**Yes**
Obs	**5782**	**4065**	**4064**	**4000**
Number of countries	**168**	**148**	**148**	**145**
Log likelihood	**−32,809.3**	**−24,255.2**	**−22,631.7**	**−21,979.6**
AIC	**65,694.5**	**48,594.5**	**45,353.4**	**44,051.3**
BIC	**65,947.7**	**48,859.5**	**45,637.4**	**44,340.8**

Notes: Reported standard errors are robust to clustering, over/underdispersion, arbitrary heteroskedasticity, and arbitrary serial correlation (Wooldridge 1999). Coefficients that have been scaled are indicated as such with the scaling factor. For example, "/ 1K" would indicate the variable was scaled to thousands. Significance level at which the null hypothesis is rejected: *** = 1%; ** = 5%; and * = 10%.

effects are not concentrated within one particular type of terrorism but span both transnational and domestic terrorist activity. Within the other covariates, we see similar patterns of effect sizes, directions, and significance to what is seen in Table 2.[8]

As discussed previously, this analysis utilizes the Poisson QMLE for its properties of consistency and fully robust standard errors. While the estimates produced by the Poisson QMLE are consistent even in cases of overdispersion, it important that the results be tested across other possible model specifications in order to establish robustness across model types. In Table 4, the panel log-linear (OLS, ordinary least squares) and panel negative binomial model are compared to the Poisson QMLE specification. The OLS models report standard errors robust to clustering and arbitrary heteroskedasticity. Additionally, the negative binomial estimators' standard errors are

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[8] While DAC country donor flows share the same effect sizes in Table 2 and Table 3, the associated covariate is statistically significant only for the transnational terrorism specification.

Table 3. Natural Disaster Deaths and Transnational Terrorism Incidence

Models:	(1)	(2)	(3)	(4)
Transnational Terrorist Attack Incidence	b/se	b/se	b/se	b/se
# Deaths from disaster / 25K	0.057	0.227***	0.198***	0.204***
	(0.035)	(0.048)	(0.040)	(0.042)
# Deaths from disaster	0.057	0.250***	0.217***	0.222***
$(t-1)$/25K	(0.052)	(0.086)	(0.067)	(0.065)
# Deaths from disaster	−0.028	0.100	0.106	0.106
$(t-2)$/25K	(0.073)	(0.141)	(0.110)	(0.110)
Log GDP per capita		−0.095	0.808*	0.831*
		(0.572)	(0.486)	(0.475)
GFCE (% of GDP)		0.026	0.036**	0.033**
		(0.019)	(0.015)	(0.015)
FDI (% of GDP)		−0.046**	−0.049**	−0.046**
		(0.021)	(0.021)	(0.022)
Net DAC flows		0.021	0.028*	0.031**
(% of GDP)		(0.013)	(0.015)	(0.014)
Log population size			4.607***	4.492***
			(1.242)	(1.240)
Population growth			0.073	0.075
			(0.077)	(0.073)
Population urban			−0.006	−0.002
(% of total population)			(0.029)	(0.029)
Civil liberties				−0.025
				(0.036)
Year effects	Yes	Yes	Yes	Yes
Fixed effects (country)	Yes	Yes	Yes	Yes
Obs	5581	3892	3891	3828
Number of countries	163	142	142	139
Log likelihood	−10,587.5	−7041.8	−6681.3	−6587.5
AIC	21,250.9	14,167.7	13,452.5	13,266.9
BIC	21,502.8	14,430.9	13,734.5	13,554.4

Notes: Reported standard errors are robust to clustering, over/underdispersion, arbitrary heteroskedasticity, and arbitrary serial correlation (Wooldridge 1999). Coefficients that have been scaled are indicated as such with the scaling factor. For example, "/ 1K" would indicate the variable was scaled to thousands. Significance level at which the null hypothesis is rejected: *** = 1%; ** = 5%; and * = 10%.

bootstrapped over 200 replications clustered by country. The findings for natural disasters are very similar to the previous tables, which lends support to the overall findings.

There is more variation in the results for the other demographic covariates. GDP per capita and GFCE are generally associated with higher levels of both transnational and domestic terrorist incidence in the Poisson specification; however, they are not statistically significant in the other specifications. Foreign direct investment is found to have a statistically significant positive association with terrorism incidence in the OLS model; however, the negative binomial model and Poisson QMLE model both report a negative effect. Population size is positive and, generally, statistically significant.

Table 5 illustrates the effects of natural disasters on terrorism incidence while separating terrorist attacks by target type—private and government. Most of the results show similarity between the two target groups. GDP per capita and population size both have statistically significant associations as seen in earlier results; however, foreign direct investment (FDI) and

Table 4. Model Specification Comparison

	Domestic Terrorism Incidence			Transnational Terrorism Incidence		
Outcome	Log linear (OLS)	Negative Binomial	Poisson QMLE	Log linear (OLS)	Negative Binomial	Poisson QMLE
Model	b/se	b/se	b/se	b/se	b/se	b/se
# Deaths from	0.126*	0.125	0.186**	0.102***	0.218***	0.204***
disaster / 25K	(0.075)	(0.083)	(0.086)	(0.022)	(0.061)	(0.042)
# Deaths from	0.198***	0.189***	0.240***	0.120**	0.198**	0.222***
disaster $(t-1)$/25K	(0.055)	(0.053)	(0.050)	(0.046)	(0.096)	(0.065)
# Deaths from	0.004	0.056	0.282***	0.027	0.065	0.106
disaster $(t-2)$/25K	(0.094)	(0.107)	(0.087)	(0.058)	(0.140)	(0.110)
Log GDP per capita	0.203	−0.003	1.267**	0.096	−0.100	0.831*
	(0.195)	(0.100)	(0.530)	(0.128)	(0.141)	(0.475)
GFCE (% of GDP)	0.010	0.011	0.042**	0.006	0.013	0.033**
	(0.010)	(0.013)	(0.021)	(0.005)	(0.011)	(0.015)
FDI (% of GDP)	0.000	−0.039***	−0.096*	0.001*	−0.036**	−0.046**
	(0.001)	(0.011)	(0.052)	(0.000)	(0.015)	(0.022)
Net DAC flows	0.001	0.009	0.031	0.006	0.020**	0.031**
(% of GDP)	(0.007)	(0.009)	(0.021)	(0.005)	(0.010)	(0.014)
Log population size	1.152**	0.196***	5.691***	1.209***	0.196***	4.492***
	(0.452)	(0.056)	(1.624)	(0.310)	(0.071)	(1.240)
Population growth	−0.045)	−0.089	−0.054	0.004	−0.037	0.075
	(0.032)	(0.059)	(0.129)	(0.019)	(0.069)	(0.073)
Population urban	−0.011	0.014**	0.002	−0.001	0.014	−0.002
(% of total	(0.014)	(0.006)	(0.032)	(0.008)	(0.009)	(0.029)
population)						
Civil liberties	−0.031	0.013	−0.111**	−0.009	0.007	−0.025
	(0.021)	(0.026)	(0.056)	(0.012)	(0.026)	(0.036)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects (country)	Yes	Yes	Yes	Yes	Yes	Yes
Obs	4000	4000	4000	3828	3828	3828
Number of countries	145	145	145	139	139	139
Log likelihood	−4969.7	−6357.6	−21,979.6	−3470.2	−4435.2	−6587.5
AIC	10,031.4	12,809.1	44,051.2	7032.4	8964.4	13,266.9
BIC	10,320.9	13,105	44,340.8	7319.9	9258.2	13,554.4

Notes: Reported standard errors are robust to clustering, over/underdispersion, arbitrary heteroskedasticity, and arbitrary serial correlation (Wooldridge 1999). OLS model standard errors are robust arbitrary heteroskedasticity and clustering. Outcome is log-transformed in log-linear models. The negative binomial utilizes dummy indicators for country fixed-effects and bootstrapped standard errors over 200 replications clustered on country. Coefficients that have been scaled are indicated as such with the scaling factor. For example, "/ 1K" would indicate the variable was scaled to thousands. Significance level at which the null hypothesis is rejected: *** = 1%; ** = 5%; and * = 10%.

our measures of civil liberties are statistically significant only for attacks against private entities. The most interesting result comes from the noticeable difference in the significance of the effects of disasters deaths between private versus government targets for total terrorist attacks. Results for natural disaster's effects on total attacks against "private" targets are similar to many of the earlier results in both magnitude and significance where the effects were most evident in the first lag; however, attacks on the government indicate only marginally significant increases in attacks during the current year and first lag. The marginal statistical significance for the first lag warrants further investigation, especially because that period was the most significant lag found

Table 5. Natural Disaster Deaths and Terrorist Attack Incidence by Target Type

Targets	Private			Government		
	Total	Domestic	Trans	Total	Domestic	Tran
Terrorism Incidence Type	b/se	b/se	b/se	b/se	b/se	b/se
# Deaths from disaster/25K	**0.162****	**0.185****	**0.173*****	**0.162***	0.170	**0.223*****
	(0.074)	**(0.080)**	**(0.062)**	**(0.094)**	(0.107)	**(0.081)**
# Deaths from disaster $(t-1)$/25K	**0.245*****	**0.267*****	**0.228*****	**0.149***	**0.168****	0.179
	(0.037)	**(0.042)**	**(0.053)**	**(0.083)**	**(0.086)**	(0.125)
# Deaths from disaster $(t-2)$/25K	**0.166****	**0.213****	0.127	**0.309*****	**0.353*****	0.017
	(0.078)	**(0.86)**	(0.099)	**(0.107)**	**(0.109)**	(0.180)
Log GDP per capita	1.061**	1.166**	0.964*	1.595***	1.694***	0.855*
	(0.513)	(0.565)	(0.524)	(0.466)	(0.487)	(0.513)
GFCE (% of GDP)	0.049**	0.052**	0.022	0.027	0.018	0.052***
	(0.021)	(0.022)	(0.017)	(0.018)	(0.020)	(0.020)
FDI (% of GDP)	−0.118**	−0.130**	−0.063**	−0.073	−0.091	−0.006
	(0.055)	(0.061)	(0.032)	(0.060)	(0.070)	(0.030)
Net DAC flows (% of GDP)	0.027	0.027	0.029*	0.034*	0.035	0.038**
	(0.022)	(0.025)	(0.015)	(0.019)	(0.023)	(0.016)
Log population size	5.536***	5.705***	4.204***	6.276***	5.890***	5.661***
	(1.541)	(1.586)	(1.320)	(1.693)	(1.913)	(1.279)
Population growth	−0.060	−0.088	0.040	0.014	0.010	0.106
	(0.115)	(0.141)	(0.080)	(0.121)	(0.132)	(0.073)
Population urban (% of total population)	0.000	0.006	0.006	−0.009	−0.003	−0.013
	(0.035)	(0.036)	(0.031)	(0.025)	(0.026)	(0.029)
Civil liberties	−0.092*	−0.121**	−0.022	−0.067	−0.087	−0.035
	(0.055)	(0.059)	(0.037)	(0.052)	(0.056)	(0.044)
Year effects	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Fixed effects (country)	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Obs	**3076**	**3076**	**3076**	**3076**	**3076**	**3076**
Number of countries	**105**	**105**	**105**	**105**	**105**	**105**
Log likelihood	**−19,605.7**	**−15,242.2**	**−5026.2**	**−10,403.1**	**−8956.8**	**−2830.2**
AIC	**39,303.3**	**30,576.5**	**10,144.5**	**20,898.1**	**18,005.6**	**5752.3**
BIC	**39,580.8**	**30,853.9**	**10,421.9**	**21,175.6**	**18,283.1**	**6029.8**

Notes: Reported standard errors are robust to clustering, over/underdispersion, arbitrary heteroskedasticity, and arbitrary serial correlation (Wooldridge 1999). Coefficients that have been scaled are indicated as such with the scaling factor. For example, "/ 1K" would indicate the variable was scaled to thousands. The analysis was restricted to the same sample of country years between the models. This was done to ensure that the difference between domestic and transnational attacks was not driven by differences in sample size. Results were qualitatively the same when all available country years were included. Significance level at which the null hypothesis is rejected: *** = 1%; ** = 5%; and * = 10%.

in previous specifications. In order to investigate this disparity, these groups were further separated by the type of terrorist attack: transnational and domestic.

Table 5 also shows the results for domestic attacks and transnational attacks against private and government entities. Once again, most of the covariates are in agreement in direction and significance. Several factors are no longer significant for domestic attacks against the government (GFCE and FDI). When looking closely at the results for domestic attacks against the government,

it is apparent that much of the significance originates during the second lag of natural disasters. The coefficient for this period is statistically significant and of very similar magnitude to that found in total attacks against the government. Set side-by-side, these results indicate natural disasters first lead to increased levels of domestic terrorism against private entities and evolve into attacks against the government. This could be an indication of a pattern of instability deriving from dissatisfaction with a government and political unrest following disasters. These findings suggest two incentives for domestic terrorism: one opportunistic and the other driven by grievances aggravated over time. This is supported further when looking at the results for transnational terrorism.

The most remarkable findings are for attacks against the government. Natural disasters have a highly statistically significant effect on transnational attacks against the government only in the first year, which explains the discrepancies seen in Table 5. As the vast majority of events for this particular division are carried out by foreign terrorist groups attacking the disaster-affected government, it is quite interesting, though not entirely surprising, that the effects are primarily in the immediate year of the disaster. The earlier these groups can act, the better they are able to take advantage of the government in a weakened state. This is indicative of transnational groups gaming disaster situations. This could result as transnational groups wishing to attack or exert influence in the disaster-afflicted area may be driven more by a perceived opportunity or weakness. This opportunity may be fleeting; thus, transnational groups need to act immediately in order to establish themselves before government forces can shore up security. Anecdotally, there has been increasing evidence of this sort of terrorist group behavior, but until now, has not been established empirically (Lancaster and Kahn 2005; Crilly and Nelson 2010; Hasan 2010; Shakir 2010). The results differ significantly from those found for domestic terrorism where the delayed onset suggests motivations rooted in rising dissatisfaction with the government over time.

For transnational attacks, it would appear that the timing for attacks against private entities following disasters are comparable with domestic terrorism. The coefficients and significance for transnational attacks against private targets are very similar to the results for domestic terrorism. While the tables suggest a similarity, a different picture results when considered as a whole with attacks against the government. Domestic attacks may be motivated by either of two incentives, opportunism and grievances, while transnational terrorism is primarily driven by opportunity. Opportunistic terrorism is based on some function of the softness of the target in relation to its value. Transnational terrorists may conduct opportunistic attacks against both private and government targets with preference initially toward weakened government targets that are of greater value. Once those government targets become hardened, transnational groups refocus towards private targets. Domestic terrorists may have no quarrel with the government initially; however, some will still take advantage of a weakened state to conduct attacks against private targets following the disaster. Once grievances have fomented, they may switch to attack government targets but still continue in parallel to attack private targets of opportunity. As a result, it may appear that attacks against private targets are similar between domestic and transnational terrorism; however, the differences in timing of attacks against government targets clarify the distinctions.

5. Conclusion

Natural disaster deaths are statistically associated with higher levels of both domestic and transnational terror. As disasters often aggravate underlying tensions within a country and

expose a government's inadequacies, initially, it was thought this might be a primarily domestic phenomenon; however, the results show that the effects of disasters span both types of terrorist activity. More specifically, the results suggest that transnational attacks occur earlier after disasters, whereas domestic terrorism takes slightly longer to foment, particularly for government targets. As the impetus for these types may be expected to vary, the observed empirical disparities are a particularly valuable finding. These differences are illuminated further by the analysis of target choice.

Terrorists are well known for exhibiting a preference for "soft" targets (Landes 1978; Atkinson, Sandler, and Tschirhart 1987; Dugan, LaFree, and Piquero 2005; Berman and Laitin 2008), and the effects of natural disasters could diminish targeting costs for some previously "hard" targets (Berrebi and Ostwald 2011). There are perhaps no harder targets for a terrorist group than the government, police, and military. They are usually well protected with extensive security, and, in the case of police and military, they have the means to fight back, increasing the risk for a terrorist group. The results strengthen suspicions that disasters present opportunities to strike more effectively at a government, and this fact does not appear to be lost on transnational terrorist groups. Where natural disasters' effects on terrorist activity against private targets are generally similar between transnational and domestic terrorism, the results are in stark contrast when comparing attacks against the government. Natural disasters increase transnational terrorist attacks against the government only for the current year of the disaster. In further lags, the effects are not statistically significant and diminish in magnitude. This is indicative of transnational groups "gaming" the chaos of a disaster to strike at objectives that they might not otherwise have targeted. As governments often recover more quickly than the general populace, attacking these targets while the window of opportunity remains open could be viewed as crucial. For domestic terrorism against the government, the opposite is true. Domestic terrorist activity against a government appeared to grow with time. This could be indicative of terrorist activity stirring as a result of pent up domestic frustration related to a government disaster response. Transnational attacks against the government are unlikely to result from internal grievances over a government's disaster response and so a fomenting period seems unnecessary.

This analysis significantly expanded upon research on the links between natural disasters and terrorism. Using a version of the GTD, which allowed for the distinction between transnational and domestic terrorism, the research determined that the effects of disasters were not limited to domestic terrorism but spanned across both types with differing effects. The disparities in effects appeared to be directly explained by target choice and timing. For attacks against private targets, disasters exerted very similar effects on both domestic and transnational terrorism; however, it was found that the timing of attacks against the government differed significantly between "homegrown" and international terrorism. In particular, transnational terrorist activity against the government increased significantly in the year of the disaster but diminished in subsequent years. For domestic incidence, the opposite was true, with terrorist activity taking longer to manifest. The disparity in results indicated the possibility of disasters triggering different underlying motives between the groups. If domestic grievances over a government's disaster response manifest as terrorist activity, a period between the catastrophe and any resulting violence would be expected in order to both observe and assess the government's response prior to any decision on whether to mount an offensive. For transnational attacks against the government, this sort of assessment seems unlikely and even detrimental, as the opportunity to exploit the government's weakness is fleeting.

While this study establishes a distinctive link between natural disasters and the two types of terrorism, the underlying motives for the differences in results warrant further direct and systematic investigation for confirmation. Recent studies have shown that transnational groups often conduct a mix of attacks, both transnational and domestic, thus separating the data at the terrorist group level poses one possible avenue of approach to further explore attack timing and target choice (Blomberg, Gaibulloev, and Sandler 2011). By comparing transnational attacks against the government to domestic attacks against the government subsequent to a disaster, we were largely able to isolate government targeted attacks from groups outside the country versus those based inside of the targeted country; however, analysis at the terrorist group level would help to further confirm which types of terrorist groups altered their strategies and targets post-disaster.

The analysis confirms the concerns for policy makers expressed by Berrebi and Ostwald (2011) while elucidating many others. Both "homegrown" and international terrorist activity rose following disasters, suggesting that these incidents are not rooted solely in domestic grievances but a combination of frustrations with the government, societal grievances, and exploitable opportunities. Establishing mutual agreements between neighboring countries to assist in border security and stability efforts after a disaster could be a potentially fruitful venture that deserves consideration; however, as foreign involvement could possibly foment terrorism, it should be considered carefully. Perhaps most important are the implications of the differential effects of disasters on transnational versus domestic attacks against the government. They suggest that states must be acutely aware of transnational groups attempting to exploit weaknesses immediately following a disaster while also being careful to deliver the best possible disaster response in order to head off the potential for future domestic discontent.

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