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Disaster Financing and Poverty Traps for Poor Households: Realities in Northern India

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Abstract

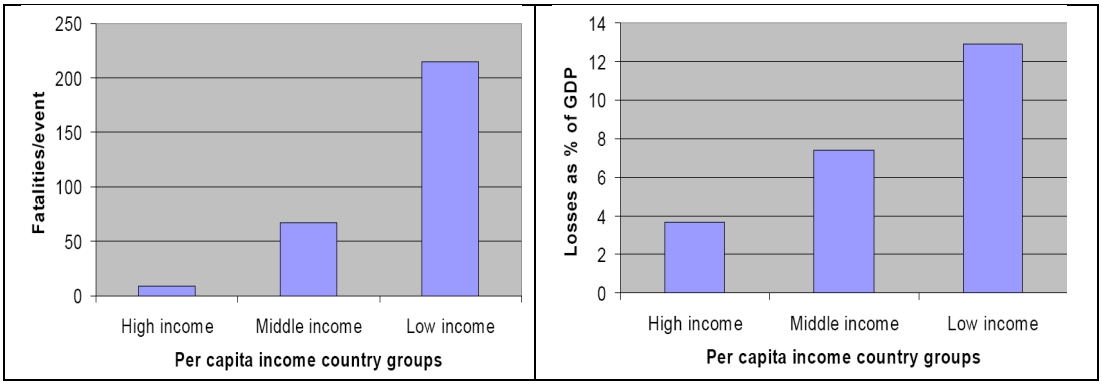
This paper addresses household-level disaster financing strategies of the poor in developing countries within the context of current poverty trap discussions. It presents findings on risk perceptions and loss financing practices in relation to floods and droughts in Uttar Pradesh, India. The study found that, due to financial shocks, the risk of households falling below the subsistence level and into a poverty trap is high. In this context, the paper links current approaches in household welfare-driven disaster risk financing to the survey results and provides policy recommendations.

Keywords: disaster risk financing, poverty traps, coping capacity, Uttar Pradesh.

Introduction

Natural hazards such as earthquakes, droughts and floods can cause devastating environmental and socioeconomic losses (Mechler 2004; Hochrainer 2006; Tran and Shaw 2007; Noy 2009). The poorer segments of society especially bear the greatest risk of detrimental disaster impacts due to their limited coping capacities such as lack of access to savings and credit, as well as higher physical vulnerability, due for example to low quality buildings (Blaikie et al. 1994; Benson and Clay 2004). This can be shown empirically by comparing the average number of fatalities per event (or losses per GDP) for high and low income country groups during the recent past (Figure 1). While high income countries incurred an average of three fatalities per disaster, low income countries incurred an average of 215 fatalities per event, i.e., 70 times higher. Similarly, losses as a percentage of GDP per event are much more severe for low income countries (13 percent) compared to high income countries (3.7 percent).

Figure 1. Comparison of Average Fatalities and Losses as Percent of GDP Per Disaster for High, Middle and Low Income Countries Between 1980 and 2004.



Source: Linnerooth-Bayer, Mechler and Pflug 2005.

In addition to the large direct impacts of natural disasters, especially on the poor, there is a growing awareness of the importance of the indirect long-term effects of such shocks on households and their livelihoods. The so-called "poverty trap", which is a situation in which recovery is not possible without external assistance, is now an important concept for tackling the issue of disaster financing and management, especially from a dynamic livelihood perspective (Bowels, Durlauf and Hoff 2006; Barrett et al. 2007). Empirical research in Ethiopia and Honduras by Carter et al. (2007) revealed that the poorest households struggle most with shocks that can trap them in an impoverished status from which they cannot escape. Such realities must be considered also from a donor perspective; limiting support to post-disaster assistance in times of crisis may not be sustainable in the long run and proactive strategies to decrease and spread risk should therefore also be investigated and supported (Linnerooth-Bayer, Mechler and Pflug 2005,

Miles and Morse 2007). Finally, disaster-related problems can easily transform into development challenges and can be considered as mutually dependent, sometimes multiplying the negative effects of disasters over the long-term (Mechler 2004; Hallegatte 2008).

In an effort to shed more light on the role of disasters in the context of current poverty trap discussions this paper (i) analyzes the different recovery strategies for disaster impacts for very poor households via detailed standardized household interviews, (ii) discusses the results in the context of poverty trap potentials, and (iii) provides suggestions on how poverty traps can be incorporated within dynamic risk-based livelihood modelling approaches, i.e., livelihood models where path dependencies and probabilities of events are explicitly incorporated. The results found in this paper serve as the starting point of a effort in which specific livelihood models are constructed and tested. The study site was in Uttar Pradesh which, in addition to facing a multitude of climate and weather-driven hazards, is one of the largest and poorest states in India. The following questions are specifically addressed within this paper:

- Question 1: What are the specific problems of disaster recovery financing for the poor, both from demand- and supply-side perspectives?
- Question 2: How can poverty trap issues be incorporated within disaster recovery financing decision-making? What are the challenges and limitations, and how could possible solutions look?
- Question 3 (empirical): Who are the rural communities in eastern Uttar Pradesh?
- Question 4 (empirical): What are their livelihoods, incomes and financial flows?
- Question 5 (empirical): How do communities perceive risk and how do hazards impact them, primarily in financial terms?
- Question 6 (empirical): How do they cope with hazards financially and what are the limitations they face?
- Question 7 (empirical): Are there further opportunities for reducing the financial impacts of disasters?
- Question 8: What are the policy implications of improved understanding gained from the questions above in the specific context of poverty traps at the household level?

The paper is organized as follows. In the next section, the first and part of the second question are addressed. Section three then introduces the study area and survey methods. In section four, the statistical analyses of the interviews are presented and discussed, i.e., questions three to seven are analyzed. Section five summarizes the findings in terms of remaining gaps and suggestions for the future (especially for Question 2), and ends with a discussion of potential policy interventions in light of poverty trap issues (Question eight).

Background and Motivation

We start with an explanation of key terms in the hazard management field that are needed for our analysis and proceed with a discussion of the current poverty trap literature.

Disasters and Hazard Management

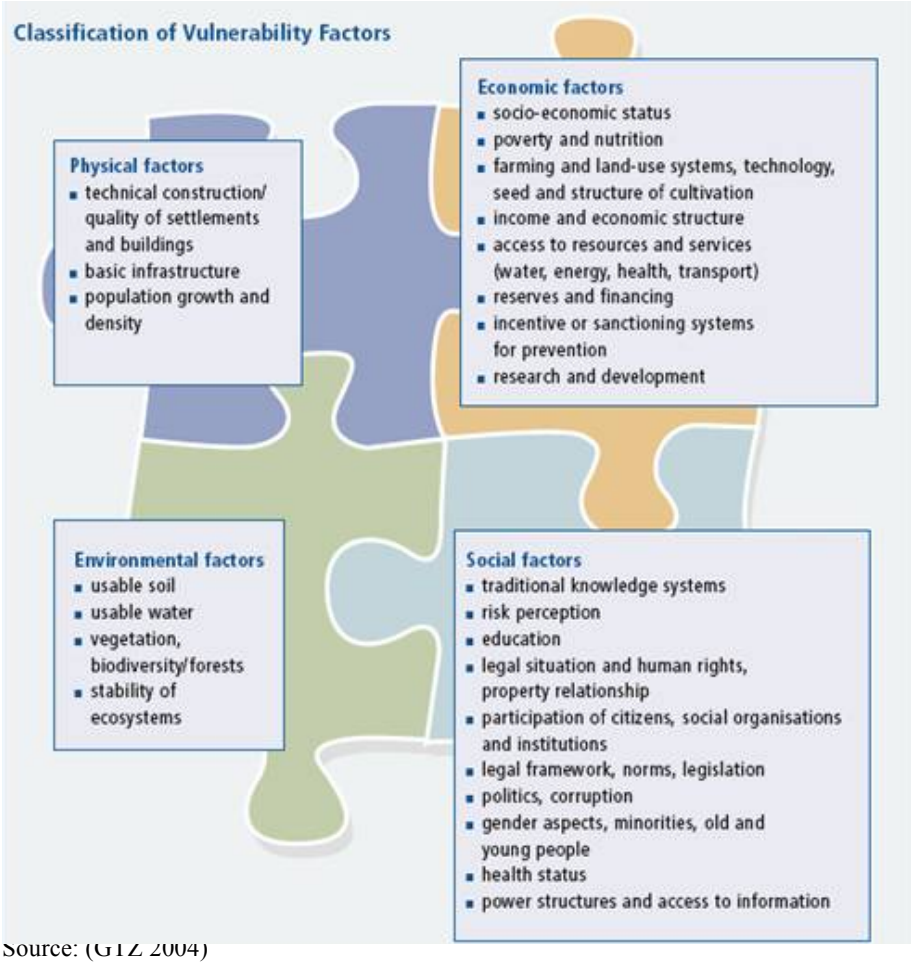
Disaster impacts can be grouped into economic (e.g., buildings destroyed), humanitarian (e.g., lives lost, people affected, psycho-social trauma) and ecological effects (e.g., damage to ecosystems, loss of arable land). Furthermore, the effects can be separated temporally into direct and indirect (long-term) effects—sometimes referred to as stock and flow effects, respectively (Mechler 2004). Direct effects happen due to the disaster itself or follow-on destruction, e.g., fires. Indirect effects occur as a consequence of the direct losses, e.g., business interruption, wage loss, or loss in biodiversity. The magnitude of the direct effects is usually determined by three pre-impact conditions that together determine risk: hazard, exposure, and vulnerability (Grossi and Kunreuther 2005). Hazard analysis involves identifying the type of hazards affecting a certain area with specific intensity and frequency. Assessing exposure involves analyzing the relevant elements (population, assets) exposed to hazards in a given area. Vulnerability is the most controversial concept in the literature as it is a multidimensional concept encompassing a large number of factors that can be grouped into physical, economical, social and environmental factors (GTZ 2004) as outlined in the Figure 2 and listed below:

- Physical: related to the susceptibility to damage of infrastructure such as houses, dams or roads.
- Social: defined by the ability to cope with impacts at the individual level as well as referring to the existence and robustness of institutions to deal with and respond to natural disaster.
- Economic: refers to the economic or financial capacity to refinance losses and recover quickly to a previously planned economic activity path. This may relate to private individuals as well as the commercial sector, asset bases and financing arrangements, or to governments that often bear a large share of a country's risk and losses.
- Environmental: a function of factors such as land and water use, biodiversity and stability of ecosystems.

Vulnerability is always defined in reference to one or more hazards. Hence, different types of vulnerabilities are seen as especially important across disciplines. While in the natural and actuarial science disciplines, vulnerability is usually referred to as physical vulnerability, i.e. susceptibility to damage which is used for example in catastrophe

model approaches to calculate the probability (risk) of losses (Grossi and Kunreuther 2005), in the social sciences social vulnerability defined as susceptibility to behavioural changes, is seen as an additional important element as it affects exposure, physical vulnerability and long term consequences (see Lindell, Prater and Perry 2006). To avoid confusion, we will always explicitly refer in the text to the specific type of vulnerability under discussion.

Figure 2. Classification of Vulnerability Factors.



Source: (GTZ 2004)

To decrease the risk of catastrophic events to acceptable levels, "environmental risk management" (Lindell and Perry 2004) is needed. This can be conceptualized in terms of four phases: disaster mitigation, emergency preparedness, emergency response and disaster recovery. Disaster mitigation activities aim to eliminate or reduce the impacts of a disaster either by modifying the event system (which is usually not possible for natural hazards) or the human system or both. Emergency preparedness refers to the need for contingency plans, procedures and resources shortly after an event, so that a timely and

effective emergency response can be established. Emergency response starts with the detection of the event and ends with the stabilization of the situation and functioning of the community, society and/or country to acceptable levels. The final phase is disaster recovery, which can be separated into short-term (relief and rehabilitation) and long-term (reconstruction) phases.

Disaster recovery financing mechanisms, including ex-post measures such as loans and grants as well as ex-ante measures such as hazard insurance, are important to decrease the economic vulnerability of an agent. However, regarding Question 1 in the introduction, poor countries generally lack insurance markets or affordable premiums (Linnerooth-Bayer et al. 2005). Hence, poor households are often primarily dependent on informal recovery financing strategies, such as geographical diversification through family networks and migration, some limited savings and/or informal insurance arrangements with neighbours (Benson and Clay 2000; Warner, Bouwer and Ammann 2007). While such strategies are useful for more frequent events, they tend to fail in the face of larger-scale disasters as spatial diversification and informal arrangements are often overwhelmed (Benson and Clay 2004). Due to the failure of traditional recovery mechanisms negative long-term consequences (high indebtedness) can be expected, potentially leading into a poverty trap situation.

Poverty Traps

Poverty trap research is a relatively new field but should be an important concept within the disaster management community, partly due to its relevance for novel disaster recovery financing strategies such as index-based insurance (Question 2 in the introduction section will now be addressed). Discussions on how to define the root causes of poverty traps are closely related with questions addressing if empirical evidence of such traps can be found. A prominent empirical study, amongst others, that found evidence for the existence of poverty traps was performed by Carter et al. (2007) for Honduras and Ethiopia. The authors defined a poverty trap in regards to a minimum asset threshold, below which livelihood growth is not feasible anymore. By analyzing the asset dynamics of households due to severe environmental shocks in both countries they estimated threshold models of poverty traps and found low-level equilibriums in both cases. For example they concluded, while pointing out that some strong assumptions had to be made, Honduran households falling below an asset threshold of $250 are expected to fall into such traps. An important empirical observation in the case of Ethiopia was that, even in times of severe losses and consequently lower income and consumption, poor households try to hold on to their few assets, which is seen as an expected behaviour in the face of a poverty trap (Carter et al. 2007). However, empirical evidence of the suggested poverty trap mechanism in the literature is still challenged and heavily discussed (see Azariadis and Stachurski, 2005; Barnett et al. 2008; and especially Perry et

al. 2006 on virtuous and vicious circles). For example, based on aggregate growth models by Kraay and Raddatz (2007), no empirical evidence was found that poverty traps arise due to low savings or low technology at low levels of development, challenging the idea that large scaling-up of aid to the poorest countries could "jump-start" a sustainable growth process. Antman and McKenzie (2007) included non-linear income dynamics at the household level in urban Mexico by using pseudo panel methods but did not find indications of a poverty trap (however, it was observed that below some threshold the growth process would take rather long).

This paper cannot add value to the empirical observation of poverty traps because our disaster recovery financing and poverty analysis is unavoidably backwards-looking and, without any longitudinal or panel data, is unable to distinguish between chronic and transitory poverty or between structural and stochastic transition limits. However, the findings presented here are needed to provide baseline estimates for calibration and testing of recovery financing strategies within dynamic poverty or livelihood models (fourth generation approaches, cf. Carter and Barret 2006). In addition, these findings identify behavioural responses to shocks such as natural disasters; provide information about risk perception, emergency response, and recovery strategies; and identify current stocks of assets and financial flows for given household groups. Such results are of utmost importance for donors and policy makers trying to answer the question how the poorest of the poor can best be helped to help themselves. This includes insights on what interventions would be best to maintain households on a sustainable growth path or at least above the subsistence level over the long run. These objectives could be achieved by, for example, creating access to insurance markets, credit instruments, structural mitigation measures and new novel insurance products that have been especially designed for the poor, namely index-based insurance.

The combination of recovery financing strategies within poverty trap models is also still in its infancy. Barret et al. (2007) uses threshold-based poverty trap concepts to determine which kind of risk financing strategy would fit best, dependent on the current wealth status of households. Sometimes poverty traps are only one dimension within a general economic growth model approach (such as analysis of development traps (Azardiadis and Drazen 1990) or business cycle models (Schenk-Hoppe 2005). In such studies poverty traps represent a point of no return, while all other stable (equilibrium) states (Barrett and Swallow 2006) can be seen as a result of choices reflecting different trade-offs between stability and growth. However, stock (asset based) and flow effects are not clearly distinguished within the poverty trap literature, but would be important for determining long-term livelihood patterns. For example, borrowing capacity is usually assumed to be zero for the poor, but this is not always the case, as our survey results show. It is interesting to note that risk perceptions of households are often neglected too. However, household behavioural responses are dependent on the perception of the threat, available protective actions, and their own capacities (Slovic 2000; Lindell and Perry

2004). Especially the perception of personal risk, e.g., the expectation of personal exposure to property damage, is a critical variable in the decision process (for a comprehensive discussion see Lindell and Perry 2004).

While poverty trap models are very useful to understand possible household livelihood dynamics, there is the additional challenge that while the concepts and mathematical treatment of/against poverty traps becomes more sophisticated, the realities of people in poverty are less and less well understood. Official statistics often do not address these groups in sufficient detail to enable more than qualitative inputs. Quantitative poverty trap models cannot be built without such additional data, as they are critical within every livelihood model approach. Without this data, models cannot be calibrated nor can policy recommendations be formulated based on conclusive results, as the baseline (real) case cannot be determined. We now proceed to answer Questions 3 to 7, first describing the study area in more detail and explaining the methodology used.

Study Area and Methodology

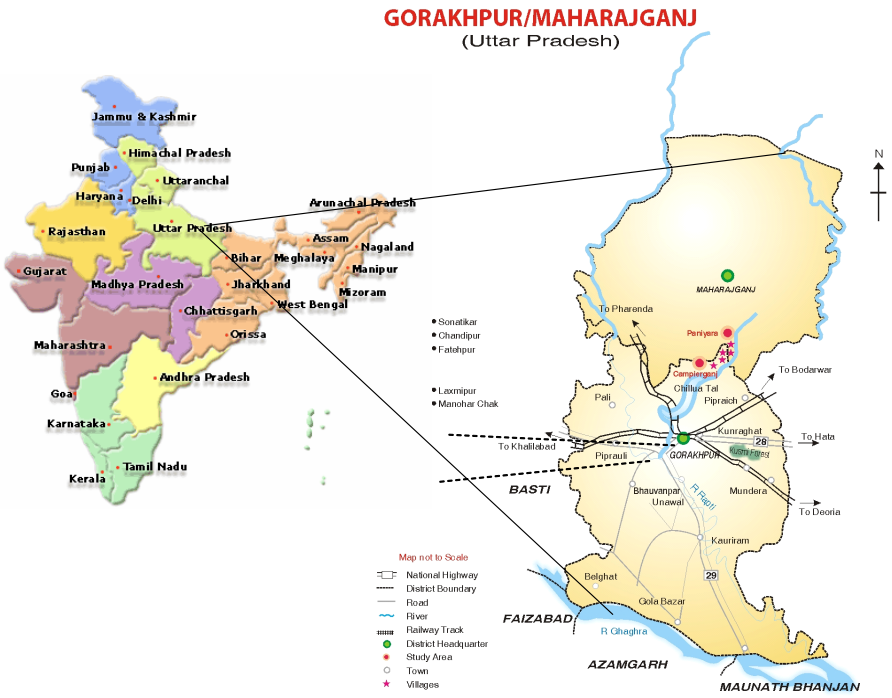
Uttar Pradesh (UP, see Figure 3) is one of the largest (geographically) and poorest states in India with an annual per capita income of around INR 10,500 (US$ 265) and roughly 40 percent of its population considered below the poverty line. It (according to the 2001 Census) continues to be the most populated state in the country, despite the state of Uttarankhand being carved out of it in 2000. UP has a population of over 166 million, of which approximately 80 percent reside in rural areas. UP belongs to the lowest strata of development, based on the Human Development Index (HDI) value (0.528 in 2006).

UP's economy has been predominantly agrarian (it is considered the bread basket of India) and the performance of agriculture and allied activities are critical in determining the growth rate of its economy. The primary sector, which is the part of the economy that collects and process natural resources such as raw material and basic foods (e.g., agriculture, mining, forestry, farming, fishing) contributed around 36.8% to the State's income in 2003-04 and provided employment to 66% of all workers (Kumar 2005). However, the share of this sector in state income has been declining over recent years while the contribution of the tertiary sector, the sector that provides services to the general population and to businesses, has been increasing.

UP faces many natural hazards, primarily climate and weather-driven: floods, droughts and fire. Annually around 2.7 million hectares are affected by floods in the State resulting in annual losses of INR 4.32 billion (US$ 93 million). In recent years, droughts have also taken a significant toll, with 2002 and 2004 experiencing severe events resulting in losses to crops (including livestock) and property amounting to INR 75.40 billion (US$ 1.6 billion) and INR 72.92 billion (US$ 1.57 billion), respectively (Disaster Management Cell, Government of Uttar Pradesh).

The Rohini Basin, which includes part of the districts of Gorakhpur and Maharajganj in eastern Uttar Pradesh, was selected as the study area due to its substantial drought and flood risk as well as high poverty levels. Considering the importance of local geographical location with regards to the different hazards, two different sampling strategies were developed.

Figure 3. Map of India, Uttar Pradesh state and the districts of Gorakhpur and Maharajganj.



For flood sampling, a two stage strategy was adopted. Villages were selected from the, upper, middle and lower sections of the Rohini River Basin. Villages were then selected within each of these basin sections based on their distance from the river banks. A complete list of existing villages was compiled on the basis of Census of India 2001. After random sampling, 28 villages were visited to (i) collect preliminary information by generating basic social-resource maps, (ii) verify the distances of villages from river banks, and (iii) collect information on decentralized community-driven flood management interventions implemented by non-governmental organizations (NGOs). Seventeen villages were ultimately selected for detailed surveys, again based on their location in the different basin sections and distances from the river banks. They are spread over an area of 1945 sq. km within both districts of Gorakhpur and Maharajganj. A total of 204 households were then randomly selected from these villages. Although

data was collected for more households (250), 46 could not be used for analysis as the responses were not consistent throughout the questionnaire.

The identification of the set of villages for the drought survey was different than for the flood survey. Villages were chosen based on simple random sampling on a single level of stratification. Specifically, the study area was identified on the basis of government declarations, e.g., Nautanwa tehsil (an administrative sub-district) was declared "drought affected" by the UP Government in 2004. Villages were classified on the basis of one important parameter for drought management, namely availability of irrigation. A random selection was performed on the basis of these criteria and ten villages were selected; three where government group tube-wells existed, three that were within the command area of a government irrigation canal, and four where there was no government irrigation. A random sampling of households in these villages was performed, resulting in the selection of 120 households.

The different sampling sizes for the flood and drought surveys are a result of the different sizes of the study areas. For drought, the study area comprised one tehsil, whereas for flood it was the entire basin (consisting of six tehsils). Thus, the flood affected households were spread over a larger area than the drought affected households resulting in the sample size for floods (204) being higher than that for drought (120).

The process of primary data collection was initiated with an exploratory visit involving a brief pilot study. The pilot study involved interviews and shared learning dialogues in both flood and drought affected villages. Primary data was collected through household surveys, with separate questionnaires developed for flood and drought study areas. Despite focusing on different hazards, both questionnaires queried common household-specific information including income, expenditure patterns, savings, borrowing, and risk financing strategies. Based on data requirements and pilot study observations, these field-based questionnaires were first formulated in English. A review of existing literature (for example Sinha 1999; Rathore 2005; Pandey et al. 2007) and available secondary data (Census of India, Statistical Abstract of Government of Uttar Pradesh and published data of other government departments) was concurrently undertaken to support finalization of the questionnaires. Testing was performed in randomly selected households from the set of predefined villages covering the entire study area. Responses from the testing were used to further modify the questionnaires resulting in a final draft that was translated into the local language (Hindi), and the consistency of these questionnaires were then checked by back-translating into English.

Questionnaire responses were coded and measured in different scales, resulting in most of the collected data being quantitative. Questions related to disaster perceptions, financial coping, and risk financing perspectives were either represented on 5 point Likert or nominal scales. Similarly, questions pertaining to basic household financial characteristics and disaster impacts were measured using both ratio and nominal scales. Although some questions were open ended and qualitative in nature, they pertained

mostly to the perception of the households regarding disaster events and disaster risk reduction options.

Surveying targeted the heads of households, under the assumption that he/she was the one who was best able to recall and quantify household economic activities and coping strategies. On average, each interview took around 35-40 minutes to fill the questionnaires. The survey was carried out for a period of four months covering the late-winter and early-spring season 2007-08, as villagers are not busy with cultivation-related work during this period.

Statistical tests for differences between sub-groups, either in the drought or flood hazard sample or both, was based on *t*-tests (where variables were normally distributed) or non-parametric tests such as the Mann-Whitney U test. The differences are considered to be significant or highly significant if the corresponding p-values of the respective tests are $p \leq 0.05$ or 0.01, respectively. Sometimes, especially if the skewness coefficient was too high, the median was used instead of the mean. To avoid confusion it is always stated explicitly which measure is used. Furthermore, we sometimes distinguish (where meaningful) between different wealth classes in the sample using the official poverty line definitions of the Government of India (see Table 1), and between the flood and drought samples.

Table 1. Wealth Classes Based on the Poverty Line Definition by the Government of India Derived From Minimum Annual Consumption Requirements.

Class	Annual consumption per person (in INR)	Annual consumption per person (US)	Class Name (unofficial, only for reference)
1	0-4380 (below poverty line "BPL")	< $111	Very poor
2	4381-6576 (1-1.5*PL)	$111 - $166	Poor
3	6577-8760 (1.5-2*PL)	$166 - $222	Middle
4	>8761 (2*PL)	> $222	Rich

Results are categorized by different household disaster recovery financing aspects and the questions stated in the *Introduction*: disaster perceptions, basic financial characteristics, disaster impacts, utilized financial coping mechanisms, and risk financing perspectives.

Results

The total sample size was 324 with 204 observations in the flood sample and 120 in the drought sample. We start first with socio-economic and other general relevant information of the respective samples (i.e., Questions 3 and 4).

Socio-economic Household Characteristics

The average household size is similar in both samples with seven persons (median) per household, receiving an average annual income of about $721 (all monetary values are reported in US, having been converted from Indian Rupees (INR) using the average exchange rate during the period of survey of 39.5 INR/US) (see table 2).

Table 2. Median Household Income, Land Owned, Debt, and Savings.

Wealth Class	Percent of sample	Annual Household Income	Land owned (in ha)	Total outstanding loan(s)	Savings
All	100.0	$721	0.320	$76	$13
Very poor	40.9	$458	0.203	$51	$0
Poor	24.7	$814	0.324	$58	$13
Middle	12.8	$1,104	0.608	$101	$13
Rich	21.6	$2,075	0.810	$152	$20

All of the variables in Table 2 except for outstanding loans show highly significant differences according to wealth class (Kruskal Wallis test for Income $H = 188.26$, $p < .000$, $df = 3$; Land size $H = 24.26$, $p < .000$, $df = 3$; Savings $H = 19.74$, $p < .000$, $df = 3$). The very poor are (unsurprisingly) far worse off than the other groups, except for outstanding loans where the poor have only slightly higher loans than the very poor.

Regarding castes, nearly 60 percent of the total sample is OBC (other backward classes), being nearly the same in both samples (55.8% for drought and 61.6% for flood). The caste system remains a social and political reality in India that has impacts on socioeconomic opportunities (Jeffery, Jeffery and Jeffery 2005). There are large wealth variations within each caste, particularly when broad caste categories are defined as in this study. Despite this, differences between income and general caste grouping were found highly significant (Kruskal Wallis $H = 24.72$, $p <. 0001$, $df = 2$) for the study region (Table 3).

Table 3. Caste Distribution and Average (Median) Annual Income.

Caste	Sample percent	Average annual household income
Scheduled Tribes & Castes (Dalit & Adivasi)	27	$557
Other Backwards Classes (OBC)	59	$785
General Caste	14	$924

Using the official poverty line (Table 1) as defined by the Government of India, 53 percent of the total sample is living below the poverty line. The percentage below the poverty line in the drought sample (63%) is (highly) significantly greater ($\chi 2 = 13.89$, $p<.0001$, $df = 1$) than in the flood sample (48%). Thirty five percent of the households have a migrant in their family (on average one per household). The main reason for migration (63%) was to compensate losses in household income, with an average time of migration of about six months.

Regarding housing, around 55 percent of households live in brick (Pucca) houses, 30 percent in mud houses (Kaccha), with the remainder in semi-pucca houses. The majority of houses (73%) lack electricity. Time spent in constructing houses (including latrines) was around 72 days. Around 70 percent of households have some form of drinking water supply, mainly from open dug wells and tube wells/hand pumps. Only 16 percent of the total sample have irrigation pipes, as well as private toilets.

Regarding assets, around 68 percent of households have grain storages in their house, 19 percent have a land-line or mobile phone, 23 percent own a television, and only 18 percent own a radio. Eighty five percent of the households own land, with a median size of 0.32 hectare. While there were no significant differences between the flood and drought samples, there are highly significant differences of land holding among the wealth classes (Kruskal-Wallis $H = 24.261$, $p <.0001$, $df = 3$).

In terms of livelihoods, 66 percent of households earn their primary income from farming, 15 percent from agricultural labour, and 14 percent from non-farm wage labour. Nearly all households engaged in farming cultivate twice a year with 20 percent using HYV (high yield variety) seeds, 45 percent using traditional seeds, and 35 percent using both types. Seventy three percent of households own at least some kind of livestock.

Financially, 69 percent of households have at least one outstanding loan. Table 4 gives an overview of the different loan sources. Reasons for taking a loan include buying agricultural inputs (32%), medical expenditures (17%) and marriage obligations (16.6%). Furthermore, although Table 2 indicates that the current total outstanding loan amount in absolute terms is highest for the “rich” class; in comparison to relative income they are the least indebted, while the poor and very poor are the most indebted.

Finally, 26 percent of households lack saving accounts, 17 percent participate in savings schemes within a Self Help Group (only 10 percent of the total respondents are actual members of SHGs), and the rest (57%) have accounts with banks and post offices. The savings are generally very low for all classes.

Disaster Perceptions

The greatest perceived disaster risks in the Rohini Basin are flood and drought; however, the importance of commodity price shocks cannot be ignored (Figure 4). Eighty six percent of drought survey respondents consider drought impacts on their families to be

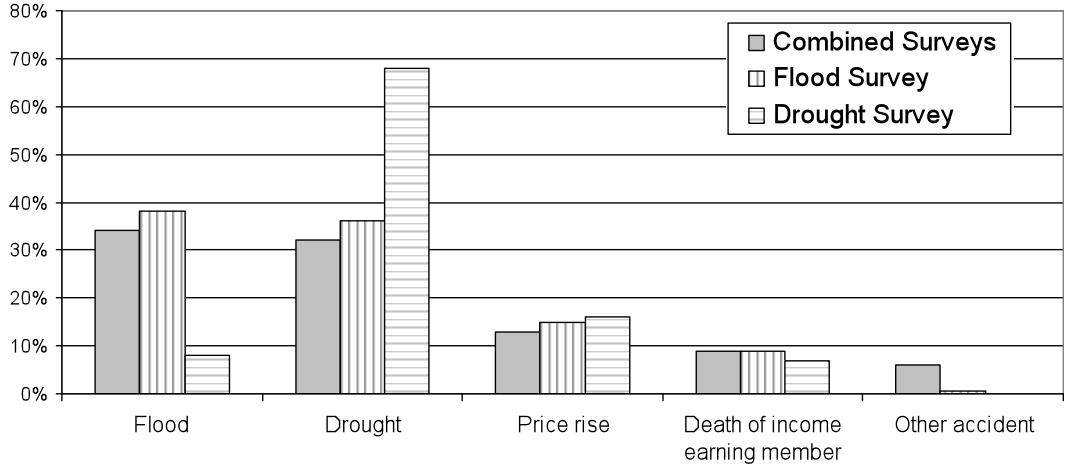
high and 80 percent of flood survey respondents say the same for flood. Considering the thematic nature of the surveys and associated discussions, these results could be biased. On the other hand, losses in terms of income indicate that the impact levels of these hazards are indeed very high.

Table 4. Sources for Loans (Percentage of Responses).

Source	Drought	Flood	Combined
Family member	9	4	6
Friend or neighbour	18	23	21
Self-help group (SHG) & other savings groups	2	8	6
Shopkeeper	3	3	4
Money lender	18	15	16
Grameen bank	25	15	19
Nationalized bank	15	19	17
Cooperative bank	7	7	7
Others	3	7	6

The dependence of the population on agriculture, as well as the sensitivity of this livelihood to external factors, is clearly demonstrated by the global price rise impacts in India (Thakurta 2008). A high rate of inflation in India is a recent phenomenon and, beginning in 2008, there has been a dramatic rise in the price of rice and other basic foodstuffs. However, the survey was performed before this increase and it is therefore assumed that the perceived risk of increased commodity prices is based on past experiences. Considering that price shocks, drought, and the death of income earners all result in primarily monetary losses (as opposed to property), as are damages caused by floods (in addition to property losses), the financial impacts of disasters are clearly of major concern at the household level.

Figure 4. Greatest Perceived Risks in the Rohini Basin.



In alignment with historical state-led disaster management approaches, 90% of the respondents feel the primary responsibility for reducing disaster risk lies with the government. The remainder generally see it as a family responsibility (5%), with an insignificant few feeling donors and the somewhat intangible concept of "the market" have primary disaster reduction responsibilities (<0.5% each). The percentages do not vary (i.e., there are no significant differences) between the flood and drought samples or among wealth classes. Respondents are generally not satisfied with the disaster reduction performance of these various actors, with only 21 percent feeling the government is doing enough, 10 percent satisfied with donor and market performance, and less than 2 percent content with private sector and SHG/NGO performance. Unsurprisingly, the best risk reduction appraisal lies with the family, although this is still only at a 26 percent satisfaction level, highlighting an opportunity for more solidarity in risk management. Despite its perceived poor performance, 94 percent still place foremost trust in the government to reduce the risk of disasters. In these perceptions no statistical differences were found according to the wealth groups. We now analyze disaster impacts in monetary terms (Question 5).

Disaster Impacts

We analyzed household losses due to the 1998 and 2007 floods as well as the drought of 2004 based on survey responses. Table 5 provides a summary in terms of monetary losses.

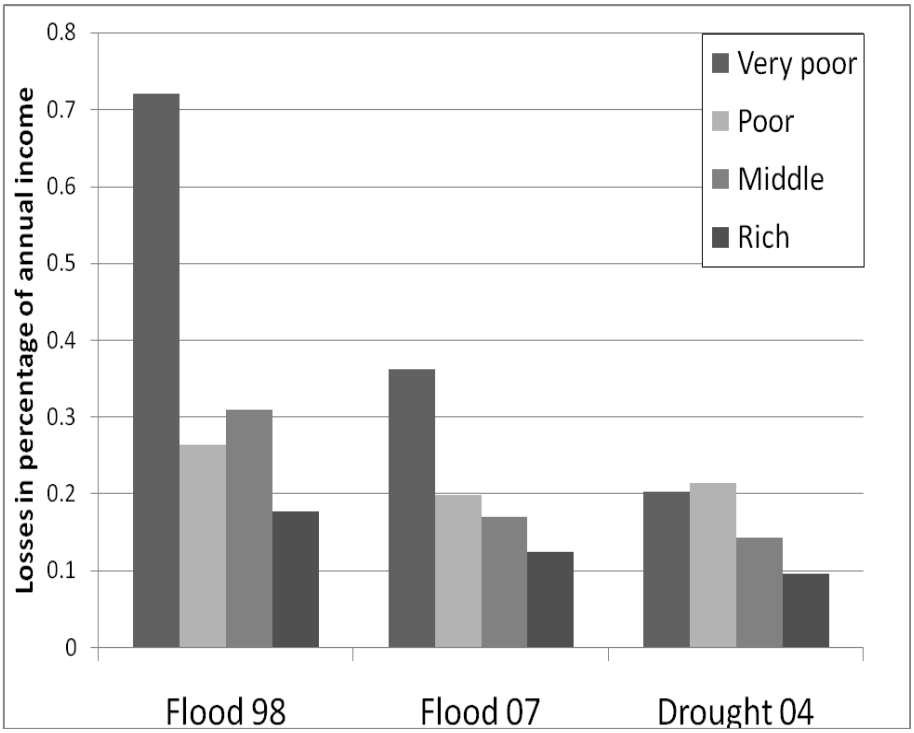
Table 5. Household Monetary Losses Due to Natural Disasters in 1998, 2007 (Floods) And 2004 (Drought). Mean and (Standard Deviation) Shown.

	1998 Flood	2007 Flood	2004 Drought
Crop Losses	$167 (303)	$175 (272)	$197 (308)
Total Wage Losses	$41 (215)	$39 (167)	$14 (24)
Total Additional Exp.	$25 (42)	$32 (56)	$82 (120)
House Damages	$168 (480)	$23 (143)	$0
Other Asset Damages	$102 (592)	$11 (66)	$0
TOTAL	$503 (949)	$384 (155)	$390 (421)

Total losses were highest during the 1998 flood with asset losses representing more than a half of the total. Crop losses in both floods were also high and nearly as damaging as during the 2004 drought. However, additional expenditures were higher during the drought than the floods, primarily due to the additional money needed for fodder, fuel wood, and health care. Comparing the total household losses with the annual household income of the different wealth classes reveals that disaster impacts in terms of income

losses are very dramatic for the "very poor," but also substantial for the other wealth classes (Figure 5).

Figure 5. Percentage of Total Household Annual Income Losses According to Wealth Class.



The differences in losses are highly significant for the 1998 flood (Kruskal Wallis $H = 11.54$, $p = .009$, $df = 3$), especially due to the very poor who experienced losses of more than 70 percent of their total annual household income. For the 2007 flood, there are also substantial group differences between the wealth classes, but these are not significant at $p \leq .05$ (Kruskal Wallis $H = 6.93$, $p = 0.074$, $df = 3$). In the case of the drought event limited differences between wealth classes were experienced. Total average losses for all groups is around 43 percent for the 1998 flood, 25 percent for the 2007 flood and 17 percent for the 2004 drought.

It has been indicated that for the surveyed households the possibilities to finance disaster losses are limited. The next section explains in detail how the households attempt to cope with the impacts.

Financial Coping

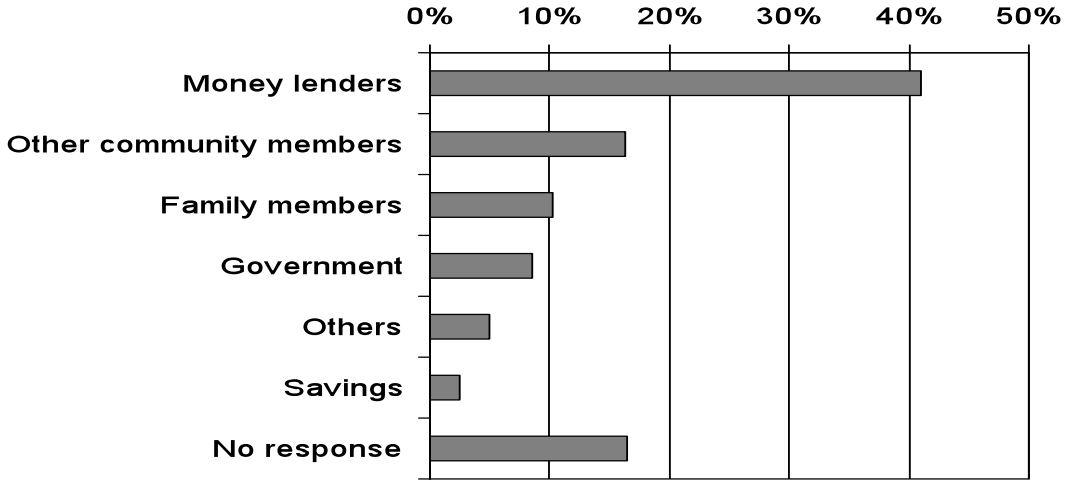
The initial and obvious source to finance the losses after an event is a household's own income. In the flood sample 73 percent reported that this was not sufficient to cope with

the disaster (as income is generated through crop yields, this question was not raised in the drought sample). More importantly, there are significant differences between the wealth classes ($\chi 2 = 16.27$, $p < 0.001$, $df = 3$). Only 15 percent of the poorest compared to around 50 percent of the richest wealth class reported income sufficient to cope with impacts. More than 38 percent of the households reported changing livelihoods after floods independent of the wealth classes (not significant). Regarding livelihood diversification, it can be said that there are only limited diversification opportunities in this highly agricultural region.

Relief, while generally not dependable, is often seen as the primary source of disaster risk financing for poor and/or marginalized communities (Linnerooth-Bayer et al. 2005). In the Rohini Basin, 29% of households received relief after floods, with only 19 percent receiving compensation after droughts (no differences between wealth classes). While the two different hazards do not show significantly different relief payment structures, a clear trend can be observed to more relief for the sudden onset hazard ($\chi 2 = 3.42$, $p = .065$, $df = 1$). With an average of US$ 8 per household (no significant differences among wealth classes), drought compensation is low compared to incurred losses. For both types of disasters relief provision is somewhat delayed; the interval is an average of one month for flood and four months for drought (highly significant differences Mann-Whitney $U = 220$, $p < .000$) but there are no significant differences among wealth classes.

Primary sources of funding during and after floods are moneylenders, followed by others in the community and the family (Figure 6).

Figure 6. Sources of Household Funding During Floods (Percent of Respondents).



Sources of (flood loss) funding accessed during and after disasters do not vary significantly among the four wealth classes. Interest rates on loans average around 10 percent with no significant differences among credit providers (money lenders versus

banks, etc.). More than 36 percent of the flood survey respondents indicated migration by some family members to compensate for reduced household income (59%) as well as losses in wage labour (16%), food insecurity (8%), agricultural losses (7%) and to obtain agricultural inputs (10%). Regarding the drought sample and post-drought relief, 34 percent of respondents would prefer cash, 27 percent food, and 39 percent a mix of both cash and food, with no (significant) variations in preference among the wealth classes.

Financing Perspectives

When asked generally which vulnerability reduction activities would improve their capacity to respond to floods, the best performers were finance-related, with life insurance mentioned by 39 percent, self-help groups by 17 percent, and livestock insurance by 9 percent.

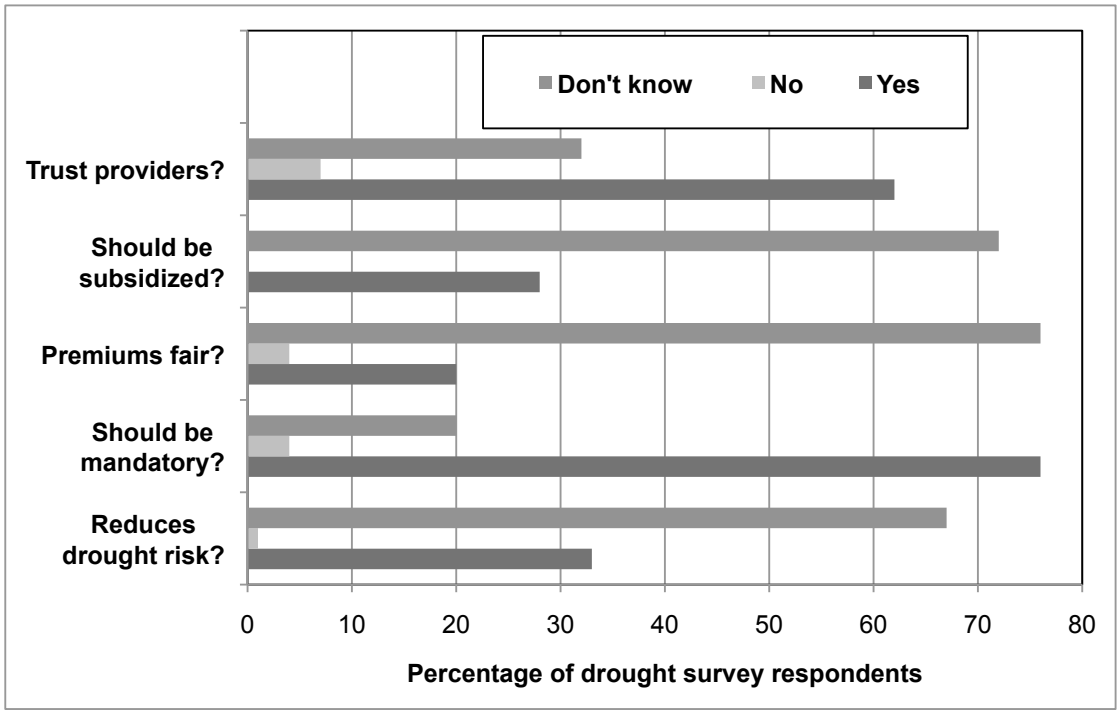
Specific perceptions on insurance were queried only in the drought survey. Only 15 percent of the respondents had any kind of insurance, primarily life (83% of those reporting any insurance), with the remainder having voluntary crop insurance. Most who had insurance had become aware of it primarily through the efforts of company agents (72%), with the remainder learning from literature sources, family/friends/neighbours and government/community programs. Insurance is generally purchased to protect the family livelihood security (75%), with some considerations of meeting future expenditure and enabling high risk-return investment options (both 10%). The primary reason for not having insurance was expense (46%), followed by lack of knowledge (22%) and to a lesser degree finding it too complicated a process, not finding it important, and not trusting insurance providers (less than 3% each). Twenty five percent referred to undefined "other" reasons for not having insurance, which could be interpreted as a further lack of knowledge or understanding of the products and/or concepts. Nearly all respondents were unaware of any insurance schemes to cover disaster losses. Specific opinions on crop insurance were dominated by a lack of knowledge and/or understanding, although those responding generally exhibited positive opinions (Figure 7).

Floods and droughts in the Rohini Basin are serious threats to household well-being for all wealth classes, but floods are especially threatening to the poor. Due to very limited savings and low income, climate variability (such as lower precipitation in a given year compared to normal years) will likely cause great financial stress even during more frequent but less intense events. Most income is derived from the farming of household-owned land or agricultural wage labour and primarily used for consumption, especially food.

Sources of funding during and after disasters are therefore very limited, with losses mostly funded by donors and moneylenders. The latter are however problematic due to the high interest rates they charge (with only 6% of households reporting that loan

providers show some flexibility in repayments during droughts), further increasing already high indebtedness after disasters. These sources of funding do not vary significantly among different wealth classes. However, in relative terms, e.g., loss to income, negative disaster impacts to wealthier people are smaller.

Figure 7. Perceptions on Crop Insurance
(Percentage of Drought Survey Respondents)



The risks of drought and other hazards are perceived as high for all wealth classes in the area. However, the opportunities to reduce these financial risks are small, generally decreasing with diminishing wealth. Furthermore, flood and drought events affect the population differentially. That is, the negative effects for drought manifest themselves over time, but floods damages primarily occur directly during or shortly after the event. If flooding is severe enough, it can also affect crop yields, thus producing severe effects on both stock (assets) and flow (seeds for next year). This has important implications for relief distribution; while food may be needed during and shortly after a flood, cash or seed distribution will be needed for the next season. Cash payments shortly after an event would also be beneficial to improve nutrition but it has to be expected that only a proportion of the money would actually be spent on food (for a full discussion see Levine, 2007).

Discussion

Implications for Poverty Traps and Risk Financing

The UP survey results yield at least five implications regarding the interaction of poverty traps and disaster financing strategies. First, when assessing the long-term risk of falling into poverty traps (cf. Carter and Barrett 2006), it is important to avoid looking only at stock effects such as asset losses or capital accumulation (Fanti and Spataro 2008). In addition, it is necessary to also explicitly incorporate long-term flow effects, such as savings and, more important, levels of indebtedness. For the poor, long-term flow effects may be more devastating than actual asset losses. Although it may appear from a short-term perspective that people could escape a potential poverty trap, it could be that their long run position is already weakened and actual growth is dampened due to lower (financial) resilience and the increased susceptibility to small variations in weather patterns.

Second, this would result in the need to include path dependencies in livelihood models. That is, different household growth paths should be included and differentiated dependent on the number and times that shocks occur during a given time period. For example, disasters in years two and six of a ten year time period would lead to a different growth path (and likelihood of falling into a poverty trap) than would be the case if disasters (with the same absolute loss impacts) occurred in years six and eight.

Third, this would also have consequences for how disasters are to be treated in poverty models; instead of deterministic shocks, probability-based approaches are needed. This would demand more robust information on potential and preferable financing options as the whole range, especially the very extreme cases, of possible futures are taken into account.

Fourth, as the survey results have shown, income for the poor and poorest is not sufficient to absorb more extreme weather variations. Out-migration, which is generally extensive in northern India (Moench and Dixit 2004), occurred in only 35 percent of rural households in the Rohini Basin. Thus, borrowing is one of the most important options for loss financing. However, as discussed earlier, indebtedness can seriously affect future coping capacity potentially leading into a poverty trap.

Post-disaster aid can be large, but it can also fluctuate widely from one event to another due to factors such as media attention, making it difficult if not impossible to depend on for household planning. This does not mean that aid is or would not be important in the future. However, (fifthly) aid may have more impact if it is used to promote ex-ante strategies, for example to increase households' financial coping capacity for floods and droughts either via risk reduction (mitigation and preparedness), financial risk pooling/spreading, or to help in developing markets in the region. The different

strategies selected will depend on the wealth level of the household (see Barrett et al. 2007; Lindell et al. 2006).

Financial Risk Reduction Opportunity: Insurance

Generally speaking, flood risk could be reduced through non-financial means such as improved embankments or clearing floodplains, but also through risk transfer such as insurance or inter-temporal risk spreading mechanisms such as (contingent) credit. That is, in exchange for an (annual) fee, the right is obtained to take out a specific loan amount after an event which has to be repaid at contractually fixed conditions. Other potential drought risk management strategies include crop diversification, irrigation or insurance arrangements.

Alternatively, index-based insurance instruments could be used to lower the costs and prevent moral hazard (i.e. behavioural changes of the insured after the purchase of the insurance, making them more risky) for both flood and drought, instead of traditional indemnity-based insurance. Index-based insurance schemes base claim payments on physical parameters, such as rainfall measured at a weather station, rather than the actual loss as in indemnity-based insurance schemes. Transaction costs of issuing contracts and settling claims can be drastically reduced, thus offering a viable alternative to traditional crop insurance. Furthermore, because of the physical trigger there is no moral hazard; to the contrary, farmers will have an incentive to reduce risk (Linnerooth-Bayer and Mechler 2009).

However considering the lack of resources, market access, and understanding of financial risk management of vulnerable communities, any attempt to strengthen household-level risk financing would need to occur holistically. Disaster mitigation and preparedness would need to be capacitated together with risk financing, as inter-linked components of a broader strategy for disaster risk management. New financial products such as index insurance would likely need to be bundled with other financial products such as credit and savings, contributing not just to disaster risk management but also general vulnerability reduction and livelihood investment potential.

Considering the institutional trust placed in the government, it would likely be a necessary partner in such an effort to develop risk instruments at the micro-level, similar to the case of index-based crop insurance in Malawi (Suarez, Linnerooth-Bayer and Mechler 2007). For example, crop loss protection insurance is viewed by most respondents as an efficient and trustworthy form of drought compensation/relief, to be supported and/or implemented by government. Hence, there does appear to be a keen interest and positive impression of its utility for reducing drought risk. Other studies have also found that fairly complex mechanisms can be understood rather well even by people with little or no formal education (Lybbert 2006, Patt et al. 2008).

At the same time, the survey revealed some possible negative consequences of providing insurance in poor areas. Of those responding, over half admit difficulties in paying premiums. Although based on only a small sample (15), the implications of how people fund insurance premiums when income is insufficient cannot be ignored. Forty percent reduce consumption, 20 percent use savings, 13 percent take loans, 7 percent each sell assets or simply default, while the remaining 13 percent find the funds through some "other" means. These actions generally do not help reduce vulnerability, thus rendering insurance counter-productive for such cases. Hence, it may be more appropriate to use such schemes only for farmers with at least some disposable income.

As the survey analysis and discussion have shown, risk management-driven poverty reduction must be implemented in an integrated manner, that is, through a combination of risk reduction efforts and risk financing strategies. Some innovative approaches have already been tested with potentially promising results. For example, changing to seed types that produce higher yields but are more vulnerable to water scarcity may be too risky as a standalone intervention. However, in combination with risk instruments such as index-based insurance such an approach seems more promising and can result in a growth trajectory with stability guarantees (Hess and Syroka 2005).

Decision-making Challenges

A related topic is the issue of climate change and its potential effects on risk financing. Particularly for insurance schemes, climate change may considerably increase the ruin probability over time and therefore necessitate increases in premiums or outside help (Hochrainer, Mechler and Pflug 2009). Furthermore, inter-generational transfers via taxes or pension schemes may help a depressed economy and are therefore important to consider in poverty trap discussions (see Fanti and Spataro 2008). Additionally, as the survey results have shown, while different financing strategies against weather extremes could be very beneficial, the land owned by poor households is usually too small to produce enough to bring them out of poverty alone. Hence, area expansion (for example by buying or borrowing land), where feasible, could be a strategy for decreasing poverty too (see Hanjra, Ferede and Gutta 2009).

From a modelling perspective to support decision-making, several limitations for assessing such traps or trends exist. Future research will assess these limitations and will be based on the results and discussions in this study. A one-dimensional (taking only financial flows into account) dynamic livelihood model on the household level (Mechler et al. 2009) has already been developed and will be expanded to study these questions in detail.

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