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Do Natural Disasters Induce More Crime?

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Abstract

The Indian Ocean Tsunami of 2004 resulted in grave consequences for South East Asia. Indonesia, in particular, had the highest death toll, losing over 150,000 people. Indonesia's coastal region Aceh was the hardest hit by this disaster. Exploiting exogenous spatial variation at the district level, we use difference-in-difference analysis to estimate the causal effect of the 2004 disaster on subsequent crime rates. We find that after the tsunami, total annual crime rate went down, on average, by 244 crimes per annum.

Introduction

The toll from natural disasters has been on rise in the past two decades and consequences have been especially severe in low-income countries (Kahn 2005; United Nations and World Bank 2010). The toll of natural disasters in terms of human life is staggering and it affect all facets of human life, *e.g.*, after the 2004 Tsunami, Indonesia reported that the disaster affected 532,898 people. In addition, the death toll due to the Tsunami stood at 165,708 and the economic costs totaled approximately 15 USD billion (PreventionWeb, n.d.).

Previous economic studies have examined the effect of natural disasters on poverty, household expenditures, incomes, remittances and child health in developing countries (Anttila-Hughes & Hsiang 2013; Baez &Santos 2008; Gignoux & Menéndez 2014; Halliday 2006; Premand 2008; Yang 2008). However, limited research identifies the true causal effects of natural disasters on subsequent crime levels (Spencer, 2014).

Crime is one of the most pressing problems in much of the developing world (Fajnzylber, Lederman, and Loayza 1998). Despite the fact that data on criminality in the developing world is scarce and data generally underestimates true crime rates[1], crime rates are still higher in the developing world than they are in high-income countries.

[1] Various reasons for this bias exist. Victims may not want to report crimes to the police because they are not easily accessible, or because they prefer to rely on their community's internal justice. Sometimes victims will not report crimes because they know

In this paper, we examine the causal effects of the 2004 tsunami on subsequent crime rates in Indonesia. The 2004 Indian Ocean earthquake and tsunami occurred on December 26th with an epicenter off the west coast of Sumatra, Indonesia. Exploiting exogenous spatial variation at the district level, we use difference-in-difference analysis on crime information gathered from the Regional Autonomy Watch KPPOD/Asia Foundation and the Baden Pusat Statistik (Indonesia's Central Bureau of Statistics, BPS) that spans over 33 provinces of Indonesia, to estimate the effect of the disaster on subsequent crime rates.

We contribute to the economics literature by estimating the causal effects of a natural disaster on criminal activity in a low-income country. Broadly, the paper contributes to an emerging literature on the effects of natural disasters on various outcomes, such as consumption, fertility, health, income, and migration. Studies of two earthquakes that struck El Salvador in 2001 find that the earthquake shock led to lower migration and a reduction in household income (Baez & Santos 2008; Halliday 2006; Yang 2008). Premand (2008) finds moderate short-term effects of hurricane Mitch on consumption growth but no evidence for persistence. In contrast to these papers, we focus on crime outcomes.

The remainder of this paper is organized as follows. The next section provides context on Indonesia and on crime in the country. The third section describes our data source and variables. The fourth section details the identification strategy. The fifth section presents our results. In the final section, we conclude.

that the police are powerless to apprehend criminals and obtain reparation. Sometimes they do not want others to know what happened to them. Police reports are therefore likely to yield an underestimation of criminality.

Natural Disasters and the Aceh Province in Indonesia

Setting

Indonesia is a low-income country that has exhibited steady progress and GDP growth for the past 30 years. The country has also experienced rapid increase in school enrollment and life expectancy as well as a large decrease in its poverty headcount, specifically in the past 10 years.

The success of the country as a whole stands in stark contrast to the economic development of the Aceh province. The province has been stuck in political and socioeconomic problems that have negatively affected the economic status of its inhabitants. Over the five years prior to the disaster, Aceh had been experiencing socio-political instability and economic disruption. The instability was rooted in the conflict between the Free Aceh Movement (GAM) and the government (Gaillard, Clave, & Kelman, 2008). Between the 1970s and the 2000s, natural gas and oil had proven to be a new prominent source of business for Aceh (Gaillard, Clave, & Kelman, 2008). Due to the discovery of these resources, GDP had begun to increase at a rate that was a faster than any other provinces in Indonesia at the time. Ironically, the rate of poverty had begun to increase at an alarming rate as well. Between the years of 1980 and 2002, the poverty rate had risen 239% while Indonesia, as a whole, witnessed a decline in its poverty rate by 47% (Athukorala et al., 2005). Between 1999 and 2002, Aceh's poverty rate had doubled. The high poverty created other dire problems; 48.5% of the population lacked access to clean water, 38% lacked access to health services and 36.3% of children under the age of 5 malnourished (Athukorala et al., 2005).

The geography of Indonesia is distinct because the country consists of over 18,000 islands, 922 of them being permanently inhabited. The islands themselves are not very large, the largest being Sumatra, in which Aceh is located. The fact that these islands are small makes them vulnerable to oceanic disasters.

The December 26th Tsunami

Between 1907-2004, Indonesia experienced 312 natural disasters, averaging three natural disasters per year. The death toll per disaster stands at 976 with another 51,000 people economically affected per event (Athukorala et al., 2005).

The 2004 tsunami is regarded as the worst natural disaster in Indonesian history. An earthquake measured at 9.0 on the Richter scale led to a massive tsunami that reached the shallow waters of Indonesia within 28 minutes. Indonesia's toll was staggering – 167,000 were reported dead, 128,000 were reported missing and 647,000 were displaced (USAID, 2005). The province of Aceh, the closest to the east of the epicenter of the earthquake, bore the largest toll. According to the Indonesian government, fatalities surpassed 125,000 people, 110,000 people were missing; and over 400,000 people were displaced within the province (Athukorala et al., 2005). The three urban centers -- Banda, Aceh Jaya and Aceh Barat --- reported the highest number of people killed or missing (Gaillard et al., 2008).

In addition to the toll of human lives, the economic toll due to the disaster was also devastating. The World Bank reported damages of approximated US $4.5 billion, equivalent to about 100 % of Aceh's total GDP during the year of 2003 (Athukorala et al., 2005).

Data

Our primary dataset combines two sources: the Asia Foundation (KPPOD) and the Indonesia's Central Bureau of Statistics (BPS). The panel dataset covers 342 regions, which spans 33 provinces in Indonesia. Crime data comes from the Central Bureau of Statistics and includes number of crimes reported within each village. The data comprises crime from theft, robbery, mistreatment, plunder, rape, drugs, and murder.

According to Indonesian Crime Prevention foundation (ICPF) survey, there have been anecdotal links to more frequent instances of crime in provinces such as Aceh, which was hit hard by the tsunami. The most frequent crimes reported from these results were theft and looting (Indonesian Crime Protection Foundation, 2015). Most of the criminals were noted as young people and nonresidents of the area. People even noted that criminals included uniformed officials. Most of the goods were taken from houses, shops, house yards, cars and even from corpses.

Table 1 provides summary statistics of our analysis data. Variables include total crime (sum of all crimes), population, poverty headcount, high school enrollment, income per capita, population and number of villages. The mean of total crime in Aceh in 2003 was 392.15 (SD =466.20); in 2005, the mean was 167.61 (SD = 150.24). The average number of crimes declined sharply in the post period. Non-Aceh areas serve as a comparison group in our analysis The mean for total crime in this area in 2003 was 145.95 (SD of 121.43); and in 2005, the mean was 131.89 (SD of 110.51). Crime data from both Aceh and the comparison areas suggest an overall decrease in crime in Indonesia in the post-disaster period.

Table 1: Summary Statistics

	Observations	Mean	St. Dev.	Min	Max
Total Crime	684	144.28	135.71	0	1433.00
Poverty Headcount	684	18.26	9.81	0	53.22
High Sch Enrollment	684	101,462.20	125869.20	0	899806.00
Number of Villages	684	203.17	164.58	0	1266
Income per Population	684	7,861,375.00	1.58e+07	0	2.30e+08
Population (in thousands)	684	635,742.90	610801.50	0	4684748.00

In Aceh, high school enrollment experienced a decline in the mean number of people from 64293.69 to 56355.85. On the other hand, all other provinces exhibited an increase in high school enrollment as the mean jumped from 98353.35 to 107880.7. Income per total population of these regions also varied significantly, as the average income per total population decreased in Aceh over time, while other regions in Indonesia demonstrated an increase in income.

Identification Strategy

To estimate the effect of the tsunami on subsequent crime rates, we employ a difference-in-differences strategy. Specifically, we estimate the following equation:

$$Yit=\beta0+\beta1Treatit+\beta2Postit+\beta3Treatit\times Postit+Xit+\varepsilon it \quad (1)$$

The treatment, $Treat_{it,}$ in this estimation is the province of Aceh, which is the most affected province by the tsunami. We use all other areas as a comparison benchmark. $Treat_{it}$ in Equation 1 captures 13 regions within the province of Aceh.

Our identification strategy controls for time in post- and pre- periods of the natural event. The pre-disaster period is 2003, a year before the disaster, and the post-disaster period is 2005. $Post_{it}$ accounts for any time trends in the outcome variable or for any interventions within the analysis period that could influence crime levels.

X_{it} in Equation 1 accounts for district-level differences in population, poverty headcount, enrollment in secondary school, income per capita, number of villages and share of agriculture as total of GDP. In our empirical specification (Equation 1), β3 captures the true causal effect of the 2004 tsunami on subsequent crime, holding all else constant. The key assumption in our analysis is that the average change in the comparison group (non-Aceh districts) represents a true

counterfactual (i.e., the non-Aceh districts and the rate of crime within them follows the same pattern of Aceh prior to the natural disaster).

Results

To uncover the causal effect of the Indian Ocean Tsunami on crime rates we run a difference-in-differences analysis. The specification without any control variables reveals a large negative relationship between the tsunami and subsequent crime rate. The regions that were affected by the tsunami, all else equal, exhibit on average 210 fewer crimes after the disaster as compared to the comparison areas (see Table 2).

Table 2: Main Results: Difference-in-Difference Estimation

Dependent Variable		
	Number of Crimes	Number of Crimes
	(1)	(2)
Treat*Post	-210.48***	-243.86***
	(52.50)	(33.89)
Mean Dependent Variable at Baseline	144.28	144.28
Controls	NO	YES
Observations	684	684

Notes: Standard errors in parenthesis. * Significant at 10%; ** significant at 5%; *** significant at 1%. Controls include poverty headcount, number completed high school, number of villages, income per capita, and population

We then run our specification with controls. We control for population, poverty, schooling, and number of villages, and income. When we run our regression again we find that the coefficient for key variable becomes -243.86, which is consistent with the first specification but likely including other covariates eliminates some of the positive bias in the first regression specification.

Discussion and Conclusion

Using data from Indonesia before and after the tsunami disaster in 2004, we attempt to measure the impact of the disaster on crime rates. We use the Aceh province as the treatment unit of our analysis and we compare it with the rest of the Indonesian provinces. We use the difference-in-difference method to estimate the causal effect of the 2004 disaster on crime rates. We find that after the tsunami, crime rate goes down on average by 243.86. A key limitation in our analysis is our inability to test for the parallel trend assumption, which requires that the trend in the crime rate for both Aceh and comparison units during the pre-disaster era are similar.

Several channels could account for our surprising result. First, disasters may strengthen social cohesion and social capital and therefore decrease individuals' criminal proclivity in disaster periods. Second, when a disaster strikes, it is plausible that many crimes do not get reported and so our analysis may not account for them. The areas impacted by the natural disaster are often left in shambles and the officials of the area might have other, more important obligations to attend to.

Our paper provides one input into the consequences of natural disasters. Given that the likelihood of natural disasters is expected to rise, and with rapid urbanization the consequences to be larger, a careful analysis of the full array of benefits and costs to a disaster are necessary.

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