Global Assessment Report
on Disaster Risk Reduction

Recent Trends in Disaster Impacts on Child Welfare and Development 1999-2009

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RECENT TRENDS IN DISASTER IMPACTS ON CHILD WELFARE AND DEVELOPMENT 1999-2009

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1. Introduction

Disasters have a disproportionate impact on the poor in developing countries, especially affecting those segments of the population that are more vulnerable. Children, and especially young children, are less well equipped to deal with deprivation and stress due to their particular physical, social and psychological characteristics (see Bartlett 2008; Cutter 1995, Peek 2008). This makes them particularly vulnerable to the effects of disasters. In the late 1990s the numbers of children affected by disasters was estimated at 66.5 million per year; climate change impacts are projected to increase this to as many as 175 million per year in the coming decade[1].

Whilst these figures are estimates, what is clear is that they are not disaggregated by age, gender or other socio-economic and contextual factors. In many circumstances children are still grouped with women thus the detailed picture that reflects the particular vulnerabilities and needs of children is missing. Disaster impact reporting often focuses on the economic loss of the disaster event and the cost of rehabilitation and repair of major infrastructure rather than the social cost. The immediate and long-term human dimensions of loss are not factored into these costs; disaster risk reduction (DRR) programmes therefore tend to focus on the protection of the economy and structures rather than looking at vulnerability and difference within communities. But disaster impacts persist into the long-term, well beyond initial mortality and infrastructural damage to include negative impacts on health, education, nutrition and morbidity; for children these can lead to lifelong impacts on well-being and achievement in their adult lives.

There is an increasing interest in the economics literature on evaluating the impact of natural disasters on individual welfare. The use of econometric techniques has identified causality between the occurrence of particular disaster events and the evolution of welfare indicators. A significant share of the research literature has focussed on how changes in child welfare respond to the occurrence of natural disasters, in particular studies on psychosocial impacts are plentiful.

Through a rapid desk-based assessment this study contributes to learning and debate by investigating whether available data gives evidence of patterns and trends of the impact of disasters on childhood welfare indicators over the past decade (1999-2009). The study is unique in presenting an initial approach to disaggregate and empirically analyse the trends of both 'extensive' and 'intensive' disaster risk on child welfare and development, using a similar and comparable methodology. This reflects a growing concern with the need for DRR practices to engage in tackling regular low level risk, as well as responding to emergency high impact situations.

Disaster data was pre-classified by risk type in the Desinventar databases (see Box 1), whilst child welfare data - sourced at the lowest available geo-political scale - fall into the broad categories of 'child health' 'education' and 'poverty'. Available data is analysed for 7 countries: **Bolivia, Indonesia, Mexico, Mozambique Nepal, the Philippines, and Vietnam**. Each country is the subject to specific regressions for both intensive and extensive risk, producing distinct sets of results for each type of risk. The results present the overall trend for the 10 year study period in childhood welfare in response to

[1] Penrose and Takaki (2006) Save the Children (2007 and 2009)

both risk types. Results presented are those which are statistically significant and provide useful insights upon which further work should be developed.

Box 1. Intensive and extensive disaster risk

According to the 2009 Global Assessment Report on DRR (GAR09), intensive and extensive risk refer to the "relative concentration or spread of disaster risk in space and time".

- "(M)ortality and direct economic loss appear to be highly concentrated geographically and associated with a very small number of hazard events. These areas where **major concentrations of vulnerable people and economic assets are exposed to very severe hazards" are referred to as intensive risk**[2]
- "(W)ide regions are exposed to more frequently occurring low-intensity losses. These widespread low-intensity losses are associated with other risk impacts such as a large number of affected people and damage to housing and local infrastructure, but not to major mortality or destruction of economic assets… This **geographically dispersed exposure of vulnerable people and economic assets to mainly low or moderate intensity hazard is described as extensive risk.**"[3]

Despite the fact that intensive risk disasters often call more attention, the cumulative effect of extensive disaster losses represent a significant and largely unrecognized component of disaster impacts and costs

The paper begins by presenting an overview of existing econometric research into disaster impacts on human welfare before discussing in detail the raw data used for this study. Recognising that exogenous shocks are mediated by the interactions between a range of causal factors and the unique context of any event it necessarily recognises the limitations in the availability and appropriateness of data from which to develop a robust understanding of childhood vulnerability and causal linkages to disaster impacts. Section four briefly introduces the methodology used for analysing extensive and intensive disaster risk impacts; a full methodological explanation is included in Annex 1.

Section 5 presents the country studies with a short contextual introduction to the disaster profile and child welfare issues in each country. Statistically significant results from the

[2] According to UNISDR "The risk associated with the exposure of large concentrations of people and economic activities to intense hazard events, which can lead to potentially catastrophic disaster impacts involving high mortality and asset loss. *Comment: Intensive risk is mainly a characteristic of large cities or densely populated areas that are not only exposed to intense hazards such as strong earthquakes, active volcanoes, heavy floods, tsunamis, or major storms but also have high levels of vulnerability to these hazards."* http://www.unisdr.org/eng/terminology/terminology-2009-eng.html

[3] According to UNISDR "The widespread risk associated with the exposure of dispersed populations to repeated or persistent hazard conditions of low or moderate intensity, often of a highly localized nature, which can lead to debilitating cumulative disaster impacts.
Comment: Extensive risk is mainly a characteristic of rural areas and urban margins where communities are exposed to, and vulnerable to, recurring localised floods, landslides storms or drought. Extensive risk is often associated with poverty, urbanization and environmental degradation." http://www.unisdr.org/eng/terminology/terminology-2009-eng.html

regression analysis of both extensive and intensive risk are presented in brief for each country study with cross-country discussion developed in section 6. Results from across all the countries are re-presented by broad welfare category and this forms the basis for a global discussion on the outcomes of the regressions. The concluding section (7) presents a way forward for the research area, identifying steps that should be taken to improve the robustness of the results whilst section 8 presents a set of recommendations based on the data needs for developing robust country level studies and for policy and practice.

2. The impact of disasters on children: a literature review

Much of the advocacy literature around children, disasters and climate change seeks to highlight the need for understanding both vulnerabilities and capacities of children in times of disaster as a pre-requisite for developing and delivering child-centred DRR and climate change adaptation policy and programmes[4].

> "Children constitute an extremely large percentage of those who are most vulnerable, and the implications, especially for the youngest children, can be long term. If speculation about the impacts of climate change fails to take into account the particular vulnerabilities (as well as capacities) of children at different ages, measures for prevention and adaptation may prove to be inadequate in critical ways, and may even result in additional stresses for young minds and bodies" Bartlett (2008)

However within this body of advocacy literature little actual evidence of the impact of natural disasters on children's welfare is given. Bartlett (2008) discusses "the probable impacts for children of different ages from the increasing risk of storms, flooding, landslides, heat waves, drought and water supply constraints that climate change is likely to bring to most urban centres in Africa, Asia and Latin America" providing an interesting matrix of "likely impacts" of climate change on children's welfare. It goes on to "explore the implications for adaptation, focusing on preparedness as well as responses to extreme events and to changes in weather patterns" with the author concluding that

> "There are strong synergies between what children need and the adaptations required to reduce or respond to more general risks. The most useful measures to protect children's health are also fundamental in reducing risks from potential disasters – such as adequate drainage, waste removal and proper sanitation. Supporting adults so that they are better able to address their children's needs also leaves them better equipped to work collaboratively on reducing risks, preparing for disasters and rebuilding their lives after a crisis. Ensuring that children continue to have opportunities to play, learn and to take an active role in finding solutions will prepare them to be the citizens we need to continue addressing the problems faced by their communities and by the planet. It has generally been found that neighbourhoods and cities that work better for children tend to work better for everyone, and this principle also undoubtedly applies to the adaptations that are being called for by climate change".

Beyond the advocacy literature it is possible to find a branch of research in economics that aims to show how natural disasters may affect population's welfare. Most of these documents produce actual estimates of the impact of natural disasters on different welfare variables. For instance, Baez et.al (2007) focus on the impact of Hurricane Mitch on children's welfare. The authors exploit the "exogenous variation in the trajectory of the hurricane in a quasi-experimental design and show that large and aggregated shocks, such as natural disasters, have adverse medium-run effects on children's well-

[4] See CCC (2009) *Children, Climate Change and Disasters: An Annotated Bibliography,* Children in a Changing Climate Research Brighton: IDS

being, particularly in terms of health, nutrition and labor force participation". The main conclusions of this paper are:

- Children living in areas directly affected by Hurricane Mitch "were 30% less likely to be taken for medical consultation conditional on being sick."
- Also, the estimates show that "children in regions hit by Mitch were 8.7 percentage points more likely to be undernourished and the overall distribution of nutritional status among children in these areas –especially of those in the tail of the distribution– worsened significantly as a result of the storm."
- Regarding labour force participation, their results show that it "increased by 58% among children in areas affected by the hurricane".
- Finally, "the proportion of children simultaneously enrolled in school and working more than doubled due to Mitch", increased "from 7.5% to 15.6%."

These results are generally 'expected' however surprisingly the authors also found there was "no significant effect of Mitch on school enrolment"

Rodriguez-Oreggia, et.al. (2010) also present very useful estimations on the impact of natural disasters at the Municipal level in Mexico. Although it is not focused on children, its conclusions are relevant and useful:

- Results show a "significant and adverse impact of natural disasters on both human development and poverty". In particular, the authors find that "for affected municipalities, the impact on the Human Development Index (HDI) is similar to going back 2 years in human development over the same period analyzed on average".
- Their results also show that "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 their results show that "floods and droughts have the more significant adverse effects".
- Finally, they also conclude that "disasters affect more poorly endowed municipalities in their long term indicators such as the HDI, but the effects seem to take a U-shape when it comes to poverty levels".

Lopez-Calva, et.al (2009) analyse different data sets for several countries in Latin American to identify the effects of natural disasters on poverty. The identification techniques applied provide estimates of the impact of natural disasters and various poverty-related indicators. Among the main conclusions presented in this document are:

- El Salvador: Results show that "2001 earthquakes are associated with a reduction of $1,760 colones in household income per capita (a reduction of 15%) or one third of the pre-shock average, in turn affecting poverty levels as well, though this change in poverty is not significant in a statistical sense".
- Also in El Salvador, estimates "show that children in households highly exposed to the 2001 earthquakes in rural areas became differentially less likely to attend school as the probability of enrolment decreased by 5.3 percentage points".
- Peru: "Households are between 2.3 and 4.8 times more likely to be "Always Poor" than to be "Never Poor" given that they have experienced a natural event".

Baez et.al (2010) develop a basic theoretical model that allows the identification of the different transmission channels through which natural disasters may affect individual's welfare status. The authors "review and assess available empirical evidence on the ex-post microeconomic effects of natural disasters on the accumulation of human capital, focusing on consumption, nutrition, education and health, including mental health."

Their main findings are:

- "Disasters appear to bring substantial damages to human capital, including death and destruction, and produce deleterious consequences on nutrition, education, health and many income-generating processes. Furthermore, some of these detrimental effects are both large and long-lasting."

- "There is a large degree of heterogeneity in the size – but not much in the direction – of the impacts on different socioeconomic groups. Yet, an empirical regularity across natural hazards is that the poorest carry the heaviest burden of the effects of disasters across different determinants and outcomes of human capital".

- "Although the occurrence of natural hazards is mostly out of control of authorities, there still is a significant room for policy action to minimize their impacts on the accumulation of human capital".

The authors present a large number of research documents that have produced estimates of the impact of natural disasters which corroborate the theoretical predictions of their basic model. The most relevant – and also related to child welfare – are presented below.

Schooling, educational attainment and children's work

- The authors argue that "the theoretical impact of natural disasters is ambiguous due to the varying nature of the effects involved". They identify:
    - Negative effects: (1) "the destruction of education-related infrastructure – such as schools and complementary installations and resources"; and (2) "worsened economic situation of households may lead to take children out of school to reduce the burden or to put them to work".
    - Positive effects: "Change in the opportunity cost of sending children to school, given a significant decrease in market wages for instance, may generate larger incentives to send children to school".
    - They also argue that "although disaggregating these effects empirically is difficult, evidence suggests that the net effect is largely negative". The authors argue that the "damage of infrastructure may have large negative effects on children's human capital accumulation, though this is not well-documented".
    - The authors present "a considerable number of papers" showing "that disasters, economic downturns, idiosyncratic shocks and risky environments are strongly correlated with a larger workforce (including

children) and more hours devoted to steady off-farm activities at the expense of lower wages[5]

Nutrition

- The authors identify two potential channels:
  - Income effect: "lower income leading to lower food consumption"
  - "Food availability or relative price of food".
- They make an important distinction between malnutrition and hunger: "Malnutrition, unlike hunger, is a life process that can affect productivity and resources devoted to health over a lifetime (Alderman et al., 2009)" and present some examples of previous findings in the economic research literature:
  - "Droughts triggering massive hungers, particularly in sub-Saharan Africa".
  - "In rural Ethiopia, for example, children between 6 and 24 months at the onset of a drought experienced about 0.9 cm less growth over a six-month period between 1995 and 1996 in communities where half the crop area was damaged compared with those without crop damage (Yamano, Alderman and Christiaensen, 2005)".
  - "Similar impacts have been documented for Kenya, where children born during the start of a drought were 36 percent more likely to be undernourished (Cord, et al., 2008)".
  - "Foster (1995) shows that children from landless households in affected areas experienced a significant worsening of their nutritional status, which the author attributes in part to credit market imperfections".
  - "The incidence of infant malnutrition also increased more than three times among the households most exposed to intense rainfall during Hurricane Mitch in Nicaragua in late 1998 (Baez and Santos, 2007)."
  - "Rain variation, more generally, is also associated with worse nutritional outcomes. Data from Ivory Coast indicates that the prevalence of malnutrition among children increased by 3-4 percentage points in those parts of the country more exposed to both positive and negative rainfall shocks between 1986 and 1987 (Jensen, 2000)."
- The long run effects of natural disasters on children can be observed as a consequence of child malnutrition leading to persistent nutritional effects, increased morbidity and mortality
  - For instance, "tracing the 1982-84 droughts in Zimbabwe in a group of 400 rural households, Alderman and colleagues (2006) found that the temporary hunger followed by stunting of those children aged between 12 and 24 months at the time of the drought –recognized as the most critical time for child growth– led them to lower height (2.3 centimeters) in late adolescence".
  - "Another drought (1994-1995) also reduced the height of Zimbabwean children of the same age group by 15-20 percent (1.5 and 2 cm) a year after the drought relative to children from a control group (Hoddinott and Kinsey, 2001). And the gaps in growth remained unchanged four years after the drought: Children at 60-72 months in 1999 (who were initially 12-24 cm in 1995) had z-scores about 6 tenths of a standard deviation below that of comparable non-affected children (Hoddinott and Kinley, 2001)".

[5] Rosenzweig and Stark (1989) and Kochar (1995, 1999) for India; Townsend (1995) for Thailand, Jalan and Ravallion, 1999 for China; Cunningham (2001) for Mexico; Vakis, Kruger and Mason (2004) and Santos (2007) for El Salvador; Baez and Santos (2007) for Nicaragua

- "Maccini and Yang (2008) establish that more birth year rainfall leads to a higher (lower) propensity to report "very good" (poor and very poor) health status; higher lung capacity; and greater height in 23 centimetres. For instance, women with 20% higher rainfall in their year and location of birth attained 0.14 cm greater height, and fewer working days absent due to illness. According to the authors, the rainfall's positive effects on crop output –and thus on household income– lead to variations in parents' abilities to purchase nutrition, medical inputs, and generally more nurturing environments for children".

General effects on health

- Mortality
  - "Noji (1997) states that during earthquakes adults over 60 and children are at increased risk of death compared to other population groups."
  - "Infant mortality has also been shown to increase in relation to El Niño in Ecuador (Vos et.al, 1999). In 1982-3, el Niño led to a substantial increase in infant mortality in the regions affected. In particular, the infant mortality rate increased from 52 per thousand before the disaster to 65 per thousand afterwards. A reduction in the coverage of immunization in 1983 is considered to have contributed to this increase in child mortality".
- Morbidity
  - "Tracing a group of children aged between 0-5 years in rural households within Central Mexico on a biannual basis from 1998 to 2000, de la Fuente and Fuentes (2008) found strong and statistically significant evidence that children became more susceptible to (self-reported) diseases as a result of weather-related (flood, drought and hurricanes) and geological (earthquakes) shocks".
  - "Most attention in the literature, however, has focused on the relationship between natural disasters and infectious diseases. Floods and standing water are sources of malaria as well as other infectious diseases, but the risk factors of outbreaks are actually primarily related to population displacement (Watson, et. al, 2007)".
  - "Jensen (2000) in his study of rain shocks between 1986 and 1987 in Cote d'Ivoire, found that the percentage of sick children taken for consultation after a rainfall shock in 1986-87 declined by around 1/3 for those who received the negative shock but increased slightly for boys in regions with normal rainfall."
  - Likewise, "Baez et.al. (2007), using longitudinal data in Nicaragua before and after Hurricane Mitch, found that -conditional on being sick - children in affected areas were 30% less likely to be taken for medical consultation, even though there was no significant difference on the prevalence of illness between affected and non-affected children".

In summary, whilst most case studies strongly support the notion that children are one of the most vulnerable sectors of the population to disasters there is empirical economic literature (mostly on Latin American countries) showing contradictory results regarding the impact of disasters on welfare. These empirical studies are supplemented by the theoretical paper of Lopez-Calva et al (2009) that explain potential reasons why disasters may generate contrary forces that affect welfare indicators in opposite ways. This study presents insightful ideas that are worth exploring empirically.

3. Understanding the data

3.1 Data sources

This study has been done using the following data sources and guidelines:

- ***Disaster Data:*** The UNISDR database 'DesInventar' is the primary source of disaster data. DesInventar data provides systematic information about the occurrence of disasters of small and medium impact and disaggregated data about the effects of large scale disasters. All data in DesInventar is attached to the equivalent of municipality/district or province/state, and has been pre-classified as Extensive or Intensive, and grouped in two sets, hydro-meteorological and geological events. These databases can be accessed at http://www.gar-isdr.desinventar.net.
- ***Child welfare and development data:*** This data was collected at the lowest available geopolitical region within the country by the UNICEF country office predominantly from Government sources. Data at the sub-national level is not uniformly available and therefore specific indicators vary between countries. The data falls under 3 broad headings: child health, education and poverty. The study does not cover an exhaustive list of variables but reflects that data which was most accessible in a timely manner and is therefore limited in coverage of the wide range of potential impacts of disasters on child welfare
- ***Countries:*** In line with the geographic scope of the Global Assessment of Risk 2011 report (GAR11), and a preliminary assessment of data available from UNICEF country offices, the study focuses on 7 countries: Bolivia, Indonesia, Mexico, Mozambique, Nepal, the Philippines, and Vietnam.
- ***Time span:*** Due to the difficulty for obtaining robust child welfare and development data, the study covers a limited time-span (1999-2009).

3.2 Data limitations

Despite the value and relevance of this study, the availability and appropriateness of data used limits the degree to which a robust understanding of childhood vulnerability and causal linkages to disaster impacts can be established. The study provides useful insights into the relationships between disaster impact and child welfare that identify a range of areas for further research (see section 6).

Scale of information: The literature review demonstrates that most of the studies obtaining estimates of the impact of natural disasters on welfare outcomes are based on micro-level information. Although the data used for this study is provided at the lowest available geopolitical region (district or region) this scale of data is only useful to provide a first picture about a particular area. Only limited statistical tests and modelling techniques can be carried out using area data. In this sense, the results presented in this document should be the basis on which to develop specific data sets to build deeper understanding.

Disaggregation: The child welfare data is poorly disaggregated. Analysis should include various disaggregated values that reflect child gender, ethnicity/caste, family wealth level as well as specific information on physical exposure to and intensity of

shocks. The education data contributes insights on questions around age through the simplistic division of primary and secondary datasets. Although this in itself is not a clear division of age as in places where attendance may be intermittent a 14 year old is as likely to be in primary education as they are to be in secondary. However even the education data misses the gender perspective. One exception is Nepal, where data was available for boys and girls and showed that patterns of enrolment for girls were lower than for boys. The data presenting the rural and urban divide is limited to data on water and sanitation in Mexico.

Understanding the degree of difference in disaster impacts on children at different stages of development, between genders, and through different types of exposure is further limited by the disaster data. Desinventar data does not provide specific information regarding children. For instance, no indicator is disaggregated by gender and mortality rates are not disaggregated by age. Information regarding variables that directly affect children (such as the number of schools affected by a disaster) is very limited. Both Mozambique and Vietnam failed to record any impact on schools and hospitals for intensive or extensive risk throughout the 10 years under study. Indonesia has a more comprehensive set of data for schools and hospitals for both extensive and intensive events (See time distribution tables in Annex 2). For other countries where some records for effected schools and hospitals exist, extensive risk appears to demonstrate a greater impact than intensive risk. What is unknown is whether this kind of reporting reflects the greater ability to report more widely on low level impact disasters compared to high impact disasters where infrastructure and economic costs are the focus or whether it is a reflection of country level capacity to gather and record data.

Coherence: There are large differences in the welfare variables (differences in the definition of indicators and the availability of information in each country data set). Moreover, not all the information was available for the same period, which in some cases made it impossible to use for the analysis, given the short time span.

Lopez-Calva, *et al*, (2009) point out two main limitations of the Desinventar data base. First, “more isolated districts do not count with any report on natural hazards in the past 36 years”. Although we were not able to corroborate this information, it should be taken into account when analyzing the results obtained through utilising this data. Second, “districts of higher rank or importance in terms of geo-political classification systematically present a higher number of reported events than the rest, even when compared to their neighbour districts." If this is the case for any of the countries included in this study, our analysis is limited to these restrictions of the dataset.

Lack of control variables: The link between natural disasters and child welfare outcomes is complex and causality is difficult to disentangle. Vulnerability of households, and children, to natural shocks is determined by several factors, however this study is limited to working with child welfare data and disaster data to identify simple patterns and trends – it does not factor in data on the mediating conditions that can affect disaster impact. These include the presence of household and community scale coping mechanisms such as self-help groups, extended family and formal social protection measures amongst others; the local economic conditions as well as the macro-economic conditions manifested through national investment and expenditure on education / health / sanitation; the existence of external funds within the provinces for health and education programmes and the presence of INGOs/CSOs operating in particular areas providing services, funds, DRR investments and emergency response.

In spite of the limitations of the dataset, this study applies a similar and comparable methodology to empirically analyze trends of the impact of both extensive and intensive disasters on children's welfare and development in a wide variety of countries.

4. Overview of the methodology

This study uses regression analysis to identify recent trends in disaster impact on children's welfare and development variables. Regression analysis tests the impact of a given shock (the disaster) on a small number of indicators of child wellbeing or development.

In order to accomplish the main objective of the study, i.e. to identify patterns and try to understand the impact (and causality if possible) of disasters on child welfare, a technique that allows the measurement of the effect of the disaster on the welfare variables of the study is used which goes beyond basic correlation from which no statistically significant results can be effectively drawn out. This work does a difference in difference analysis, which measures the change induced by a particular treatment or event (the disaster).

The technique that we used has a number of advantages compared to limiting the analysis to the results of a correlations analysis:

Advantages:

- **Difference-in-difference estimation provides insights towards the impact of a disaster on children's welfare**. Correlations do not allow us to establish this.
- **Data from *all* the areas within a country, where it is available, is used**. The analysis is not limited to observe those areas in which disaster information is observed.
- **Objective criteria to define control and treatment areas.** Two different criteria, one for extensive risk and other for intensive risk are used. For extensive risk treatment and control areas are identified based on an objective threshold: the median (see Box 2). In the case of intensive risk, for each district or province where an intensive risk disaster was recorded between 1999 and 2009, the period is divided in two: one before the disaster (control) and one after the disaster (treatment), (see Box 3)

Limitations:

As noted in the previous discussion some limitations of the methodology used in this report – for example the lack of control variables - could be solved by obtaining additional data, or by running additional models. This exceeded the scope of this rapid and initial desk-assessment, but should be taken forward in future research (see Section 7)**.** In addition to this it is important to recognise that**:**

- **Results do not control for migration**: results could be biased given that there is no information on migration between treatment and control areas included in the data sets. In this sense, the effect of a disaster could be over / underestimated.
- **Disaster events may have effects that go beyond the period of analysis**: it is possible that the evolution of the welfare variables observed in the period 1999-2009 respond to a disaster occurring before this period, and not necessarily to a disaster occurring toward the end of this period. In this sense, we are not able to control for potential lags – or forward lags.
- **The results do not provide insights into spatial or temporal difference in outcomes over the 10 year period**

4.1The models and identification strategy

The following equation is estimated:

$$y_{it} = \alpha_i + \beta_1 d_i + \beta_2 p_t + \beta_3 d_i p_t + \mu_{it}$$

Where:

- y_{it} is the outcome analyzed (i.e. enrolment rate, child undernourishment) in province/district i and period t; t is the period of available data for each variable
- α_i represents the particular characteristics of each region[6];
- d_i is a dummy variable that takes the value of 1 if province/region or municipality/district is considered a *treatment* area, or 0 if it is a *control* area;
- p_t is a dummy variable that takes the value of 1 if the observation corresponds to a *post* disaster period, or 0 if the observation corresponds to a *pre* disaster period;
- $d_i p_t$ is the multiplication of the previous two dummy variables, and the coefficient of this term will indicate the "impact" of the disaster event observed in period t on the outcome variable (our main interest); and
- μ_{it} is the error of the equation.

The method is interested in estimating the value of β_3 that measures the impact of disasters on children's welfare.

Scale of analysis: It is important to recall that in the estimations the smallest possible aggregation level has been used for each country (see Table 1), as it provides more variability and thus it is more likely to obtain significant results. The way the data is organized within each country is not uniform as some variables may be aggregated to province/region level and others to district/municipality level. Thus the scale of analysis is equal to the lowest available scale where data for the child welfare outcome exists.

Table 1: Geo-political study level per country

Country	Disaggregation level
Bolivia	Region / District
Indonesia	Region
Mexico	State and Urban / Rural
Mozambique	Province / District
Nepal	Region / Province
Philippines	Region / Province
Vietnam	Region / District

[6] For a detailed discussion on the application of both fixed (FE) and random effects (RE) procedures refer to Annex 1.

The identification strategy: In the case of extensive disasters we choose treatment and control provinces based on historical criteria (disasters data from the period 1988-1998). For the case of intensive disasters treatment and control areas are defined based on the occurrence of disaster events in the period 1999 - 2009. Boxes 2 and 3 elaborate the process of identification for extensive and intensive risk.

Box 2. Identification strategy – extensive risk

Treatment vs. control regions

In the case of extensive-disaster events, **our strategy relies on historical data** held in the Desinventar database**.** Based on the frequency of extensive-disaster events during the period 1988-1998, each region is assigned to the treatment group if its frequency is higher than the median of the distribution or to the control group if the frequency is lower than the median. The threshold, in each country, allows the differentiation of those regions that are more at risk of suffering an extensive disaster (treatment) from others that are less prone to experience these disasters (control).

In an attempt to assess the robustness of the results, additional treatment groups (and control groups, therefore) are considered based on alternative thresholds defined around the value of the median (See Table 2 below).[7]

For instance, for Nepal, the median of the distribution of natural disasters in the period 1988-1998 per area is 39. Therefore, treatment groups – those largely exposed to extensive disasters - are defined as those areas that experience 39 or more extensive disasters during this period (and control groups, less than 39 events). Alternative models are run with treatment groups being defined using 29 and 49 disaster events as thresholds.

Table 2. Treatment groups per country

	Median	Alternative treatment groups	
	d_i^M	d_i^1	d_i^2
Bolivia	>1	>2	
Indonesia	>7	>6	>9
Mexico	>100	>110	>90
Mozambique (province)	>71	>70	>72
Mozambique (district)	>3	>2	>4
Nepal	>39	>29	>49
Philippines	>12	>11	>13
Vietnam	>6	>5	>7

[7] This was the case for models run for extensive disasters.

Box 3. Identification strategy – intensive risk

In the case of intensive-disaster events **the strategy relies on the occurrence of an intensive event during the period being analyzed (1999-2009)**. To elaborate a historical profile of the occurrence of intensive events a larger span of data and complex analysis would be needed; for example to determine that a particular area is prone to earthquakes or other geological events a detailed geological analysis would be needed and may require techniques that go beyond the scope of this study.

Treatment vs. control data
To identify the effect of a disaster event on children's outcomes, the period 1999 – 2009 is split into two sub-periods: a pre-event period, and a post-event period. For each district (or province) where there was an intensive risk disaster between 1999 and 2009, a pre-event period is defined as the years before the disaster occurred (control) and the post-period as the years after the disaster occurred (treatment). All treatment and control data for each affected district or province is used in the analysis. To define this structural change, we rely on 4 variables available on Desinventar:

- Frequency of disaster events for a region during the year (i.e. no of data cards over time),
- Number of deaths and missing people as a consequence of a disaster event in a region during the year,
- Number of damaged and destroyed houses as a consequence of a disaster event in a region during the year, and
- Number of schools and hospitals destroyed as a consequence of a disaster event in a region during the year

We first observe the *number* of data cards *(event reports)* to see if there is a change in the trend at some point during the observed period (See tables in Annex 2). If this measure does not show a clear break, we look at the trends of the variables as listed above. In some cases, the number of death and missing people is more useful to establish a pre/post period than the number of schools and hospitals destroyed after a disaster event, or vice versa. One possibility that could be explored in future work is the construction of an index based on the first 3 measures, which according to UNISDR are the most representative, that indicates the gravity/intensity[8] of the disasters each year.

The methodology presents an initial and novel approach to analyse recent trends over the past decade in disaster impact on child outcomes in response to two different types of risk. However, further extensions to this model are recommended in the future in order to get more robust results (see conclusions in section 7).

[8] It should be noted that the coefficient we are estimating when it comes to "extensive events" recovers the effect of a change in this trend, which - we expect - represents a change in the intensity of the extensive disasters during the observed period. This is not the same in the case of "intensive" disasters, as these are less frequent and, therefore, the ante/post periods are defined by the occurrence and not by their intensity.

5. Children and Disasters – Country level trends 1999-2009

This section presents in brief the regressions analysis results that were *statistically significant* in identifying disaster impact on child welfare variables over the 10 year period for the 7 case studies. A result is statistically significant when there is a high probability that the observed relationship did not occur by pure chance (see Box 4). In simpler words, the statistical significance tells us something about whether the results are "true" (significant) in the sense of being representative. In our case, this means that the analysis shows an impact of the disaster on the welfare variable and suggests some degree of causality.

Box 4. Statistical significance

A result is statistically significant when there is a high probability that the observed relationship did not occur by pure chance. In simpler words, **the statistical significance tells us something about whether the results are "true"** (significant) in the sense of being representative. In our case, **this means that the analysis shows an impact of the disaster on the welfare variable**.

Annexes 3 and 4 include a summary of the results, with the associated level of significance. This level of significance is given by a "p-value" (a "probability-value"), which represents the reliability of the result. The p-value is a number between 0 and 1. The higher the p-value (i.e. 0.99), the less we believe that the observed relation between the variables is a reliable indicator (and would therefore indicate no relationship). Relations that are significant (i.e. low p-values, such as 0.01) are identified in the tables with one, two or three asterisks: *, **, *** (where * is of low significance and *** is more significant). If there is no asterisk the relation is not significant and no confident evidence of a relationship was found. For this reason, the analysis below only takes into account statistically significant relationships.

For extensive risk some of the results may be sensitive to the different models that were run, i.e. a relation may be significant for one model and not for another one. The models reflect the use of different thresholds to define treatment and control areas and for use of fixed and random effects (see Box 2 and Table 13 in Annex 1). All results where at least one of the models was statistically significant are presented[9]. For intensive risk disaster we run one model and use both fixed and random effects estimations.

In the following section 7 country disaster profiles are presented together with the statistically significant patterns that were obtained with regression analysis; further detail on the country profiles and detailed discussion on limitations and implications is provided in country specific reports that complement this global study. Tables of significant results found for the impact of extensive and/or intensive disasters are presented in the country level summaries below and indicate positive or negative relationships, exact figures are not provided due to the multiple limitations of the data which may bias the results[10]. The results are then presented 'thematically' before a global discussion of the results is developed.

[9] Results are more robust when they are statistically significant for all models. However, given the goal of this study to identify trends, we include results which are statistically significant for one or more models.

[10] Annexes 3 and 4 present detailed results

5.1 Bolivia

Bolivia is the highest country in South America, the 5th largest in the region and completely landlocked. Bolivia is split in three topographical regions: the Andes and arid highlands of the west, the semi-tropical valleys in the middle third of the country, and the tropical lowlands of the east. According to the World Development Indicators (2009), the population of Bolivia is of 9,862,860 with the most populated cities being La Paz, Cochabamba and Santa Cruz de la Sierra. According to UNICEF, children and adolescents constitute almost half of the total population in Bolivia[11].

According to the Desinventar data,[12] the main events historically reported for Bolivia are floods, landslides and droughts. Effects of landslides and floods occur mainly between November and March, during the rainy season. Droughts occur mostly between September and December, but also during the rainy season. In addition, there are fires that occur mostly during dry seasons (May to September).

During this period, floods and earthquakes are the cause of most houses destroyed and damaged (36% and 47% respectively), with landslides generating 17% and 20% of the deaths and missing people.[13] Other main causes of deaths and missing people are floods (18%), flash floods (14%) and earthquakes (12%).

Whilst floods, landslide and drought are the most frequently occurring disasters Figure 1 indicates that epidemics have had the greatest human cost. There does not seem to be a clear historical pattern in the number of disasters occurring during the past century although there are clear peaks in 1979 and 2004-2006 (see Figure 2)[14].

[11] http://www.unicef.org/bolivia/children_1540.htm

12 This information has been taken from http://gar-isdr.desinventar.net/

[13] Missing refers in Desinventar to people who disappeared due to a disaster but whose body was not found. Deaths are people whose body was found. According to UNISDR, it is more accurate to use the sum of deaths and missing people as an indicator of the impact of a disaster on casualties. Through the document we refer to "deaths and missing" in this sense.

[14] Source: http://gar-isdr.desinventar.net/DesInventar/profiletab.jsp?countrycode=bo3

Figure 1: Disaster causes of deaths and missing in Bolivia 1974-2009

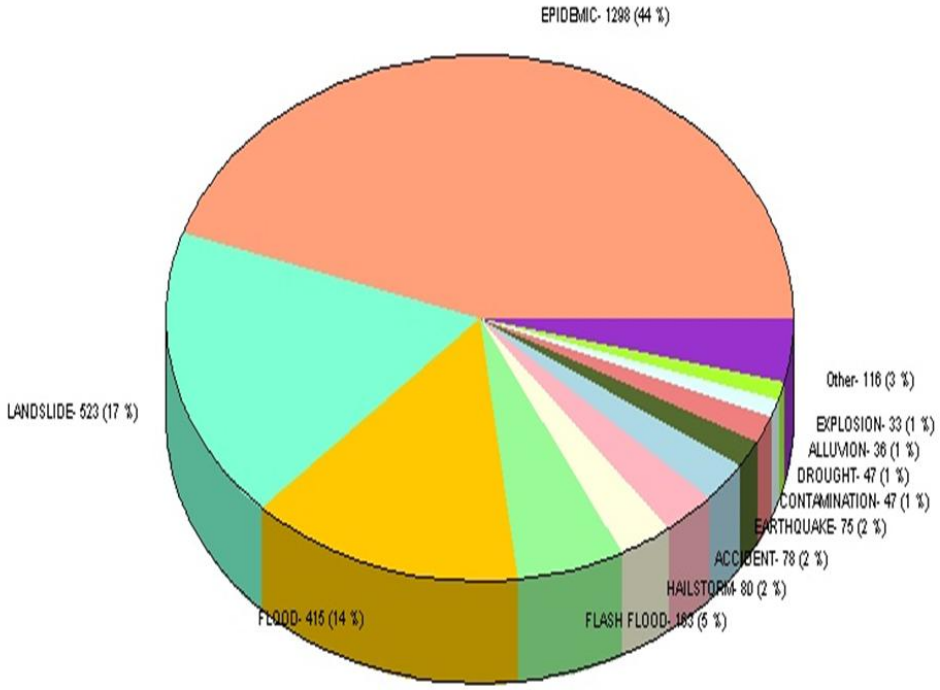
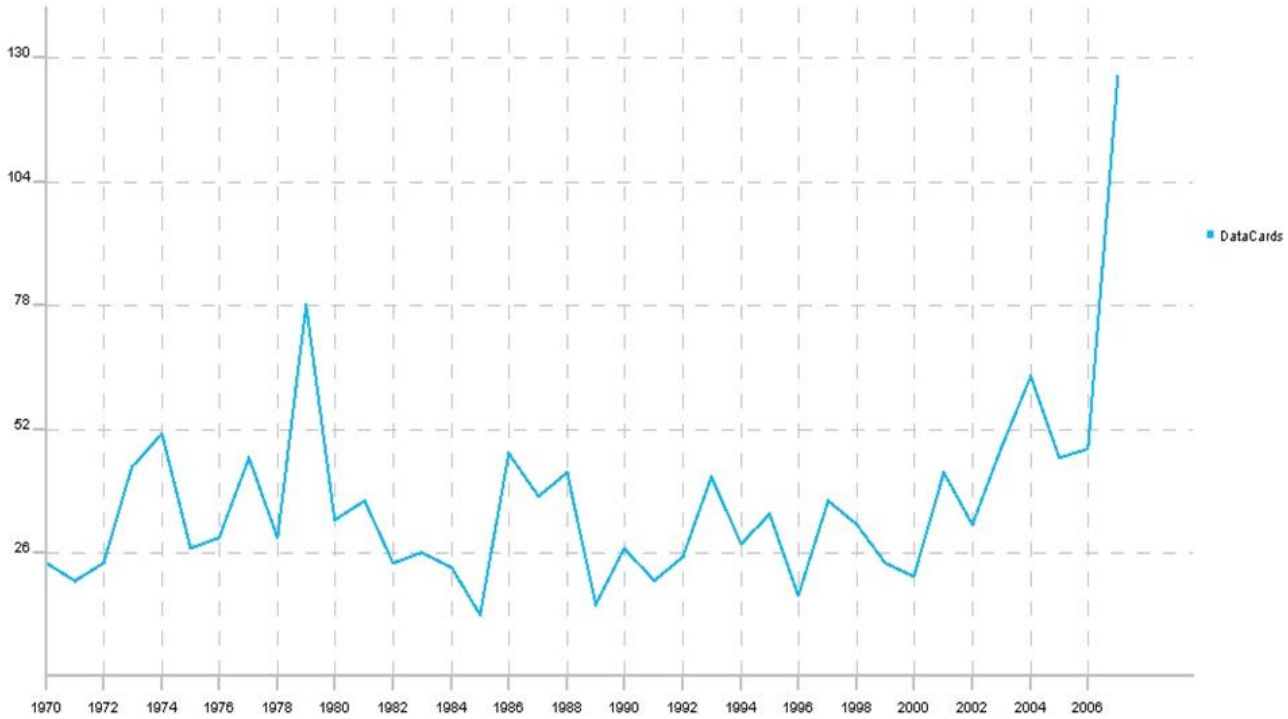
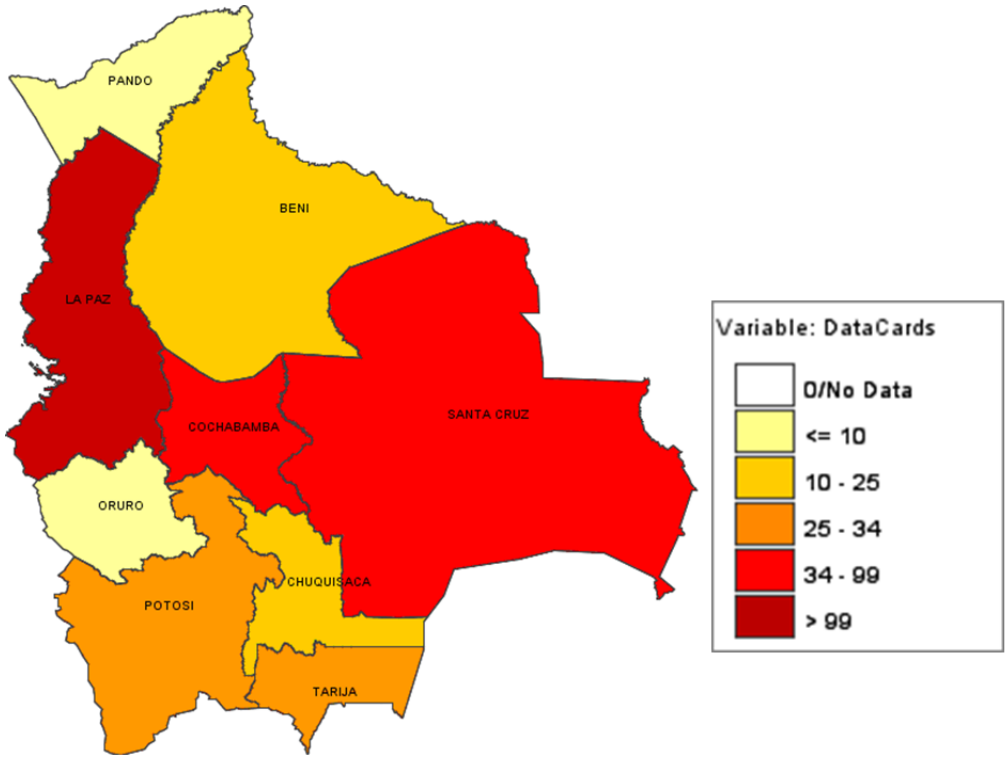


Figure 2: Data cards for natural disasters in Bolivia 1974-2009



Extensive Risk Disasters: According to Desinventar (see Map 1), the departments of Bolivia that present a higher number of extensive risk disaster events registered are La Paz (with more than 99 registered events and more than 58 deaths and missing people reported), followed by Santa Cruz and Cochabamba (with between 34 and 99 events) – the three most populated departments. Oruro and Pando present lower registrations of events (less than 10 events registered)

Map 1: Number of extensive disasters recorded per department 1999-2009



Intensive Risk Disasters: According to Desinventar, there were only three intensive risk disasters registered between 1999 and 2009 in Bolivia. The hailstorm of February 2002 caused the flood of Choqueyapu River (that runs through La Paz), when 69 people died. The other two disasters were floods in Cochabamba, one in December 2003 and the other in January 2005. The flood of 2003 (in Villa Tanuri – Chapare, a rural province in the northern region of Cochabamba Department) caused the collapse of a bridge that resulted in 45 deaths. The flood of 2005 occurred in Mizque, a town in the Cochabamba Department, destroyed 500 houses.

La Paz Department, with a population of 2,350,466 people (2001 census) is located at the western border of the country. Its topography is very varied, as it includes both the high mountains of the Cordillera Real (with altitudes of more than 6,000 meters) and the Yungas, a transitional zone between the Andean highlands and the eastern forests of the Amazon basin. La Paz is mostly affected by floods (38% of registered events for that period) and landslides (16%). Landslides caused 190 deaths in the province of La Paz between 1999 and 2009. The hailstorm of February 2002 in the city of La Paz caused 69 deaths.

Santa Cruz is the largest department of Bolivia and according to the 2001 census it has a population of 2,029,471. It is one of the wealthiest states in Bolivia with huge reserves of natural gas. Cochabamba produces a great variety of agricultural products. It has population of approximately 1,750,000. Santa Cruz and Cochabamba are mostly affected by floods and epidemics. However, the event that caused most deaths (a total of 47) in the province of Santa Cruz was the drought of March 2004 in Camiri y Gutiérrez (Cordillera). For the case of Cochabamba, the event that caused the highest number of deaths (a total of 52) was the flood of December 2003 in Villa Tunari (Chapare).

The regression: Socio-economic data for Bolivia was given at the **district level** and regression analysis was done using this level of disaggregation. Child welfare variables fell into the broad categories of **education and health**; full results significant and non-significant for each variable are in Annex 3 and 4. The equation is estimated, where y_{it} represents the socio-economic indicator, and β_3 the "impact" of the disaster on this indicator.

Significant results for extensive risk:

Education

- As expected, extensive risk disasters reduce net enrolment rates in preschool, increase preschool dropout rates and increase gender gap in primary achievement rates.
- Unexpectedly, we find evidence that extensive risk disasters increase primary net enrolment rates.

Health

- As expected, extensive disasters increase the incidence of diarrhoea per 1000 of the under 5 years old population.

Significant results for intensive risk:

No statistically significant results are identified for intensive disasters**.** This is probably due to the short period of analysis: within the time span of the study 1999-2009 only three years of recorded intensive events exist, which impedes drawing any conclusions according to statistical analysis.

Table 3: Summary of significant results for Bolivia

Risk Type	Variable	Expected Results	Unexpected Results
Intensive	**Education**	3 years recorded intensive events during the time period of the study, *no statistically significant results*	
	Health		
Extensive	**Education**	Reduced net enrolment (preschool) Incr. Dropout rates (preschool) Incr. Gender gap in achievement rates (primary)	Incr. net enrolment (primary)
	Health	Incr. incidence of diarrhoea per 1000 in under 5's	

5.2 Indonesia

Indonesia is the largest archipelagic nation in the world with more than 17,000 islands of which about 1,000 are permanently settled. The five main islands are Java, Kalimantan, Papua, Sumatra, and Sulawesi. According to the World Development Indicators (2008), the population of Indonesia is of 227,345,082 and it is the world's fourth most populous country. The larger islands of Indonesia are mountainous. There are some 400 volcanoes, of which 100 are active.

According to UNICEF, Indonesia has significantly reduced mortality rates of children under five years of age during the past thirty years. In 1960 the rate was 210 deaths per 1,000 live births and by 1991 this figure decreased to 97 per 1,000 births. Mortality rates for infants also fell from 128 per 1,000 births in 1960 to 35 per 1,000 in 2002. Despite this progress, child mortality remains a serious problem in Indonesia[15].

Schooling is compulsory in Indonesia at the primary and, since 1993, junior high levels. This has improved school enrolment figures in recent years. Currently, an estimated 90% of children reach fifth grade and around 50% complete nine years of schooling[16]. Despite this progress, around 2 million of Indonesian children do not attend school, of which 15% are children aged 7 to 15 years[17]. An estimated 1 million children drop out of school each year.

Indonesia is regularly affected by disasters. According to UNISDR 2009, Indonesia has the higher number of people living in areas potentially affected by tsunamis in the world (more than 5,000,000), ranks second in the world (only after India) in number of people exposed to landslides triggered by precipitation or earthquake per year (with more than 200,000) and third in number of people exposed to earthquakes and exposed to drought. The country is also at very high risk of floods. It ranks sixth in the world in number of people exposed to floods per year and it is among the 20 countries with a higher GDP exposed to floods and exposed to earthquakes per year.[18] During the last century, according to Desinventar, earthquakes caused 43% of deaths and missing people and landslides 21% and tsunamis 17% (Figure 3). Earthquakes generated 68% of houses destroyed and damaged, floods 18% and landslides and tsunamis 6%.

Figure 3 shows the total number of deaths and missing in response to disasters since the Desinventar records began. Figure 4 provides a time line to show the number of data cards submitted each year. Figure 4 raises issues around the reliability of the disaster record over the full period of time, with few or no disasters recorded in the early days, and it should be viewed in light of the increasing maturity of the process of recording and measuring disasters in recent times.

[15] http://www.unicef.org/indonesia/children.html
[16] http://www.unicef.org/indonesia/children_2833.html
[17] http://www.unicef.org/indonesia/children_2834.html
[18] UNISDR 2009, Chapter 2.

Figure 3: Number of deaths and missing due to disasters (1974-2009)[19]

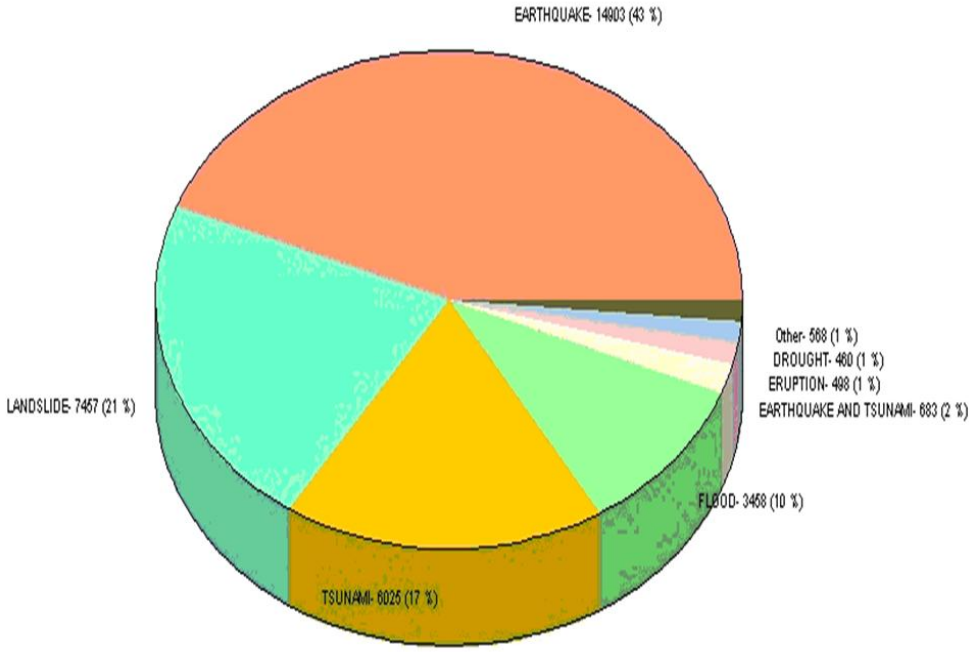
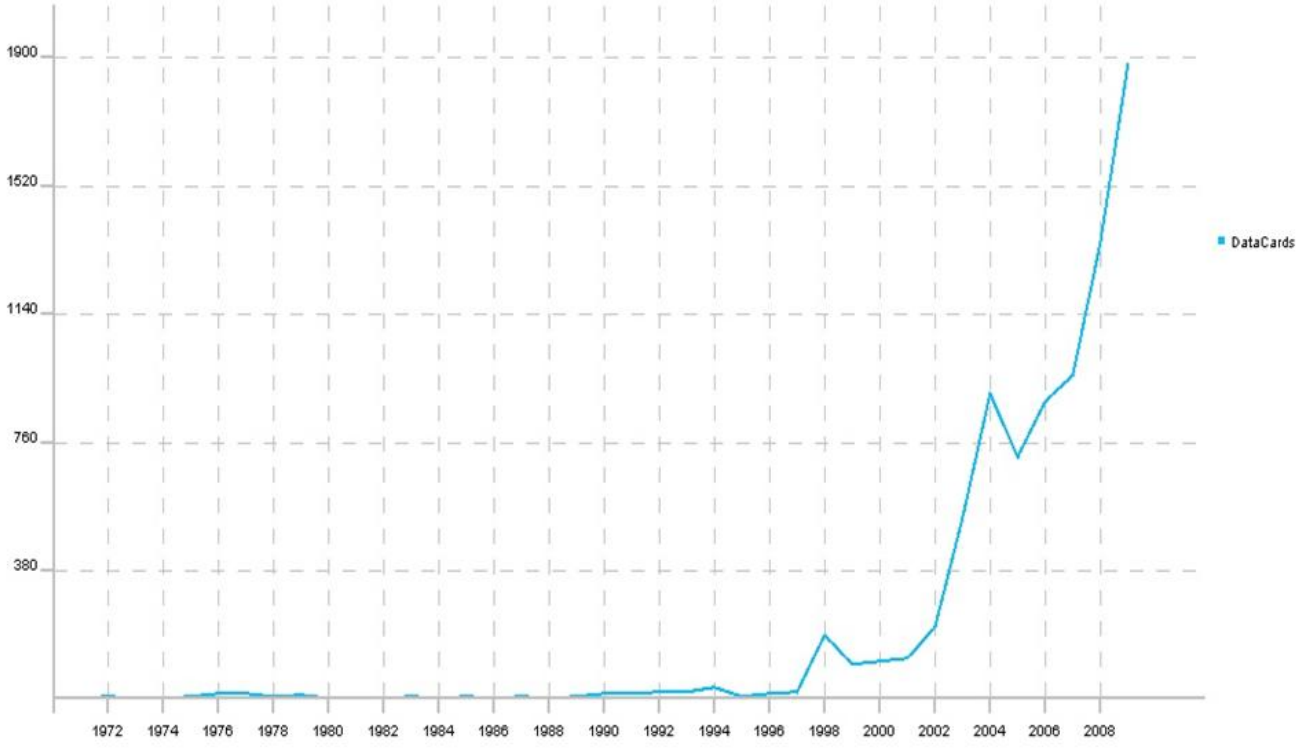


Figure 4: Indonesia: Number of data cards 1972 - 2008



[19] Source: http://gar-isdr.desinventar.net/DesInventar/main.jsp?countrycode=id3

Extensive Risk Disasters[20]**:** Jawa Tengah and Jawa Barat concentrate most extensive disasters registered in Desinventar between 1999 and 2009. Jawa Tengah (Central Java) is one of six provinces on the island of Java and concentrates 16% of the total extensive disasters registered on the Desinventar database between 1999 and 2009. The population is 32,864,000 (as of 2009), making it the third most-populous province in Indonesia. Jawa Tengah's geography presents both lowlands near the northern and southern coast and mountains in the centre. There are several active volcanoes - Mount Slamet, the Dieng Volcanic Complex, Mount Merapi volcano (the most active volcano in Indonesia) and Mount Merbabu volcano, among others – and two major rivers run through Jawa Tengah - the Serayu in the west and the Solo River which flows to the East Java province.

Jawa Barat (West Java) is the most populous province of Indonesia, with a population of around 43 million and concentrates 9% of the total extensive disasters registered on the Desinventar database between 1999 and 2009. West Java borders Jakarta and Banten province to the west and Central Java to the east. To the north is the Java Sea and to the south is the Indian Ocean. The province has a combination of volcanic mountains, steep terrains, forest, mountains, rivers, fertile agricultural land, and natural sea harbours.

Most deaths and missing people for this period however are registered in Nusa Tenggara Timur (15%), a province located in the eastern portion of the Lesser Sunda Islands, where poverty indicators are below Indonesian averages, secondary school enrolment rates are below the average, and child malnutrition and child mortality are higher than in most of the country.

Intensive Risk Disasters[21]***:*** Intensive events occurred yearly in Indonesia. The Special Region of Yogyakarta, located near the south coast of the island of Java, is the smallest province of Indonesia, with a population of approximately 3 million people. This region was most affected in term of deaths and missing between 1999 and 2009 with almost 5000 cases (45%). These deaths were caused by the earthquake of 2006, which had a magnitude of 5.9 on the Richter scale. The same earthquake of 2006 also affected Jawa Tengah, which presents 12% of the deaths and missing for this event, and Sumatera Utara (North Sumatra) with 11%. Sumatera Barata has 12% of the deaths and missing registered (most of them due to the earthquake of September 2009).

The regression: Socio-economic data for Indonesia was given at the **provincial level** and regression analysis was done using this level of disaggregation. Child welfare variables fell into the broad categories of **education, health and poverty**; full results significant and non-significant for each variable are in Annex 3 and 4. The equation is estimated, where y_{it} represents the socio-economic indicator, and β_3 the "impact" of the disaster on this indicator.

[20] At the time that this report was written, there was no map available on the Desinventar website for Indonesia.

[21] It is recognised that text on the impact of the Tsunami is not reflected here, data was disaggregated between provinces and districts and is reflected in the tables for intensive events in Annex 2

Significant results for extensive risk:

- Unexpectedly, extensive risk disasters increase net enrolment rates (NER) for primary school and secondary school.

- As expected, extensive disasters increase the percentage of people living under the poverty line (models 5 and 6).

Significant results for intensive risk:

Education

- As expected, intensive risk disasters reduce secondary net and gross enrolment rates.

Health

- Intensive risk disasters increase infant mortality rates and reduce the share of households with access to sanitation.

Poverty

- As expected intensive risk disasters significantly increase the number of people living under the poverty line.

Table 4: Summary of significant results for Indonesia

Risk Type	Variable	Expected Results	Unexpected Results
Intensive 10/10 years recorded events	**Education**	Reduce net and gross enrolment (secondary)	Incr. preschool participation
	Health	Incr. Infant mortality Reduced share of houses with access to sanitation	
	Poverty	Incr. number of people living under poverty line	
Extensive	**Education**		Incr. net enrolment (primary and secondary) Incr. gross enrolment (secondary)
	Health	*No statistically significant results*	
	Poverty	Incr. % of people living under the poverty line	

5.3 Mexico

Mexico is the eleventh most populous country in the world with 106,350,434 people (WDI, 2008). The country is crossed from north to south by two mountain ranges: Sierra Madre Oriental and Sierra Madre Occidental. At the centre and from east to west, the country is crossed by the Trans-Mexican Volcanic Belt (or Sierra Nevada). Most lowlands are located along the coasts and in the Yucatan Peninsula.

According to UNICEF,[22] Mexico's population between 0 and 5 years old is approximately 11.6 million (2009), of which 5.9 million are boys and 5.7 million are girls. 61.2% of these children live in 'asset poverty' and 27.4% in 'food poverty'. Although the situation for

[22] http://www.unicef.org/mexico/spanish/ninos.html

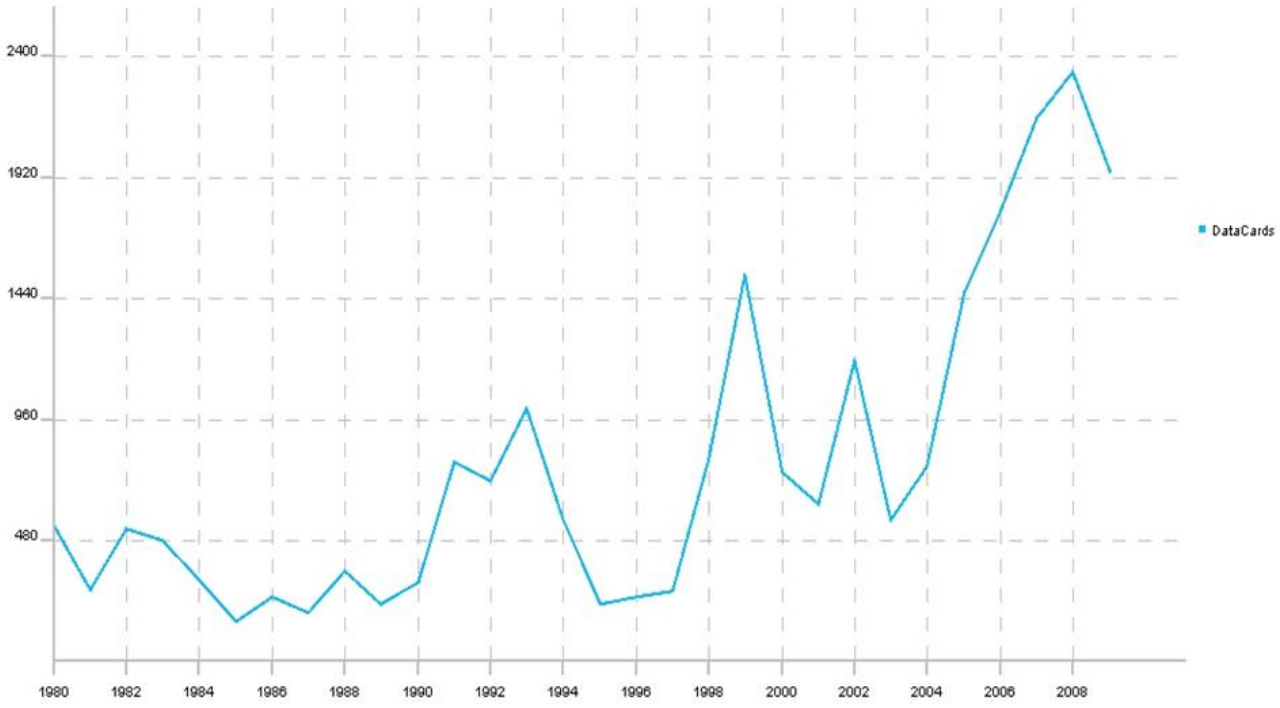
children has improved over the past decade, there is still a lot to do. In 1960, of a thousand children born alive, 134 died before the age of 5. This mortality rate fell to 17.9 per thousand in 2008. Pre-school education has improved since it became compulsory in 2005 for children as young as 4 and 5 years old. Preschool enrolment rates for 5 year old children went up to 93.9% in 2008-2009.

In 2009 there were 13 million children between 6 and 11 years old (6.6 million boys and 6.4 million girls). School enrolment rates were 97.9% for boys of this age range and 98.6% for girls. There were 12.8 million adolescents in 2009, 6.3 women and 6.5 men. 55.2% of Mexican adolescents are poor. Almost 3 million adolescents did not go to school in 2008.

According to UNISDR 2009, Mexico ranks fourth in GDP losses and eighth in number of people exposed to landslides triggered by precipitation or earthquake. It ranks eleventh in number of people and eight in GDP exposed to earthquakes. It is also highly exposed to storms and tropical cyclones, ranking seventh in number of people exposed per year to storm surge for all categories of tropical cyclone and eleventh in GDP exposed to tropical cyclones.

As can be seen in Figure 5, the number of registered disasters has been constantly increasing in Mexico over the past century, most of them being floods and droughts. However, according to Desinventar, between 1974 and 2009, earthquakes caused 25% of the deaths and missing people and floods 11%. Floods, rains and earthquakes generated 44%, 36% and 8% of the houses destroyed and damaged.

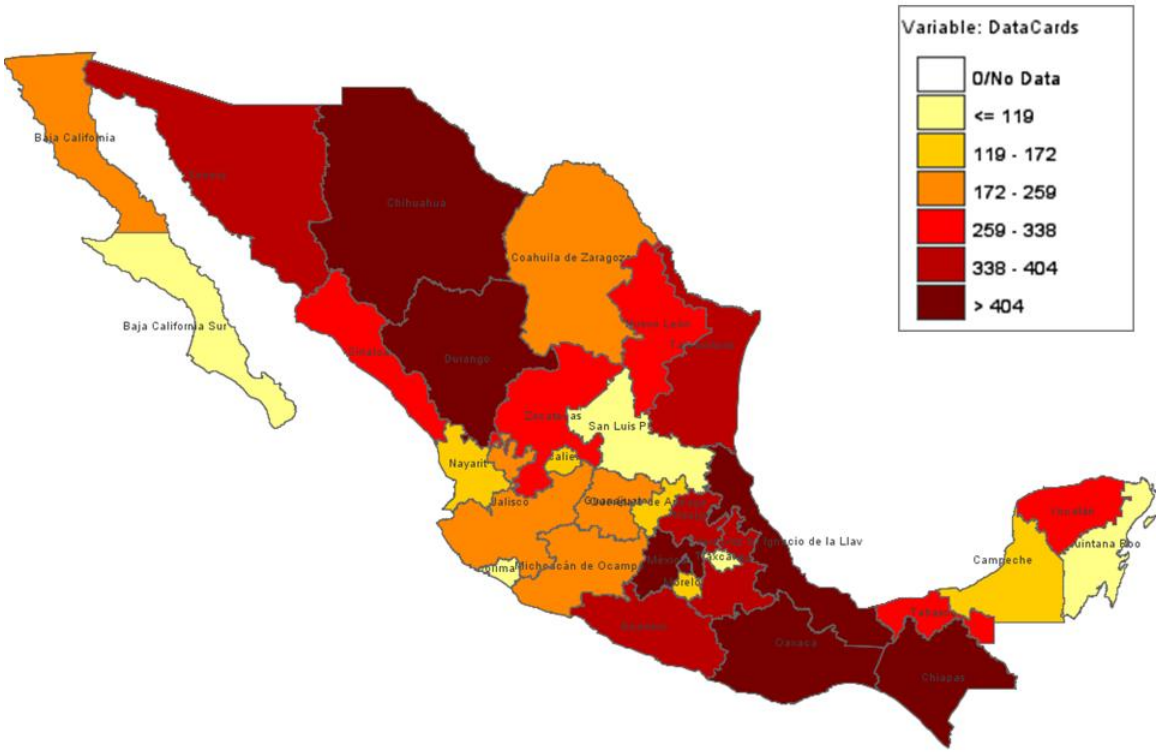
Figure 5: Number of data cards recorded for Mexico 1974 – 2008



Extensive Disasters: Mexico is severely affected by extensive disasters. As can be seen on Map 3, most provinces have registered more than 120 records over the past 10

years. Chihuahua, Veracruz and Puebla have more than 400 deaths and missing people registered for this period. Chihuahua is a state located in Norwest Mexico and has a population of more than 3,000,000 people. Mountains account for one third of the state's surface area. Veracruz is a strip of land wedged between the Sierra Madre Oriental to the west and the Gulf of Mexico con the East. It has more than 7,000,000 people. Puebla, one of the poorest states of the country, stands in the centre east of the country between the Sierra Nevada and the Sierra Madre Oriental. Its population is higher than 5,000,000.

Map 2: Extensive disasters recorded per province 1999-2009



Intensive Disasters: Intensive disasters are recorded for 7 out of the 10 years under study. Veracruz and Tabasco (a state locate in the south east of Mexico with close to 2,000,000 inhabitants) were affected by more than 5 intensive disasters between 1999 and 2009. Veracruz has more than 2000 (54%) deaths and missing people registered and Chihuahua more than 882 deaths and missing people (23%). Intensive floods generated 67% of houses destroyed and damaged for the same period.

The regression: Socio-economic data for Mexico was given at the **provincial** level and regression analysis was done using this level of disaggregation. Child welfare variables fell broadly into the categories of **education, health and poverty**; full results significant and non-significant for each variable are in Annex 3 and 4. The equation is estimated, where y_{it} represents the socio-economic indicator, and β_3 the "impact" of the disaster on this indicator.

Significant results for extensive risk:

Significant only for health variables

- As expected, extensive risk disasters reduce the share of children population accessing water and sanitation (both urban)
- Unexpectedly, increase the share of children population accessing sanitation (rural)

Significant results for intensive risk:

Education

- Unexpectedly, intensive risk disasters increase primary net attendance rates and reduce primary dropout rates.

Health

- Unexpectedly, intensive risk disasters reduce child mortality rates and increase share of children accessing water (urban)
- As expected, intensive risk disasters reduce the share of children accessing sanitation (rural).

Table 5: Summary of significant results in Mexico

Risk Type	Variable	Expected Results	Unexpected Results
Intensive 7/10 years recorded events	**Education**		Incr. net attendance (primary) Reduce dropout rates (primary)
	Health	Decr. Share of child population accessing sanitation (rural)	Decr. child mortality (under 1 year old) Incr, share of child population accessing water (urban)
	Poverty	*No statistically significant results*	
Extensive	**Education**	*No statistically significant results*	
	Health	Reduced share of child population accessing water (urban) Reduced share of child population accessing sanitation (urban)	Incr. share of child population accessing sanitation (rural)
	Poverty	*No statistically significant results*	

5.4 Mozambique

Mozambique is a country with a population of 22,382,533 (WDI, 2008) and is divided into two topographical regions by the Zambezi River. To the north of the river the coastline changes into hills, low plateaus and further west to rugged highlands as it moves inlands. To the south of the river, the lowlands are broader with the Mashonaland plateau and Lebombo mountains.

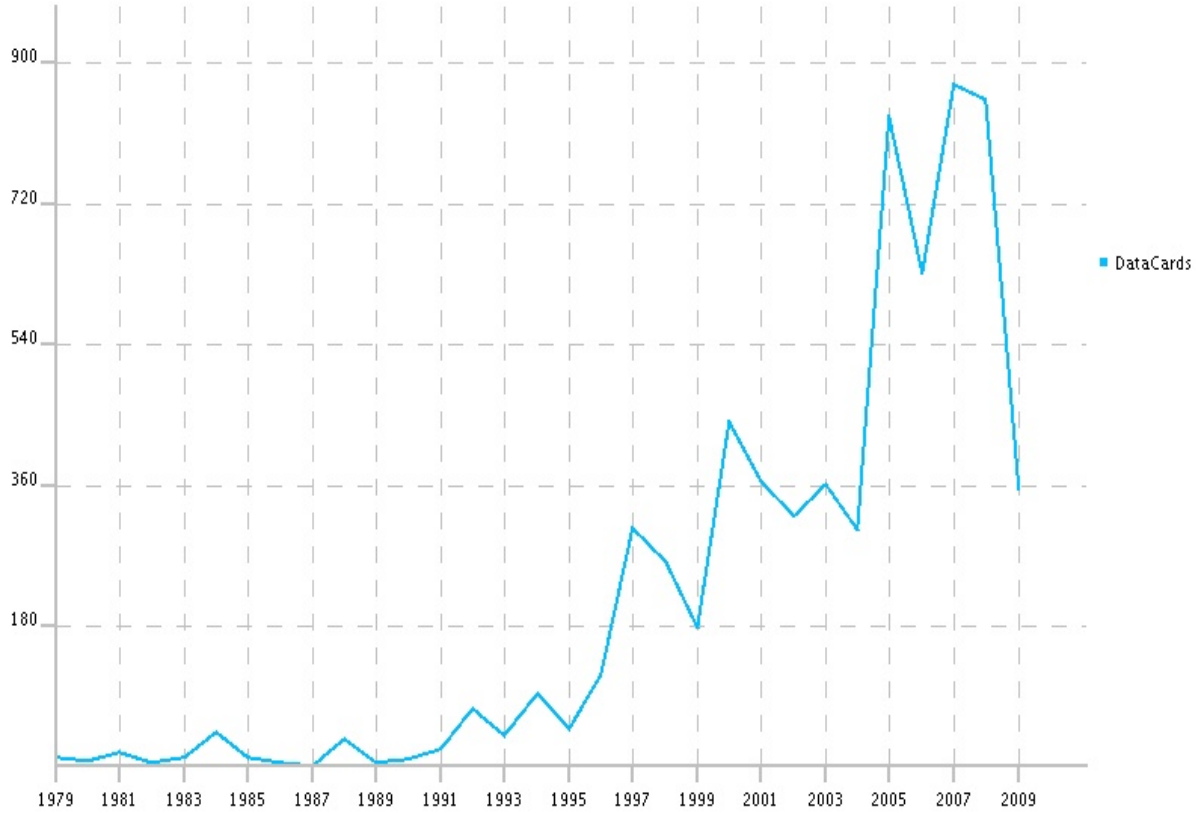
According to UNICEF,[23] Mozambican children today are more likely to live beyond their fifth birthday than twenty years ago. However, mortality rates still remain high - 320 children under five die every day due to diseases such as malaria, respiratory infections and diarrhoea. Approximately 41% of children are chronically malnourished. Education figures have also improved: today, 83% of the children are enrolled in primary school, compared to 32% in 1992. The number of primary and secondary schools has tripled since 1992. Unfortunately, the quality of education and of the schools is still very poor. Also, there is inequality in terms of access to education, based on where a child lives and on gender.

According to UNISDR 2009, Mozambique is one of the 10 countries with a higher mortality risk to tropical cyclones, suffers the highest relative economic loss risk as a proportion of the size of the affected economy and is among the 20 countries with higher percentage of people and percentage of GDP exposed to floods. As a result of this, the country is one of the 18 countries in the world with a "very high economic vulnerability to natural hazards". More than 60 percent of Mozambique's population lives in coastal areas, and is therefore highly vulnerable to cyclones and storms. Floods, epidemics and cyclones are the most frequent disasters, although drought affects by far the largest number of people.

According to Desinventar records there is a clear tendency of disasters increasing, especially during the past 25 years (see Figure 6). Floods caused more than half of the deaths and droughts 40%. Cyclones and floods are the causes of most houses destroyed and damaged (54% and 20% respectively).

[23] http://www.unicef.org/mozambique/

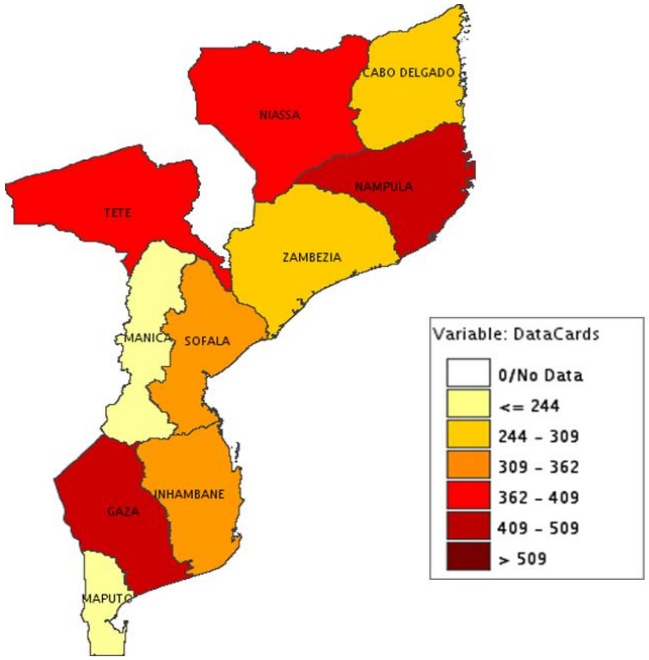
Figure 6: Number of data cards recorded from 1974 – 2008



***Extensive Disasters**:* According to Desinventar,[24] Gaza and Nampula present more than 500 registrations of extensive disasters during 1999-2009. Gaza is a province located to the south of the country with a population of 1,333,106.[25] Most of the district stretches out in the basin of the Limpopo River. Nampula is located to the north east and has approximately 4,000,000 habitants. Deaths and missing people due to this type of event are more concentrated on Gaza and Zambezia (with more than 200). Zambezia is the most-populous province of the country (3,794,509) and it is located in the central coastal region.

[24] http://moz.gripweb.org/DesInventar/
[25] Instituto Nacional de Estadistica, 2006

Map 3: Extensive disasters per province 1999-2009



Intensive disasters: intensive disasters were registered in 9 out of 10 years under study. Nampula has 66 intensive events registered between 1999 and 2009. This is the highest number among all provinces in all countries analyzed. Floods caused 70% of deaths and missing and cyclones generated 49% of houses destroyed and damaged.

The regression: Socio-economic data for Mozambique was given at the **provincial** level and regression analysis was done using this level of disaggregation. Child welfare variables fall broadly into the categories of **education and health**; full results significant and non-significant for each variable are in Annex 3 and 4. The equation is estimated, where y_{it} represents the socio-economic indicator, and β_3 the "impact" of the disaster on this indicator.

Significant results for extensive risk:
Health

- According to regression analysis, as expected, extensive disasters increase low birth weights.

***Significant results for intensive risk*:**
Education

- According to regression analysis, unexpectedly, intensive risk disasters increase secondary achievement rates

Table 6: Summary of significant results for Mozambique

Risk Type	Variable	Expected Results	Unexpected Results
Intensive 9/10 years recorded events	**Education**		Incr. achievement rates (primary and secondary)
	Health		
Extensive	**Education**	*No statistically significant results*	
	Health	Incr. low birth weight (under 2.5Kg when born)	

5.5 Nepal

Nepal is a landlocked country located in the Himalayas with a population of 28,809,526 (WDI, 2008). The country has a rich geography including eight of the world's ten tallest mountains. Nepal is commonly divided into three physiographic areas: Terai (the southern lowland plains), the Hill (with mountains from 800 to 4,000 meters) and the Mountain region (situated in the Great Himalayan Range, making up the northern part of Nepal and containing the highest elevations in the world including 8,848 metres height Mount Everest).

According to UNICEF,[26] neonatal mortality in Nepal accounts for 54 per cent of under-five mortality. About one in 25 children die during the first month of life in Nepal. Most deaths occur due to diarrhoea and/or acute respiratory infections, conditions that are exacerbated by underlying malnutrition, and poor standards of care and environmental hygiene. Despite the fact that education is compulsory and there is free schooling for children aged from five to nine years, only about four out of every five primary school-aged children are in school. In addition, dropout and repetition rates are high. Regarding adolescents, only about a third of children aged 13 to 16 years are enrolled in secondary school.

Nepal is affected by flood, landslide, earthquake, fire, hailstorms, and glacial lake outburst flood (GLOF), cloudburst ("an extreme form of precipitation, sometimes with hail and thunder, which normally lasts no longer than a few minutes but is capable of creating flood conditions"),[27] drought and epidemics. According to UNISDR 2009, Nepal ranks seventh in the world in the percentage of people exposed to floods per year. It stands among the 15 countries with a higher percentage of GDP exposed to floods per year. It is among the 15 countries with higher percentage of people and % of GDP exposed to landslides triggered by precipitation or earthquake per year.[28]

According to Desinventar between 1974 and 2009, 50% of deaths and missing are caused by epidemics, 14% by landslides and 11% by floods (see Figure 7). Floods (45%), earthquakes (23%) and fires (18%) are the principal cause of houses destroyed

[26] http://www.unicef.org/nepal/
[27] Definition taken from http://en.wikipedia.org/wiki/Cloudburst
[28] UNISDR 2009, Chapter 2.

and damaged. According to disaster records the number of disasters is increasing over time in Nepal, particularly, since the mid 90s (see Figure 8)[29].

Figure 7: Number of deaths and missing due to disasters (1974-2009)

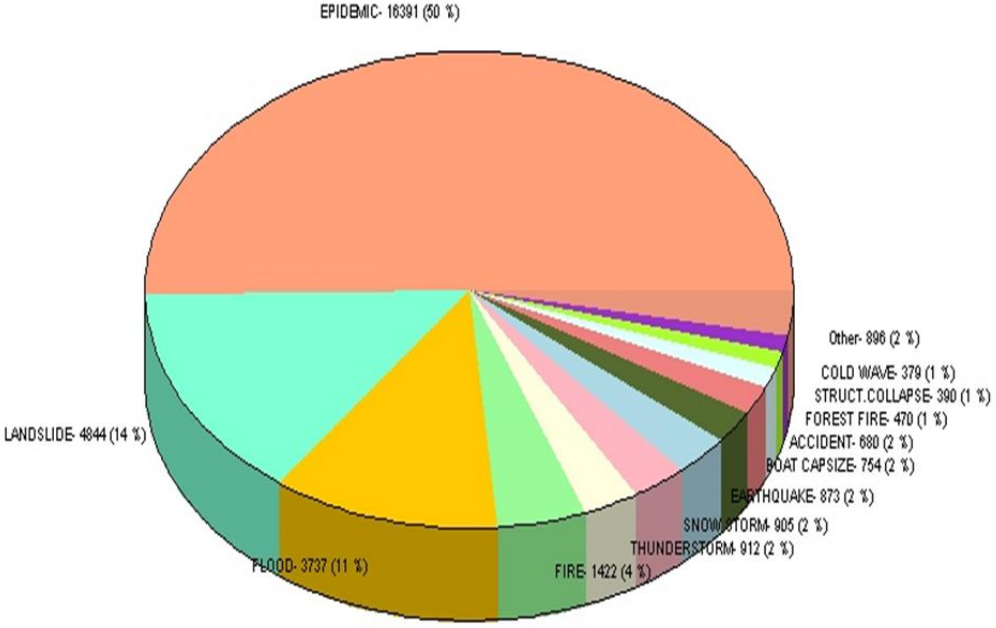
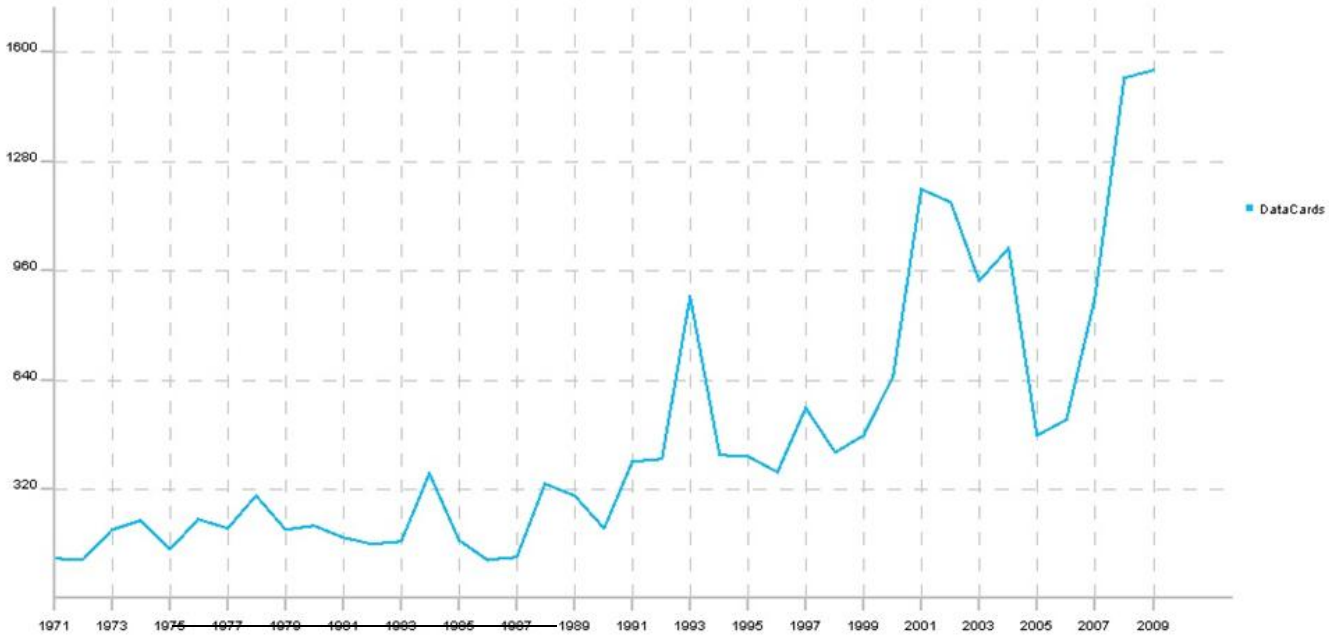


Figure 8: Number of data cards recorded 1974 – 2008

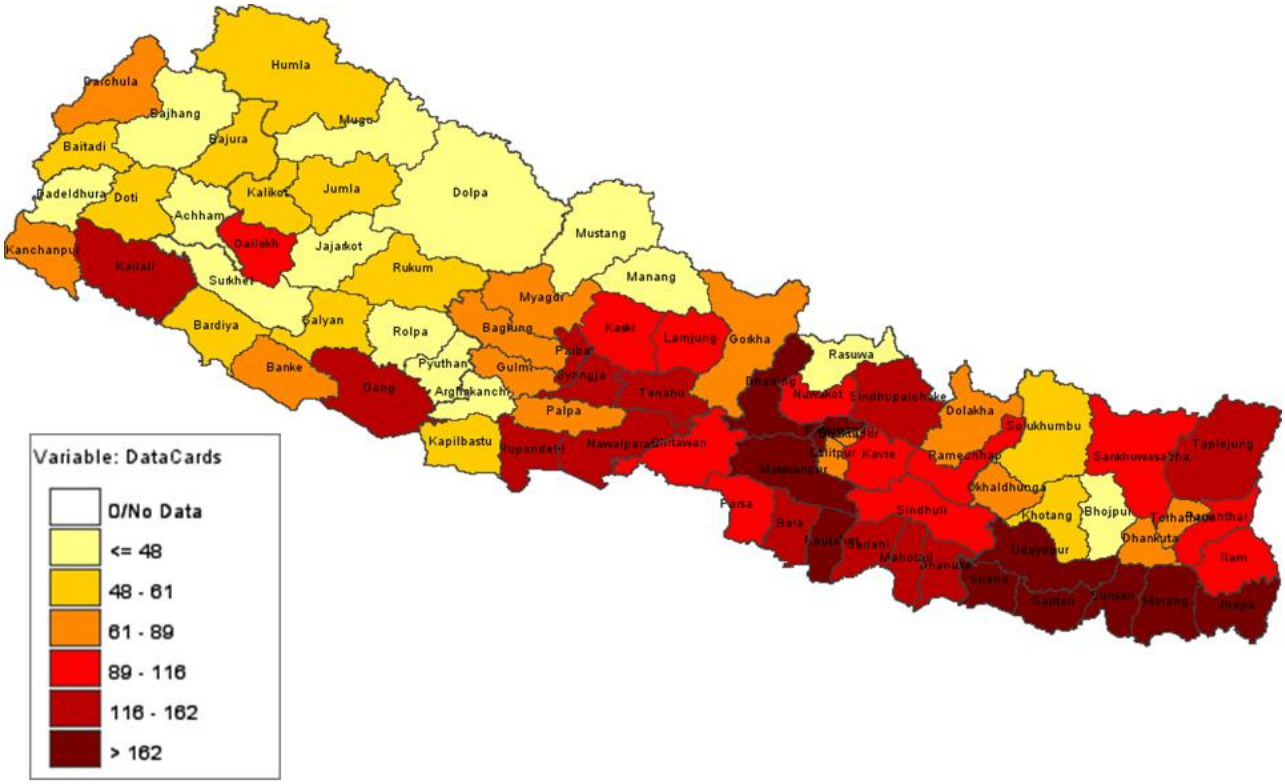


[29] Source: http://gar-isdr.desinventar.net/DesInventar/main.jsp?countrycode=np1

***Extensive Risk Disasters*:** According to Desinventar, the Central and the Eastern region suffered most extensive disasters registered than the other regions during 1999-2009. Most deaths and missing people were generated by landslides (36%), followed by floods (18%) and snow storms (25%). Floods (54%) and fires (18%) caused most destruction and damage to houses.

Map 4 presents extensive risk data cards disaggregated by province. Saptari, a province with approximately 570,000 inhabitants and located in the Eastern region presents the highest number of data cards (mostly fires, floods, thunderstorms and cold waves).

Map 4: Extensive Disasters records by district 1999-2009



Intensive risk disasters: intensive disasters were recorded during 5 out of the 10 years under study. The Eastern region is the only one affected by more than 2 intensive disasters during 1999 -2009, all of them floods. No deaths were registered due to these floods. Almost all deaths and missing people were registered in the Central region. Intensive landslides generated 76% of deaths and missing people during the same period and floods 16%.

The regression: Socio-economic data for Nepal was given at the **provincial** level and regression analysis was done using this level of disaggregation. Child welfare variables were available in the broad categories of **education and health**; full sets of results, significant and non significant for all variables are found in Annex 3 and 4. The equation is estimated, where y_{it} represents the socio-economic indicator, and β_3 the "impact" of the disaster on this indicator.

Significant results for extensive risk:

Education:

- As expected, extensive risk disasters reduce both primary gross enrolment rates and gross intake ratios for grade one.
- Unexpectedly, extensive risk disasters increase the number of students enrolled in secondary education and the total number of schools (per province).

Health,

- As expected, extensive risk disasters increase total fatality rates
- Increase the proportion of malnourished children (< 3 years old) and ARI fatalities.
- Unexpectedly, over the study period looked at in this report extensive risk disasters reduce the incidence of ARI per 1000 under 5 years and reduce the incidence of pneumonia per 1000 under 5years.

Significant results for intensive risk:

No estimations were produced in this case given that the socioeconomic data is only available for the period 2006-2009, and it is not possible to establish a pre/post disaster-event-period for the purpose of regression analysis

Table 7: Summary of significant results in Nepal

Risk Type	Variable	Expected Results	Unexpected Results
Intensive 5/10 years recorded events	**Education**	*No results as child welfare data was only available for 2006-2009 and disallowed studies of intensive risk*	
	Health		
Extensive	**Education**	Reduced gross intake ratio for grade 1 Reduced gross enrolment (primary)	Incr. No. of students (secondary) Incr. no. of schools
	Health	Incr. fatality rates of total population Incr. ARI fatality Incr. proportion of malnourished under 3 years	Reduce incidence of ARI per 1000 under 5 years Reduce incidence of pneumonia per 1000 under 5 years

5.6 Vietnam

Vietnam is the easternmost country on the Indochina Peninsula in Southeast Asia. The county's population is 86,210,781 (WDI, 2008). The topography is a combination of hills and densely forested mountains. To the north of the country are located the highlands and the Red River Delta. The south has coastal lowlands, the mountains of the Annamite Chain and forests.

According to UNICEF[30], there are approximately 30 million children in Vietnam. 14.3 % of the total male and 13.4 % of the total female population is under 16 years of age.

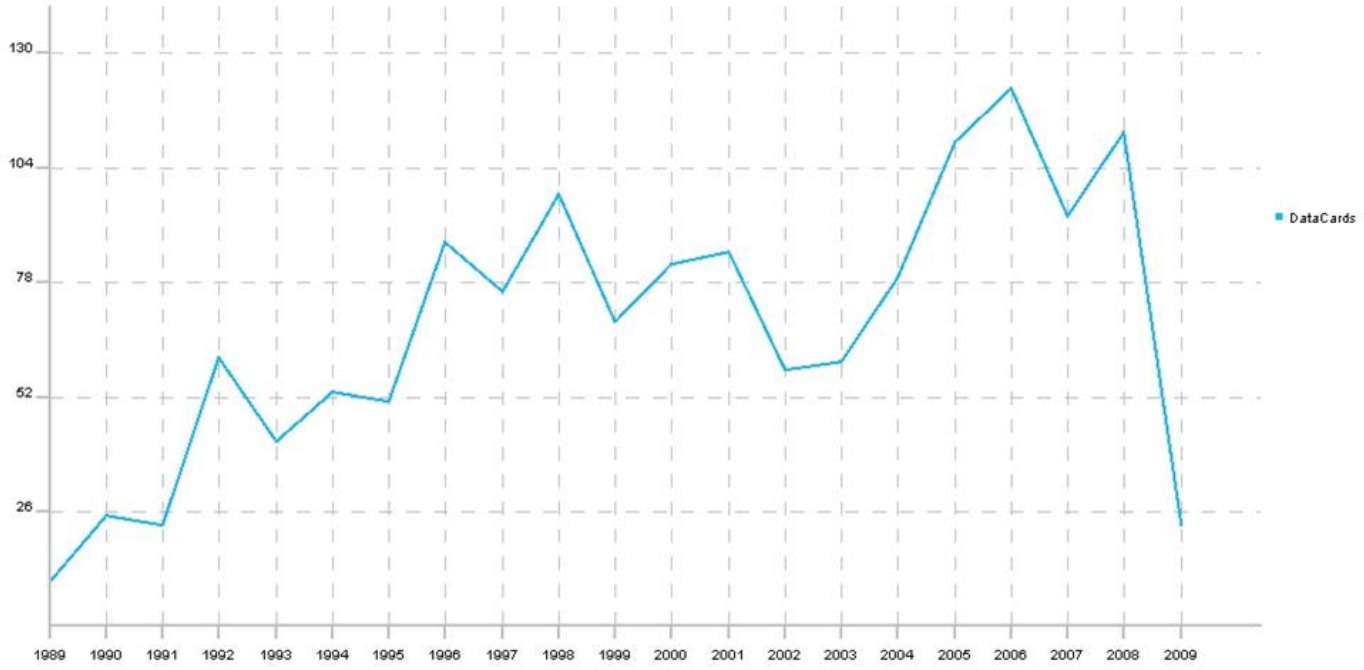
[30] http://www.unicef.org/vietnam/children.html

Most children attend primary and secondary school; most have access to adequate health care and can expect to live longer than their parents. However, there are wide disparities between the rich and the poor, the majority and ethnic minorities, and between urban and rural areas. For instance, in 2006, 40% of children living in rural areas were poor compared to about 10 % of children living in cities. Approximately 75% of urban children attend preschool while with only 51% attend in rural areas.

Rates show that in 2006, about one third of children below 16 years of age can be considered poor, one third of children below five are stunted and almost half of all children do not have access to hygienic sanitation facilities.

In the decade 1995 – 2006, natural disasters caused an average economic damages equivalent to 1.5% of the country Gross Domestic Product (GDP), and in the decade 1999 – 2008, they were responsible for 4,556 deaths. UNISDR 2009 puts Vietnam at high economic vulnerability to disasters. Disaster occurs almost year round in Vietnam: flood, storm, tropical depression, storm surge, inundation, whirlwind, flash flood, river bank and coastline erosion, hail, rain, drought, landslide, and forest fire. According to historical data, floods are responsible for 70% of deaths and of 41% of houses destroyed and damaged. As seen in figure 9, the number of data cards registered has increased, although with an unexpected drop for 2009. The Vietnam Desinventar databases include only climate related events**.**

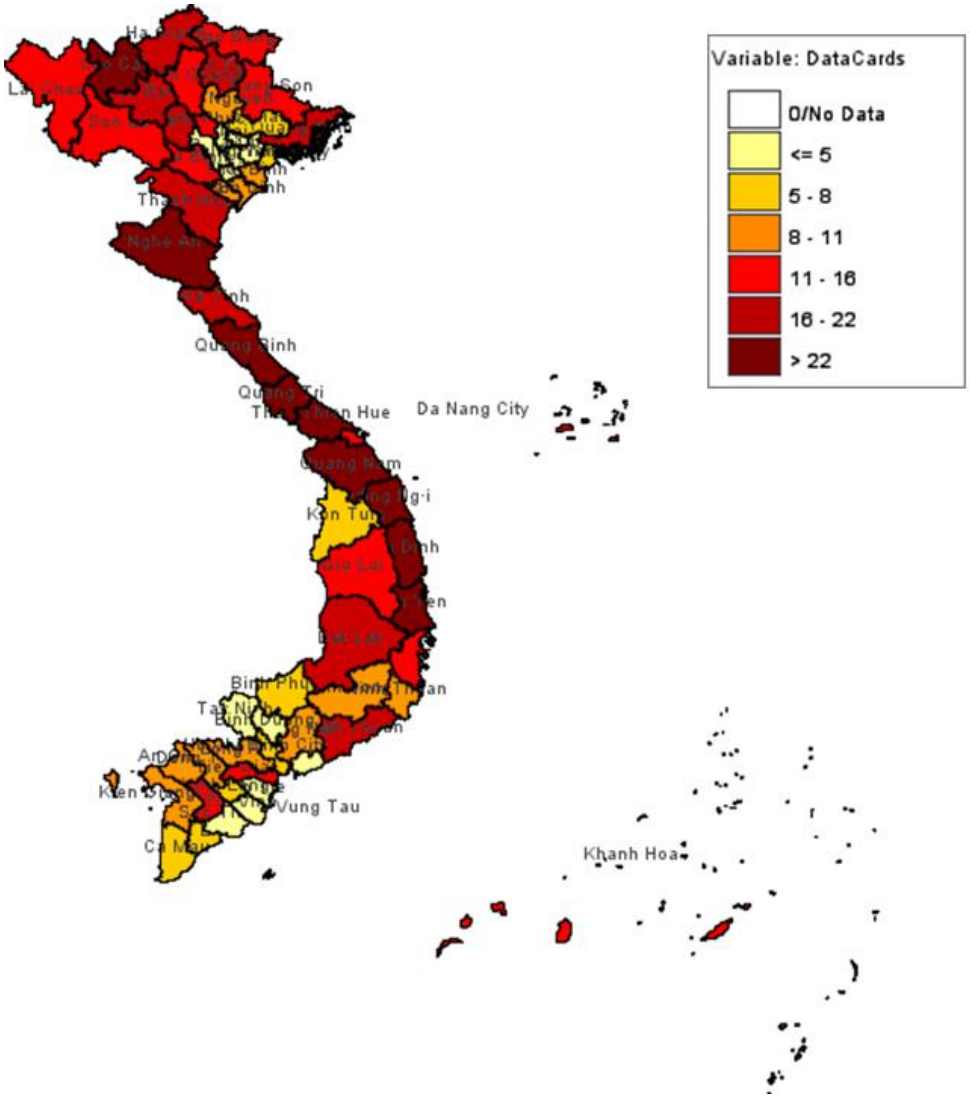
Figure 9: Number of data cards for disasters 1974-2009



Extensive Disasters: Most provinces of Vietnam register more than 20 extensive disasters for period 1999-2009. Floods cause 56% of deaths and missing people, whilst

storms cause 15%. 42% of houses destroyed and damaged were due to hailstorms, 24% to flash floods and 19% to storms.

Map 5: Extensive Disasters recorded 1999-2009



Intensive Disasters: Records of intensive disasters existed in 10 out of the 10 years under study. Intensive floods generated more than 80% of deaths and missing between 1999 and 2009. Floods and storms caused 42% and 40% of houses destroyed and damaged respectively.

The regression: Socio-economic data for Vietnam was given at the **provincial** level and regression analysis was done using this level of disaggregation. Child welfare variables fell into the broad categories of **education, health and income levels** (a proxy for poverty); full sets of significant and non-significant results for all variables can be found in Annexes 3 and 4. The equation is estimated, where y_{it} represents the socio-economic indicator, and β_3 the "impact" of the disaster on this indicator

Significant results for extensive risk:

Education

- As expected, extensive risk disasters reduce the number of classes, reduce the total number of primary schools and reduce the total number of primary students.
- Unexpectedly, extensive risk disasters increase net enrolment rate (lower secondary), increase the total number of students (upper secondary), increase the number of secondary schools, of teachers and of schools

Health

- As expected, extensive risk disasters significantly increase infant mortality rates, reduce the percentage of population with access to improved sanitation and reduce the percentage of population with access to improved water sources
- Unexpectedly, reduce the percentage of severe underweight.

Significant results for intensive risk:

According to regression analysis, there is no significant impact of intensive disasters on education, health and poverty indicators

Table 8: Summary of significant results for Vietnam

Risk Type	Variable	Expected Results	Unexpected Results
Intensive 10/10 years	**Education**	*No statistically significant results*	
	Health		
	Poverty		
Extensive	**Education**	Reduce no. of classes Reduce total no. of students (primary) Reduce no. schools (primary)	Incr. Net enrolment (lower secondary) Incr. total no. of students (upper secondary) Incr. no. of secondary schools Incr. no. of teachers Incr. no. of schools
	Health	Incr. infant mortality rates Incr. % moderate underweight and stunting Reduces % of population with access to improved sanitation Reduces % of population with access to improved water source	Reduces % severe underweight and stunting
	Poverty	*No statistically significant results*	

Box 5. Young Lives[31] 'environmental shocks' study – Vietnam

Using data from first two rounds of the longitudinal survey (2002 and 2006) of the younger cohort of the Young Lives sample - born in 2001/2002 - the analysis measured the medium-term effects of drought, flooding, crop failure, and pests on aspects of child well-being to address some of the following questions:

(a) What was the extent of the environment related shocks?
(b) Which children were more likely to experience environmental shocks?
(c) What was the impact of environmental shocks on children?
(d) How did households respond to environmental shocks and what were the effects of protective factors?

For Young Lives children in Vietnam:

- Children in rural households were particularly likely to be affected by environmental shocks, with households being affected by pests the most common. Linked with this particular minority ethnic groups of children and those engaged in agricultural work were at a particular risk of experiencing shocks.
- Households affected by shocks were typically at raised risk of experiencing other shocks also.
- Typical responses to environmental events include reporting doing nothing, eating less and buying less. Increasing work activity and receiving help from others, including from government and using credit or savings also come out as important responses.

The micro level data used in the Young Lives study focuses on the type of shock and the impact of that shock in relation to ethnicity, household wealth, occupation, education level of head of household and their gender. This scale and type of data collation reveals the differential impacts on groups within communities rather than relying on government indicators, it also looks at a wider range of shocks than those posed by natural hazards, although the links have begun to be articulated. The potential for combining these approaches to produce more robust outcomes of disaster impact and causality would clearly be beneficial (see section 7).

5.7 The Philippines

The Philippines is an archipelago of more than 7,000 islands where 90,348,437 people live (WDI, 2008). The country is divided into three island groups: Luzon, Visayas, and Mindanao. Luzon, at the north, is a very mountainous island and it is the largest and most economically and politically important in the country. Visayas consists of several islands in the middle. Mindanao is a group of three islands and the south. The island of Mindanao is also mountainous.

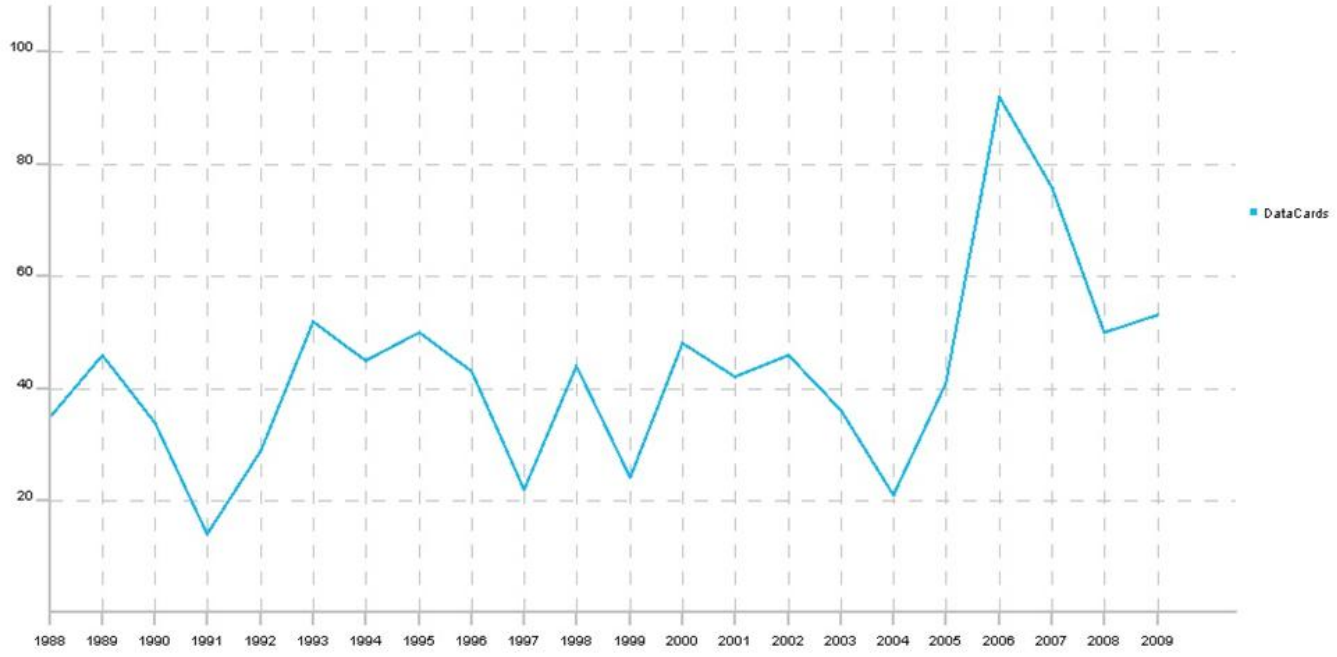
[31] Young Lives is a research project that investigates the changing nature of childhood poverty by following the lives of 12,000 children in four countries, Peru, Vietnam, Ethiopia and India (in India it collects data from the State of Andhra Pradesh) over 15 years. Since the sample is pro-poor and longitudinal, it is not nationally representative but can be used to explore differences between groups

According to UNICEF,[32] there are close to 12 million children below 5 years old. Child mortality rates have steadily decreased since 1998 with differences across regions. In 2003, 7 out of 17 regions were estimated to have infant and under-five mortality rates higher than the national average. These figures are worst for rural areas were infant mortality rate go up to 36 deaths per 1,000 live births. Data from the education department show that only 3 of 10 children attend pre-school or day care services. The prevalence of underweight children (0-5 years old) has decreased since 1998 from 32% to 28% in 2003.

There are approximately 13 million children are aged 6-11 years old. The net enrolment rate is of 90%, which is a sharp drop from the 2000 estimate of 97%. There are approximately 10 million adolescents (12-17 years old) in the Philippines. The net enrolment ratio in public secondary education in 2002 was only 57%. Almost 60% of those who enter high school reach and complete the last year.

The Philippines is exposed to natural perils like earthquakes, volcanic eruptions, typhoons and their resultant effects like tsunami, landslides, floods and flash floods. It ranks second in the world in higher mortality risk to tropical cyclones, second in number of people exposed to tropical cyclones, and second in number of people exposed to earthquakes. The country is at high threat of tsunami. It ranks fifth in number of people living in areas potentially affected by tsunamis. Eastern Visayas is the region most affected in terms of deaths and missing (23%) followed by Western Visayas (17%) and Central Luzon (9%). Tropical cyclones caused 99% of damages and destroyed houses. Figure 10 shows the historical tendency of disasters in the Philippines.

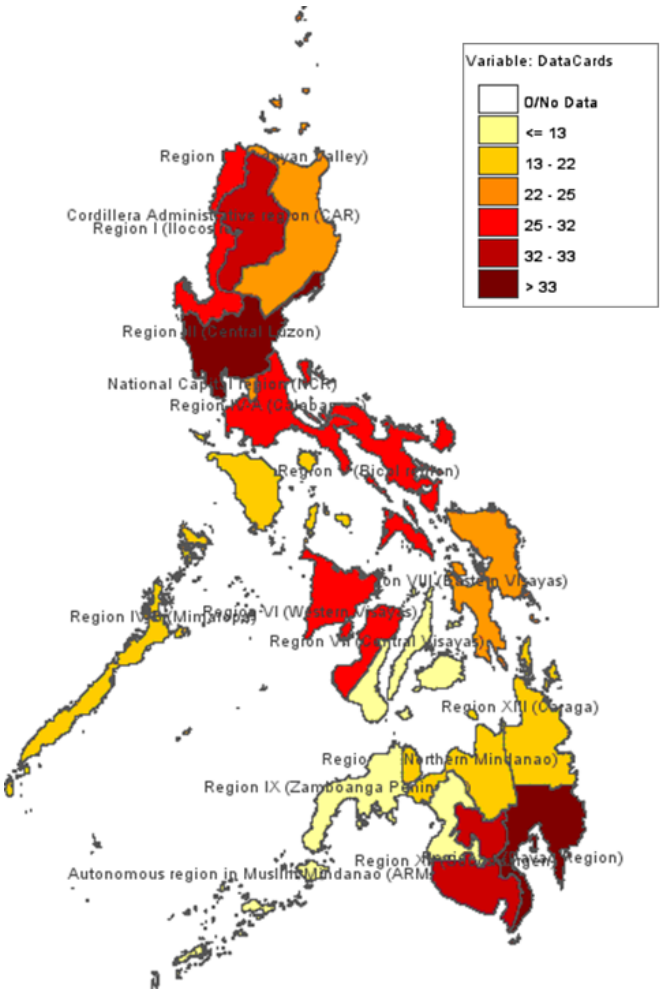
Figure 10: Number of disasters recorded 1974 - 2008



[32] http://www.unicef.org/philippines/childrensrights_8920.html

***Extensive Disasters*:** Central Luzon and Davao Region registered more than 33 extensive disasters between 1999 and 2009. 76% of deaths and missing people were caused by tropical cyclones as well as 77% of the houses destroyed and damaged. Central Luzon is located north of Manila (in the island of Luzon) with close to 10,000,000 inhabitants. Davao Region is located on the south-eastern portion of Mindanao, with more than 4,000,000 people.

Map 6: Extensive Disasters recorded per administrative region 1999-2009



Intensive risk disasters: intensive risks were recorded in every year of the period of study Central Luzon was affected by more than 10 intensive disasters between 1999 and 2009. Cyclone and landslides caused 75% and 23% of deaths and missing respectively. Tropical cyclones were the cause of 99% of houses destroyed and damaged.

Note: Disaster data for the Philippines has the following additional limitations: the disaster dataset was provided at the regional level, and only in very few cases were there data cards at the provincial level. Where a disaster affected more than one

province UNISDR disaggregated the disaster by assigning a proportional value to each affected province which was used as the basis for the regressions.

The regression: Only **education** data was provided for the Philippines and was given at the **provincial** level. Both significant and non-significant results are presented for all education variables in Annexes 3 and 4. Regression analysis was done using this level of disaggregation. The equation is estimated, where y_{it} represents the socio-economic indicator, and β_3 the "impact" of the disaster on this indicator.

***Significant results for extensive risk*:**

- Unexpectedly, extensive risk disasters reduce secondary drop-out rates and increase secondary cohort survival rates.

Significant results for intensive risk:

- As predicted, increase secondary drop-out rates, reduce secondary cohort survival rates and reduce secondary cohort survival rates.

Table 9: Summary of significant results for the Philippines

Risk Type	Variable	Expected Results	Unexpected Results
Philippines			
Intensive 10/10 years	**Education**	Incr. drop-out rates (secondary) Reduce achievement rates (secondary) Reduce cohort survival (secondary)	
Extensive	**Education**		Reduce drop out (secondary) Incr. survival rate (secondary)

A wide range of expected and unexpected results have been presented in these country overviews. The next section explores some of the expected and unexpected results presented from a global perspective**.**

6. Discussion

This discussion is based on a non-technical review of the significant results re-presented here under the broad child welfare headings and classified as 'expected' and 'unexpected' for both extensive and intensive risk. Recognising the limitation of the data, the discussion seeks to identify areas that pose questions for both intensive disaster risk management and extensive disaster risk management, and indicate potential relationships that are worthy of further exploration.

Table 10: Global significant results - health
All countries excluding the Philippines provided variables for health

	Intensive		Extensive	
	Expected	**Unexpected**	**Expected**	**Unexpected**
Bolivia			Incr. incidence of diarrhoea per 1000 in under 5's	
Mexico	Decr. Share of child population accessing sanitation (rural)	Decr. child mortality (under 1 year old) Incr, share of child population accessing water (urban)	Reduced share of child population accessing water (urban) Reduced share of child population accessing sanitation (urban)	Incr. share of child population accessing sanitation (rural)
Mozambique			Incr. low birth weight (under 2.5Kg when born)	
Nepal	n/a	n/a	Incr. fatality rates of total population Incr. ARI fatality Incr. proportion of malnourished under 3 years	Reduce incidence of ARI per 1000 under 5 years Reduce incidence of pneumonia per 1000 under 5 years
Vietnam			Incr. infant mortality rates Incr. % moderate underweight and stunting Reduces % of population with access to improved sanitation Reduces % of population with access to improved water source	Reduces % severe underweight and severe stunting
Indonesia	Incr. Infant mortality Reduced share of houses with access to sanitation			

Table 11: Global significant results - education
All countries provided variables for education

	Intensive		Extensive	
	Expected	**Unexpected**	**Expected**	**Unexpected**
Bolivia			Reduced net enrolment (preschool) Incr. Dropout rates (preschool) Incr. Gender gap in achievement rates (primary)	Incr. net enrolment (primary)
Mexico		Incr. net attendance (primary) Reduce dropout rates (primary)		
Mozambique		Incr. achievement rates (primary and secondary)		
Nepal	n/a	n/a	Reduced gross intake ratio for grade 1 Reduced gross enrolment (primary)	Incr. No. of students (secondary) Incr. no. of schools
Vietnam			Reduce no. of classes Reduce total no. of students (primary) Reduce no. schools (primary)	Incr. Net enrolment (lower secondary) Incr. total no. of students (upper secondary) Incr. no. of secondary schools Incr. no. of teachers Incr. no. of schools
Indonesia	Reduce net and gross enrolment (secondary)	Incr. preschool participation		Incr. net enrolment (primary and secondary) Incr. gross enrolment (secondary)
Philippines	Incr. drop-out rates (secondary) Reduce achievement rates (secondary) Reduce cohort survival (secondary)			Reduce drop out (secondary) Incr. survival rate (secondary)

Table 12: Global significant results - poverty
Note that only three countries provided data that could be considered as a proxy for poverty.

	Intensive		Extensive	
	Expected	**Unexpected**	**Expected**	**Unexpected**
Mexico				
Vietnam				
Indonesia	Incr. % of people living under the poverty line		Incr. % of people living under the poverty line	

The study found 53 statistically significant results: 28 expected and 25 unexpected. Most of the expected results are in response to extensive risk (20 of 28). Of the 28 expected results 14 were linked to health (11 extensive and 3 intensive), 12 to education (8 extensive and 4 intensive) and 2 to poverty (1 extensive and 1 intensive). All countries exhibited expected results.

The majority of unexpected results are also in response to extensive risk (18 of 25 unexpected results). Only in 3 countries (Indonesia, Mexico and Mozambique) the analysis revealed unexpected results in response to intensive risk (7 of 25 unexpected results). Of these unexpected results 18 were linked to education indicators (13 extensive and 5 intensive) and 7 to health indicators (5 extensive and 2 intensive). Unexpected education impacts were found in all countries excluding Mexico, where health impacts were unexpected, alongside Vietnam and Nepal.

6.1 Intensive risk results – discussion

Where there are significant results in high risk countries (e.g. Indonesia and the Philippines) they are generally expected, i.e. they negatively impact on education, health and poverty levels. However Mozambique, Mexico and Indonesia all demonstrated some unexpected results with regards to intensive disaster impact on education variables - and for Mexico also on health variables. The degree to which these unexpected results follow country patterns of improvement and the relative improvement compared to country-wide tendencies are not accounted for in the regression analysis due to lack of controls. However the unexpected results for education follow that of Baez et al (2007) who found that Hurricane Mitch had no impact on educational enrolment. Whilst interpretation of these results should be cautious in light of the aggregate nature of the data

spatially and the lack of control data to account for interventions, investment and the identification of other kinds of shock occurring during the 10 year period under study; in their theoretical model Baez et al 2010 recognise that disasters can also generate the context for positive impacts - "Change in the opportunity cost of sending children to school, given a significant decrease in market wages for instance, may generate larger incentives to send children to school".

In order to better understand the causal relationship between disaster events and changes in child welfare a wider range of variables and data would be needed at both the household (micro) level and at the macro-economic level. It is now well established that the occurrence of a 'disaster' – as opposed to a hazard event - is related to exposure, vulnerability and the capacity of individuals and networks of agents to respond to that individual context. Social and community factors combine with national level responses to modify the impact of disaster. Including other control variables in the regression analysis would help better explain the incidence of the disaster in a particular region and the use of household data would improve the understanding of the local contextual factors mediating the impact on child welfare variables. In these cases where intensive disasters have been seen to have impacted positively on child welfare the need for additional data to isolate the causal linkage to disasters is clear. At the same time it does present some interesting areas where further empirical research should be developed.

Notwithstanding the need for further data to isolate the causal relationship with disaster, where intensive disasters demonstrate no or positive impacts on child welfare, the hypothesis that humanitarian aid and emergency interventions in post-disaster situations could lead to a longer term trend of improvement in some aspects of child welfare is worthy of investigation. Detailed analysis of the types and investment in interventions would be required to better understand how short-term, often high value, programmes could lead to longer term gains. This kind of research would necessarily need to be alert to the potential alternative explanations such as ongoing government programmes as well as the possibility that disasters can create positive benefits. Understanding the relationships which may exist between emergency aid/humanitarian systems and government departments or agencies in the countries where the education sector appears to have 'built back better' - improving attendance at primary level in Mexico and improving achievement rates in both primary and secondary education in Mozambique - may provide useful lessons for improving post-disaster efforts in an attempt to secure long term development gains.

Alongside these larger questions about bridging the gap between short-term responses and long-term development, there is a need to look within the humanitarian system to understand for example, why health gains in the urban areas of Mexico are not reflected in rural areas? Accessing those who are affected by extreme disasters in remote areas is recognisably more difficult than reaching the urban affected - who are often within the reach of operational centres, with road infrastructure and telecommunication networks - but are there other drivers that lead to positive gains in the urban areas but not the rural?

In Mexico positive gains in the urban environment for access to water in response to intensive risk are countered by a negative impact of extensive risk on urban water access and sanitation; in contrast the rural areas of Mexico exhibit gains in access to sanitation and water as a result of extensive risk - an inverted impact of the intensive risk which saw the rural child population with reduced access to sanitation.

6.2 Extensive risk results – discussion

Where extensive risk is a low impact but high frequency event the impacts of extensive risk are observed in the wider development challenge with programmes targeted at reducing poverty and improving livelihoods in the face of daily risk and seasonal variability in climate. At the international level disasters are increasingly recognised as reversing development gains and disaster risk reduction programmes are gaining credibility within the wider development process. The decade under study for this report reflects one that saw an increasing influence of the DRR community on the political and policy agenda, visible in the signing of the international HFA mid-way through, and increasing awareness of the linkages between disasters and development. The decade under study also reflects a development agenda driven by the Millennium Development Goals with significant national efforts directed to improving access to and quality of education and health services for children as well as others.

Within the significant results of the analysis for extensive risk impacts on child welfare there are clear dichotomies and difference between both countries and variables. In Bolivia, Nepal and Vietnam for example there are a number of expected results showing the impact of extensive risk on education outcomes, however for these countries and in Indonesia and the Philippines there are also a surprisingly high number of unexpected educational gains.

Further consideration of the results reveals that the educational gains are predominantly in the secondary sector for all countries excluding Bolivia where gains in primary enrolment contrast with decreased enrolment and higher dropout rates in pre-school. In Indonesia gains are seen in both primary and secondary enrolment and it is considered that this could be a reflection of the volume of aid received in the post-tsunami period, although detailed work would be needed to understand the aid flows to clarify this and to understand the relationship with intensive disaster.

The general emphasis on gains in secondary education do point to greater efforts at this scale to either reduce risk through DRR interventions or to improve basic education services, which may arise in response to a wide range of drivers, such as the MDGs or a 'World Fit for Children'.[33] The results in Vietnam show a stark contrast between negative impacts at the primary scale, where classes, students and schools all decreased, in contrast with all round gains at secondary level. Whilst this could lead to interpretations that younger children are more vulnerable the determinants of access to primary and secondary education need to be taken into account in each setting. Without undertaking empirical research in country as to the political economy of the decision-making and investments across scales that contribute to these outcomes and the coping strategies available to individuals it is difficult to reach any clear conclusions.

However education is considered to be one of the more advanced sectors in DRR and much DRR awareness and structural programmes - particularly where schools are designated as evacuation centres - are targeted at schools and students. Further studies should review the mediating factors for improved gains in the education sector to better understand and draw lessons on if or how the role of disaster risk reduction programmes can contribute to securing educational gain in the face of disaster.

In the Philippines and Indonesia gains in educational attainment made in response to extensive risk are at risk of being completely reversed by a major event. In both countries where the frequency of intensive events is high, these gains may be as fleeting as they are

[33] See http://www.unicef.org/specialsession/wffc/

unexpected. Running the regression models for complete disaster datasets would provide results on the net disaster impacts on child welfare, leading to more conclusive discussion around whether possible gains are cancelled out through the cumulative impact of extensive risk, or whether gains through educational investment or programmatic interventions are cancelled out by major events. The focus of this study was to begin to understand the different types of impact that different types of risk may generate but the results raise this as a crucial issue for disaster risk reduction programmes.

Similar issues arise when you look at the impact of extensive risk on health variables across the countries. In Bolivia, Nepal, Mexico, Mozambique and Vietnam there are a greater number of negative impacts on health outcomes, although Nepal, Vietnam and Mexico also return unexpected gains. In Mexico the urban decline in child access to water and sanitation indicates the expected cumulative effect that these lesser events have over time and this is reflected in similar results in Vietnam where access to water and sanitation also declines. The rural gains in Mexico again raise the question of equity in access to resources and support in the face of both intensive and extensive risk. Where extensive risk may be the focus of community-based development and/or DRR interventions the focus of efforts and resources appear to be biased to the rural areas of Mexico. Questions around why this is the case may require improved understanding of the capacities and structures of urban governance and, with many informal settlements and unofficial infrastructure connections, there may be physical barriers that inhibit simple programmatic solutions, making work in the rural areas a quicker win.

In Nepal the health gains are disease related, although reduced incidence of ARI in under 5's contrasts with the increased numbers of fatal cases. Detailed studies at country level could explore the political economy of the decisions and investments that may generate these gains, drawing out lessons for other aspects of health, education and child development. However in a country where malnutrition is known to be a problem the fact that extensive risk is exacerbating the situation demonstrates a severe lack of capacity to cope with even low level disaster impacts. The evidence of the impact of regular low level disasters on nutritional status through an increase in low birth weight in Mozambique also reflects this. In Vietnam the positive impact on the percentage of the child population recorded as severely underweight and severely stunted contrasts with the negative impact on numbers of moderate underweight and stunting. Data to support clear understanding of why this may occur is not available within this study but these results may reflect ongoing interventions to target those severely underweight or stunted thus increasing the exposure of others to the impacts of extensive risk.

The studies highlighted by Baez et al (2010) in the review for this paper corroborate the impacts of low level frequent disaster, such as rainfall variation, as being clearly associated with worse nutritional outcomes and go on to elaborate the long term health effects of low nutritional status on long term development. The specific impact of disasters however is not clear with alternative transmission routes being identified by Baez *et al* (2010) through disasters leading to a 'lower income effect leading to lower consumption' and/or through disasters devastating crops and/or transport routes leading to a 'lack of food availability'. Notwithstanding the potential transmission routes it is clear that interventions to reduce malnutrition need to factor in the ongoing impacts of low level disasters when programmes are being planned and not just consider the preventative/emergency responses necessary in light of the possibility of major events.

For the available poverty data (3/7 countries) the only significant results were found in Indonesia where, as expected, the percentage of the population living under the poverty line increased for both intensive and extensive risk. The wider lack of data on poverty is clearly

problematic for developing studies that can further isolate the impact of disaster in child welfare.

7. Conclusions

This study presents a novel way to separately investigate trends during the past decade regarding the impact of extensive and intensive disasters on child welfare and development. Studies covered a broad variety of countries located in different geographical regions and exposed to different types of hazard. This research presents an initial assessment of the trends for recent years which generally corroborate the patterns of disaster impact on child welfare promoted through the advocacy literature and thus support much of the child-centred advocacy in the DRR sphere - however it has also shown that disasters can also create unexpected impacts that improve welfare outcomes.

Following Baez *et al* (2010), the outcomes indicate that there are likely to be a wide range of transmission channels through which disasters affect individual's welfare. Disasters generally have a negative effect on human capital, nutrition, education, health and mental health. However, as Baez *et al* argue, there is an ambiguous impact of the disasters on welfare variables due to the varying effects involved. Empirical disaggregation of these impacts is difficult and requires meticulous research. Whilst there is limited data in this study to further explore the specific transmission channels and mediating factors the limitations of the data help identify ways forward in terms of data collection and modelling.

The reasons why unexpected results are found may be related to the limitations of the data set and the modelling, as clearly articulated in section 3**.** Whilst lack of controls in the study is already discussed and identified as a key factor in understanding and explaining the results it could be misleading to try to wholly explain the unexpected results based only on the lack of additional information regarding investments, programs and other policies. Other potential influences should be recognised:

- **Individual's characteristics.** The vulnerability of a population to the potential consequences of natural disasters may be related to individual characteristics and social structures that may not be recovered by aggregated data which does not allow individual heterogeneity to be taken into consideration. Relationships that appear apparent when analyzed at the district/region level may be wrongly assumed to operate at the individual level. In this sense, to test the robustness of the estimated effect, it would be useful to use individual level socio-economic information.
- **Insufficient data span.** The balance of statistically significant results to favour extensive risk may be due to the limitations of the time span for studying intensive risk. However, in some cases, the time span covered by the socio-economic data is too short to reveal a trend or significant change in a variable. This may bias the estimation results, hiding the real impact of disaster events on the variable of interest.
- **Insufficient geographical variation.** Data is only available for large geopolitical areas (predominantly provincial instead of district/communities). Therefore, the estimated impact may be under/overestimated by those factors that vary within a particular area and are not taken into consideration given the large aggregation of the variable of interest. The most efficient way of solving this issue is to produce data aggregated to the smallest geopolitical division possible.
- **Migration effects:** A very important issue beyond the data provided for this study and which may potentially affect the estimates presented is the possible population migration from treatment to control areas after a particular disaster. If the most vulnerable population migrates from treatment areas to control areas, it is possible

that our results underestimate the real effect of the disaster, or vice versa. It also misses data on the relocation of 'at risk communities'.

Recommendations for further statistical analysis:
To create depth for studies at country level:

- ✓ **Micro-level data** should be used in combination with disaster data in order to further study the impact of disasters on children's welfare. For example, the use of micro-level data means one could *better* determine why children living in an area affected by a flood are more or less likely to attend school in comparison with other children who may not be affected by the flood; results may show that the reason why child enrolment is low in a flood prone particular area is due to the lack of investment in education or due to poverty factors that limit access to education and not *totally* explained by the disaster *alone*. Micro-level data should be collected with location/geographical information in order to ensure the viability of disaster impact analysis.

Box 6. Micro-level data

The reviewed literature shows that the use of micro-level data seems the most accurate way of estimating the effects of natural disasters on welfare indicators. Micro-level data is information about the socio-demographic and economic characteristics of individual people and/or their households. These data are normally collected in household surveys. Examples of micro-level data, other than Census Surveys, that could be used to further explore the impact of disasters on children's welfare are:

- the Demographic and Health Surveys (DHS):[34] nationally representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, fertility, family planning, maternal and child health, gender, HIV/AIDS, malaria, and nutrition;
- the Multiple Indicator Cluster Survey (MICS):[35] international household survey initiative of UNICEF that provides statistically sound and comparable estimates of a range of indicators in the areas of health, education, child protection and HIV/AIDS; or
- the Young Lives:[36] a longitudinal household survey that involves the repeated observation of the same individuals over long periods of time. This survey aims to uncover trends across populations and life spans, and to track life events through generations. For example, the survey collects information about children's weight and height (and that of their caregivers), and test the children for school outcomes (language comprehension and maths). The survey also asks the children about their daily activities, their experiences and attitudes to work and school, their likes and dislikes, how they feel they are treated by other people, and their hopes and aspirations for the future. It also gathers data on environmental shocks (see Box 5)

Micro-level data also has some limitations: these data are collected for a sample and are thus subject to sampling error and sample size restrictions. They contain

[34] http://www.measuredhs.com/aboutsurveys/dhs/start.cfm
[35] http://www.unicef.org/statistics/index_24302.html
[36] http://www.younglives.org.uk/what-we-do/research-methods/household-and-child-survey

very detailed socio-demographic information, but each record about an individual or household may have limited geographic, location information. **Geographic and location information are essential when studying the impact of disasters on socio-economic variables and therefore, should be part of the micro-level data collected**.

- ✓ **Increasing data span**: further analysis should be done regarding intensive risk disasters to include longer periods of time
- ✓ **Increase knowledge around control variables through quantitative and qualitative research.** A combination of desk-based and field research at country level regarding policies, programmes and projects on health, education and poverty would improve the understanding of the impact of disasters on welfare variables. Utilising qualitative research methods would reveal the wider range of impact on child welfare that disasters bring.
- ✓ **Include migration controls.** There are several ways that could be used to control for migration: first, including the relative evolution of population figures in the model (these figures would be obtained from census data) or second, using migration figures from specialised agencies if they are available per region/district level.
- ✓ **Comparative variables:** In order to make cross-country comparisons, information on variables that are more similar across countries would be needed. This would be the case if some of the above mentioned household survey methods would be used.

8. Recommendations

The evidence indicates that both extensive and intensive risks are likely to have both short term and in some instances potential long term impacts on child welfare. The results identify a set of specific areas for further study to better understand the factors mediating the impact of disaster at the country and local scale including:

- the need for a political economy perspective of the way that both disasters and child welfare are articulated and prioritised at the country level;
- data on flows of investment from government, donors and humanitarian agencies in relation to both development priorities and disasters;
- improved understanding of the individual and social contexts that mediate the impact of disasters.

From a global perspective the study concludes that disaster risk reduction policies need to take account of the impacts of disaster on different sectors of the population; children are vulnerable to a wide range of impacts that have the potential to lead to changes in long term welfare and development outcomes. In contrast child protection and development policies need to take into account the potential effects of both extensive and intensive risk when designing child-centred policies and programmes. In order to do so detailed studies of impacts and mediating factors at the local level, that engage with children in the process, are needed to better inform policy and programming.

Although there is a clear need for improving the understanding of different transmission channels that can result in a range of both positive and negative disaster impacts on child welfare this study identifies a number of key policy areas and considerations with regard to both data needs and policy.

Data implications:

- ✓ Disaster data should be collected at a more disaggregated level. Data should take into account the particular effect of disasters on different groups, for example by disaggregating mortality rates by age group and by gender.
- ✓ Information on the effect of disasters on variables that are likely to affect child welfare should be consistently and accurately recorded. For example, recording schools destroyed or affected by disasters will improve understanding of the transmission channels
- ✓ Micro-level household data, for example DHS data or Young Lives data, should include spatial/geographical information in order to ensure the viability of disaster impact analysis
- ✓ As a minimum child welfare data should be better disaggregated by age and gender
- ✓ Investment in capacity building at the local, regional and national scale to better collect and record disaggregated data on hazards and on child welfare outcomes is therefore required to improve data sets and knowledge on differentiated impacts of disasters on vulnerable sectors of the population

Policy and programme implications:

- ✓ Disaster risk reduction approaches need to be driven throughout both development and child-centred policy and programming and vice versa **-** to ensure that complementarity links should be strengthened between communities of practice and programmes seeking to achieve improved development outcomes (including the MDGs) and with DRR practitioners
- ✓ DRR interventions should be tailored to meet the needs of children at different ages and developmental stages. The views of children themselves should be integrated in the build-up of these programmes to better recognise different needs – as well as capacities
- ✓ Evidence of impacts on health, in particular nutritional status in Mozambique and Nepal, raises the need to further improve and invest in welfare interventions and safety net provision in areas where children are already susceptible to low welfare outcomes - there needs to be clear response and contingency plans within these programmes to cope with both low level and severe shocks from natural hazards
- ✓ Programmatic interventions targeted at improving child welfare must take into account the disaster profile of the area and ensure that interventions are resilient in the face of both low level frequent disasters but also high impact low frequency events - more needs to be done to reduce the impact of intensive risk which in some circumstances negates the unexpected gains of managing extensive risk
- ✓ Evidence of possible spatial inequity in access to resources and support in the face of disaster (extensive and intensive) needs to be addressed both by humanitarian agencies and development and DRR agencies
- ✓ Post-disaster aid and humanitarian agencies should ensure relationships with both government and development agencies that support rehabilitation and reconstruction programmes in 'building back better' and improving child welfare outcomes

Annex 1. Regression analysis

Estimation procedure: fixed vs. random effects

The argument to choose fixed (FE) or random effects (RE) relies on the nature of the problem being analyzed, which is reflected in the structure of the error term μ_{it} of the equation. The data available in our case corresponds to a region (province or district) which is observed along a period of time. Each region has its own particular characteristics – represented by α_i. If these characteristics are assumed to be fixed during the period of time observed, then the fixed-effects estimator is considered. If these characteristics are assumed to follow a process, for instance to be affected by the economic cycle or another non-fixed event, then the random-effects estimator should be chosen and the error term becomes $\mu_{it} + \alpha_i$.

It could be argued that in a 10-year period these characteristics may not change significantly, and thus, by choosing the fixed-effect (FE) estimator, the identification of the effect of a disaster event on children's outcomes would not be affected.

However, it could be argued that the period observed is long enough to have a significant change in regions' characteristics. If these changes affect children's vulnerability, the estimates of the effect of a disaster on children's welfare status could be biased. By choosing the random-effects (RE) estimator, the process behind the region's characteristics is controlled for, and the estimates recover the isolated effect of the disaster event on the dependent variable.

Although the coefficient of interest is β_3, it should be noted that the fixed effect estimator does not provide estimation for the coefficient of d_i. The reason for this is that the estimation process applies the average of the value of each variable within the same period to each observation. Given that d_i does not change along the period of observation for each period its value is the same as the average. This is not the case of the random-effects estimator. For further insights on these estimation procedures, see Cameron and Trivedi (2008), Wooldridge (2009) or Baltagi (2008).

The following table summarizes the models that are run for each country's development indicator in the case of external risks, considering the different treatment groups defined for each country, as well as the time distribution of disasters (see Annex 2). In the case of the models assessing extensive risks disasters, no alternative thresholds are considered to define treatment and control areas are considered, as it was mentioned earlier. Therefore, only FE and RE are reported for each model.

Table 13: List of models per country

	Model Indicator for evaluating extensive risks disasters in each country					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Bolivia[37]	d_i^M - FE	d_i^M - RE	d_i^1 - FE	d_i^1 -RE	-	-
Indonesia	d_i^M - FE	d_i^M - RE	d_i^1 - FE	d_i^1 -RE	d_i^2 - FE	d_i^2 -RE
Mexico	d_i^M - FE	d_i^M - RE	d_i^1 - FE	d_i^1 -RE	d_i^2 - FE	d_i^2 -RE
Mozambique (province)	d_i^M - FE	d_i^M - RE	d_i^1 - FE	d_i^1 -RE	d_i^2 - FE	d_i^2 -RE
Mozambique (district)	d_i^M - FE	d_i^M - RE	d_i^1 - FE	d_i^1 -RE	d_i^2 - FE	d_i^2 -RE
Nepal	d_i^M - FE	d_i^M - RE	d_i^1 - FE	d_i^1 -RE	d_i^2 - FE	d_i^2 -RE
Philippines	d_i^M - FE	d_i^M - RE	d_i^1 - FE	d_i^1 -RE	d_i^2 - FE	d_i^2 -RE
Vietnam	d_i^M - FE	d_i^M - RE	d_i^1 - FE	d_i^1 -RE	d_i^2 - FE	d_i^2 -RE

[37] The median of the distribution of extensive disasters per province in the period 1999-2009 is 1. Therefore, we only use 2 as an alternative threshold to define treatment areas, as using 0 would imply that all areas in Bolivia were treatment areas and no estimates would be produced.

Annex 2: Time distribution of disasters

The time distribution of disasters is calculated based on the *Desinventar* database. It provides the time distribution within the period 1999-2009 of the following variables:

(1) Number of deaths & missing inhabitants as a consequence of an extensive/intensive disaster,
(2) Number of houses destroyed and damaged as a consequence of an extensive/intensive disaster,
(3) Number of schools and hospitals affected a consequence of an extensive/intensive disaster, and
(4) Number of areas (region/province or municipalities/districts –according to the country) affected by an extensive/intensive disasters.

Based on the distribution at district or provincial scale, the pre/post period for intensive risk are determined. These are identified by the dummy variable p_t (1 if the year is considered post-period, and 0 otherwise).

Extensive risk disasters[38]

	Total average per province affected		
Bolivia	Deaths & missing	Destroyed and damaged Houses	Schools and Hospitals
1999	0.02	4.17	0.02
2000	1.19	4.19	0.00
2001	0.09	6.45	0.00
2002	0.95	4.95	0.05
2003	2.29	4.04	0.00
2004	0.04	4.19	0.02
2005	0.41	2.61	0.01
2006	0.15	10.19	0.10
2007	0.38	4.92	0.00
2008	0.00	0.00	0.00
2009	0.19	6.98	0.01

[38] All tables were build using Desinvetar data: http://www.desinventar.net/

	Total average per province affected		
Indonesia	**Deaths & missing**	**Destroyed and damaged Houses**	**Schools and Hospitals**
1999	0.32	62.39	0.68
2000	3.29	68.71	6.00
2001	1.64	55.72	0.16
2002	2.96	38.82	0.92
2003	1.14	32.97	4.07
2004	0.30	55.47	2.15
2005	0.28	73.53	0.49
2006	0.56	80.28	2.14
2007	0.64	116.25	3.70
2008	0.25	53.91	0.88
2009	0.13	30.60	0.63

	Total average per province affected		
Mexico	**Deaths & missing**	**Destroyed and damaged Houses**	**Schools and Hospitals**
1999	2.36	68.20	3.57
2000	0.89	51.38	0.00
2001	0.54	52.14	0.19
2002	0.56	59.38	0.04
2003	0.72	261.05	0.15
2004	0.77	51.83	0.03
2005	0.67	741.38	0.02
2006	0.49	31.86	0.02
2007	0.32	77.01	1.78
2008	0.25	76.21	0.45
2009	0.22	58.99	0.34

	Total average per province affected		
Mozambique	**Deaths & missing**	**Destroyed and damaged Houses**	**Schools and Hospitals**
1999	0.28	14.11	0.00
2000	0.94	18.94	0.00
2001	0.30	9.77	0.00
2002	0.23	42.15	0.00
2003	0.17	17.71	0.05
2004	0.11	15.77	0.00
2005	0.12	11.52	0.00
2006	0.08	16.65	0.00
2007	0.19	31.48	0.00
2008	0.26	50.08	0.00
2009	0.25	14.58	0.00

	Total average per province affected		
Nepal	Deaths & missing	Destroyed and damaged Houses	Schools and Hospitals
1999	1.10	12.70	0.01
2000	0.61	8.23	0.02
2001	0.55	8.73	0.01
2002	0.68	16.34	0.00
2003	0.90	4.25	0.04
2004	0.59	7.94	0.04
2005	0.43	5.96	0.05
2006	1.09	6.05	0.00
2007	2.09	8.60	0.06
2008	0.51	9.13	0.07
2009	0.53	13.16	0.05

	Total average per province affected		
Vietnam	Deaths & missing	Destroyed and damaged Houses	Schools and Hospitals
1999	3.74	337.93	0.00
2000	4.34	160.78	0.00
2001	3.29	212.22	0.00
2002	4.13	470.53	0.00
2003	2.20	203.71	0.00
2004	3.03	232.67	0.00
2005	3.18	196.56	0.00
2006	3.90	208.32	0.00
2007	3.82	506.43	0.00
2008	3.93	120.00	0.00
2009	4.06	96.18	0.00

Intensive risk disasters[39]

	Total average per province affected		
Bolivia	**Deaths & missing**	**Destroyed and damaged Houses**	**Schools and Hospitals**
1999	-	-	-
2000	-	-	-
2001	-	-	-
2002	69.00	0.00	0.00
2003	55.00	0.00	0.00
2004	-	-	-
2005	0.00	510.00	0.00
2006	-	-	-
2007	-	-	-
2008	-	-	-
2009	-	-	-

	Total average per province affected		
Indonesia	**Deaths & missing**	**Destroyed and damaged Houses**	**Schools and Hospitals**
1999	0.00	714.00	0.00
2000	96.50	50.00	0.00
2001	0.00	6179.00	16.00
2002	2.19	1952.81	12.19
2003	12.25	2028.72	6.81
2004	11068.93	14757.20	62.33
2005	105.67	9680.89	254.89
2006	288.04	14926.13	161.38
2007	15.60	7643.35	158.55
2008	5.00	2795.00	50.40
2009	66.83	22861.17	456.91

[39] As can be seen, many values are missing in these tables. This happens when there was no intensive disaster registered for a year.

	Total average per province affected		
Mexico	**Deaths & missing**	**Destroyed and damaged Houses**	**Schools and Hospitals**
1999	186.47	5056.79	445.26
2000	-	-	-
2001	-	-	-
2002	0.00	11515.67	0.00
2003	-	-	-
2004	0.00	1687.00	0.00
2005	10.38	37809.88	0.25
2006	-	-	-
2007	5.00	12918.42	126.50
2008	13.25	4530.50	110.25
2009	3.00	15500.00	0.00

	Total average per province affected		
Mozambique	**Deaths & missing**	**Destroyed and damaged Houses**	**Schools and Hospitals**
1999	-	-	-
2000	58.68	4750.75	0.00
2001	53.17	1694.50	0.00
2002	0.00	1135.00	0.00
2003	11.12	4756.94	0.00
2004	50.50	3119.50	0.00
2005	38.18	3265.09	0.00
2006	27.00	815.75	0.00
2007	1.96	4750.78	0.00
2008	4.39	2887.63	0.00
2009	1.33	1474.67	0.00

	Total average per province affected		
Nepal	**Deaths & missing**	**Destroyed and damaged Houses**	**Schools and Hospitals**
1999	-	-	-
2000	-	-	-
2001	-	-	-
2002	13.25	707.50	0.00
2003	-	-	-
2004	-	-	-
2005	-	-	-
2006	0.00	8315.00	0.00
2007	0.00	3100.00	0.00
2008	1.60	939.10	0.00
2009	0.00	534.00	30.00

	Total average per province affected		
Vietnam	Deaths & missing	Destroyed and damaged Houses	Schools and Hospitals
1999	95.13	7808.00	0.00
2000	68.00	966.50	0.00
2001	53.14	1123.71	0.00
2002	43.67	42258.00	0.00
2003	15.75	1134.25	0.00
2004	10.67	1269.33	0.00
2005	177.50	2564.00	0.00
2006	17.50	24014.63	0.00
2007	15.80	2196.00	0.00
2008	41.40	450.60	0.00
2009	39.17	10594.83	0.00

Annex 3: Regression analysis – Extensive risk disaster

These tables present the sign and significance of the coefficient $\beta 3$, which measures the impact of disasters on any of the variables listed in the first column of the table. The following columns present the different models that were estimated for each case to control for the sensitive of the results.

Bolivia – Extensive risk disaster

Bolivia Extensive Disaster	Time 1 / Treatment 1 - FE	Time 1 / Treatment 1 - RE	Time 1 / Treatment 2 - FE	Time 1 / Treatment 2 – RE	Time 2 / Treatment 1 - FE	Time 2 / Treatment 1 - RE	Time 2 / Treatment 2 - FE	Time 2 / Treatment 2 – RE	Comments
Education									
Net Enrolment Rate – Primary Education	(-) **	(-) **	(+) ***	(+) ***	(-) ***	(-) ***	(+) **	(+) **	- All significant - Opposite signs - Interaction between Time 1 and treatments is negative and significant - Interaction between Time 2 and treatments is positive and significant
Net Enrolment Rate – Secondary Education	(-)	(-)	(+)	(+)	(-)	(-)	(+)	(+)	- Same signs as for primary education but nothing is significant
Net Enrolment Rate – Preschool	(-)	(-)	(-)	(-)	(-) **	(-) **	0	0	- All negative except for Time 2 and treatment 2 - Only significant interaction between Time 2 and treatment 1
Net Enrolment Rate – All levels	(-) **	(-) **	(+) **	(+) **	(-) ***	(-) ***	(+) *	(+) *	- Similar analysis to primary education
Achievement Rate – 6 years of primary education	(-)	(-)	(+)	(+)	(-) **	(-) **	(+) *	(+) *	- All signs similar to primary education - Only significant for Time 2
Achievement Rate – 8 years of primary education	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(-)	- No significant results - All negative except for Time 1 and Treatment 1
Achievement Rate – 4th grade of secondary education	(+)	(+)	(+)	(+)	(+)	(+)	(+) **	(+) **	- All positive - Significant for Time 2 and Treatment 2
Gender gap in achievement rate – primary education	(+)	(+)	(-)	(-)	(+) ***	(+) ***	(+)	(+)	- All positive except for Time 1 and treatment 2 - Only significant when Time 2 and treatment 1
Gender gap in achievement rate – secondary education	(-)	(-)	(+)	(+)	(-)	(-)	(-)	(-)	- No significant results - Only positive when Time 1 and treatment 2
Drop out – Primary rate	~0	~0	0	0	~0	~0	~0	~0	- Very close to 0 - No significant result
Drop out – Preschool	(+) ***	(+) ***	(+)	(+)	(+) *	(+) *	(+)	(+)	- All positive - All significant except Time 1 and treatment 2
Drop out – Secondary school	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - All non significant
Transition rate – primary – secondary	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - All non significant
Health									
Vaccination coverage	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - All non significant
Rate of institutional births	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - All non significant
Incidence of diarrhoea per 1000 < 5 population	0	0	(+) ***	(+) ***	(+) *	(+) *	(+) ***	(+) ***	- All positive (or 0) - All but Time 1 and treatment 1 are significant
Incidence of IRA per 1000 < 5 population	(-)	(-)	(+)	(+)	(-)	(-)	(+)	(+)	- No significant result - Negative for interactions with Treatment 1 - Positive for interactions with Treatment 2

Indonesia - Extensive risk disaster

Indonesia Extensive Disaster	MODEL 1 Time / Treatmen t 7 - FE	MODEL 2 Time / Treatmen t 7 - RE	MODEL 3 Time / Treatmen t 6 - FE	MODEL 4 Time / Treatmen t 6 - RE	MODEL 5 Time / Treatmen t 9 - FE	MODEL 6 Time / Treatmen t 9 - RE	Comments
Education							
Net Enrolment Rate – Primary School	(+) ***	(+) ***	(+)	(+)	(-)	(+)	- All positive expect interaction except treatment 9 FE - Interaction with Treatment 7 is significant
Net Enrolment Rate – Secondary School	(+) ***	(+) ***	(+) ***	(+) ***	(+)	(+)	- All positive - Interaction with treatments 7 and 6 is significant
Participation rate in pre-school (4-6)	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant result
Drop out – Primary education	(+)	(-)	(-)	(-)	(+)	(+)	- No clear pattern - No significant result
Drop out – Secondary education	(+)	(+)	(+)	(+)	(-)	(-)	- Positive for interactions with Treatments 7 and 6 - No significant result
GER Primary	(+)	(+)	(-)	(-)	(-)	(-)	- Negative for interactions with Treatments 6 and 9 - No significant result
GER Secondary	(+) **	(+) ***	(+) **	(+) **	(+)	(+)	- All positive - Significant for interactions with Treatments 7 and 6
Health							
Infant mortality rate – SUPA estimates	(-)	(-)	(+)	(+)	(+)	(+)	- Positive for interactions with Treatments 6 and 9 - No significant result
% of children under 5 severely undernourished	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Poverty							
% of people living under poverty line	(+)	(+)	(+)	(+)	(+) *	(+) *	- All positive - Significant for interaction with Treatment 9
Share of houses with sustainable access to clear water	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
Share of houses with sustainable access to adequate sanitation	(-)	(+)	(+)	(+)	(-)	(-)	- No clear pattern - No significant result

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

Mexico - Extensive risk disaster

Mexico Extensive Disaster	MODEL 1 time / Treatment 90 – FE	MODEL 2 Time / Treatment 90 - RE	MODEL 3 Time / Treatment 100 - FE	MODEL 4 Time / Treatment 100 - RE	MODEL 5 Time / Treatment 110 - FE	MODEL 6 Time / Treatment 110 - RE	Comments
Education							
Net attendance ratio – Primary Schooling	(-)	(-)	(-)	(-)	(+)	(+)	- No significant result - Negative for interactions with treatment 90 and 100
Net attendance ratio – Secondary Schooling	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant result
Drop out rate – Primary education	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant results
Drop out rate – Secondary education	(+)	(+)	(-)	(-)	(-)	(-)	- No significant result - Negative for interactions with treatments 100 and 110
Health							
Child mortality rate (per 1000 under 1 year old)	(-)	(-)	(-)	(-)	(+)	(+)	- No significant results - Negative for interactions with treatments 90 and 100
Children population accessing water and sanitation	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant results
Children population accessing water and sanitation – urban areas	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant results
Children population accessing water and sanitation – rural areas	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
Share of children population accessing water	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
Share of children population accessing water – urban areas	(-)	(-)	(-) **	(-) **	(-) **	(-) **	- All negative - Significant for interactions with treatment 100 and 110
Share of children population accessing water – rural areas	(-)	(-)	(+)	(+)	(+)	(+)	- No significant effect - Positive for interactions with treatments 100 and 110
Share of children population accessing sanitation	(-)	(-)	(+)	(+)	(+)	(+)	- No significant effect - Positive for interactions with treatments 100 and 110
Share of children population accessing sanitation – urban areas	(-)	(-)	(-)	(-)	(-) **	(-) **	- All negative - Significant for treatment 110
Share of children population accessing sanitation – rural areas	(+)	(+)	(+) ***	(+) ***	(+) **	(+) **	- All positive - Significant for interaction with treatments 100 and 110
Poverty							
Income	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
Income – urban	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
Income – rural	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results

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

Mozambique - Extensive risk disaster

Mozambique Extensive Disaster	MODEL 1 Time / Treatmen t 3 – FE	MODEL 2 Time / Treatmen t 3 - RE	MODEL 3 Time / Treatmen t 4 - FE	MODEL 4 Time / Treatmen t 4 - RE	MODEL 5 Time / Treatmen t 2 - FE	MODEL 6 Time / Treatmen t 2 - RE	Comments
Education							
Attendance rate – Primary education	0	0	~0	~0	~0	~0	- Almost no effect
Attendance rate – Secondary education	(-)	(-)	(+)	(+)	(-)	(-)	- All very close to 0 - No significant result
Achievement rate – Primary education	(+)	(+)	(+)	(+)	(+)	(+)	- All positive (close to 0) - No significant result
Achievement rate – Secondary education	(+)	(+)	(+)	(+)	0	0	- All positive (close or equal to 0) - No significant result
Drop out rate – Primary education	~0	~0	~0	~0	~0	~0	- Almost no effect
Drop out rate – Secondary education	(-)	(-)	(+)	(+)	(-)	(-)	- All very close to 0 - no significant result
Health							-
Number of first medical visits (0-11 months)	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant result
Number of follow up medical visits (0-11 months)	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant result
Low birth weight (<2.5 kg over total born)	(+) **	(+) **	(+) **	(+) **	(+) **	(+) **	- All positive - All significant

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

Nepal - Extensive risk disaster

Nepal Extensive Disaster	MODEL 1 Time / Treatment 29 – FE	MODEL 2 Time / Treatment 29 - RE	MODEL 3 Time / Treatment 39 - FE	MODEL 4 Time / Treatment 39 - RE	MODEL 5 Time / Treatment 49 - FE	MODEL 6 Time / Treatment 49 - RE	Comments
Education							
Total number of students enrolled in ECD/PPC - boys	(+)	(+)	(+)	(+)	(-)	(-)	-
Total number of students enrolled in ECD/PPC – girls	(+)	(+)	(+)	(+)	(-)	(-)	-
Total number of students enrolled in ECD/PPC	(+)	(+)	(+)	(+)	(-)	(-)	-
Students enrolled in primary education	(-)	(-)	(+)	(+)	(+)	(+)	-
Students enrolled in secondary education	(+)	(+)	(+) **	(+) **	(+) ***	(+) ***	- All positive - Significant for interaction with treatments 39 and 49
Total number of schools	(+) ***	(+) ***	(+) ***	(+) ***	(+) ***	(+) ***	- All positive - All significant
Gross intake ratio grade 1	(-) ***	(-) ***	(-)	(-)	(-)	(-)	- All negative - Significant for interaction with treatment 29
Gross enrolment rate – Lower secondary	(-)	(-)	(-)	(-)	(+)	(+)	-
Gross enrolment rate – Primary	(-) ***	(-) ***	(-) **	(-) **	(-) *	(-) *	- Al negative - All significant
Gross enrolment rate –Secondary	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
Health							
Incidence of Diarrhoea per 1000 < 5 years old population	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
Diarrhoeal deaths per 1000 < 5 pop	(-)	(-)	(+)	(+)	(+)	(+)	-
Case fatality rate / 1000	(+) **	(+) **	(+) **	(+) **	(+) **	(+) **	- All positive - All significant
Incidence of ARI per 1000 < 5 year population	(-) ***	(-) ***	(-)	(-)	(-)	(-)	- All negative - Significant for interaction with treatment 29
ARI – Incidence of Pneumonia (Mild + Severe) / 1000 < 5 children	(-) ***	(-) ***	(-) ***	(-) ***	(-)	(-)	- All negative - Significant for interaction with treatments 29 and 39
ARI case fatality rate / 1000	(+)	(+)	(+) **	(+) **	(+)	(+)	- All positive - Significant for interaction with treatment 39
ARI mortality per 10000 target population	(-)	(-) *	(-)	(-)	(-)	(-)	- All negative - Only significant interaction with 29 (RE)
ARI - % on new cases treated with antibiotic	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant results
DPT 3 coverage	(-) **	(-) **	(-) ***	(-) ***	(-) *	(-) *	- All negative - All significant
Measles coverage	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
BCG vs measles drop out	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
DPT wastage rate	(-) ***	(-) ***	(-) **	(-) **	(-) *	(-) *	- All negative - All significant
Prop. of malnourished children (weight/age) < 3 children	(+)	(+)	(+) *	(+) *	(+)	(+)	- All positive - Significant for interaction with treatment 39

Philippines - Extensive risk disaster

Philippines Extensive Disaster	MODEL 1 Time / Treatment 11 – FE	MODEL 2 Time / Treatment 11 - RE	MODEL 3 Time / Treatment 12 - FE	MODEL 4 Time / Treatment 12 - RE	MODEL 5 Time / Treatment 13 - FE	MODEL 6 Time / Treatment 13 - RE	Comments
Education							
Enrolment – Primary education	0	0	0	0	0	0	-
Enrolment – Secondary education	0	0	0	0	0	0	-
Achievement – Primary education	(+)	(+)	(-)	(-)	(+)	(+)	-
Achievement – Secondary education	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant results
Drop out rate – Primary education	(-)	(-)	(+)	(+)	(-)	(-)	-
Drop out rate – Secondary education	(-) *	(-) *	(-) *	(-) *	(-) *	(-) *	- All negative - All significant
Cohort survival rate – Primary education	(-)	(-)	(-)	(-)	(+)	(+)	-
Cohort survival rate – Secondary education	(+) *	(+) *	(+) *	(+) *	(+) *	(+) *	- All positive - All significant

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

Vietnam - Extensive risk disaster

Vietnam Extensive Disaster	MODEL 1 Time / Treatment 5 – FE	MODEL 2 Time / Treatment 5 - RE	MODEL 3 Time / Treatment 6 - FE	MODEL 4 Time / Treatment 6 - RE	MODEL 5 Time / Treatment 7 - FE	MODEL 6 Time / Treatment 7 - RE	Comments
Education							
NER – Primary School	(+)	(+)	(-)	(-)	(-)	(-)	-
NER – Lower Secondary	(+) ***	(+) ***	(+) ***	(+) ***	(+) **	(+) ***	- All positive - All significant
Achievement – lower secondary	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Achievement – lower upper secondary	(+)	(+)	(-)	(-)	(-)	(-)	-
Number of classes	(-) **	(-) **	(-) ***	(-) ***	(-) ***	(-) ***	- All negative - All significant
Number of pupils	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Number of teachers	(-) **	(-) **	(-) **	(-) **	(-) **	(-) **	- All negative - All significant
Total number of students	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Total number of students – primary education	(-) ***	(-) ***	(-) ***	(-) ***	(-) ***	(-) ***	- All negative - All significant
Total number of students – lower secondary	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant result
Total number of students – upper secondary	(+) **	(+) **	(+) ***	(+) ***	(+) ***	(+) ***	- All positive - All significant
Number of schools – Primary education	(-)	(-)	(-)	(-)	(-) *	(-) *	- All negative - Only significant for interaction with treatment 7
Number of schools – Lower secondary	(+)	(+)	(+)	(+)	(+) **	(+) **	- Al positive - Only significant for interaction with treatment 7
Number of schools – Upper secondary	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant result
Total number of schools	(+) ***	(+) ***	(+) ***	(+) ***	(+) **	(+) **	- All positive - All significant
Total number of teachers	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant result
Total number of teachers – primary education	(-)	(-)	(-)	(-)	(-) **	(-) **	- All negative - Only significant for interaction with treatment 7
Total number of teachers – lower secondary	(+) ***	(+) ***	(+) ***	(+) ***	(+) ***	(+) ***	- All positive - All significant
Total number of teachers – upper secondary	(+)	(+)	(+)	(+)	(-)	(-)	-
Total number of classes	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Total number of classes – primary	(-)	(-)	(-)	(-)	(-)	(-)	- All negative

education	**	**	**	**	***	***	- All significant
Total number of classes – lower secondary	(+)	(+)	(+) *	(+) *	(+) **	(+) **	- Al positive - Only significant for interaction with treatment 7
Total number of classes – upper secondary	(+)	(+)	(+) **	(+) **	(+) **	(+) **	- Al positive - Significant for interaction with treatments 6 and 7
Health							
Infant mortality rate	(+) ***	(+) ***	(+) ***	(+) ***	(+) **	(+) ***	- All positive - All significant
Rate of births attended by skilled health personnel	(+)	(+)	(+)	(+)	(+)	(+)	- All positive - No significant result
% of people with access to improved sanitation facilities	(-)	(-)	(-) *	(-) *	(-) **	(-) **	- All negative - Significant for interaction with treatments 6 and 7
% of people with sustainable access to an improved water source	(-)	(-)	(-) *	(-) *	(-) **	(-) **	- All negative - Significant for interaction with treatments 6 and 7
Underweight - moderate (%)	(+)	(+)	(+)	(+)	(+) *	(+) *	- Al positive - Only significant for interaction with treatment 7
Underweight - severe (%)	(-) **	(-) **	(-) **	(-) **	(-) ***	(-) ***	- All negative - All significant
Underweight – very severe (%)	(-)	(-)	(-)	(-)	(-) *	(-) *	- Al negative - Only significant for interaction with treatment 7
Stunting - moderate (%)	(+)	(+)	(+)	(+)	(+) **	(+) **	- Al positive - Only significant for interaction with treatment 7
Stunting - severe (%)	(-) *	(-) *	(-) **	(-) **	(-) ***	(-) ***	- All negative - All significant
Wasting (%)	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Health services provided by a doctor	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Health services provided by a physician	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Health services provided by a nurse	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Health services provided by a midwife	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result
Poverty							
Income	(-)	(-)	(-)	(-)	(-)	(-)	- All negative - No significant result

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

Annex 4: Regression analysis – Intensive risk disaster

Bolivia – Intensive risk disaster

Bolivia Intensive Disaster	Time / Treatment 2 - FE	Time / Treatment 2 - RE
Education		
Net Enrolment Rate – Primary Education	(-)	(-)
Net Enrolment Rate – Secondary Education	(-)	(-)
Net Enrolment Rate – Preschool	(-)	(-)
Net Enrolment Rate – all levels	(-)	(-)
Achievement Rate – 6 years of primary education	(-)	(-)
Achievement Rate – 8 years of primary education	(-)	(-)
Achievement Rate – 4th grade of secondary education	(-)	(-)
Gender gap in achievement rate – primary education	(+)	(+)
Gender gap in achievement rate – secondary education	(+)	(+)
Drop out – Primary rate	(+)	(+)
Drop out – Preschool	(-)	(-)
Drop out – Secondary school	(+)	(+)
Transition rate – primary – secondary	(-)	(-)
Health		
Vaccination coverage	(-)	(-)
Rate of institutional births	(-)	(-)
Incidence of diarrhoea per 1000 < 5 population	(+)	(+)
Incidence of IRA per 1000 < 5 population	(-)	(-)

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

Indonesia – Intensive risk disaster

Indonesia Intensive Disaster	Time / Treatment 2 - FE	Time / Treatment 2 – RE
Education		
Net Enrolment Rate – Primary School	(-)	(-)
Net Enrolment Rate – Secondary School	(-) ***	(-) ***
Participation rate in pre-school (4-6)	(+) ***	(+) ***
Drop out – Primary education	(-)	(-)
Drop out – Secondary education	(-)	(-)
GER Primary	(+)	(+)
GER Secondary	(-) **	(-) **
Health		
Infant mortality rate – SUPA estimates	(+) ***	(+) ***
% of children under 5 severely undernourished	(-)	(-)
Poverty		
% of people living under poverty line	(+) ***	(+) ***
Share of houses with sustainable access to clear water	(-)	(-)
Share of houses with sustainable access to adequate sanitation	(-) ***	(-) ***

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

Mexico – Intensive risk disaster

Mexico Intensive Disaster	Time / Treatment 2 – FE	Time / Treatment 2 - RE
Education		
Net attendance ratio – Primary Schooling	(+)	(+) *
Net attendance ratio – Secondary Schooling	(-)	(-)
Drop out rate – Primary education	(-)	(-) *
Drop out rate – Secondary education	(-)	(-)
Health		
Child mortality rate (per 1000 under 1 year old)	(-) **	(-) **
Children population accessing water and sanitation	(-)	(-)
Children population accessing water and sanitation – urban areas	(+)	(+)
Children population accessing water and sanitation – rural areas	(-)	(-)
Share of children population accessing water	(+)	(+)
Share of children population accessing water – urban areas	(+) *	(+)
Share of children population accessing water – rural areas	(+)	(+)
Share of children population accessing sanitation	(-)	(-)
Share of children population accessing sanitation – urban areas	(-)	(-)
Share of children population accessing sanitation – rural areas	(-)	(-) *
Poverty		
Income	(+)	(+)
Income – urban	(-)	(-)
Income – rural	(+)	(+)

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

Mozambique – Intensive risk disaster

Mozambique Intensive Disaster	Time / Treatment 2 – FE	Time / Treatment 2 - RE
Education		
Attendance rate – Primary education	(+)	(+)
Attendance rate – Secondary education	(+)	(+)
Achievement rate – Primary education	(+) *	(+) *
Achievement rate – Secondary education	(+) ***	(+) ***
Drop out rate – Primary education	(+)	(+)
Drop out rate – Secondary education	(+)	(+)
Health		
Number of first medical visits (0-11 months)		
Number of follow up medical visits (0-11 months)		
Low birth weight (<2.5kg over total born		

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

Vietnam – Intensive risk disaster

Vietnam Intensive Disaster	Time / Treatment 2 - FE	Time / Treatment 2 - RE
Education		
NER – Primary School	(+)	(+)
NER – Lower Secondary	(+)	(+)
Achievement – lower secondary	(-)	(-)
Achievement – lower upper secondary	(+)	(+)
Number of classes	(+)	(+)
Number of pupils	**(-)**	**(-)**
Number of teachers	(+)	(+)
Total number of students	(-)	(-)
Total number of students – primary education	(-)	(-)
Total number of students – lower secondary	(-)	(-)
Total number of students – upper secondary	(+)	(+)
Number of schools – Primary education	(-)	(-)
Number of schools – Lower secondary	(-)	(-)
Number of schools – Upper secondary	(-)	(-)
Total number of schools	(-)	(-)
Total number of teachers	(+)	(+)
Total number of teachers – primary education	(-)	(-)
Total number of teachers – lower secondary	(+)	(+)
Total number of teachers – upper secondary	(+)	(+)
Total number of classes	(-)	(-)
Total number of classes – primary education	(-)	(-)
Total number of classes – lower secondary	(-)	(-)
Total number of classes – upper secondary	(+)	(+)
Health		
Infant mortality rate	(-)	(-)
Rate of births attended by skilled health personnel	(+)	(+)
% of people with access to improved sanitation facilities	(+)	(+)
% of people with sustainable access to an improved water source	(+)	(+)
Underweight - moderate (%)	(-)	(-)
Underweight - severe (%)	(-)	(-)
Underweight – very severe (%)	(-)	(-)
Stunting - moderate (%)	(+)	(+)
Stunting - severe (%)	(-)	(-)
Wasting (%)	(-)	(-)
Health services provided by a doctor	(-)	(-)
Health services provided by a physician	(-)	(-)
Health services provided by a nurse	(+)	(+)
Health services provided by a midwife	(-)	(-)
Poverty		
income	(-)	(-)

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

Philippines – Intensive risk disaster

Philippines Intensive Disaster	Time / Treatment 2 - FE	Time / Treatment 2 - RE
Education		
Enrolment – Primary education	(+)	(+)
Enrolment – Secondary education	(+)	(+)
Achievement – Primary education	(-)	(-)
Achievement – Secondary education	(-) **	(-) **
Drop out rate – Primary education	(+)	(+)
Drop out rate – Secondary education	(+) ***	(+) ***
Cohort survival rate – Primary education	(-)	(-)
Cohort survival rate – Secondary education	(-) ***	(-) ***

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

References

Baez, Javier E., A. de la Fuente, and I. Santos (2010). *"Do Natural Disasters Affect Human Capital? An Assessment Based on Existing Empirical Evidence"* IZA Discussion Papers 5164, Institute for the Study of Labor (IZA).

Baez, J. and I. Santos (2007) *Children's Vulnerability to Weather Shocks: A Natural Disaster as a Natural Experiment*. Mimeo

Bartlett, Sheridan (2008). *Climate Change and Urban Children – Impacts and Implications for adaptation in low- and middle-income countries*. Human Settlements Discussion Paper.

Bartlett, Sheridan (2009). *Children – a large and vulnerable population in the context of climate change*. Expert Group Meeting on Population Dynamics and Climate Change UNFPA and IIED

Cutter SL. (1995) 'The forgotten casualties: women, children, and environmental change' *Global Environmental Change* 5.3: 181-94

Lopez-Calva, Luis Felipe; et.al. (2009) *Evidence and Policy Lessons on the Links between Disaster Risk and Poverty in Latin America*. UNDP Regional Bureau for Latin America and the Caribbean. MPRA Paper No. 18342

Peek, L., (2008) 'Children and Disasters: Understanding Vulnerability, Developing Capacities and Promoting Resilience – An Introduction' Children, Youth and Environments, 18, 1-29.

Penrose, A. and M. Takaki (2006) 'Children's rights in emergencies and disasters' *The Lancet.* 367, 698-699.

Rodriguez-Oreggia, Eduardo; et.al. (2010) *The Impact of Natural Disasters on Human Development and Poverty at the Municipal Level in Mexico*. CID Working Paper No. 43.

Save the Children. 2007. Legacy of Disasters: The impact of climate change on children. London; Save the Children UK.

Save the Children. 2009. Feeling the Heat: Child Survival in a Changing Climate. London; Save the Children UK.

UNISDR (2009) Risk and Poverty in a Changing Climate: Invest today for a safer tomorrow. 2009 Global Assessment Report on Disaster Risk Reduction.