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ABSTRACT

This paper seeks to analyze the impact of natural hazards on human development and poverty at the municipal level in Mexico. We control for a set of geographical and natural location characteristics which make municipalities more prone to the occurrence of these events. We also employ a set of institutional, economic and demographic characteristics to control for baseline heterogeneity. Using an adjusted difference-in-difference regression with data for 2000 and 2005, results show a significant decrease of social indicators for general events, and especially for flood and droughts.

Key words: natural disasters, impact, poverty, human development, geography

JEL classification: C52, I31, O10, O54, Q54

1. Introduction

The social and economic consequences of recent natural disasters across the world have reiterated the need to place more attention to natural disaster as part of the global poverty agenda. In parallel, there is mounting evidence that global climate change is increasing the recurrence and virulence of climatic hazards in vast parts of the world, such as hurricanes and floods (IPCC, 2007).

Mexico cannot be indifferent to any of these trends. The country lies within one of the world's most active seismic regions; prone to constant droughts in its northern cone and in the path of hurricanes and tropical storms originating in the Caribbean Sea, Atlantic and Pacific Oceans. This wide geographic exposure renders that a high share of the country's population and GDP may be at hazard risk.

And yet, with a few exceptions (UNISDR, 2009), the foreseeable effect of geological and climatic hazards on poverty has not translated into a systematic research agenda that illustrates their connection. Major reviews on poverty dynamics have noted, for instance, that only a few studies account for this type of risk impacts (Baulch and Hoddinott, 2000; Dercon and Shapiro, 2007). Perhaps, the single most important explanation for this shortcoming is data availability. The standard tools for measuring poverty (household surveys) lack risk modules upon which one can create counterfactuals to explore actual impacts; an alternative is to import disaster data into them.

Disentangling the causal impact of natural disasters on social welfare indicators in a credible way is also a complex task. While the occurrence of a natural hazard could be considered exogenous, its transformation into a disaster is not. It is the number of people located in certain areas combined with the human, material and environmental circumstances of households and the localities where they live that shapes their chances of weathering a natural hazard or not, and certainly less resourceful households located in hazard-prone areas are more vulnerable. So estimating the impact of disasters on poverty requires data spanning many object categories and techniques to address the existence of a double causality.

In this context, at least three streams of literature can be identified. The first focus on natural hazard and what are the determinants of vulnerability to disasters (e.g.: McGuire et al, 2002; Pelling, 2003; Wisner et al, 2004; among others); a second focus on how when a disaster occurs impact the macro level of the economy (e.g.: Auffret, 2003; Benson and Clay, 2003; Skidmore and Toya, 2002; Strobl 2008 and 2008a) and the third studies the impact that disasters have at the micro level or households within localities localities (e.g.: Carter et al, 2007; De Janvry et al, 2006; Dercon 2004; Dercon et al, 2005; Guarcello et al, 2007; Kahn, 2005). We will insert this paper in the third stream of the literature. The purpose of this paper is therefore to contribute to the scant literature on the impact of natural disasters to poverty in Mexico. More concretely, this paper aims to answer if natural disasters occurring between 2000 and 2005, time for which data is available, affected poverty and long-term indicators such as human development.

To explore these issues, the paper draws on a unique poverty panel dataset of municipalities across Mexico and merges it with a database of natural disasters (DESINVENTAR) at municipal level too. Using the natural hazards as an exogenous shock we use a Difference-in-Difference methodology to isolate the impact. We then bring baseline data from other public sources to account for the natural, geographic and socio-demographic characteristics of municipalities, as well as for their institutional capacities to cope with disasters. This rendered a Regression Adjusted Difference-in-Difference.

Our main results show that natural disasters reduce human development and increase poverty, and this effect can be sizeable: The average impact on human development in the affected areas is similar to going back 2 years in terms of their human development gains over the 5-year period reviewed. And the impact of natural disasters is higher for those municipalities with lower levels of human development while no effects are found for the wealthier municipalities.

The paper is structured as follows. Section 2 develops a framework for understanding the impacts of natural disaster in localities and their driving factors. Section 3 presents an overview of the various social indicators considered in the present analysis and Section 4 the methodology used, data and model applied. Section 5 introduces the different results. Section 6 outlines the conclusions.

2. Background

a. The literature on natural disasters

The literature on natural disasters and economic consequences is still scarce and can be divided mainly in three strands. One strand of the literature has focused on how some factors exacerbate vulnerability to natural events. They have developed a natural hazard framework considering changing climate, deforestation and geophysical factors (McGuire, Mason and Kilburn, 2002), in addition to increasing urbanization which brings environmental hazards and exposure to risk from lack of adequate urban planning and dual political discourse (Pelling, 2003 and 2003a), or even geographical proximity to exposure, access to assets and public facilities as well as political and social networks (Bosher, 2007).

All these factors become a thread to population, their belonging and possessions, and their productive capacity, becoming then a natural hazard. And when such hazard is realized, then it becomes a natural disaster (see McGuire, Mason and Kilburn, 2002). Even though this strand of the literature recognizes that such hazard factors affect the impact of the disasters, they only briefly mention basically the number of fatalities, or some rough costs.

A second strand of the literature focuses on the impact of natural disasters on macroeconomic indicators. Auffret (2003) analyzed the impact of natural disaster on Latin America and the Caribbean, and found the impact very significant, especially for the Caribbean, where the volatility of consumption is higher than in other regions of the world, where inadequate risk-management mechanisms have been available in the region.

This strand of the literature has been even contradictory to some extent. For example Benson and Clay (2003) have argued that the long term impact of natural disasters on national economic growth is negative, while Skidmore and Toya (2002) argue that such disaster may have a positive impact in the long run growth, derived from a reduction to returns to physical capital but an increase in human capital, leading to higher growth. Strobl (2008) finds for the US coastal regions that hurricanes decrease county's growth initially by 0.8 per cent, while recovering after in 0.2 per cent. This author also finds for Central America and the Caribbean that the impact from a destructive hurricane is a reduction of 0.8 percent of economic growth (Strobl, 2008a).

When analyzing what additional factors reduce or increase the impact of the disasters on macro indicators, Kahn (2005) and Toya and Skidmore (2007) find that institutions, higher education and trade openness, as well as strong financial sector and smaller governments are important factors in determining the impact that natural disasters have on development at the international level.

The third stream of the literature measures the impact and coping mechanism for natural disasters mostly at the household and village levels. Here, natural disasters are shocks that households have to face as they are adverse events leading to a decrease in income or consumption, and also a loss in productive assets.

Alderman et al (2006) using data for households in Zimbabwe focused on height development of children as consequence of a drought and civil war in Zimbabwe, finding that children affected by such shock have achieved lower education levels and could have been taller otherwise. Dercon (2004) used growth in consumption among household in selected villages in Ethiopia, and did not find that shocks have an effect in the reduction of assets due to the 1980s famine, but some covariates for the famine are related to subsequent low growth. Dercon et al (2005) also find for Ethiopia that droughts and illness shocks are associated to low levels of per capita consumption in household for shocks between 1999 and 2004.

Carter et al (2007) analyzed the impact of droughts in Ethiopia and of hurricane Mitch in Honduras on growth of assets at the household level. For Ethiopia they find a pattern of assets smoothing among low wealthy families, i.e. such household hold on their assets even they are few in periods where income and consumption decreases, such as the big drought occurred. They find for Honduran households that relatively wealthy families recovered faster from the shock than low income families, and that a poverty trap is set below a given level of income. Baez and Santos (2007) also analyzed the effects of Mitch on households indicators, finding no effect on school enrollment of children, but a significant increase in their labor participation.

Others have analyzed how some coping mechanisms within households affect recovery from a shock derived from a natural disaster. De Janvry et al (2006) shows that conditional cash transfers availability previous to a disaster serve as a safety net for those exposed to the disaster, while those uninsured and vulnerable non extremely poor use as coping mechanism an increase in child labor, and savings in nutrition and school costs. Alpizar (2007) also finds that access to formal financial services mitigates the negatives effects from natural disaster shocks for farmers in El Salvador, as it leads to more efficient production.

However, a less developed area is the impact at the regional level. Yamano et al (2007) focus on manufacturing and business centers. These authors use district level data for employment and output, estimating that economic loses are not in proportion to the distribution of industrial activities and population concentration, suggesting that policies to alleviate loses should be considered from a higher order. Burrus et al (2002) also analyzed how low intensity hurricanes can impact local economies through interruption of activity. They use data from the local Chambers of Commerce surveys in North Carolina and because of their frequency the impact could be a reduction between 0.8 and 1.23 per cent of annual output and up to 1.6 per cent of regional employment.

However, there is a gap in the analysis of how local social indicators are affected by natural disasters. This is important to bring to the fore since the effects seem to be spread around all different levels, macro, micro and local, and how policies to address those shocks can be better planned.

b. A framework for analyzing the impact of natural disasters on social variables

While households appear as the natural unit of analysis for looking at the effect of natural disasters on poverty, it can also make sense to scale the analysis up as household responses to hazards are often affected by the broader policy context. Indeed, households have tangible and intangible assets at their disposal, and their ability to maintain or mobilize them in the presence of natural hazards (which may condition the extent to which they can avoid falling into poverty) will be shaped by the structures and processes such as - governance and institutional arrangements, broader policies and existing conditions at municipal and regional level. Moreover, the exposure of households to hazard loss can and has been traditionally scaled up to higher levels of aggregation (UNDP, 2008). It is the number of people located in certain areas combined with the human, material and environmental circumstances of households and the localities where they live that shapes their collective possibilities to deal with a natural hazard. Therefore, we refer to the municipal level of analysis while thinking of the implications that hazards can have on the welfare (poverty) of larger populations.

Governments tend to embark in multiple strategies to deal with natural hazards. In the past, they have traditionally responded through disaster relief, but more recently there has been a tendency to emphasise cash transfers as well. Even if both measures are adopted further effectiveness could be accomplished by adopting hazards reduction and mitigation mechanisms that address the structural factors which make households more exposed to natural hazards. Having mechanisms in place before the realization of hazards is fundamental. At the macro level, early warning systems and community disaster-preparedness programs seem particularly relevant, so as enough fiscal resources to promote recovery (subsidies, debt or revenue recovery write-off), as well as tax incentives for households or communities to adopt mitigation measures.

Another form of defending the value of assets at the macro level could be through economic diversification. The increase in sectoral (primary, secondary and tertiary sectors) and spatial activities in the economy, can provide a wider pool to spread the risk of suffering hazard losses, and additional opportunities to increase and stabilize returns. Conversely, the concentration of economic and sectoral activities would be consistent with reduced ability of households to manage and respond to hazards.

There is also a set of intangible features which might potentially limit (improve) the household efforts to surmount the effect of natural hazards on them, just as unfavourable socio-economic opportunities might well do. The political economy and institutional features of the context where assets are deployed along with the system of convictions, norms and beliefs embedded in the behaviour of communities' members might prove fundamental while employing and mobilizing assets for confronting hazards. Ideally, one should be able to explain how culture and governance arrangements come into play when they interact with the broader setting of hazards, assets and welfare outcomes. However, most of these features will be hard to operationalize empirically during our technical analysis. We limit ourselves to acknowledge the potential for rich cross-fertilization between the proposed methods in this document and qualitative work in this respect.

Successful coping against hazards is harder to attain in a context of low productivity, staled economic growth, lack of access to productive assets (such as water, credit, etc.), absence of financial reserves and safety nets in place, and wide inequalities across geographic, economic, or ethnic lines. Lack of health facilities, remoteness and low levels of education may also compound these vulnerabilities. As a result, the covariate nature of many natural hazards and the policy-induced macro conditions affecting the speed and chances of successfully coping with them might reflect varying welfare impacts across district and sub-district levels.

Finally, communities can aggravate these natural, location and practice-specific factors through disinvestment in physical and social infrastructure at the household (housing materials) and community level (roads and bridges). Both as a result of poor geographic (location), physical and financial capitals. In the case of rural areas, these shortages can be compounded by a high incidence of hazards as a result of being encrusted hazard-prone areas, deepening the susceptibility of households to suffer hazard losses.

Even though the impact a natural event is an exogenous factor, vulnerability of agents, making the impact of the event higher or lower, is not. Vulnerability to natural disasters is a complex issue, as it is determined by the economic structure, the stage of development, prevailing of social and economic conditions, coping mechanisms, risk assessments, frequency and intensity of disasters, etc.

Lindell and Prater (2003) outline the importance of determining the impact and the affected agents in natural disasters. First, that information is useful for policy makers, as they can know the need for external assistance and which may be more effective. Second, specific segments of affected can be identified, e.g. how low income household are affected, characteristics of localities etc; and third, it may be also useful for planning assistance for natural disasters and the potential consequences. They also outline how the impact of natural disasters should take into account other mechanisms, such as mitigation practices emergency preparedness, assistance, etc, to determine the real impact.

One of the main questions regarding the impact of natural disaster on households or localities is how random they may be. Donner (2007) analyzed the effects of tornadoes in the US and found that the effects are not random, because some factors such as environmental, organization, demographic, and technological, have an incidence on the impact of such events. In general the flow of impact of natural disasters can be outlined as in Figure 1.

INSERT FIGURE 1 ABOUT HERE

Other factor is how authorities have specific practices regarding natural disasters and how they organize help in the aftermath can also be determinant of the impact. For example, Peacok and Girard (1997) document how the recovery process after hurricane Andrew in Florida was determined more by organizational impediments rather than lack of resources. The availability of some mechanisms that can be used for coping when natural disasters occurs may make a difference on the magnitude of the impact on social indicators at local and household levels.

In next section we will take into account the previous factors in order to determine the impact of natural disasters in local social indicators such as the Human Development Index, and poverty levels.

3. Methodology, Data and Variables

Methodology

We have data for 2,454 municipalities, from which several have experienced natural disasters between 2000-05, while others do not. This allows for comparisons between treatment and control groups, assuming that disasters introduce an exogenous shock to social welfare indicators at sub-national level. Taking advantage of the natural disaster as an exogenous shock, we will use a Difference in Difference specification, in the following way:

(1) $Y_{jt}=\alpha_0+\alpha_1 T_i+\alpha_2 D_t+\alpha_3 T_i D_t+\alpha_4 X_{jt}+u_{jt}$

Where Y denotes the social welfare variable (HDI or poverty level) in municipality i at time t. T denotes a dummy for areas considered treatment (i.e. municipalities with an incidence of a natural disaster); D_t is a dummy variable taking the value of 1 after the natural disaster occurs, X is a vector of municipal characteristics (geographical, natural, socio-economic, institutional and financial). The term α_3 measures the impact of a natural disaster on the outcome variable Y. Treatment (T) can be defined as those municipalities that will experience a natural disaster in the period analyzed.

However, this specification assumes that municipalities under treatment and control are similar in every way except in that treatment suffer from a natural disaster. As we are taking a sample of the whole municipalities, this assumption may be difficult to hold; especially since conditions for vulnerability affecting the impact may not be that similar, requiring additional adjustments to calculate a better impact effect.

Following Hotz, Imbens and Klerman (2000 and 2006), we use the heterogeneity in the sample, exploiting the experimental data on the control group, determining in this way a more reliable non-experimental estimator of the differential effects of municipalities with treatment and those who are under control. Adjustment through pre-shock variables, especially for those making vulnerability more likely to occur, allows the data for the control group to empirically adjust for across-shocks differences in population and treatment component assigned mechanisms, helping in this way to isolate a consistent estimate of α_3. These authors show that this is a more conservative method for estimating the impact than other methods which derives in similar results such as those non parametric versions of the same equation based on matching methods and with similar results. The equation then becomes:

(2) $Y_{jt}=\alpha_0+\alpha_1 T_i+\alpha_2 D_t+\alpha_3 T_i D_t+\alpha_4 X_{jt}+\alpha_5 T_i X_{jt} +u_{jt}$

We will include in X different sets of variables pre-shock for which municipalities may be more heterogeneous in their vulnerability and response to a shocks from a natural disaster and also for responding to the levels of social indicators of interest, or making the municipality more prone to natural disasters. Thus in the next subsection we present the sets of variables, their sources, and basic statistics.

Data and Variables

We are using data from different sources. We are interested in dependent variables such as the Human Development Index (HDI), as published by the UNDP at the municipal level for years 2000 and 2005, and also the poverty levels in three definitions (food, capacities, assets) as published by CONEVAL (2008) also for 2000 and 2005 at the municipal level.

Data for natural disasters was extracted from a hazard (DESINVENTAR) database, covering events at municipal level (see Annex 1 for a description of this database),. Comments on benefits and drawbacks using this kind of databases can be found in Wisner et al (2004), although the Desinventar database does not focus on casualties but in a more broad definition for collecting data.overlaid with the existing poverty maps.

In a first step we include a dummy variable for disasters in general, where the comparisons are those municipalities without any natural hazard. In a second stage we divide the events in categories (floods, droughts, etc), and comparisons are carried out against municipalities without disasters. Finally we restrict the sample to those municipalities that have experienced disasters, where the comparison groups are municipalities with other disasters.

The geographical distribution of natural disasters is shown in the Maps in the Annex 2, where we can see that some patterns can be seen but they do not seem to be too strong in some cases. For example, floods events seem to be distributed all around the country, droughts seem to be more concentrated to some extent in the north areas of the country, while frosts also seem to be concentrated in the north, finally rains seem to be concentrated in northern and southern areas mostly in coastal zones.

Dependent variables are categorized following the framework outlined in Figure 1 above. At the municipal level, there are numerous characteristics that might be associated with poverty, including the geographical isolation, a low resource base, and other inhospitable climatic conditions which would ideally need to be captured. We therefore control for relevant natural and geographical characteristics of municipalities (Geography and Nature), including measures of latitude, altitude, surface length, percentage of arid and semiarid areas within the municipality, deforestation rates, and maximum and minimum average temperatures and rainfall. Data under this category is from years previous to 2000.

We also account for hazard mitigation practices, and emergency preparedness at the municipality (Institutional /Local Capacity). This includes a set of variables that may affect the response capacity of local governments to natural events, such as the existence of hazard maps, civil defense units and plans against contingencies, and also if the municipality received federal resources after the disaster; as well as the share of local financial resources (tax base).

We also constructed a number of baseline (2000) municipal-level variables that may affect the vulnerability of the municipal population to natural disasters. This include the share of individuals or households with the following characteristic within the municipality: proportion of rural population; migration intensity; shares of population working in different economic sectors; share of population with social security; share of indigenous population; demographic composition of population; and degree of inequality within the municipality (Gini index). And finally we took into consideration state level effects.

All basic statistics are presented in Table 1.

INSERT TABLE 1 ABOUT HERE

4. Results

We estimated equation (2) to assess the impact of natural disasters on human development and poverty. In the next tables we present the results for the adjusted Difference-in-Difference. All specifications have dummy variables at the state level in the last two columns. In addition, we ran different specifications using varying sets of control variables.

As Table 2 shows, the occurrence of a natural disaster in the period 2000-2005 reduced the Human Development Index by -0.0069 on average, which represents about 0.8 percent of the average Human Development Index. For those municipalities affected by a natural hazard over the reviewed period this would be equivalent to losing on average 2 years of human development gains over the same period. This is a substantial reversal.

INSERT TABLE 2 ABOUT HERE

As for poverty, the occurrence of a natural disasters during 2000-05 increased food poverty by 3.6 percent (which is about an eight percent increase in the food poverty of those municipalities who experienced a disaster); which represents a 5.8 percent increase on average for affected municipalities) and assets poverty by 1.5 percent (which is about a 2.3 per cent increase in poverty for affected municipalities).

Table 3 shows welfare impacts disaggregated by type of event. Droughts reduce HDI in about 0.0096, representing on average drop of 1.3 percent of the index. The impact of rains is not constant through different specifications, and it even appears positively significant. This is not entirely surprising as there might be cases where storms actually raise industrial growth (Loayza et al., 2009). Other disasters[1] have also a significant decrease of 0.008 of the HDI, which represents around 1 percent drop in such index.

INSERT TABLE 3 ABOUT HERE

[1] Comprises: avalanche, eruption, hailstorm, surge, snowstorm, earthquake, electric storm, tornado, strong winds.

Regarding the impact on the various poverty levels[2], floods increase food poverty by 3.5 percentage points while droughts do so by 4.2 percentage points. It is not entirely clear why floods appear to strongly affect poverty, but not medium-term indicators such as health and education contained in the human development index. The impacts of other types of disasters are not significant.

INSERT TABLE 4 ABOUT HERE

In Table 5, again, the relevant disasters are flood, droughts and others. The higher incidence of floods increases capacities poverty by about 2.9 percent, while drought bring poverty up by about 3.7 percentage points, and others disasters about 2.9 this poverty line.

INSERT TABLE 5 ABOUT HERE

Finally, Table 6 shows results for the impact of disasters on asset poverty, which comprises the previous two poverty measures. Floods, droughts and others disasters, including earthquakes, also increase asset poverty significantly. The incidence of floods increases assets poverty in 1.9 percent, while droughts do so by 2.5 percent.

INSERT TABLE 6 ABOUT HERE

Robustness checks

The methodology described previously reduces the heterogeneity among municipalities, however, we also performed checks on the robustness of the impacts obtained by restricting the sample to those municipalities who experienced at least one natural disaster over the period analyzed. In this way, we get a more compact sample for

[2] Food poverty takes into account the population without enough income to buy a basic food basket. Capacities poverty considers the population without enough income to simultaneously satisfy their needs for food, health and education. Asset poverty considers the population without enough income to satisfy food, health, education, shelter, public transport, clothing and footwear needs.

comparison, with the comparison group being the municipalities with other disasters, and applying the same specifications than before results are presented in Table 7.

Doing so reduced the sample to 1,031 municipalities with HDIs, and to 1,034 with poverty data.

INSERT TABLE 7 ABOUT HERE

In this exercise, the HDI is adversely affected: we got a significant coefficient of 0-.0088 for droughts, compared to municipalities with other disasters. Although this coefficient is compared to the average municipality with a disaster, instead of the average municipality as in Table 3, the coefficients are similar in magnitude. The impact on the poverty measures show that floods increase food poverty by about 3.2%, capacities poverty by 2.7% and asset poverty by 1.9%, compared to average municipalities with other type of disasters. Droughts have also a significant negative impact on poverty: 4.2% increase in food poverty, 3.8% in capacities poverty, and 2.6% in asset poverty. These increments are similar to the coefficients obtained with the full country sample.

Finally, we explored the impacts of hazards on poverty and human development across their respective distributions (Koenker and Basset, 1978). For this purpose, we estimated equation 2 using quantile regression.

Table 8 displays results for the differential impact of hazards evaluated at different parts of the distributions (quantiles), and the presented results are those using the full model as explained above. Disaggregating by quartiles of the HDI shows that, as expected, the higher the level of human development in the municipality, the lower the impact on such indicator. The impact of natural disasters is higher for worst endowed municipalities in terms of HDI. Similar evidence has been observed internationally, where developing countries experience a higher shock from natural disaster in macro indicators, relative to developed countries (Noy, 2009).

INSERT TABLE 8 ABOUT HERE

Regarding poverty levels, the findings are different, as the lower quartile indicate municipalities with lower poverty, i.e. more developed areas. For extreme or food poverty (PL1), the higher effects are in the two ends of the distribution: localities with lower food poverty experience an increase of about 4.7 percentage points, while those with more food poverty experience an increase of about 4.8 percentage points. For other poverty levels, the impact is also distributed unevenly. In all cases, the pattern seems to take a u-shape. This may be understandable if we suppose that in localities with higher poverty have a more widespread effect, and localities with lower poverty levels may have an impact more acute on those under the poverty line.

5. Conclusion

Natural disasters affecting different parts of Mexico have gained prominence, including the 2005 hurricane season and the 2007 floods in the southeastern state of Tabasco (the worst floods in the state's recent history). The debate on whether such events affect the development of affected areas is still under way. In this context, this paper analyzes the effect of natural disasters on human development (Human Development Index) and three different measures of poverty (food, capacities and assets).

To exploit the heterogeneity of local characteristics across municipalities in Mexico, we used an adjusted difference-in-difference regression, where we control for different sets of pre-shock variables that may influence the impact of natural disasters. We control for local variables such as geographical and natural characteristics, socioeconomic factors, institutional and local administrative capacity, as well as financial coping mechanisms and political covariates.

Our results show a significant and adverse impact of natural disasters on both human development and poverty. For affected municipalities, the impact on the Human Development Index is similar to going back 2 years in human development over the same period analyzed on average. Natural disasters increase extreme (food) poverty by 3.6 percentage points, capacities poverty by 3 percentage points, and assets poverty by 1.5 percentage points. Disaggregating by type of event we find that floods and droughts have the more significant adverse effects. In addition, we also observe that disasters affect more poorly endowed municipalities in their long term indicators such as the HDI, but the effects seems to take a U-shape when it comes to poverty levels.

This paper contributes to the debate on the impact of natural disasters in developing countries with recurrent hazards. While such events reduce social welfare at the local level, public policies for attenuating such impacts must be more focused on those under the poverty lines and in implementing mechanisms for keeping elements considered in the human development index that are affected due to these shocks. Additional research could focus on how coping and preventive mechanisms at municipal level affect micro effects on households as well as the reasons behind the u-shape effect of natural hazards on poverty.

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Annexes 1

The DesInventar database

DesInventar is a conceptual and methodological tool for the construction of databases of loss, damage, or effects caused by emergencies or disasters. As a system of consultation DesInventar includes Methodology, Database and Software. It defines a disaster as the combination of effects produced by an event on human lives, infrastructure or economy in a geographical unit. In this setting an event may be registered as many times as geographic units affected. The database contains information such as location, date, source, causes and effects (on population, housing, infrastructure and services).

DesInventar is an initiative of the Social Studies Network for Disaster Prevention in Latin America (LA RED). It contains information for a set of countries such as Mexico, Guatemala, El Salvador, Costa Rica, Colombia, Ecuador, Peru and Argentina. This system follows a methodology for recording information that includes characteristics and effects of various types of disasters. This methodology was designed to capture the effects of disasters on politico-administrative units.

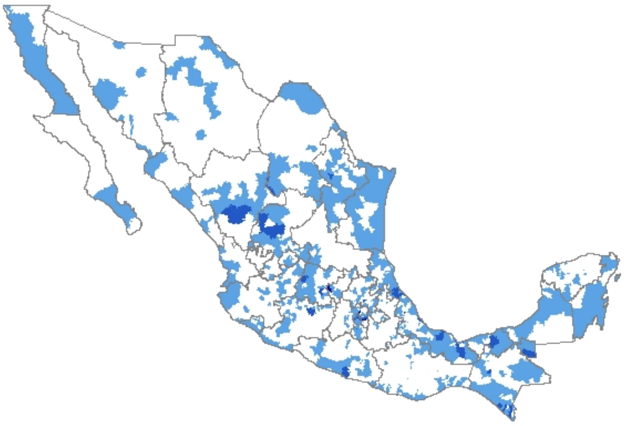
The module for Mexico contains information from 1980 to 2006 with a total of 17 thousand 177 disasters. Over 60% of these disasters are due to flood (22.1%), epidemic (8.4%), drought (7.0%), frost (6.6%), forest fire (5.6%), fire (5.6%) and rains (4.6%). The disaster information is collected from national and local newspapers.

Source: La Red (2003). Guía Metodológica de DesInventar 2003. Universidad del Valle. Consulted www.desinventar.org.

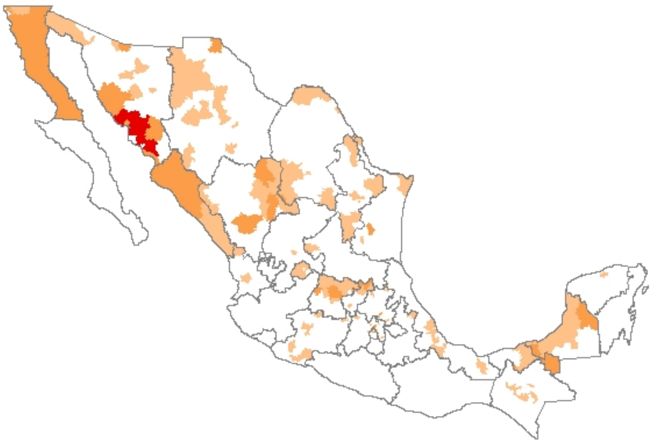
Annex 2.

Maps on the distribution of natural hazards for 2005 using DesInventar database

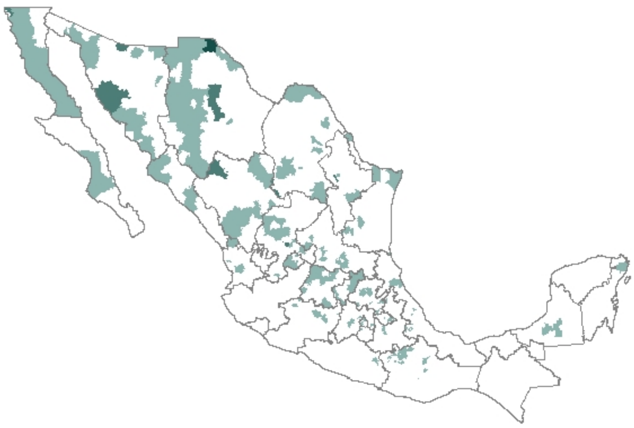
Floods distribution



Droughts distribution



Frost distribution



Rains distribution

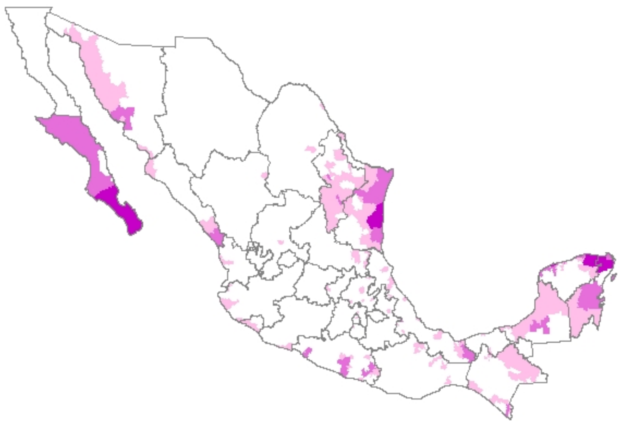
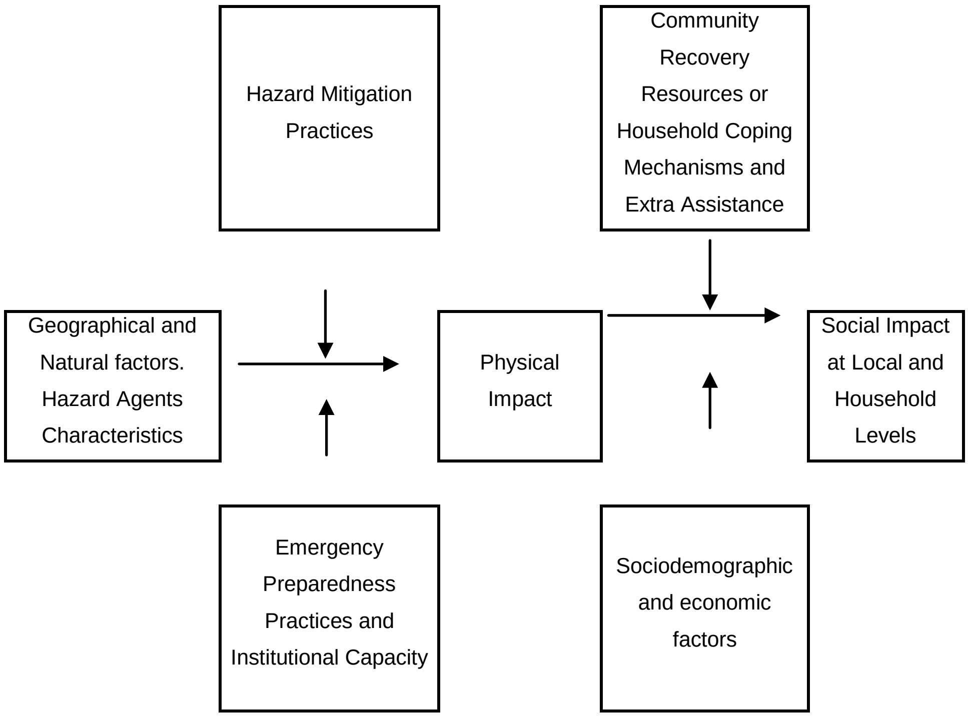


Figure 1. Model of Disaster Impact



Source: Own adaptation from Lindell and Prater (2003)

Table 1

Descriptive statistics	Mean	Std. Dev.	Min	Max
Dependent				
HDI *	0.7079	0.0758	0.3915	0.9165
Food poverty incidence*	0.4438	0.2423	0.0160	0.9680
Capacities poverty incidence*	0.5141	0.2427	0.0280	0.9810
Assets poverty incidence*	0.6828	0.2119	0.0920	0.9950
Natural Disasters Occurrence				
Any event /2	0.4234	0.4942	0	1
Flood /2	0.2326	0.4226	0	1
Frost /2	0.0835	0.2768	0	1
Drought /2	0.0831	0.2761	0	1
Rains /2	0.0811	0.2730	0	1
Landslide /2	0.0590	0.2356	0	1
Others /2	0.1716	0.3771	0	1
Geography and Nature				
Altitude *	1304	819	2	2924
Latitude *	198388	33461	143827	322993
Length *	985658	43623	865878	1166813
Arid surface *	6.49	17.04	0.00	97.50
Semiarid surface*	16.38	20.22	0.00	72.50
Deforestation rate *	-18.27	17.89	-62.57	-0.56
Minimum temperature *	7.25	5.74	0.00	24.00
Maximum temperature *	27.46	2.90	16.00	30.00
Minimum rain*	15.76	10.17	1.50	57.40
Maximum rain *	175.78	51.93	8.00	315.50
Socioeconomic				
Rural municipalities **	0.8350	0.3713	0.0000	1.0000
Economic dependency rate *	0.8333	0.1693	0.3945	2.3700
Population with social security **	0.2148	0.1824	0.0000	0.8055
Population living in the same state 5 years before **	0.9677	0.0252	0.6714	1.0000
Indigenous population **	0.0379	0.0993	0.0000	0.7682
Gini coefficient*	0.4044	0.0556	0.1955	0.5978
Employed at primary sector ** /1	0.1284	0.0781	0.0005	0.5533
Employed at secondary sector ** /1	0.0705	0.0458	0.0000	0.3461
Employed at tertiary sector ** /1	0.0968	0.0618	0.0023	0.4098
Coping Funds and Covariates				
With CENAPRED resources 2000-2005 **	0.8014	0.3990	0.0000	1.0000
Same political party at municipal and state level when hazard occur	0.0348	0.1833	0	1
Same political party at municipal and federal level when hazard occur	0.0168	0.1285	0	1
Institutional/Local Capacity				
NGO for consultation or courses	0.2645	0.4412	0	1
Seminar attendance	0.1716	0.3771	0	1
No NGO	0.3014	0.4590	0	1
Associated services	0.2158	0.4115	0	1
Municipal regulations	0.2121	0.4089	0	1
Municipal development plan	0.7211	0.4485	0	1
Civil defense unit	0.5733	0.4947	0	1
Civil defense program	0.4607	0.4986	0	1
Natural contingency in tne 1990s	0.5909	0.4918	0	1
Hazard map	0.3055	0.4607	0	1
Tax resources **	6.4960	8.1633	0	90
Federal resources **	40.9682	19.8749	0	100

Notes: *average ** proportion. /1 Relative to total population. / 2 between 2000-2005. Data for year 2000 exceptt coping
Sources: UNDP (2008), CONEVAL (2008), CONTEO 2005 (ITER), CENSO 2000. CNA (2007). INEGI (2008), CENAPRED (2008). Data on deforestation came from FAO indicators in Davis, R. (2007).

Table 2

Results of Impact of Aggregated Natural Disasters on Municipal Indicators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
HDI	-0.00691*	-0.00691*	-0.00691*	-0.00692***	-0.00694***	-0.00691**	-0.00691**	-0.00689***	-0.00689***
	(0.00406)	(0.00357)	(0.00353)	(0.00176)	(0.00175)	(0.00329)	(0.00327)	(0.00174)	(0.00174)
Adjusted R-squared	0.134	0.331	0.344	0.837	0.839	0.432	0.438	0.841	0.842
FGT0 PL1	0.0369***	0.0369***	0.0369***	0.0366***	0.0367***	0.0369***	0.0369***	0.0367***	0.0367***
	(0.0124)	(0.0102)	(0.0100)	(0.00585)	(0.00580)	(0.00953)	(0.00951)	(0.00571)	(0.00570)
Adjusted R-squared	0.094	0.392	0.404	0.798	0.802	0.464	0.467	0.808	0.808
FGT0 PL2	0.0304**	0.0304***	0.0304***	0.0299***	0.0301***	0.0304***	0.0304***	0.0300***	0.0300***
	(0.0127)	(0.0102)	(0.0101)	(0.00580)	(0.00575)	(0.00958)	(0.00956)	(0.00564)	(0.00564)
Adjusted R-squared	0.079	0.399	0.411	0.807	0.810	0.472	0.475	0.817	0.817
FGT0 PL3	0.0161	0.0161*	0.0161*	0.0153***	0.0154***	0.0161*	0.0161*	0.0154***	0.0154***
	(0.0113)	(0.00898)	(0.00889)	(0.00522)	(0.00520)	(0.00843)	(0.00842)	(0.00504)	(0.00503)
Adjusted R-squared	0.042	0.400	0.412	0.797	0.799	0.471	0.473	0.811	0.811
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

***** p<0.01, ** p<0.05, * p<0.1**

Standard errors in parentheses. N=4886 for HDI and 4836 for PL

Table 3

Results of Impact of Specific Natural Disasters on Municipal Indicators, HDI

Impacts on HDI by type of natural hazard

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flood	-0.00282	-0.00282	-0.00282	-0.00283	-0.00285	-0.00282	-0.00282	-0.00282	-0.00281
	(0.00488)	(0.00432)	(0.00424)	(0.00221)	(0.00219)	(0.00403)	(0.00402)	(0.00218)	(0.00218)
Frost	-0.00503	-0.00503	-0.00503	-0.00503	-0.00503	-0.00503	-0.00503	-0.00503	-0.00503
	(0.00731)	(0.00647)	(0.00635)	(0.00330)	(0.00329)	(0.00603)	(0.00601)	(0.00326)	(0.00326)
Drought	-0.00969	-0.00969	-0.00969	-0.00970***	-0.00971***	-0.00969	-0.00969	-0.00967***	-0.00967***
	(0.00730)	(0.00647)	(0.00635)	(0.00330)	(0.00328)	(0.00602)	(0.00601)	(0.00326)	(0.00326)
Rains	0.00646	0.00646	0.00646	0.00646*	0.00646**	0.00646	0.00646	0.00645**	0.00645**
	(0.00732)	(0.00648)	(0.00636)	(0.00331)	(0.00329)	(0.00604)	(0.00602)	(0.00327)	(0.00326)
Landslide	0.00452	0.00452	0.00452	0.00452	0.00452	0.00452	0.00452	0.00451	0.00451
	(0.00832)	(0.00737)	(0.00723)	(0.00376)	(0.00374)	(0.00686)	(0.00684)	(0.00371)	(0.00371)
Others	-0.00806	-0.00806*	-0.00806*	-0.00806***	-0.00808***	-0.00806*	-0.00806*	-0.00805***	-0.00805***
	(0.00549)	(0.00486)	(0.00477)	(0.00248)	(0.00247)	(0.00453)	(0.00452)	(0.00245)	(0.00245)
Adjusted R-squared	0.208	0.379	0.402	0.838	0.840	0.461	0.465	0.842	0.843
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

***** p<0.01, ** p<0.05, * p<0.1**

Standard errors in parentheses. N=4836

Table 4

Results of Impact of Specific Natural Disasters on Municipal Indicators, PL1

Impacts on FGT PL 1 by type of natural hazard

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flood	0.0354**	0.0354***	0.0354***	0.0351***	0.0352***	0.0354***	0.0354***	0.0351***	0.0351***
	(0.0150)	(0.0124)	(0.0122)	(0.00728)	(0.00724)	(0.0117)	(0.0117)	(0.00713)	(0.00712)
Frost	-0.0107	-0.0107	-0.0107	-0.0105	-0.0105	-0.0107	-0.0107	-0.0105	-0.0105
	(0.0226)	(0.0186)	(0.0183)	(0.0109)	(0.0109)	(0.0176)	(0.0175)	(0.0107)	(0.0107)
Drought	0.0424*	0.0424**	0.0424**	0.0417***	0.0418***	0.0424**	0.0424**	0.0417***	0.0417***
	(0.0225)	(0.0186)	(0.0183)	(0.0109)	(0.0108)	(0.0176)	(0.0175)	(0.0107)	(0.0107)
Rains	-0.00198	-0.00198	-0.00198	-0.00151	-0.00154	-0.00198	-0.00198	-0.00152	-0.00152
	(0.0225)	(0.0186)	(0.0183)	(0.0109)	(0.0108)	(0.0175)	(0.0175)	(0.0107)	(0.0107)
Landslide	-0.0123	-0.0123	-0.0123	-0.0117	-0.0117	-0.0123	-0.0123	-0.0117	-0.0117
	(0.0257)	(0.0212)	(0.0209)	(0.0124)	(0.0124)	(0.0200)	(0.0200)	(0.0122)	(0.0122)
Others	0.0341**	0.0341**	0.0341**	0.0337***	0.0338***	0.0341***	0.0341***	0.0338***	0.0338***
	(0.0169)	(0.0140)	(0.0138)	(0.00819)	(0.00814)	(0.0132)	(0.0132)	(0.00802)	(0.00801)
Adjusted R-squared	0.160	0.427	0.445	0.803	0.806	0.490	0.492	0.811	0.812
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

***** p<0.01, ** p<0.05, * p<0.1**

Standard errors in parentheses. N=4886

Table 5

Results of Impact of Specific Natural Disasters on Municipal Indicators, PL2

Impacts on FGT PL 2 by type of natural hazard

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flood	0.0297*	0.0297**	0.0297**	0.0292***	0.0293***	0.0297**	0.0297**	0.0293***	0.0293***
	(0.0154)	(0.0125)	(0.0123)	(0.00723)	(0.00720)	(0.0118)	(0.0118)	(0.00706)	(0.00705)
Frost	-0.00832	-0.00832	-0.00832	-0.00802	-0.00801	-0.00832	-0.00832	-0.00801	-0.00801
	(0.0231)	(0.0188)	(0.0185)	(0.0108)	(0.0108)	(0.0177)	(0.0177)	(0.0106)	(0.0106)
Drought	0.0385*	0.0385**	0.0385**	0.0376***	0.0377***	0.0385**	0.0385**	0.0376***	0.0376***
	(0.0230)	(0.0188)	(0.0185)	(0.0108)	(0.0108)	(0.0177)	(0.0176)	(0.0106)	(0.0106)
Rains	-0.00705	-0.00705	-0.00705	-0.00644	-0.00646	-0.00705	-0.00705	-0.00645	-0.00645
	(0.0230)	(0.0188)	(0.0185)	(0.0108)	(0.0108)	(0.0177)	(0.0176)	(0.0106)	(0.0106)
Landslide	-0.0105	-0.0105	-0.0105	-0.00970	-0.00974	-0.0105	-0.0105	-0.00972	-0.00972
	(0.0262)	(0.0214)	(0.0210)	(0.0123)	(0.0123)	(0.0201)	(0.0201)	(0.0121)	(0.0120)
Others	0.0292*	0.0292**	0.0292**	0.0287***	0.0287***	0.0292**	0.0292**	0.0287***	0.0287***
	(0.0173)	(0.0141)	(0.0139)	(0.00813)	(0.00809)	(0.0133)	(0.0132)	(0.00794)	(0.00793)
Adjusted R-squared	0.145	0.431	0.450	0.811	0.812	0.496	0.498	0.819	0.820
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

***** p<0.01, ** p<0.05, * p<0.1**

Standard errors in parentheses. N=4886

Table 6

Results of Impact of Specific Natural Disasters on Municipal Indicators, PL3

Impacts on FGT PL 3 by type of natural hazard									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flood	0.0196	0.0196*	0.0196*	0.0189***	0.0189***	0.0196*	0.0196*	0.0189***	0.0189***
	(0.0138)	(0.0111)	(0.0109)	(0.00655)	(0.00653)	(0.0105)	(0.0104)	(0.00633)	(0.00632)
Frost	-0.000652	-0.000652	-0.000652	-0.000221	-0.000209	-0.000652	-0.000652	-0.000212	-0.000212
	(0.0208)	(0.0166)	(0.0163)	(0.00982)	(0.00979)	(0.0157)	(0.0157)	(0.00949)	(0.00948)
Drought	0.0271	0.0271	0.0271*	0.0256***	0.0257***	0.0271*	0.0271*	0.0256***	0.0256***
	(0.0207)	(0.0166)	(0.0163)	(0.00981)	(0.00978)	(0.0157)	(0.0156)	(0.00948)	(0.00947)
Rains	-0.0143	-0.0143	-0.0143	-0.0134	-0.0135	-0.0143	-0.0143	-0.0135	-0.0134
	(0.0207)	(0.0166)	(0.0163)	(0.00981)	(0.00978)	(0.0156)	(0.0156)	(0.00947)	(0.00946)
Landslide	-0.0138	-0.0138	-0.0138	-0.0126	-0.0126	-0.0138	-0.0138	-0.0126	-0.0126
	(0.0236)	(0.0189)	(0.0186)	(0.0112)	(0.0111)	(0.0178)	(0.0178)	(0.0108)	(0.0108)
Others	0.0143	0.0143	0.0143	0.0135*	0.0136*	0.0143	0.0143	0.0136*	0.0136*
	(0.0156)	(0.0125)	(0.0123)	(0.00737)	(0.00734)	(0.0118)	(0.0117)	(0.00711)	(0.00711)
Adjusted R-squared	0.102	0.425	0.444	0.799	0.800	0.488	0.490	0.812	0.813
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

*** p<0.01, ** p<0.05, * p<0.1

Standard errors in parentheses. N=4886

Table 7

Results of Impact of Specific Natural Disasters on Municipal Indicators. Only Municipalities with Disasters.

Impacts on HDI by type of hazard

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flood	-0.000537	-0.000537	-0.000537	-0.000540	-0.000540	-0.000537	-0.000537	-0.000533	-0.000533
	(0.00592)	(0.00543)	(0.00543)	(0.00249)	(0.00249)	(0.00493)	(0.00493)	(0.00244)	(0.00243)
Frost	-0.00453	-0.00453	-0.00453	-0.00453	-0.00453	-0.00453	-0.00453	-0.00454	-0.00454
	(0.00747)	(0.00685)	(0.00685)	(0.00314)	(0.00314)	(0.00622)	(0.00622)	(0.00307)	(0.00307)
Drought	-0.00883	-0.00883	-0.00883	-0.00885***	-0.00885***	-0.00883	-0.00883	-0.00882***	-0.00882***
	(0.00745)	(0.00684)	(0.00684)	(0.00314)	(0.00314)	(0.00621)	(0.00621)	(0.00307)	(0.00306)
Rains	0.00722	0.00722	0.00722	0.00723**	0.00723**	0.00722	0.00722	0.00721**	0.00721**
	(0.00741)	(0.00680)	(0.00680)	(0.00312)	(0.00312)	(0.00617)	(0.00617)	(0.00305)	(0.00304)
Landslide	0.00518	0.00518	0.00518	0.00520	0.00520	0.00518	0.00518	0.00517	0.00517
	(0.00842)	(0.00773)	(0.00773)	(0.00354)	(0.00354)	(0.00702)	(0.00702)	(0.00347)	(0.00346)
Adjusted R-squared	0.218	0.341	0.341	0.861	0.861	0.457	0.457	0.867	0.868
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

***** p<0.01, ** p<0.05, * p<0.1**
Standard errors in parentheses. N=2062

Impacts on FGT PL 1 by type of hazard

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flood	0.0412***	0.0326**	0.0326**	0.0324***	0.0324***	0.0326**	0.0326**	0.0324***	0.0324***
	(0.0149)	(0.0150)	(0.0150)	(0.00820)	(0.00820)	(0.0139)	(0.0139)	(0.00812)	(0.00810)
Frost	-0.00313	-0.00851	-0.00851	-0.00827	-0.00827	-0.00851	-0.00851	-0.00825	-0.00824
	(0.0224)	(0.0190)	(0.0190)	(0.0104)	(0.0104)	(0.0176)	(0.0176)	(0.0103)	(0.0102)
Drought	0.0474**	0.0426**	0.0426**	0.0420***	0.0420***	0.0426**	0.0426**	0.0420***	0.0420***
	(0.0226)	(0.0189)	(0.0189)	(0.0103)	(0.0103)	(0.0175)	(0.0175)	(0.0102)	(0.0102)
Rains	0.00224	-0.00193	-0.00193	-0.00147	-0.00147	-0.00193	-0.00193	-0.00143	-0.00143
	(0.0226)	(0.0188)	(0.0188)	(0.0103)	(0.0103)	(0.0174)	(0.0174)	(0.0101)	(0.0101)
Landslide	-0.00624	-0.0111	-0.0111	-0.0105	-0.0105	-0.0111	-0.0111	-0.0105	-0.0105
	(0.0257)	(0.0214)	(0.0214)	(0.0117)	(0.0117)	(0.0198)	(0.0198)	(0.0116)	(0.0115)
Adjusted R-squared	0.149	0.405	0.405	0.823	0.823	0.491	0.491	0.826	0.827
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

***** p<0.01, ** p<0.05, * p<0.1**
Standard errors in parentheses. N=2068

Impacts on FGT PL 2 by type of hazard

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flood	0.0279	0.0279*	0.0279*	0.0277***	0.0277***	0.0279**	0.0279**	0.0277***	0.0277***
	(0.0182)	(0.0153)	(0.0153)	(0.00833)	(0.00833)	(0.0141)	(0.0141)	(0.00817)	(0.00816)
Frost	-0.00601	-0.00601	-0.00601	-0.00568	-0.00568	-0.00601	-0.00601	-0.00567	-0.00567
	(0.0229)	(0.0193)	(0.0193)	(0.0105)	(0.0105)	(0.0178)	(0.0178)	(0.0103)	(0.0103)
Drought	0.0391*	0.0391**	0.0391**	0.0383***	0.0383***	0.0391**	0.0391**	0.0382***	0.0382***
	(0.0229)	(0.0193)	(0.0193)	(0.0105)	(0.0105)	(0.0178)	(0.0178)	(0.0103)	(0.0103)
Rains	-0.00670	-0.00670	-0.00670	-0.00608	-0.00608	-0.00670	-0.00670	-0.00605	-0.00604
	(0.0227)	(0.0191)	(0.0191)	(0.0104)	(0.0104)	(0.0176)	(0.0176)	(0.0102)	(0.0102)
Landslide	-0.00918	-0.00918	-0.00918	-0.00836	-0.00836	-0.00918	-0.00918	-0.00832	-0.00832
	(0.0259)	(0.0218)	(0.0218)	(0.0119)	(0.0119)	(0.0201)	(0.0201)	(0.0116)	(0.0116)
Adjusted R-squared	0.169	0.412	0.412	0.825	0.825	0.499	0.499	0.832	0.832
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

***** p<0.01, ** p<0.05, * p<0.1**
Standard errors in parentheses. N=2068

Impacts on FGT PL 3 by type of hazard

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Flood	0.0195	0.0195	0.0195	0.0191**	0.0191**	0.0195	0.0195	0.0191**	0.0191**
	(0.0167)	(0.0137)	(0.0137)	(0.00814)	(0.00814)	(0.0128)	(0.0128)	(0.00778)	(0.00777)
Frost	0.000982	0.000982	0.000982	0.00150	0.00150	0.000982	0.000982	0.00151	0.00151
	(0.0211)	(0.0174)	(0.0174)	(0.0103)	(0.0103)	(0.0161)	(0.0161)	(0.00982)	(0.00982)
Drought	0.0278	0.0278	0.0278	0.0265***	0.0265***	0.0278*	0.0278*	0.0265***	0.0265***
	(0.0211)	(0.0173)	(0.0173)	(0.0103)	(0.0103)	(0.0161)	(0.0161)	(0.00980)	(0.00979)
Rains	-0.0138	-0.0138	-0.0138	-0.0128	-0.0128	-0.0138	-0.0138	-0.0128	-0.0128
	(0.0209)	(0.0172)	(0.0172)	(0.0102)	(0.0102)	(0.0160)	(0.0160)	(0.00972)	(0.00972)
Landslide	-0.0127	-0.0127	-0.0127	-0.0114	-0.0114	-0.0127	-0.0127	-0.0114	-0.0114
	(0.0238)	(0.0196)	(0.0196)	(0.0116)	(0.0116)	(0.0182)	(0.0182)	(0.0111)	(0.0111)
Adjusted R-squared	0.123	0.407	0.407	0.792	0.792	0.489	0.489	0.810	0.811
Geography and Nature		yes	yes	yes	yes	yes	yes	yes	yes
Socioeconomic				yes	yes	yes	yes	yes	yes
Coping Funds and Covariates						yes	yes	yes	yes
Institutional/Local Capacity								yes	yes

***** p<0.01, ** p<0.05, * p<0.1**
Standard errors in parentheses. N=2068

Table 8

General impacts on human development and poverty by quartile

	HDI	PL 1	PL 2	PL 3
	-.0060769**	.04743***	.04368***	.025294***
q 20	(.0025232)	.0081805	(.008458)	(.008047)
	[0.6456]	[0.5481]	[0.5746]	[0.6065]
	-.0049387**	.04063***	.032889***	.019517
q 40	(.0020223)	.0072601	(.007399)	(.312334)
	[0.6413]	[0.5923]	[0.6087]	[0.6158]
	-.0031631*	.03762***	.028734***	.011451**
q 60	(.0017112)	.006932	(.007397)	(.005618)
	[0.6377]	[0.6214]	[0.6293]	[0.6143]
	-.0000746	.04800***	.036652***	.013336**
q 90	(.002127)	.0097821	(.009122)	(.0065494)
	[0.6371]	[0.6323]	[0.6257]	[0.5641]
Number of observations	4860	4884	4884	4884
Geography and Nature	yes	yes	yes	yes
Socioeconomic	yes	yes	yes	yes
Coping Funds and Covariates	yes	yes	yes	yes
Institutional/Local Capacity	yes	yes	yes	yes

***** p<0.01, ** p<0.05, * p<0.1**
Bootstrap Standard errors in parentheses. Pseudo R2 in brackets.
State level fixed effects included.