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The Short and Long-Term Human Development Effects of Climate-Related Shocks: Some Empirical Evidence

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1. Introduction

Weather-related disasters are usually seen as 'here-today-gone-tomorrow' events. However, the effects that they have on long-term prospects for development can unlock cumulative cycles of disadvantage. Although they have immense immediate costs in terms lives lost and impaired livelihoods, weather-related shocks have also many other intrinsic costs that often go unnoticed as far as policy is concerned. For example, although the loss of assets during a flood, drought or cyclone is a terrible event in its own right, it has also has the potential to leave people more exposed to future vulnerability. Droughts can have a huge tool on poverty, but they also have the potential to deplete the household's productive potential once the drought is over. Similarly, if people are forced to lower their calorie intake, this can leave children more susceptible to illness, exacerbating already existing low nutrition levels.

Research regarding disasters is abundant but usually focuses on the immediate impact on the asset stock of households or on the coping mechanism that households undertake to smooth consumption. The results vary but the common understanding is that in the absence of credit and insurance markets, households will deplete their asset stock. To cope with the impacts of these events, several mechanisms have been developed by communities across the world, some of which tend to increase future vulnerability.

Climate-related disasters confront households with an additional set of challenges: not only do they deplete the capacity of households to earn income and accumulate wealth, they also force them make decisions that can impact their prospective development in areas such as health and education. In other words, climate-related events force households to cope with crises through market mechanisms and consumption smoothing, but also have the potential to limit their future sets of choices and therefore place constraints on human development.

In this paper, we use the human development framework—broadly defined as the process of enlarging people's choices—to analyze interlocking disadvantages due to shocks. We analyze the short and medium term effects of weather-related shocks on different non-monetary dimensions of human development. We focus on weather-related disasters and analyze household data for four countries—Ethiopia, Kenya, India and Niger—which have suffered recurrent climate disasters including floods and droughts. Our broad aim is to gauge the possible impact of changing weather patterns—which could include more frequent and stronger droughts, floods and hurricanes—due to climate change.

The paper is organized as follows: section 2 reviews the existing empirical literature on weather-related disasters and human development; section 3 provides the human development framework and set the stage for this study; section 4 describes the data and estimation process; section 5 describes the results and section 6 concludes with a discussion on how these effects can lead to lifelong cycles of disadvantage or low human development traps.

2. Literature review

The literature on sudden shocks and their impact on welfare has grown tremendously over the past decade. Analysis of the impacts of financial crises (Lustig, 2000); civil wars (Collier et al 2003) and natural calamities are common in the literature. These generally fall into two categories: while some studies have explored the direct impacts of shocks, others have looked at the efficiency of the coping mechanisms that people use to reduce their exposure to risk ex-ante and the consequences arising from the decision made to smooth consumption ex-post. In this brief review of the existing literature, we will focus on these aforementioned studies in the context of weather-related events for reasons that were explained in the introduction.

Weather-related disasters affect people through many different channels:

- *Death and disability* – Disasters can disrupt well-being through death and disability. If the primary breadwinner dies during the disaster, a household may be forced to incur debt as it will be stripped from its most predictable source of cash flow. Disability has a similar effect, sometimes compounded by expensive medical treatment.

- *Sudden loss of income* – In the immediate aftermath of a disaster, people affected often find themselves without their means of subsistence: droughts imply the loss of crops, and all natural disasters imply to a certain extent the loss of jobs and the general slowing of the national economy, which can have large impacts on the capacity of people to earn income.

- *Depletion of assets* – Besides the loss of housing and other assets during a climate-related shock, short-term responses to sudden losses of income force families to sell their little physical assets and productive tools. In the absence of insurance mechanisms, poor households often collect some asset—livestock, grains and agricultural tools—that they may be able to sell in the contingency of a natural disaster. However, these assets often have a dual function as they serve as productive gear as well, leaving households with a difficult decision to make regarding their sale—often well below cost in the case of covariate shocks—or retention.

- *Loss of public infrastructure* –Damages to schools, hospitals and roads are common after a natural disaster; the collapse of electricity and sewage grids are also frequent occurrences in urban areas. In rural zones, damage to irrigation and transportation networks can affect agricultural production and marketing.

- *Macroeconomic effects.* When major natural disasters impact the entire country, there can be negative macroeconomic effects that can lead to an overall reduction in the economy's productive capacity which in turn can translate into human development challenges.

Probably the best understood link between climate-related events and welfare is their physical tool and their impact on income, consumption and asset accumulation. Mortality, the number of people affected and the extent of the economic damage incurred are obvious examples. For instance, in 2005 alone, natural disasters have affected a total of 127 countries, claimed an estimated 89,916 lives, affected about 160 million people and created damages of about US$159 billion, a clear increase over the decade prior (CRED, 2006).

Some physical impacts of disasters are not always directly observable. For example, a study examining the impacts of the 1997-1998 drought and smoke haze crises and the Asian financial crisis on infant mortality and birth weight in Indonesia found that there was strong adverse effect on infant mortality, especially in poorer areas (Jayachandran, 2006). Similarly Rose (1999) showed that there was a strong link between favorable rainfall shocks in childhood and increased survival probabilities of girls relative to boys in rural India.

It is also evident how a flood, drought or hurricane will affect individual wealth. Examples abound: empirical evidence from Ethiopia (Dercon, 2004) shows that 95 % of households in the country observed a serious decline in income as cause of some sort of shock (drought, illness or death) between 1999 and 2004 and 47% of those were affected by a drought—higher than any other impact. The authors estimated that the poverty rate caused by drought was about 15 %—half the total poverty that would exist in the absence of droughts or if the consumption of people was fully insured. In Honduras, following Hurricane Mitch, it has been estimated that rural poverty jumped by more than 5 %, reaching 75 % (Morris, 2002).

Yet the most pervasive consequences do not necessarily arise as the result of the loss life, income flows or assets. In fact, as we argue in this paper, focusing on monetary measures of welfare—such as consumption or income poverty—can severely understate the consequences of natural disasters. People under stress face difficult trade-offs: the decisions taken to “smooth” consumption which often include the sale of livestock, debt, food rationing and child labor can have long-term negative implications for the level and progress in human development in the individual’s life cycle. These effects can in turn contribute to poverty and deficiencies across generations.

Even if a shock does not increase mortality rates, it can severely affect the health and nutrition status of children. For instance, in a study of the impacts of the 2001-2002 southern African droughts on maternal micronutrient status and infant growth, Gitau et al (2005) found that maize price increases resulting from the drought had modest effects on maternal micronutrient status; yet this led to an increase in stunting among the infants of such mothers. In Bangladesh, following the 1998 flood, Buttenheim (2006) found that the flood caused marginal growth faltering for some children, with wide variances between households according to the extent of flood exposure. The results suggested that food aid targeting played a significant role in these variations.

A different strand of the literature on natural disasters has examined the coping mechanisms that households employ to either reduce the risk of a tragedy or to cope with the impacts of one. These coping strategies usually involve some measures of consumption smoothing that have consequences on asset stocks and other determinants of human development. These can include inefficient ex-ante risk reduction measures such as a geographic diversification of plots to ensure against localized shocks or a strategic decision on the part of households to have plant different types of crops that are drought resistant but provide lower yields (Murdoch, 1998). Following a disaster, household may opt to sell some of there assets. In the case of covariate shocks, this sale of assets can cause a precipitous drop in the price of the asset being sold. As a result, the proceeds do not generally generate enough income to meet household needs (Fafchamps et al 1996, Carter et al 2005).

Furthermore, some of the decisions made in the aftermath of disasters can also affect children significantly. Baez et al. (2007) found that in the aftermath of Hurricane Mitch, which hit Nicaragua in 1998, children in the areas that were affected were less likely to be taken for medical consultation even while their probability of their being malnourished quadrupled. The authors found no significant effect on school enrollment but labour force participation by children increased and the proportion of children simultaneously enrolled in school and working doubled.

Other studies have also found an increase in children's labor supply: Jacoby and Skoufias (1997) found that in the Semi-Arid Tropic (SAT) region of India, children in small farm households have a greater probability of dropping out of school in the aftermath of a weather shocks. Similar evidence was presented in another study in Mexico (de Janvry et al., 2006).

Taking this notion further, some studies have shown that child disadvantages will translate into adult disadvantages, sometimes perpetuating gender inequalities and other cycles of disadvantage. For instance, in exploring the impacts of large shocks on long-term child and adult health in Zimbabwe and Ethiopia, Dercon et al (2003) found that there were substantial fluctuations in bodyweight and growth retardation resulting from the shocks, with adult women experiencing the most severe impacts. Moreover, children were not able to fully recover from the shocks and consequentially their adult health and education outcomes and their lifetime earnings were affected.

A similar study using longitudinal data from rural Zimbabwe traced the consequences of shocks affecting children prior to the age of three on their health and education attainments as young adults (Alderman et al 2004). The authors found that shocks such as droughts and war were among the determinants of differences in preschool heights and that improved preschooler nutritional status was associated with increased height as a young adult, an earlier age at which a child started school, and a greater number of grades completed in school. The authors concluded that interventions focused on mitigating the impacts of shocks on young children are important for ensuring subsequent human capital formation.

In assessing the impact of drought on adult health in rural Zimbabwe, Hoddinott et al (2000) found that women, but not men, were adversely affected and that women in poor households and daughters in general suffered the most. The authors also found that the ex-ante private coping strategy of accumulating livestock protected women from the adverse effects of the shock.

There is also a gender dimension to weather shocks: as with many other systemic disturbances, they have the potential to perpetuate gender disparities. Looking at the impact of rainfall around the time of birth on the health, education, and socioeconomic outcomes of Indonesian adults born between 1953 and 1974, Maccini et al (2007) found that higher early-life rainfall had a positive impact on the adult outcomes of women but not on those of men. The study found that this was because rainfall had a positive impact on agricultural output leading to higher household incomes and increased spending on infant girls' health, which in turn led to better adult outcomes. The authors suggested that since infants are particularly vulnerable to environmental and economic shocks, interventions should focus on shielding infants from the health consequences of such shocks.

Our study follows some of these results. Our attempt is to further explore the long-term consequences of short-term shocks using the human development framework. We provide evidence that weather related events can have negative impacts on the human development process of households and communities, creating what we call "human development reversals".

3. Weather-related disasters and human development: a conceptual framework

We use the human development framework as a starting point for our analysis. Human development is described as "the process of enlarging people's choices" (UNDP 1990). More concretely, the human development framework is based on the capabilities theory developed by Amartya Sen. This theory describes people's welfare as a result of what individuals can achieve, her "doings and beings" or in general her "functionings". The capability approach is at the same time a critique and an expansion of the utility framework used extensively in economic analysis. By developing the capability approach, Sen demoted the idea that human welfare can be described completely by a unique dimension of "commodities" (Sen in Readings of Human Development, p 4).

The human development framework has been used extensively in the past 17 years following the publication of the first Human Development Report in 1990. Since then, the empirical and conceptual elements of the human development approach have been developed at length: the families of human development indices published each year with the HDR are just a sample of the measurement dimension of human development. At the same time, the human development framework has also been used to explain cultural liberty (UNDP 2004), democracy (UNDP 2002) and to make the case for greater gender equality (UNDP 1995).

Central to the capability approach, is that "capability reflects a person's freedom to choose between different ways of living" (Sen in Readings of Human Development, p 5). In that broad sense, anything that limits that choice can be seen as a hindrance to the expansion of capabilities and substantive freedoms. Our attempt is to analyze the impacts that one-time shocks can have in the present and future levels of human development for households and individuals. In other words, we study how such events, occurring over a very short period of time, can permanently diminish the set of choices that people have.

Arguably, one of the most arbitrary and random elements of nature are weather-related events [1]. They can have anywhere from a benign to a wide range of negative consequences, depending on the timing, magnitude and location of these events. As a result, they fit into the capability framework insofar as they can limit choice before, during and potentially long after the event in question.[2]

Death, injury and loss of assets can carry with them substantial economic hardship but they are also clear examples of events that curtail capabilities. Similarly, the fact that people engage into inefficient risk reduction activities that they would otherwise not have engaged into helps to explain much of the high levels of poverty prevalent in some countries, but more importantly they also limit substantive individual freedoms. As documented in the previous section, some of these costs of natural disasters have received their due attention in the literature.

Much less studied within this context has been the human development angle, namely how these events curtail choice for the poor. In light of the fact that anthropogenic climate change promises to increase both the scale and scope of weather-related disasters, it is of particular importance to understand the mechanisms through which people are going to be affected.

We focus on early disadvantages, namely if one was born during a disaster or not. This focus on early disadvantages that are caused by negative climate related events goes to the heart of the curtailment of capabilities. Most of us agree that our birthdates and birth locations should not determine whether we should live in poverty while lacking the freedoms and capabilities necessary to live lives that we value.

When climate events strike, they create handicaps and impose a further burden on people, reinforcing patterns of chronic multidimensional poverty and increasing inequality. Children are most at risk: since they are accumulating the basic requirements to enhance their present and future development, any event that limits the process of accumulation of any set of basic capabilities will essentially impact their "beings", which in turn can create an impediment on their "doings". For example, a child who drops out of school because of lack of income will not only be deprived of the vital information that can be

[1] Although it can be argued that with human induce climate change, climate events are not entirely exogenous anymore.

[2] We focus on weather-related disasters, but in principle, the analysis presented here can be expanded to any unexpected short-term shock.

provided by formal education—the “being”—but will be also be unable to achieve many things as a result—the “doing”. These factors can in turn lead to long run cycles of disadvantage or “low human development traps” which will be discussed in the last section of this paper.

4. Data and empirical strategy

4.1. Choice of indicators

In principle, there is a wide set of indicators that can be used to monitor the human development impacts of weather-related disasters, including morbidity and mortality indicators and hard to measure indicators such as achieving self-respect, emotional scaring etc. (Sen in Readings in HD p.5). In practice, many of these are not readily available and in some cases, their analyses involve a great deal of subjectivity. As a result, our analysis focuses on measurable outcomes such as nutritional indicators for children and educational outcomes for adult women.

The focus on nutritional indicators for children and education outcomes for adults follows from the fact that it is now well established across many disciplines that early childhood is a critical phase in one’s human development. Some key areas that link early childhood development and human development are essentially education, health and the acquisition of social capital to a certain extent (van der Gaag 2003). In many different studies, a critical ingredient that has consistently explained children’s better educational outcomes, improved health and adequate stature as an adult, and better reproductive health for women has been child nutrition (Glewwe et al 1999; Jukes 2006; Handa et al 2006; Maluccio et al 2006, Mayer-Foulkes 2006).

As is evident from these studies, early childhood development, particularly in terms of nutrition sets a critical foundation for human development over an individual’s lifetime. As a result, nutrition indicators provide a good benchmark for assessing the human development impact of weather-related disasters. This framework also serves as a possible link for the education indicators for adults. Even though education is one of the pillars of human development and therefore is important in its own right, the evidence described above provides a clearer conceptual link for the long-term impacts of these events.

4.2. The data

To measure the short and particularly the long-term human development impacts of extreme weather events, it is preferable to use panel data where the same individuals are surveyed at different points in time, throughout their lives. An added requirement for this particular exercise is that the study design needs to be carefully conducted such that some of those who are affected by a disaster and those who are not have the same baseline characteristics. To date, datasets that meet these stringent requirements are extremely rare.

It is also obvious that due to the varied and insidious human development impacts of weather-related disasters discussed throughout this paper, both the consequences and the responses across countries and across communities will be context specific, requiring a holistic and contextual approach to their measurement. To circumvent these problems, we use Demographic and Health Surveys (DHS) and supplement them with disaster data from the Emergency Events Database (EM-DAT) which is maintained by the WHO collaborating Centre for Research on the Epidemiology of Disasters (CRED).

4.2.1. Demographic and Health Surveys

Demographic and Health Surveys (DHS) are the most extensive standardized dataset on housing and demographic characteristics. The DHS are mostly funded by USAID within its “Monitoring and Evaluation to Assess and Use Results” (MEASURE) program. These surveys collect information on a wide set of variables at the individual, household and community level and are conducted every five years to allow comparisons over time. DHS are generally multistage clustered sampling surveys that are nationally representative. They usually sample 5,000-30,000 households in each round but do not have a longitudinal design, which constitutes a major drawback.

To mitigate this issue, we use a synthetic cohort type of design. The details and statistical issues that arise from using this particular strategy are discussed below; but briefly summarized, they enable us to select children and adults into control and treatment groups before and after an extreme-weather event.

The DHS’ primary focus is on women aged 15-49. They collect information on a range of indicators that include age, education, reproductive health, contraceptive use, anthropometric measures and knowledge of prevalent health threats like HIV/AIDS. The surveys also collect information on other members of the family, including an extensive set of monitoring indicators on children aged five and under. Those indicators include among others, vital statistics, immunization and nutritional and health status. At the household level, DHS provide information on living conditions—such as access to basic services like drinking water and adequate sanitation facilities—and also socio-economic information through the collection of data concerning the ownership of durable assets such as having a television, a refrigerator and so forth.

DHS also provide some birth information such as women and children’s date of birth but do not provide information regarding the actual place of birth. Specifically, in a typical DHS, one can identify people who have lived in the same place throughout their lives, but for those who have moved, it is impossible to trace their place of birth. In addition, mortality statistics are collected for children under the age of five, but for women aged 15-49, this information is not generally collected. From a statistical viewpoint, these issues can give rise to a selection problem that we will address in the *identification strategy* section of this paper.

4.2.2. The International Disasters Database (EM-DAT)

The EM-DAT is an international disasters database that presents core data on the occurrence of disasters worldwide from 1900 to the present. Disasters in EM-DAT are defined as: "a situation or event which overwhelms local capacity, necessitating a request to the national or international level for external assistance, or is recognized as such by a multilateral agency or at least by two sources, such as national, regional or international assistance groups and the media".

The database covers a wide range of events including natural and technological disasters. Its main objective is to facilitate humanitarian action at national and international levels, including particularly the rationalization of decision making prior to and following such an event. These include disaster preparedness and disaster risk management, as well as the provision of an objective base for vulnerability assessment and priority setting. Since context is arguably as important as the magnitude of a disaster, information derived from EM-DAT can serve as the basis for determining whether a particular intervention is relevant in a given setting and should be prioritized when preparing for a disaster. The information in EM-DAT is gathered using various sources including international agencies such as the United Nations, non-governmental agencies (NGOs), insurance companies and press agencies[3].

For a disaster to be recorded in the database, it has to meet one or more of the following criteria:

- 10 or more people are killed;
- 100 people or more are reported affected;
- A state of emergency is declared;
- An international call for assistance is issued.

A key feature of the database is that it records both the date of occurrence of a disaster—relatively recent ones—its location, and the extent of its severity through the number of people affected, the number of casualties and the financial damage sustained (Guha-Sapir et al. 2004).

4.3. Empirical Strategy

To capture the extent of the threat to human development that is embedded in climate-related shocks, we attempt to measure the short- and long-term effects of being born in a disaster-affected area. More specifically, some critical determinants of human development outcomes are examined for children less than five years of age and adult women between the ages of 15 and 30, and those who were affected by a disaster were compared with those who were not.

The approach we use borrows from impact evaluation techniques widely used in the social sciences. For children under the age of five, the outcome indicators used are:

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[3] http://www.em-dat.net/who.htm

stunting (low height for age), wasting (low weight for height) and malnourishment (low weight for age). For adult women 15–30, the outcome indicator was educational outcome. As indicated earlier, in the absence of longitudinal data, we construct a set of synthetic before and after cohorts and compare their outcomes using logit regression models with a difference-in-difference approach, controlling for individual, household and community characteristics.

Weather-related disasters tend to strike the same communities. For example, some areas in a given country may be more prone to droughts while others may be more prone to floods or cyclones. This is the case of India for example. While most of the country is flood-prone, the eastern and south-eastern parts—coastal states like Andhra Pradesh, Orissa, Tamil Nadu and West Bengal—are more prone to cyclones and the central states such as Madhya Pradesh, Rajasthan, Gujarat and parts of Maharashtra are more prone to droughts. Consequently, people living in those regions may have lower nutritional characteristics—particularly in the case of droughts—but also their overall level of human development may be influenced by the local weather conditions. Consequently, to properly isolate the impact of these weather events on people, it is necessary to account for baseline differences.

The estimation method that we use in this paper is particularly suited to deal with this issue. As an example, let us consider the case of Niger (figure 1). We identify two groups of children: those who were born anywhere within the country during the disaster (group 1) and those who were born before the disaster (group 2). In addition, we select children who live in districts that were affected by the 1989 drought—Diffa, Zinder, and Maradi—which we label "affected group (ag)" and those who live in a region that was not affected, which we label "not affected group (nag)".

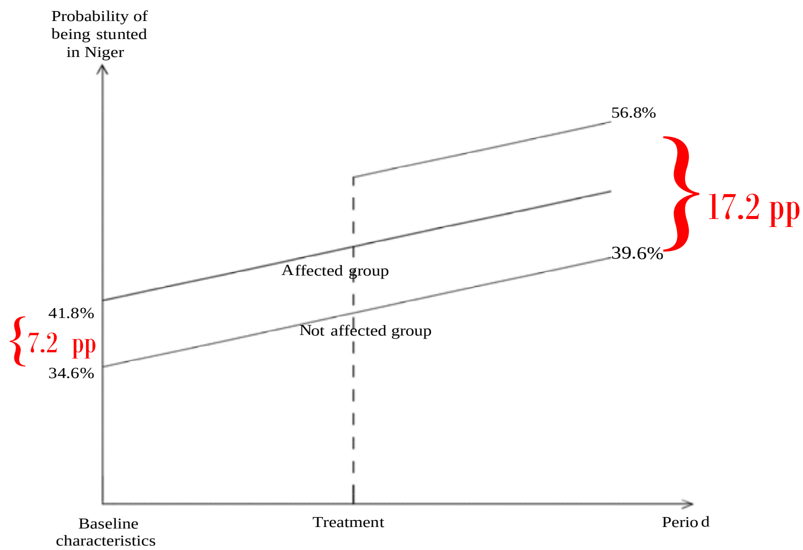
To construct the cohorts, we identify children and adult women in DHS and track their birth dates. The subject's birth date and birth location is then crosschecked against the occurrence of a natural disaster as indicated in EM-DAT. The following groups are identified:

- Children born during a disaster in an area that was affected (affected, born during disaster—group 1, affected).
- Children born during a disaster in an area that was not affected (born during, not affected—group 1, not affected).
- Children born before a disaster in an area that was subsequently affected (affected, born before the disaster—group 2, affected).
- Children born before a disaster in an area that was not subsequently affected (not affected, born before —group 2, not affected). Using these different groups we estimate the following model:

$$\hat{\phi} = \frac{1}{N}\sum_{i=1}^{n}[(y_{i1}^{nag} - y_{i1}^{ag}) - (y_{i2}^{nag} - y_{i2}^{ag})]$$

where y_i is the outcome of interest for the ith person. In a multivariate regression setting, this is equivalent to controlling for the period of birth, whether one was born in an area affected and the interaction of those two terms which indicates if the person was born during a disaster and in an area that was affected. At each step, we use a set of control variables to identify the effects of specific characteristics on children's nutritional outcomes. These included individual variables (the sex of the child, birth intervals and such maternal characteristics as mother's age and education) and community-level variables (e.g., urban/rural location). A regression analysis was then conducted to isolate the specific risks associated with being affected by a disaster.

Figure 1 illustrates the strategy used to estimate the human development impacts of weather related disasters. The DiD estimates compare outcomes before and after the disaster for children. In the case of Niger, we can see that the incidence of stunting was 7.2 percentage points higher for children who were born before the 1989 drought but lived in districts that were subsequently affected. Consequently, if there was no drought in 1989, following a linear trend, we would have expected the incidence of stunting to be around 47% in the "affected" districts[4]. However, as we can see, among the affected group, the incidence of stunting increased to 56.8%, nearly 10 percentage points higher than in a "business as usual scenario".



Source: Adapted from Deb and Conning (2007)

For adults, in line with the arguments put forth in this paper, if it is assumed that disasters are a deterministic process—also termed path dependence—then virtually every indicator including household socio-economic characteristics is influenced by early exposure to a disaster and is therefore endogenous. As a result, only variables that can reasonably be assumed exogenous, such as religion and ethnic group were included.

4.3.1. Country selection criteria

[4] This can be attributed to many factors such as a worsening of macroeconomic conditions or the fact that the drought itself may have reduced resources nationwide.

As mentioned above, DHS are designed to be nationally representative and, strictly speaking, are not specifically designed for this kind of study. Therefore, in cases where natural disasters are localized events, the sampling design of these surveys, coupled with the restrictions placed on the treatment group—being born during a disaster, in an area that was affected—treatment status becomes a rare event in a statistical sense (see Fuentes et al. (2006) for a discussion of the issues involved in rare event statistical estimation).

As a result, for the purposes of this study, only countries where over 1,000,000 people were reported affected by a disaster were selected. For children under the age of five countries that had a DHS with a geographic positioning system (GPS) module two to three years following a disaster were selected. The selection of countries with GPS modules was necessary, especially for countries where some administrative districts were more affected than others (Kenya is a prime example). For adult women, we limit the selection to India where the sample size is large enough (almost 100,000 observations) and major disasters (drought in 1972-73 and flood in 1977) had occurred during the 1970s. Table 1 presents the sample characteristics for each country.

4.3.2. Identification

The model described in the previous section raises some substantive statistical issues. For example, since the survey questionnaire does ask weather a person was affected by a disaster or the degree of severity (which could be endogenous), some people will be selected into the treatment group even though they are not affected by a disaster. Hence, our variable of interest—namely being affected by a disaster—is measured with error. However the same reasoning applies to the control group: some people will be selected into a control group but were affected by a disaster. Our identifications strategy in this case depends on the fact that this is a classical measurement error and the direction of the effect will not *a priori* bias the results in any specific direction.

A second issue relates to a problem mentioned above. DHS only identify the date of birth, the area of residence and the length of time the person has lived in their current location. Given this information, one can only identify people who were born during a disaster in an area that was affected but have not moved. For those who have moved or have died as a result of a disaster, we cannot collect this information. This in turn can give rise to a selection problem whose direction will primarily depend on who selects to move. For example, if the people who select to more or migrate following an extreme-weather event are those who are the most resilient (i.e. the better-off and the able-bodied), then the impacts on those who have remained behind will be an overestimate of the true effect, and vice versa. Unfortunately, with the data on hand, we have no foul proof way of determining the direction of the effect.

In any case, death as a result of famine induced droughts and other extreme weather events can be extensive and far reaching. Our exercise does not take into account this aspect of weather related disasters. However, it is fairly clear that viewed from this lens, the impacts that we will find through this exercise will most likely constitute floor estimates of the true human development cost of weather-related disasters.

Finally, one needs to worry about the age-cohort problem. By design, children who were born before the drought are older than those that were born during. The DiD estimator in this instance does not distinguish between those effects that are due to the age of the child and those that are the result of the disaster. To remedy this problem, we exclude from our samples children who were born after the disaster and restrict our estimation to children who were aged 1 or older by the time the drought officially ended. We also include an indicator of whether the child is above the age of two or not.

5. Results

5.1. Means comparison tests

Table 2 presents group means comparison tables for children. The procedure is the same as the one illustrated in figure 1. As panel (a) in table 2 indicates, nearly half of all Ethiopian children in the sample are stunted (low height for age), about two-thirds are wasted (low weight for height) and 42% are malnourished. In each case, we can see that children who were born at the time of a disaster and also lived in an area that was affected have the highest incidence rates. The following column in the table takes a difference in means within group. These results suggest that children living in affected areas, irrespective of when they were born are worse off than their counterparts who were born in areas that were not affected by the drought.

For example, for stunting, the results imply that children who were born during a disaster but didn't reside in an area that was affected (born during but not affected) are 10.3 percentage points or about 24 percent less likely to be stunted than children who were born at the same time and were affected by the drought (born during and affected). For wasting and malnourishment, the differences are respectively 5.1 and 14.6 percentage points. Looking at the group of children who were born before the drought (baseline difference in outcomes), the differences are much narrower and the effects are statistically significant.

The difference-in-difference estimates are presented in the next column of the panel. The results for Ethiopia suggest that the drought increased stunting rates amongst the affected group by 8.6 percentage points; wasting rates practically did not change, and malnourishment rates increased by 8.0 percentage points.

In the case of Kenya (panel b) and Niger (panel c), the results indicate that the drought has affected stunting rates but some of the results, especially for wasting and malnourishment (in Kenya) are a bit counterintuitive. For Kenya for example, lower rates of wasting can be found for the affected group and the drought didn't seem to have a noticeable impact on wasting rates. For malnourishment, again a sizable difference can be found between affected and unaffected groups: for those born during the drought, the difference is 8.0 percentage points and for those born before the difference is 9.8

percentage points, suggesting that the impact of the drought may have been worse within group but has in fact reduced the incidence of malnourishment within the born during group.

For Niger, wasting rates behave in a similar fashion and the affect of the drought on malnourishment has the expected sign. These results can be due to many different factors. One obvious explanation that is not accounted for by the simple difference in means is the age effect. For stunting, this is not really a problem as children who are stunted past the age of two rarely recover and tend to have a lower stature later in life (Mayer-Foulkes, 2006). In the multivariate analysis, we will account for the age of the child.

A possible explanation for the counterintuitive results found for Kenya and Niger—especially for wasting—could be explained by the fact that wasting—weight for age—is a short term measure of nutrition as opposed to stunting which monitors long-term chronic malnutrition. Since these surveys were conducted when the situation was considered normal in the respective countries, wasting outcomes may reflect conditions other than the drought past.

5.2. Multivariate regressions

Logistic regression estimates for children are presented in the form of odds ratios in tables 3-5 for each country. A clear and notable pattern of results emerges:

- In Ethiopia, children who were born during a disaster, in an area that was affected (affected for short) are 35.5 percent more likely to be malnourished; they are also 41 percent more likely to be stunted.

- In Kenya, children between the ages of one and two who were affected by the drought are 50.7 percent more likely to be malnourished but the results are only significant at the 10% level. However, strong negative effects are found for children who were born during the drought, irrespective of where they were born. These children are 49.8 percent more likely to be malnourished and also 46% more likely to be stunted. The risks of severe malnourishment and severe stunting—which refers respectively to a weight and height for age three standard deviations below the reference median—are also extremely high among these children, reaching respectively 95.6 and 66.0 percent.

  Being born in a drought prone area also increases the risk of stunting in Kenya: these children have respectively a 50.4 percent higher probability of being stunted and a 71.1 percent higher chance of being severely stunted.

- In Niger, the chance of being malnourished more than doubles for children between the ages of one and two who were affected by the drought. Similarly, as with Kenya, being born during a disaster, irrespective of the birth location increases the risk of being malnourished by 55.5 percent.

- Across all of the countries, the risk of being wasted did not change for those who were affected by the droughts. In Ethiopia, the risk of being wasted increased only for those children living in areas that are drought prone. A likely explanation for these results, as mentioned above is that wasting is a short-term measure of nutrition and its incidence varies based on the current conditions.

Other results such as the impact of mother's education are also worth mentioning: As the results indicate, secondary education strongly reduces the risk of poor nutrition. For instance, in Ethiopia, the risk of malnutrition decreases by almost two-thirds and the risk of stunting decreases by nearly one-half. For Kenya and Niger, the corresponding figures are respectively 70.7 and 61.6 percent for malnutrition and 41.1 and 70.8 percent.

- In India, we use educational indicators for women aged 15-30. The results are presented in table 4. Adult women who were affected by the drought in 1972-1973 or the flood in 1977 were 19.4 percent less likely to ever attend primary school. As the second column of the table indicates, this deficit carries aver to secondary school and stands at 16.5 percent.

These results carry a great deal of significance given the important role that mother's education plays in the child's nutrition, as described above. This is just one of many channels through which disasters contribute to the intergenerational transmission of low human development.

6. *Discussion and human development implications*

Human development is not a linear process. We provide further evidence that short-term shocks have immediate effects on the nutritional and health status of children and those effects can linger long afterwards. This evidence is consistent with other studies showing the effects of severe shocks. The potentially long lasting effects of weather-related disasters also point to something important: they have the potential to lock people into long lasting cycles of disadvantage. These results are also all the more relevant and should draw particular attention on the part of policymakers, especially in the context of the climate change debate. Climate change, as shown by the fourth assessment of the IPCC, will increase the severity and frequency of weather-related disasters.

Economists have often used the concept of poverty traps to explain the persistence of poverty within demographic and other groups. They are usually explained by market failures. They result when certain groups of the population are unable to accumulate the critical level of assets that would allow them—or their offspring—to achieve their productive potential, participate efficiently in economic activity and ultimately escape poverty (Banerjee et al, p. xxxiii). Market failures explain poverty traps because if perfect insurance and credit markets existed, poverty traps would not exist.

Two mechanisms explaining poverty traps are common in the literature: the first one arises when resources fall short of a basic level: i.e. nutrition and health level below which workers cannot effectively function or children cannot properly develop. A second mechanism—which has featured prominent—is the presence of imperfection in the credit markets. This market failure impedes efficient investments by the poor in both human and physical capital. Citing Banerjee "poverty is self-sustaining because the poor are credit constrained and as a result choose not to invest. Consequently, they earn low rates of return to their investment and do not accumulate wealth fast enough to get out of the trap" **(Dercon p 66)**. Different commentators have identified different types of investments: in education, in health or in capital.

Expanding the concept, we can think of a low human development trap as the incapacity of a household or an individual to expand the set of choices available to lead a life they value. This in turn, as suggested in this paper can be the consequence of a decision made to cope with a shock. More specifically, a low human development trap can serve as the analytical instrument to describe the long-term consequences of short-term shocks. Given the data at our disposal, we are not able to prove their existence. However our exercise certainly points in that direction.

How is a low human development trap different from a poverty trap? As explained above, a poverty trap is explained by lack of earning potential, thus, a household will break the trap if earnings—and/or earning potential—are high enough, regardless of the level of education or health. In contrast a low human development trap is an event that keeps households and individuals in the vicious circle of low education, low health and low earnings.

In practice, it might be difficult to differentiate a poverty trap from a low human development trap, mainly because the different dimensions of well being are very often strongly correlated. However, one can well imagine a situation where family members decide to work longer hours to increase their income (devoting less time to school) or engage in riskier activities. If there is a trade-off between hours worked and education, these households may well be trapped in a low human development cycle since education is important for children's health, their school attendance and overall participation in society. These are for example functions that are above and beyond the economic returns in the form of wages that a good education can deliver. In other words, the benefits of education go much beyond the efficiency in returns argument.

Moreover, there is also ample evidence that education of the parents plays a critical role in many other dimensions of family and especially of children's well being. For example, better decision making during a shock—keeping children in school regardless of the level of hardship—can certainly be one of those channels. Hence, better educated parents imply a lower risk of children dropping out of school in the face of distress, even after controlling for wealth levels (Rucci 2003).

Finally, a low human development trap can exist even when household income returns to pre-shock levels: if the larger set of choices available to the households and individuals has been permanently affected despite the recovery of earnings, we consider the household to be in a low human development trap.

The distinction is also important for policy reasons: education and health are not only instruments (investments, in economic parlance) to achieve higher earnings; they are goals in themselves. Thus, in the face of a shock, governments and policy makers should be as concerned with the impact that this event might have in health and education as the more measurable impact on income. In fact, evidence suggest that income levels will return, albeit slowly, to pre-shock levels and trends. That is not necessarily the case for health and education as early malnourishment will have a permanent effect on health, and once a child drops out of school, it is highly unlikely he will return.

These results are also important in the context of the climate change debate. Climate change, as shown by the fourth assessment of the IPCC, will increase the severity and frequency of weather-related disasters. This phenomenon can trigger reversal in development for the most vulnerable segments of the world's population. Our research was an attempt to put this debate in perspective while showing that the consequences of climate change will be represented in several dimension of human development and will be carried on through the years. Hence, the evidence presented in this paper suggests that climate change can be a driver of poverty and vulnerability in the short, medium and long terms.

Further research to capture the full extent of these impacts is needed. As shown, weather-related disasters have the potential to set in train these so-called "low human development traps"—the incapacity of a household or an individual to expand the set of choices to lead a life the value as a consequence of a decision made to cope with a shock. Better data will be necessary and can help illuminate the ways in which shocks can cause the transmission of disadvantages across generations.

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Table 1: Country coverage and data characteristics

Country	Year(s) of Disaster	Number of casualties	Number of affected	Survey Year	Sample Size
Children					
Ethiopia	2003-2004	0	12,600,000	2005	9861
Kenya	1999-2002	85	23,000,000	2003	5949
Niger	1988	0	1,000,000	1992	6899
Adults					
India	1972-1973	0	100,000,000	1998	99,257

Table 2: Simple difference in means results for Ethiopia, Kenya and Niger

	Panel a: Ethiopia			Panel b: Kenya			Panel c: Niger		
Stunted	group means	first difference in means	Difference in difference	group means	first difference in means	Difference in difference	group means	first difference in means	Difference in difference
born during, not affected	43.6%			35.3%			39.6%		
	(0.496)	-10.3%		(0.478)	-11.9%		(0.489)	-17.2%	
born during, affected	53.9%	(0.026)		47.2%	(0.025)		56.8%	(0.022)	
	(0.499)		***-8.6%***	(0.500)		***-1.7%***	(0.496)		***-10.0%***
born before, not affected	47.9%	-1.7%	***(0.001)***	26.6%	-10.2%	***(0.001)***	34.6%	-7.2%	***(0.003)***
	(0.500)	(0.025)		(0.442)	(0.033)		(0.477)	(0.055)	
born before, affected	49.6%			36.8%			41.8%		
	(0.500)			(0.483)			(0.495)		
Total	**49.2%**			**34.5%**			**45.4%**		
	(0.500)			**(0.476)**			**(0.498)**		
Wasted									
born during, not affected	10.6%			8.2%			11.4%		
	(0.308)	-5.1%		(0.274)	0.2%		(0.318)	-3.9%	
born during, affected	15.7%	(0.017)		7.9%	(0.014)		15.3%	(0.014)	
	(0.364)		***-0.3%***	(0.271)		***0.2%***	(0.361)		***2.2%***
born before, not affected	6.3%	-4.8%	***(0.001)***	4.9%	0.0%	***(0.001)***	5.1%	-6.1%	***(0.001)***
	(0.242)	(0.014)		(0.216)	(0.015)		(0.221)	(0.027)	
born before, affected	11.1%			4.9%			11.2%		
	(0.314)			(0.216)			(0.316)		
Total	**11.2%**			**7.0%**			**12.4%**		
	31.5%			**25.5%**			**(0.329)**		
Malnourished									
born during, not affected	36.1%			24.2%			38.9%		
	(0.481)	-14.6%		(0.428)	-8.0%		(0.488)	-15.4%	
born during, affected	50.8%	(0.026)		32.2%	(0.023)		54.3%	(0.022)	
	(0.500)		***-8.0%***	(0.468)		***1.9%***	(0.498)		***-4.3%***
born before, not affected	37.1%	-6.6%	***(0.001)***	17.2%	-9.8%	***(0.001)***	29.0%	-11.1%	***(0.003)***
	(0.483)	(0.024)		(0.378)	(0.030)		(0.455)	(0.054)	
born before, affected	43.8%			27.1%			40.2%		
	(0.496)			(0.445)			(0.492)		
Total	**42.6%**			**23.5%**			**43.6%**		
	(0.495)			**(0.424)**			**(0.496)**		

Standard deviations are in parentheses

Table 3: Ethiopia	Malnourished (under weight for age)			Stunted (under height for age)			Wasted (under weight for height)		
	Any	Moderate	Severe	Any	Moderate	Severe	Any	Moderate	Severe
born in affected area	1.015	0.977	1.093	0.955	0.881	1.06	1.672**	1.708**	1.466
	(0.13)	(0.19)	(0.49)	(0.4)	(0.97)	(0.47)	(2.51)	(2.22)	(1.11)
born during disaster	0.943	0.771*	1.451**	0.842	0.822	0.966	1.231	1.527*	0.511
	(0.47)	(1.84)	(1.98)	(1.42)	(1.35)	(0.24)	(0.92)	(1.69)	(1.37)
affected by disaster	1.355**	1.347*	1.072	1.410**	1.343*	1.166	0.843	0.786	1.051
	(2.07)	(1.85)	(0.31)	(2.4)	(1.71)	(0.91)	(0.7)	(0.87)	(0.1)
Child's Characteristics									
aged 12-24months	1.162	1.14	1.068	1.119	1.306**	0.888	1.999***	1.714***	3.319***
	(1.38)	(1.13)	(0.44)	(1.04)	(2.18)	(0.96)	(4.31)	(3.08)	(3.17)
female	0.922	0.929	0.96	0.938	0.948	0.973	0.863	0.968	0.597**
	(1.09)	(0.94)	(0.37)	(0.86)	(0.63)	(0.33)	(1.27)	(0.26)	(2.12)
int_long	0.919	0.972	0.876	0.811**	0.991	0.770***	1.221	1.185	1.32
	(1.02)	(0.33)	(1.09)	(2.57)	(0.09)	(2.79)	(1.58)	(1.21)	(1.09)
season_winter	1.378***	1.450***	0.975	1.477***	1.350**	1.206	0.968	1.002	0.86
	(2.89)	(3.15)	(0.16)	(3.57)	(2.33)	(1.57)	(0.18)	(0.01)	(0.41)
season_spring	1.186	1.146	1.109	1.044	1.282**	0.831	1.244	1.301	1.005
	(1.57)	(1.15)	(0.66)	(0.4)	(1.96)	(1.5)	(1.28)	(1.38)	(0.01)
season_summer	0.988	1.161	0.721**	0.789**	1.022	0.711***	1.056	1.103	0.894
	(0.11)	(1.28)	(1.97)	(2.21)	(0.17)	(2.73)	(0.33)	(0.53)	(0.34)
Maternal characteristics									
education: primary	0.835	0.908	0.803	0.788**	0.972	0.747**	1.249	1.231	1.24
	(1.59)	(0.8)	(1.29)	(2.11)	(0.23)	(2.27)	(1.35)	(1.13)	(0.69)
education: secondary and higher	0.407***	0.445***	0.512	0.523***	0.752	0.430***	0.501	0.592	0.296
	(3.79)	(3.06)	(1.62)	(2.93)	(1.14)	(2.83)	(1.54)	(1.07)	(1.2)
mother aged less than 20	1.095	1.162	0.896	0.901	1.041	0.845	1.21	1.177	1.29
	(0.61)	(1)	(0.48)	(0.7)	(0.24)	(1.02)	(0.82)	(0.61)	(0.62)
mother aged 20-34	1.174	1.031	1.351*	1.074	1.027	1.07	1.225	1.384*	0.805
	(1.46)	(0.27)	(1.84)	(0.65)	(0.22)	(0.57)	(1.17)	(1.65)	(0.67)
Household and community characteristics									
third quintile and above	0.779***	0.946	0.635***	0.91	1.166	0.772**	0.526***	0.652**	0.225***
	(2.63)	(0.56)	(3.03)	(0.98)	(1.44)	(2.44)	(3.89)	(2.42)	(3.7)
ethnic group 1	1.248*	1.344**	0.918	1.01	1.253*	0.819	1.016	0.96	1.21
	(1.88)	(2.41)	(0.51)	(0.09)	(1.77)	(1.57)	(0.09)	(0.2)	(0.62)
ethnic group 2	0.793**	1.052	0.536***	0.689***	0.961	0.648***	0.799	0.835	0.733
	(2.27)	(0.47)	(3.93)	(3.61)	(0.36)	(3.99)	(1.39)	(0.99)	(1.01)
ethnic group 3	1.119	1.403**	0.665**	0.689***	1.222	0.507***	0.828	1.016	0.351**
	(0.76)	(2.34)	(2.01)	(2.66)	(1.35)	(4.23)	(0.87)	(0.07)	(2.04)
Community characteristics									
capital, large city	0.307***	0.291***	0.482	0.569*	0.732	0.396*	0.403	0.629	
	(2.99)	(2.89)	(0.89)	(1.71)	(0.84)	(1.74)	(1.19)	(0.58)	
small city	0.806	0.695	1.237	0.908	0.906	0.898	1.276	1.378	1.119
	(0.76)	(1.2)	(0.4)	(0.35)	(0.32)	(0.31)	(0.55)	(0.6)	(0.15)
countryside	1.474**	1.146	2.264**	1.871***	1.376	1.819**	1.137	1.675	0.316**
	(1.99)	(0.66)	(2.11)	(3.27)	(1.49)	(2.36)	(0.36)	(1.18)	(1.97)
Observations	**3137**	**3137**	**3137**	**3137**	**3137**	**3137**	**3137**	**3137**	**3030**

Robust z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Kenya	Malnourished (under weight for age)				Stunted (under height for age)		
	Any	Moderate	Severe		Any	Moderate	Severe
born in affected area	1.379*	1.304	1.542		1.504***	1.235	1.711**
	(1.89)	(1.48)	(1.13)		(2.64)	(1.22)	(2.44)
born during disaster	1.498***	1.345**	1.956***		1.463***	1.218*	1.660***
	(3.59)	(2.44)	(2.68)		(3.84)	(1.75)	(3.37)
affected by disaster	0.684*	0.718	0.639		1.004	1.164	0.734
	(1.67)	(1.38)	(0.93)		(0.02)	(0.68)	(1.08)
aged 12-24 months, affected	1.507*	1.618*	0.984		0.954	0.836	1.161
	(1.74)	(1.91)	(0.04)		(0.22)	(0.78)	(0.53)
Child's characteristics							
aged 12-24 months	1.014	0.868	1.518**		1.200*	1.219*	1.056
	(0.12)	(1.13)	(2.01)		(1.84)	(1.76)	(0.38)
female	0.811**	0.819**	0.88		0.775***	0.752***	0.933
	(2.56)	(2.28)	(0.81)		(3.58)	(3.53)	(0.69)
3 year birth interval	0.837*	0.806**	1.015		0.9	0.93	0.906
	(1.85)	(2.08)	(0.08)		(1.24)	(0.76)	(0.82)
born Jan-March	1.338**	1.158	1.900**		0.953	1.043	0.845
	(2.39)	(1.1)	(2.42)		(0.46)	(0.35)	(1.1)
born April-June	1.255*	1.153	1.570*		0.945	0.958	0.951
	(1.88)	(1.08)	(1.71)		(0.55)	(0.37)	(0.34)
born July-Sept	1.534***	1.396**	1.783**		1.279**	1.167	1.277
	(3.4)	(2.52)	(2.19)		(2.31)	(1.3)	(1.63)
Maternal Characteristics							
education: primary	0.597***	0.750***	0.428***		1.216**	1.450***	0.86
	(5.19)	(2.79)	(4.86)		(2.03)	(3.41)	(1.2)
education: secondary	0.293***	0.393***	0.191***		0.589***	0.947	0.321***
	(8.1)	(5.8)	(4.82)		(4.14)	(0.38)	(5.49)
mother aged less than 20	1.198	1.209	1.046		1.162	1.18	1.033
	(1.09)	(1.1)	(0.14)		(0.99)	(1)	(0.15)
mother aged 20-34	1.086	1.101	1.004		0.95	0.926	1.017
	(0.61)	(0.69)	(0.02)		(0.41)	(0.57)	(0.1)
Household and community characteristics							
ethnic group: kikuyu	0.643***	0.704***	0.542**		0.896	0.87	0.998
	(3.42)	(2.66)	(2.21)		(1.05)	(1.21)	(0.01)
ethnic group: lihya	0.681***	0.691***	0.763		1.061	0.958	1.211
	(2.84)	(2.58)	(1.03)		(0.53)	(0.36)	(1.22)
ethnic group: luo	0.514***	0.533***	0.576		1.036	1.125	0.866
	(3.82)	(3.43)	(1.57)		(0.26)	(0.81)	(0.69)
rural	1.636***	1.682***	1.211		1.415***	1.408***	1.218
	(4.16)	(4.21)	(0.9)		(3.62)	(3.22)	(1.39)
Observations	**3685**	**3685**	**3685**		**3685**	**3685**	**3685**

Robust z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Niger	Malnourished (under weight for age)			Stunted (under height for age)		
	Any	Moderate	Severe	Any	Moderate	Severe
born in affected area	1.376	1.093	2.033	1.026	0.946	1.093
	(1.2)	(0.31)	(1.37)	(0.1)	(0.18)	(0.27)
born during disaster	1.555**	1.184	2.317*	1.209	1.198	1.097
	(2.39)	(0.77)	(1.88)	(1.04)	(0.77)	(0.37)
affected by disaster	1.022	0.952	0.839	1.542	1.225	1.425
	(0.08)	(0.17)	(0.32)	(1.62)	(0.61)	(1.06)
aged 12-24 months, affected	2.193***	1.544	1.164	1.228	0.739	1.715*
	(2.89)	(1.6)	(0.47)	(0.81)	(1.04)	(1.92)
Child's characteristics						
aged 12-24 months	1.832***	1.508**	1.540*	1.257	1.448*	0.884
	(3.82)	(2.24)	(1.79)	(1.36)	(1.75)	(0.56)
female	1.109	0.905	1.390**	1.011	0.876	1.16
	(1.15)	(0.93)	(2.32)	(0.12)	(1.24)	(1.35)
3 year birth interval	0.813*	0.821	0.949	0.824*	0.874	0.89
	(1.84)	(1.6)	(0.35)	(1.66)	(1.06)	(0.97)
born Jan-March	1.403**	1.158	1.450*	1.256	1.153	1.178
	(2.33)	(0.97)	(1.79)	(1.63)	(0.84)	(0.91)
born April-June	1.269*	1.159	1.224	1.319**	1.311	1.107
	(1.76)	(1.05)	(0.9)	(1.98)	(1.63)	(0.54)
born July-Sept	1.214	1.061	1.298	1.314**	1.309*	1.107
	(1.35)	(0.41)	(1.2)	(2.02)	(1.74)	(0.53)
Maternal Characteristics						
education: primary	0.99	1.138	0.79	0.678**	0.866	0.659*
	(0.06)	(0.81)	(0.9)	(2.12)	(0.82)	(1.83)
education: secondary	0.384***	0.703	0.051***	0.292***	0.513**	0.236***
	(3.99)	(1.38)	(3.05)	(4.88)	(2.54)	(2.68)
mother aged less than 20	1.031	1.08	0.941	1.14	1.430*	0.814
	(0.17)	(0.37)	(0.24)	(0.68)	(1.75)	(0.94)
mother aged 20-34	1.109	1.139	0.979	1.27	1.162	1.177
	(0.74)	(0.77)	(0.11)	(1.53)	(0.87)	(0.93)
Household and community characteristics						
ethnic group: Haoussa	1.329*	1.476**	0.93	1.181	1.114	1.117
	(1.72)	(2.15)	(0.26)	(0.95)	(0.6)	(0.56)
ethnic group: Djerma	0.913	1.322	0.546**	0.715*	1.308	0.447***
	(0.5)	(1.47)	(2.03)	(1.74)	(1.4)	(3.43)
ethnic group: Touareg	1.522**	1.478*	1.113	1.252	1.072	1.212
	(2)	(1.8)	(0.33)	(0.99)	(0.3)	(0.74)
Observations	**2459**	**2459**	**2459**	**2459**	**2459**	**2459**

Robust z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: India	Educated (primary and above)	High education (secondary and above)
born in affected area	1.862***	1.481***
	(10.71)	(6.93)
born during disaster	0.958**	0.97
	(1.98)	(1.38)
affected by disaster	0.806**	0.835*
	(2.29)	(1.9)
Religion: muslim	0.117***	0.140***
	(38.81)	(38.47)
Religion: Hindu	0.235***	0.315***
	(31.8)	(29.25)
Scheduled caste	0.290***	0.265***
	(40.11)	(40.21)
Scheduled tribe	0.200***	0.199***
	(42.93)	(42.18)
Backwar tribe	0.501***	0.493***
	(26.97)	(27.33)
Observations	**42265**	**42265**

Robust z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%