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Takashi Kurosaki

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Institute of Economic Research
Hitotsubashi University
2-1 Naka, Kunitachi, Tokyo, 186-8603 JAPAN
http://cei.ier.hit-u.ac.jp/English/index.html
Tel:+81-42-580-8405/Fax:+81-42-580-8333

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Takashi Kurosaki

Institute of Economic Research, Hitotsubashi University, 2-1 Naka, Kunitachi, Tokyo 186-8603, Japan. Phone: +81-42-580-8363; Fax: +81-42-580-8333; E-mail: kurosaki@ier.hit-u.ac.jp.

Abstract:

Based on a panel survey conducted in rural Pakistan, this paper analyzes the extent to which households recovered from damage due to floods that hit the country in 2010. With regard to initial recovery, households who had initially fewer assets and were hit by greater flood damage had more difficulty in recovering. After one year, the overall recovery had improved, with initially rich households associated with faster recovery but the speed of recovery decelerated. The overall pattern indicates that the village economy was turning towards the initial asset distribution despite the short-run disturbance to the household economy.

Keywords: natural disaster, recovery, resilience, Asia, Pakistan.

JEL classification codes: O12, D12, D91.

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1. INTRODUCTION

Households throughout the world face a wide variety of risks arising from natural disasters, such as floods, droughts, and earthquakes. For instance, Pakistan, from which the household data are taken for this paper, experienced in July–August 2010 the worst floods in its history, which affected 84 districts out of a total 121 districts, killing more than 1,700 persons (United Nations, 2010). Households in low-income developing countries are particularly vulnerable, since their initial welfare levels are already close to the poverty line, institutional arrangements used to cope with disasters are lacking, and early warning systems are absent. To compound issues, the number of natural disasters reported appears to be increasing globally—from fewer than 100 per year in the mid-1970s to approximately 400 per year during the 2000s, according to the emergency events database (EM-DAT).[1]

As summarised by Cavallo & Noy (2009) and Sawada (2007), much research in both social and natural sciences has been devoted to increasing our ability to predict disasters, while the economic research on natural disasters and their consequences including the recovery process is fairly limited. In the limited economics literature, macroeconomic impacts, both direct and indirect, have been investigated by several authors. For instance, using cross-country panel data, Noy (2009) shows that developing countries face much larger output declines following a disaster of similar relative magnitude than do developed countries or bigger economies, suggesting the importance of an increased ability to mobilize resources for reconstruction. Using similar cross-country panel data, Sawada et al. (2011) demonstrate that natural disasters have positive impacts on welfare (measured by per-capita GDP) in the long run, despite they generate large negative welfare impacts in the short run. Coffman & Noy (2012) use a synthetic control methodology to estimate the long-term impacts of a 1992 hurricane on the island economy of Kauai, Hawaii, showing that Kauai's economy was yet to recover after 18 years of the event. These macroeconomic studies tend to treat the disaster as an economy-wide covariant shock, not focusing on within-country or within-village heterogeneity.

On the other hand, in terms of microeconomic impacts of exogenous shocks, there is an accumulation of theoretical and empirical studies in development economics focusing on households' ability to cope with these shocks. These studies have shown that poor households are likely to suffer not only from low levels of welfare on average but also from fluctuations in their welfare due to their limited coping ability (Fafchamps, 2003; Dercon, 2005). The inability to avoid welfare declines when hit by exogenous shocks can be called vulnerability, for which we have now a substantial literature on its measurement (Ligon & Schechter, 2003; Dercon, 2005; Kurosaki, 2006; Dutta et al., 2010). These studies tend to focus on the welfare impacts of idiosyncratic shocks. This focus has led to econometric specifications in which all village-level (or higher level) shocks are often controlled through fixed-effects. This is unsatisfactory, particularly when considering the growing influence of aggregate shocks on the welfare of villagers in the process of globalization and global warming. Furthermore, Ligon & Schechter (2003) demonstrate that aggregate risk is much more important than idiosyncratic sources of risk. Nevertheless, there has been less effort in microeconometric studies to explain the sources and impacts of aggregate shocks than idiosyncratic shocks. Research on the heterogeneity of the household-level recovery process from natural disasters is thus lacking in the existing literature.

To cope with such aggregate shocks, aid from outside is expected to play an important role in supplementing local reciprocity networks and self-insurance. Nevertheless, the economics literature on aid is limited and in its infancy (Jayne et al., 2002; Morris & Wodon, 2003; Takasaki, 2011a; 2011b). The village economy and individual households are expected to recover from natural disasters by combining their own coping strategies and aid from outside. In the ecology literature, the concept of "resilience" is often employed to describe the extent and speed of such recovery (e.g., Gunderson & Pritchard, 2002). In economics research, the extent and speed of recovery from natural disasters is thus potentially an important topic, on which both empirical and theoretical work is limited.

This paper attempts to fill these gaps in the literature by investigating the following questions. Which type of households are quicker in recovery from damage due to nation-wide floods? Is there any heterogeneity in recovery attributable to the variation in the damage size and aid distribution? Does the recovery pattern change over time, i.e., is the recovery pattern different between the period immediately after floods and a year after? Does the dynamic recovery pattern suggest that the village economy is turning towards the initial asset distribution? To examine these questions, this paper employs data collected in a pilot panel survey in ten villages in the province of Khyber Pakhtunkhwa,[2] Pakistan, in December 2010–February 2011 and one year after. The survey area was one of the areas severely hit by the nation-wide, unprecedented floods in Pakistan that occurred in July–August 2010.

Since the recovery process is dynamic in nature, a single “snapshot” survey after a disaster cannot provide detailed information on it. By combining data from these two rounds of the pilot panel survey, we can obtain rich information on household-level recovery, both immediately after the floods and in subsequent years. Utilizing the panel nature of the post-disaster dataset, this paper will show that households who had initially fewer assets and were hit by greater flood damage had more difficulty in recovering; the overall recovery had improved after one year, but there remained substantial variation across households regarding the extent of recovery; and initially rich households were associated with faster recovery than other households at the time of the second survey, although the speed of recovery declined during the most recent year. We will then speculate long-term implications of these findings. Given the scarcity of analysis in the literature, the evidence shown in this paper is expected to shed light on the issue of the recovery process from natural disasters, despite the small sample size involved.

The rest of this paper is organized as follows. After this introductory section, Section 2 briefly describes the study area, survey design, and the dataset. Section 3 explains the empirical strategy. Section 4 provides the results of the regression analysis with respect to the level of recovery. Section 5 concludes the article.

2. DATA

(a) The 2010 floods in Pakistan

In July–August 2010, heavy torrential rains and flash floods severely affected human lives, livestock, infrastructure, crops, and livelihoods all over Pakistan. By November 2010, the Government of Pakistan assessed that more than 20 million Pakistanis had been affected, approximately 1.88 million houses damaged, 1,767 persons killed or missing, and 2,865 persons injured (Government of Pakistan, 2010). The province of Khyber Pakhtunkhwa was affected most; the main reason for this was the fact that the province was affected directly by rains, and that no flood warning had been issued in most of the province when flash floods hit, as it occurred during the night time.

In response to the disaster, relief activities were quickly organized by international and domestic nongovernment organizations (NGOs) and government agencies. The Pakistani government also initiated its *Watan* card program, in order to help the flood-affected population reconstruct damaged houses. Under the program, flood-affected families were registered by the government authority and were issued automated teller machine (ATM) cards that were keyed to accounts to which a total of Rs. 100,000 was to be paid in five equal installments. These cards were distributed in December 2010, and the first installment payment was released between December 2010 and April 2011. In July–October 2011, the government issued *Watan* cards to areas to which an initial allotment had not been assigned. The second installment was delayed in most of Pakistan, due to the government's failure to secure the related budgetary funding. Due to the intensity of the damage, these aid inflows did not appear to be sufficient.

(b) The pilot panel survey

To assess the vulnerability and resilience of rural economies against this unexpected natural disaster, we conducted the first round of a pilot panel survey of village economies in the Peshawar District of Khyber Pakhtunkhwa, Pakistan, in the 2010/11 fiscal year. The survey covered 10 sample villages and 100 sample households (i.e., 10 from each sample village). The sample villages were chosen in a way similar to that in which the authors surveyed villages in the same district in 1996/97 and 1999/2000 (Kurosaki & Hussain, 1999; Kurosaki & Khan, 2001). We chose villages with different characteristics in terms of economic development, but with similar characteristics in terms of ethnicity and culture, in order to elicit the dynamic implications of economic development from a cross-section. Of the three villages surveyed in the previous panel surveys, two villages were successfully resurveyed in the pilot survey while one village was not covered for security reasons. Eight villages were added to the pilot survey; each of them satisfied the above inclusion criterion, as well as an additional criterion: Sample villages must present various levels of flood damage to its houses and infrastructure.

The actual survey for the first round was carried out between December 2010 and February 2011. In the survey, village-level information was collected from knowledgeable villagers,[3] via a structured questionnaire. From each of these 10 sample villages, 10 sample households were chosen for the household survey; they did not strictly constitute a random sample, as they were chosen to represent, as comprehensively as possible, the various levels of flood damage the village had sustained. A structured questionnaire for households was used in the survey. Kurosaki & Khan (2011) provide detail about the first round survey and the characteristics of surveyed villages and households.

Important findings from the first round of the pilot panel survey include the followings (Kurosaki & Khan, 2011). (1) There were both between-village and within-village variations in flood damage. (2) Different types of damages were not highly correlated. (3) The aid distribution across villages appeared to be well-targeted toward severely affected villages. (4) The aid allocation within villages was targeted toward households with greater house damage, but not toward households with greater damage to land, crop, or other assets. (5) Aid recipients did not show higher or lower recovery than non-recipients, especially in terms of house damage.

In order to collect information on changes since the first round of the pilot survey, we conducted a second round survey approximately 12 months after the first round, between December 2011 and January 2012. The second survey successfully covered all 10 sample villages and 100 sample households. We thus compiled a balanced panel of 100 household observations. In the second round survey, a structured questionnaire was used, whose focus was on the changes that had occurred since the first round survey with regard to household demography, labor force, physical assets, monetary assets, aid receipt, and so on.

(c) Characteristics of sample households

Table 1 summarizes the household-level data obtained from the two rounds of surveys. Since the sampling probability differs from village to village (Kurosaki & Khan, 2011), the table shows weighted statistics that were adjusted for the different sampling probabilities. As shown in the table, the average age of the household head was 47 and his/her education level was 6.9 years of schooling. The average education level is higher than the national average for the same age cohort by approximately one year, which appears to indicate the prevalence in the study area of the idea of education investment as being key to poverty reduction (Kurosaki & Khan, 2006).

<Table 1 here>

The average household size increased by 0.41 persons during the previous year. Most of this increase was attributable to new births—another indicator of recovery. The average number of working household members increased by 0.23 persons during the previous year (not shown in the table). Most of the new jobs were in the private sector, dominated by low-paying, daily-wage labor. This indicates that after the floods, the demand for such jobs increased as a result of reconstruction activities. The increase in the working population may have been a result of the pressure to generate more income to reconstruct houses and other properties. The overall composition of sectors for these working members remained the same as before: The largest labor absorber was primary industry.

As shown in Table 1, the average land-holding before the floods was 2.7 acres. These figures are smaller than the national average but similar to the average land-holding size in Peshawar District. The average land asset value is Rs. 4.3 million (mean) or Rs. 0.69 million (median).[4] Regarding land distribution, the average figure may be misleading, since as much as 42% of the sample households did not own any land. Owing to this skewed distribution, the median land-holding size was less than 1.0 acre. Livestock is another physical asset of importance in the study area. About 58% of the sample households owned large livestock animals, such as cattle and buffalo; 78% of them owned some kind of livestock animals, including goats and poultry. Livestock assets are thus more equally distributed than land assets; nonetheless, their distribution is not completely egalitarian, resulting in a huge difference between its mean (Rs. 72,000) and median (Rs. 35,000). The distribution of core physical assets (houses, land, and large livestock animals) is thus characterized by a large mass of households that each holds a small lot of assets, and a small pool of middle-class households whose asset levels are comparatively and distinctively higher. This pre-flood distribution is similar to that seen in the panel data of 1996/97–1999/2000 (Kurosaki & Hussain, 1999; Kurosaki & Khan, 2001), where the welfare levels of the former group were at around the income poverty line, while those of the latter group were above the poverty line.

The last section of Table 1 summarizes information on aid receipt. Slightly less than one-half of the sample households received emergency aid from NGOs, emergency aid from the government, and *Watan* cards, while the total receipt in terms of money equivalent was only 5% of the estimated value of the average damage due to the 2010 floods. Therefore, the aid receipt on average was not large relative to the flood damage sustained. Nevertheless, for those households whose initial wealth level was not high and which had suffered a substantial loss to houses, the percentage was much higher, that is, compensating for 20–30% of the flood damages.

As the key variable in this paper, we collected variables on the level of recovery, taking one of the 11 percentage-point categories, from 0 (no recovery) to 100 (complete recovery). Although figures are based on subjective assessments, they correspond well to the changes in asset values reported by households. The recovery rates at the ends of 2010 and 2011 are summarized in Table 2. At the end of 2010, the recovery rates were higher for crops than houses, land, and livestock; at the end of 2011, the recovery rates were improved with respect to all kinds of damage. The average overall recovery rate was 86%, compared to 69% one year earlier. Especially with regard to crops and livestock, the recovery was quick, and the average was close to 100%. On the other hand, the recovery rates from land and house damage were not very high. A substantial portion of the sample households reported that their recovery rates in land and houses were less than 50% at the end of 2011. Besides own resources, informal credit transactions played the most important role in helping affected households rehabilitate their livelihoods and reconstruct their asset bases—A total of 47 instances of informal borrowings were reported by the respondents, while only two instances of institutional-source borrowing were reported during the second survey.

<Table 2 here>

3. EMPIRICAL STRATEGY

Descriptions in the previous section show that at the time of the second round survey, most of the affected households were in the process of recovering from flood damage. The main source of recovery funding was their own sources, supplemented by informal borrowing. Other sources—like aid receipt from the government and NGOs—were limited during the rehabilitation phase, although the receipt of relief helped flood victims consolidate savings for reconstruction.

In this section, we describe how we attempt to quantify the above summary situations, using household-level econometrics. Since our sample is not strictly a random one, the level of the explanatory variables may contain measurement error—especially at the village level. For this reason, we focus on within-village variation and address the question: What type of households achieved more recovery than others in the same village?

To address this question, we regress the explanatory variable of the extent of recovery (reported in Table 2) on the following explanatory variables. First, the list of explanatory variables includes village fixed effects to control for unobservable factors that affected the recovery process at the village level. Second, the list includes a vector of variables that characterize asset positions before the floods: human capital indicators, such as household size (quantity of human capital); the household head's education (quality of human capital in the modern context); and the household head's village leader dummy (quality of human capital in the traditional context). The list also includes physical capital indicators, such as the number of housing buildings, the value of land, and the value of livestock owned by each household before the floods. See Table 1 for summary statistics of these variables. Third, to capture the impact of flood damage on subsequent recovery, we include a vector of asset amounts damaged by the floods. Since some of the household-level variation in flood damage is endogenous, we follow the approach of Kurosaki & Khan (2011) and use the fitted residuals from regression models where observed levels of flood damage are regressed on village fixed effects and the household asset variables mentioned above. The regression results associated with the calculated residuals are reported in Appendix Table 1. The fitted residuals contain the component of variation in flood damage not explained by village fixed effects and households' initial assets. Therefore, coefficients on the fitted residuals can be interpreted as the recovery response to asset amounts damaged by the floods, after controlling for the flood damage endogenously determined by households' initial assets. In addition to these basic variables, we also attempted a specification with the fitted residuals for aid receipt, similarly constructed for the fitted residuals for flood damage.

4. CORRELATES OF THE RECOVERY PROCESS

(a) Regression results

The regression results are reported in three tables that correspond to different dependent variables, without using aid receipts as explanatory variables. This is because all of aid-receipt residuals we attempted (those for emergency aid from the government, emergency aid from NGOs, reconstruction aid from the government, and reconstruction aid from NGOs) had insignificant coefficients. This could probably be due to the mixing of the recovery-promoting effect of aid and the selection effect for aid toward households that inherently have more difficulty with recovery.

The results in Table 3 correspond to the specification using the recovery level at the end of 2010 as the dependent variable; those in Table 4 show the results one year later (i.e., the recovery level at the end of 2011); and those in Table 5 correspond to the specification using the change in recovery from the end of 2010 to the end of 2011 as the dependent variable.

<Table 3 here>

Regarding the initial recovery, Table 3 shows that household size has positive and significant coefficients with regard to overall and land recovery; the education of the household head was found to have a positive effect on the overall recovery; the village leader dummy had a positive coefficient, which is statistically significant (though the significance level was low); and the initial livestock assets contributed to the livestock recovery, which is commonsense, because it is easier for households with a larger initial volume of livestock to compensate for the loss of one animal than for households with smaller volumes. Looking at flood damage, most of the flood damage variables have negative coefficients, as expected; two of them—that is, house damage on house recovery and crop damage on recovery in 2010/11 *Rabi* cropping—were statistically significant. The coefficients indicate that if the damage to a house were Rs.100,000 greater, the household's house recovery percentage would have been lower by 5.2 percentage points; if the damage to crops were Rs.100,000 larger, the household's *Rabi* crop recovery percentage would have been lower by 1 percentage point. The regression results in Table 3 thus confirm that households with initially fewer assets and those hit by more extensive flood damage were slower to recover.

<Table 4 here>

One year later, had this pattern changed? To address this question, the dependent variable in Table 3 is replaced by a similar variable that correspond to one year later. The results are reported in Table 4. Since the recovery rates approached 100% in the cases of crops and livestock (so that the variation in the dependent variable is minimal), the results for crops and livestock recovery are not reported. Table 4 shows a pattern similar to that seen in Table 3: Pre-flood human capital assets have positive coefficients and flood damage has negative coefficients. This pattern is less statistically significant than observed one year earlier, however. In addition, there is one difference is in the impact of the initial house asset: It now has a significantly negative coefficient, indicating that those households with more housing buildings before the floods were slower to recover than other households. Even after controlling for the extent of house damage, households with more houses had difficulties in recovering quickly, because they needed to spread their limited resources across more houses. The coefficient was also negative at the end of 2010, but was statistically insignificant. However, those households with more houses are richer than other households. Therefore, their relatively late recovery may not be a serious concern, from a policy perspective. The positive impact of modern (education) and traditional (*Jirga* leader) human capital on recovery remains statistically significant for the house recovery, but became insignificant for overall recovery.

<Table 5 here>

To cleanly identify changes that occurred in the previous year, Table 5 reports the regression results based on the first difference of recovery levels, between the two surveys. This specification has an advantage that household fixed effects on the recovery level are controlled perfectly. A disadvantage is that the sample size becomes smaller, because we need to exclude those households whose recovery rate was already at 100% at the end of 2010. For such households, the change in recovery rate cannot be defined in a meaningful way. As a result, we do not report regression results for land recovery, because the sample size is as small as 11. The results in Table 5 show that pre-flood asset variables now have negative coefficients, and some of them are statistically significant. For example, the recovery rate of households whose head is a traditional leader was slowed by 11 percentage points in the previous year.

The results in Tables 3-5 were found to be robust to various alterations.[5] Namely, we tried different empirical definitions with respect to the pre-flood assets, adopted weighted least squares reflecting the difference in sampling probability instead of OLS, and Tobit specifications reflecting the limited range of the dependent variables.

(b) Interpretations of the results

Does the recovery process characterized by the regression results indicate a recovery of the village economy to the initial asset distribution, or a transition to a new regime with a different distribution of welfare levels and assets?[6] The coefficients on the initial asset variables in Tables 3 and 4 indicate the tendency for initially rich households to recover quickly. If this effect dominates, inequality in physical assets should be exacerbated as a result of turbulence due to the floods.

On the other hand, the coefficients on these variables in Table 5 indicate the tendency for the recovery rate of initially rich households to slow down significantly. Furthermore, those households with initially more assets tended to suffer greater damage from floods, and the greater damage makes recovery more difficult. In addition, the aid allocation was targeted towards those with lower initial assets, although weakly (Kurosaki & Khan, 2011). These tendencies work in the direction of reducing inequality in physical assets.

From the regression results alone, it is difficult to judge which effect dominates. However, it appears to be safe to conclude that a drastic change in inequality in physical assets cannot be expected to be an ultimate result of the 2010 floods. Furthermore, the field observations did not indicate that the 2010 floods had destroyed human or social capital or changed the way in which human and physical assets translate into household well-being.

Thus the tentative conclusion of this paper is that although damage stemming from the 2010 floods was massive, the resulting turbulence did not result in a transition to a new regime with a completely different distribution of welfare levels and assets; instead, the rural economy seems to be recovering to the initial regime. Based on the 1996/97–1999/2000 panel survey (Kurosaki & Hussain, 1999; Kurosaki & Khan, 2001), the initial asset distribution can be characterized by a mass of households whose asset levels are so low that their welfare levels are around the poverty line and a small group of households that correspond to the middle-class, far above the poverty line. Unfortunately, due to the lack of necessary information on household income/consumption and returns on various types of assets (including human and social capital) and the small sample size, we cannot quantify the asset distribution in detail for the whole ten villages in the pilot survey.

5. CONCLUSION

This paper analyzed the household-level process of recovering from damage due to floods in Pakistan in 2010, based on a pilot panel survey of villages and households conducted two times after the floods. With regard to the initial recovery from flood damage, it was found that households who had initially fewer assets and faced more extensive flood damage had greater difficulty in recovering. After one year, overall recovery had been improved, but there remained substantial variation across households regarding the extent of recovery. The initially rich households tended to recover more quickly than other households at the time of the second round survey, but the speed of recovery had significantly declined during the previous year. The overall pattern appears to indicate that the village economy was gradually recovering towards the initial asset distribution, which was characterized by a large mass of households whose welfare and asset levels were around the income poverty line, together with a small grouping of middle-class households whose asset levels were sufficiently high to ensure them a welfare level above the poverty line.

The findings of this paper have several implications to policy-oriented research regarding household-level resilience against natural disasters in developing countries. First, the pattern of recovery dynamics is heterogeneous so that minute targeting is required. It may be the case that an intervention to cope with natural disasters without such concern is not effective towards some households in the affected area. Second, the contrast found in this paper between the recovery process immediately after floods and the recovery process a year after appears to indicate that the recovery process at the household level is non-linear and time-varying. In such situations, a single "snapshot" survey after a disaster may not provide precise information on who needs to be supported. Additional knowledge gain from the resurvey could be substantial. Third, the overall pattern we described above regarding the Pakistani case applies to the long-run and average description of the village economy in the study area. It does not imply that there were no individual households that suffered a sustained deterioration in their welfare levels. There is an important role for public policies in supporting such households in the aftermath of devastating floods.

Because of the small sample size and the limited information on returns on various types of assets therein, the conclusion of this paper is tentative and preliminary. We cannot claim the general applicability of our findings to other settings, either. The provision of further support for this paper's findings and interpretations thereof is left to future research.

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Notes

[1] Available on http://www.emdat.be/natural-disasters-trends (accessed on October 25, 2011). In interpreting such data, we should pay attention to the possibility that the reported increase is partly due to an increased tendency to report, not necessarily an increase in the occurrence of disasters.

[2] Khyber Pakhtunkhwa is one of the four provinces that comprise Pakistan. The province was formerly known as the North-West Frontier Province (NWFP).

[3] In each village, a group comprising two to five villagers who knew the village well was interviewed for the survey. Such knowledgeable villagers included social workers appointed by the government, union councilors, traditional village leaders such as members of the *Jirga* or village *Malik*, and Islamic leaders.

[4] "Rs." stands for Pakistani rupee; at the time of the first survey, US$1.00 = Rs. 86.

[5] Details of these robustness checks are available on request.

[6] This question is motivated by the ecology literature on resilience. For instance, Gunderson & Pritchard (2002) define "engineering resiliency" as the quickness in time required for a system to recover to the initial regime after turbulence, and "ecological resiliency" as the threshold turbulence above which the system transitions to a new regime.

Table 1: Characteristics of the sample households, Khyber Pakhtunkhwa, Pakistan

	Survey[(a)]	Positive[(b)]	Mean	(Std.Dev.)	Median	Minimum	Maximum
1. Characteristics of household heads at the end of 2010							
Age	1	100	47.5	(14.4)	47.0	20	80
Years of formal schooling	1	62	6.93	(6.17)	10.00	0	16
Village leader dummy[(c)]	1	16	0.20	(0.40)	1.00	0	1
2. The number of household members							
End of 2010	1	100	9.47	(4.19)	9.00	2	38
Change during 2011	2	37	0.41	(1.00)	0.00	-2	3
End of 2011	2	100	9.88	(4.55)	9.00	2	41
3. Assets before the 2010 floods							
Number of house buildings owned	1	89	0.95	(0.31)	1.00	0	2
Land ownership (acres)	1	58	2.70	(5.83)	0.25	0	40
Value of land owned (Rs.1,000)	1	58	4327.3	(10521.1)	690.0	0	60000
Number of large animals[(d)] owned	1	58	1.53	(2.27)	1.00	0	12
Value of all livestock animals[(d)] owned (Rs.1,000)	1	78	71.6	(140.5)	35.5	0	1250
4. Damage due to the 2010 floods (Rs.1,000)							
House buildings	1	87	137.4	(124.1)	135.3	0	650
Agricultural land	1	19	33.6	(140.8)	0.0	0	2000
Standing crops	1	75	342.9	(941.3)	75.0	0	5250
Livestock	1	28	7.2	(21.0)	0.0	0	100
Others	1	7	14.1	(100.7)	0.0	0	1000
Total	1	99	535.1	(989.4)	250.0	0	6770
5. Amount of aid received including the imputed value of in-kind transfers (Rs.1,000)							
Emergency aid from NGOs, 2010	1	46	7.2	(9.0)	5.0	0	40
Emergency aid from the government, 2010	1	43	4.2	(6.3)	0.0	0	30
Reconstruction aid from NGOs, 2011	2	7	4.8	(16.7)	0.0	0	100
Reconstruction aid from the government, 2011	2	4	0.4	(1.8)	0.0	0	50
Income transfer through Watan cards	2	42	12.7	(14.4)	0.0	0	40

Notes: The number of observations (NOB) is 100 (10 from each sample village). Means, standard deviations (Std.Dev.), and medians are weighted to reflect the difference in sampling probability.
(a) Survey 1 corresponds to the first round (fiscal year 2010/11) and Survey 2 corresponds to the second round (fiscal year 2011/12).
(b) This column indicates the number of observations whose value is strictly positive.
(c) When the household head is either village *Malik* (=village head), *Jirga* leader, or *Jirga* member, the dummy takes the value of one. *Jirga* is a traditional dispute-solving institution in the Pakhtun society.
(d) "Large animals" include buffalo, cattle, horse, and mule. "All livestock animals" in addition include goat, sheep, and chicken.

Source: Two rounds of pilot survey data (same for the following tables).

Table 2: The extent of recovery from the 2010 floods

Type of recovery	Assessment period	Positive[a]	0-9%	10-19 %	20-29 %	30-39 %	40-49 %	50-59 %	60-69 %	70-79 %	80-89 %	90-99 %	100%	Mean	(Std. Dev.)
			Frequency distribution of the recovery extent[a]											Summary stat.	
Overall	End of 2010	99	3	2	0	3	3	24	4	12	21	6	21	68.8	(25.5)
	End of 2011	99	0	0	1	1	3	4	3	10	8	17	52	86.3	(19.8)
House buildings	End of 2010	87	3	0	1	14	3	31	1	10	2	0	22	57.4	(28.9)
	End of 2011	87	0	0	3	3	1	8	3	3	12	6	48	84.6	(22.9)
Agricultural land	End of 2010	19	5	0	1	2	0	2	0	0	1	0	8	59.9	(43.6)
	End of 2011	19	2	0	0	1	0	1	2	0	4	0	9	74.1	(33.7)
Crops[b]	*Rabi* 2010/11	75	5	0	0	1	1	6	1	4	2	2	53	88.1	(26.8)
	Kharif 2011	75	1	0	0	0	0	2	2	1	0	0	69	97.0	(13.5)
	Rabi 2011/12	75	0	0	0	0	0	0	1	0	4	0	70	99.5	(3.4)
Livestock	End of 2010	28	14	0	0	0	0	1	0	1	1	0	11	50.5	(48.1)
	End of 2011	28	0	0	0	0	0	0	0	0	0	0	28	100.0	n.a.

Notes: (a) The recovery extent is a concept applicable only to those households with positive flood damage. Therefore, the sum of frequency distribution is the same as the number reported in the column named "Positive".
(b) *Kharif* is a monsoon season whose harvest comes on September-December (major crops: maize, rice, etc.) and *Rabi* is a dry season whose harvest comes in March-June (major crops: wheat).

Table 3: Initial recovery from floods, extent of flood damage, and households' initial capital

	Dependent variable: Recovery status in percentage points at the end of 2010											
	Overall		Overall		House		Land		Rabi 2010/11		Livestock	
Household's initial capital												
Number of household members	1.014	**	1.024	**	1.005		5.080	**	-0.192		0.130	
	(0.452)		(0.477)		(0.604)		(1.862)		(1.157)		(2.753)	
Years of education of the hh head	0.814	**	0.813	*	0.524		1.263		-0.382		3.353	
	(0.395)		(0.412)		(0.584)		(1.766)		(0.660)		(2.525)	
Village leader dummy of the hh head	11.494	*	11.226		14.339		9.859		-7.181		-43.533	
	(6.689)		(6.911)		(9.032)		(17.330)		(7.750)		(31.511)	
Number of house buildings owned	-12.000		-12.121		-8.972		9.727		-2.199		23.161	
	(8.042)		(8.208)		(12.135)		(23.789)		(7.023)		(27.709)	
Owned land value (Rs.100,000)	0.039		0.039		0.027		0.017		0.003		-0.439	
	(0.028)		(0.030)		(0.026)		(0.028)		(0.031)		(0.382)	
Livestock asset value (Rs.1,000)	0.017		0.017		0.004		-0.013		-0.015		0.149	*
	(0.013)		(0.013)		(0.017)		(0.019)		(0.027)		(0.077)	
Flood damage in Rs.100,000 (fitted residual from Appendix Table 1)												
House damage	-2.102				-5.171	*						
	(1.907)				(3.009)							
Land damage	-0.748						-0.577					
	(0.651)						(1.161)					
Crop damage	0.023								-1.003	**		
	(0.323)								(0.397)			
Livestock damage	7.758										11.609	
	(10.048)										(38.832)	
Other asset damage	-5.818											
	(4.451)											
All damage aggregated			-0.282									
			(0.246)									
Village fixed effects	Full		Full		Full		Village		Full		Village	

R-squared	0.370		0.332		0.321		0.837		0.443		0.414	
F-statistics for zero slopes	4.54	**	3.35	**	3.04	**	17.81	**	4.74	**	4.10	**
F-statistics for zero village fixed effects	4.69	**	4.49	**	1.26		4.24	*	3.10	**	1.50	
Number of observations	99		99		87		19		75		28	

Notes: Huber-White robust standard errors are shown in parenthesis. OLS regression with village fixed effects is employed (a village fixed effect was included when the observation in the village was more than four). The regression coefficient is significantly different from 0 at the 1% (***), 5% (**), and 10% (*) level.

Table 4: Recovery a year after from floods, extent of flood damage, and households' initial capital

	Dependent variable: Recovery status in percentage points at the end of 2011							
	Overall		Overall		House		Land	
Household's initial capital								
Number of household members	0.087		0.096		-0.046		3.153	
	(0.182)		(0.185)		(0.319)		(2.407)	
Years of education of the hh head	0.271		0.270		0.626	*	0.568	
	(0.205)		(0.223)		(0.368)		(2.477)	
Village leader dummy of the hh head	-1.525		-1.784		14.750	**	-2.847	
	(4.039)		(4.187)		(5.835)		(22.336)	
Number of house buildings owned	-9.089	**	-9.206	**	-0.318		12.638	
	(3.587)		(3.709)		(9.771)		(30.189)	
Owned land value (Rs.100,000)	-0.006		-0.006		0.008		0.088	
	(0.008)		(0.012)		(0.015)		(0.058)	
Livestock asset value (Rs.1,000)	-0.003		-0.003		0.000		0.027	
	(0.004)		(0.005)		(0.008)		(0.033)	
Flood damage in Rs.100,000 (fitted residual from Appendix Table 1)								
House damage	-1.724	**			-2.935			
	(0.863)				(1.852)			
Land damage	-1.060	**					0.873	
	(0.524)						(1.758)	
Crop damage	0.066							
	(0.117)							
Livestock damage	3.941							
	(3.734)							
Other asset damage	-0.600							
	(1.712)							
All damage aggregated			-0.202	**				
			(0.084)					
Village fixed effects	Full		Full		Full		Village 3,5	
R-squared	0.729		0.704		0.414		0.362	
F-statistics for zero slopes	9.81	***	11.18	***	5.16	***	0.69	
F-statistics for zero village fixed effects	12.01	***	13.54	***	4.07	***	0.34	
Number of observations	99		99		87		19	

Notes: See Table 3.

Table 5: Changes in recovery from floods, extent of flood damage, and households' initial capital

	Dep. var.: Changes in recovery status in % points from the end of '10 to the end of '11					
	Overall		Overall		House	
Household's initial capital						
Number of household members	-0.279		-0.249		-0.319	
	(0.321)		(0.365)		(0.622)	
Years of education of the hh head	0.102		0.032		0.357	
	(0.290)		(0.277)		(0.379)	
Village leader dummy of the hh head	-2.157		-2.549		-10.981	*
	(4.664)		(4.641)		(6.459)	
Number of house buildings owned	-3.859		-3.118		1.612	
	(8.130)		(7.340)		(7.539)	
Owned land value (Rs.100,000)	-0.037	***	-0.032	**	-0.012	
	(0.012)		(0.012)		(0.017)	
Livestock asset value (Rs.1,000)	-0.018	***	-0.015	*	-0.015	
	(0.006)		(0.008)		(0.012)	
Flood damage in Rs.100,000 (fitted residual from Appendix Table 1)						
House damage	1.651				-3.045	
	(1.285)				(3.573)	
Land damage	-0.709	**				
	(0.348)					
Crop damage	-0.121					
	(0.160)					
Livestock damage	2.441					
	(6.305)					
Other asset damage	6.232	**				
	(2.643)					
All damage aggregated			-0.049			
			(0.148)			
Village fixed effects	Full		Full		Full	
R-squared	0.341		0.266		0.204	
F-statistics for zero slopes	5.17	***	2.69	***	0.98	
F-statistics for zero village fixed effects	3.21	***	2.58	**	1.16	
Number of observations	78		78		65	

Notes: See Table 3. In this regression, the subsample whose recovery extent was below 100% in the end of 2010 is used.

Appendix Table 1: Multiple regression results to explain different types of flood damages

	Dependent variable: Flood damages in Rs. 1,000.									
	House damages		Land damages		Crop damages		Livestock damages		Other asset damages	
Household's initial capital										
Number of household members	-1.850		-5.151		8.236		0.478		0.978	
	(2.311)		(4.422)		(13.069)		(0.680)		(2.188)	
Years of education of the hh head	-2.036		1.997		21.864		-0.368		1.445	
	(2.274)		(4.044)		(15.009)		(0.426)		(0.979)	
Village leader dummy of the hh head	-68.291		13.924		-363.064		0.035		-10.510	
	(42.807)		(58.030)		(229.354)		(6.024)		(13.248)	
Number of house buildings owned	103.775	**	-30.246		-211.486		9.500		-5.260	
	(44.598)		(29.500)		(134.648)		(6.761)		(22.225)	
Owned land value (Rs.100,000)	-0.181		0.462		6.843	***	-0.006		-0.004	
	(0.130)		(0.369)		(2.110)		(0.011)		(0.043)	
Livestock asset value (Rs.1,000)	0.050		0.131		-0.019		0.007		0.629	***
	(0.059)		(0.122)		(0.284)		(0.033)		(0.140)	
Village fixed effects	Yes		Yes		Yes		Yes		Yes	
R-squared	0.154		0.173		0.566		0.373		0.771	
F-statistics for zero slopes	2.12	**	1.30		8.57	***	1.72	*	2.49	***
F-statistics for zero village fixed effects	0.68		1.05		2.55	**	2.05	**	1.20	

Notes: Huber-White robust standard errors are shown in parenthesis. OLS regression with village fixed effects is employed.
The number of observations is 100. The regression coefficient is significantly different from 0 at the 1% (***), 5% (**), and 10% (*) levels.