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Household-level Recovery after Floods in a Developing Country: Further Evidence from Khyber Pakhtunkhwa, Pakistan

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Household-level Recovery after Floods in a Developing Country: Further Evidence from Khyber Pakhtunkhwa, Pakistan

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Takashi Kurosaki, Humayun Khan, Mir Kalan Shah, and Muhammad Tahir*

Abstract:

Based on a second survey of villages and households one year after a pilot survey, we analyze the household-level recovery process from damage due to floods in Pakistan in 2010. With regard to initial recovery from flood damage, we find that 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, but there remained substantial variation across households regarding the extent of recovery. Initially rich households were associated with faster recovery than other households at the time of the second survey, but the speed of recovery declined during the most recent year. The overall pattern appears to indicate that the village economy was turning towards the initial regime, where the income distribution was characterized by a large mass of households whose welfare and asset levels were around the income poverty line and a small middle class of households whose asset levels were sufficiently high to ensure a welfare level above the poverty line.

JEL classification codes: O12, D12, D91.

Keywords: natural disaster, recovery, resilience, Pakistan.

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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. 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. Furthermore, 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] Nevertheless, economics literature on the impact of natural disasters is scarce (Sawada, 2007), and economics literature on disaster relief is still nascent (Morris and Wodon, 2003; Takasaki, 2011).

To fill these literature gaps, we conducted a pilot survey in December 2010–February 2011, to analyze the impact of floods that hit Pakistan in July–August 2010 (Kurosaki et al., 2011; Kurosaki and Khan, 2011). The floods were indeed unprecedented in Pakistan, and they had affected about two-thirds of Pakistan's districts. The pilot survey was conducted in Khyber Pakhtunkhwa,[2] which was most severely hit by the floods. From the pilot survey, we found that (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, and (6) households that had initially fewer assets and were afflicted by greater flood damage had more difficulty in recovery (Kurosaki et al., 2011; Kurosaki and Khan, 2011).

Since the recovery process is dynamic in nature, a single "snapshot" survey after a disaster cannot provide detailed information on it. For this reason, we conducted a second survey of villages and households covered in the pilot survey, one year later. By combining data from these two surveys, 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 reports preliminary results regarding recovery dynamics. This type of analysis is lacking in the literature on South Asian economies; given this scarcity, the evidence shown in this paper is expected to shed light on the issue of natural disasters and the recovery process, 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 and survey design. Section 3 summarizes village- and

[1] Available on http://www.emdat.be/natural-disasters-trends (accessed on October 25, 2011).
[2] Khyber Pakhtunkhwa is one of the four provinces that comprise Pakistan. The province was formerly known as the North-West Frontier Province (NWFP).

household-level changes that occurred between the two surveys. Section 4 provides the results of the regression analysis with respect to the level of recovery. Section 5 contains a summary and concluding remarks.

2. The 2011/12 Resurvey

2.1. Study area and the 2010/11 survey

In July–August 2010, heavy torrential rains and flash floods severely affected human lives, livestock, infrastructure, crops, and livelihoods all over Pakistan. 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.

To tackle the aftermath and the inherent difficulties therein, 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.

To assess the vulnerability and resilience of rural economies against this unexpected natural disaster, we conducted a pilot survey of village economies in the Peshawar District of Khyber Pakhtunkhwa, Pakistan, in the 2010/11 fiscal year. The pilot 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 and Hussain, 1999; Kurosaki and 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 (Tarnab and Damane Hindko) were successfully resurveyed in the pilot survey. One village (Yousuf Khel) was not covered for security reasons. Eight villages were added to the survey; each of them satisfied the above inclusion criterion, as well as an additional criterion: sample villages must present various levels of damage due to the flooding.

The actual survey for the first round was carried out between December 2010 and February 2011. We successfully surveyed 10 villages, each of which had different levels of flood damage to its houses and infrastructure. 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 et al. (2011) provide greater detail about the first survey and its background.

2.2. The 2011/12 resurvey

In order to collect information on changes since the first round of the pilot survey, we conducted a second 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 (i.e., 10 from each sample village) in Peshawar, Pakistan. Table 1 shows the list of the 10 villages surveyed; in that second survey, a structured questionnaire was used, whose focus was on the changes that had occurred since the first survey with regard to household demography, labor force, physical assets, monetary assets, aid receipt, and so on.

Table 2 summarizes the household-level data obtained from the two rounds of surveys. Since the sampling probability differs from village to village (Kurosaki et al., 2011), we report unweighted statistics as well as 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 and Khan, 2006).

The average land-holding before the floods was 3.7 acres (unweighted) or 2.7 acres (weighted). 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. 4.6 million (mean) or Rs. 1.0 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 equal to or less than 1.0 acre. Livestock is another physical asset of importance in the study area. About 58% of the sample households

[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.

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. 74,000) and median (Rs. 34,000) (unweighted statistics). 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 and Hussain, 1999; Kurosaki and 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 2 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 4–5% 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 3. 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 just below 90%, compared to less than 70% one year previous. 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.

3. Changes during the One-Year Period

This section summarizes the village- and household-level changes that our survey team found to have occurred between the two surveys. Wherever corresponding data were collected in the second survey, quantitative evidence is also provided in the section.

3.1. Borrowing and lending

To cope with disaster and emergency situations, self-coping through borrowing is an important strategy throughout the world. With regard to borrowing and lending, institutional sources are rarely used in this area; only two instances of institutional-source borrowing were reported during the second survey, and they were for social and business purposes. Institutional-source borrowing was avoided by respondents in the sample villages, because of the interest charged on these loans—a practice prohibited by Islamic law and which is contrary to the people's social norms. Other factors responsible for this response could be the lengthy and difficult procedures involved, a lack of collateral, and the illiteracy of some of the affected households.

Informal credit sources were often used in the study area. Borrowing from friends and relatives is common, and this indicates strong social connections among the people. Reported borrowings from this source occur without any interest payments, without any need for collateral, and with no fixed duration for repayment. These loans are based totally on faith and on relationships that prevail in the study area. A total of 47 instances of informal borrowings were reported by the respondents. Informal borrowings were most frequently found in Damane Hindko village, where every respondent reported borrowing more than once during the reported period. These informal borrowings helped households replenish their livestock; the sample households in Damane Hindko suffered from the largest livestock losses due to the 2010 floods. These informal credit transactions thus played the most important role in helping affected households rehabilitate their livelihoods and reconstruct their asset bases.

3.2. Availability of outside aid

Outside aid can be classified as rehabilitation and relief aid. Aid for pure emergency relief was seen only during the first several months of the period between the two surveys.

Government departments independently and in collaboration with different international organizations (e.g., WFP, UN, Care, and USAID) provided relief aid to the flood-affected areas, in the forms of food, medication, agricultural inputs, business support, and payment for the compensation of standing crops. Food aid, for example, continued in the most heavily affected areas for those in need, until March 2011. NGOs also played an active role in providing relief activities, like the supply of food, clothes, utensils, etc. during the reported period. The role of NGOs in providing such aid was limited, due mainly to breakdowns in law and order and to a general lack of funds.

Some NGOs provided services for distributing government aid, while international organizations devised from their own sources aid-distribution programs. Noteworthy here is a program run by the Sarhad Rural Development Programme (SRDP). Under the program, people

mostly with agriculture backgrounds were contacted and hired as labor to rehabilitate public properties (e.g., clearance of irrigation channels and drains). The participants were paid in kind with food and clothes. The program was praised by the people of the localities, on the basis that the aid was provided with honor and not as a work-free "handout."

The Watan card program was a basic tool of government rehabilitation programs. In the province of Khyber Pakhtunkhwa, the second installment payment was released fully in the worst affected districts of Charsadda and Nowshera and partially in other districts (i.e., only in the worst affected Union Councils in these districts). Only in the villages of Jala Bela and Mian Gujar did respondents report the receipt of the second installment. Due to the delays in Watan payment, most of the people perceived the program as having failed to meet its basic objective.

To facilitate rehabilitation, several NGOs and local business communities provided affected people with raw materials for house reconstruction. Such aid, in most cases, was allocated based on merit and need. However, in one instance in Mian Gujar, we saw that reconstruction material had been provided to a few households in excess of the genuine need pertaining to house damage; this instance provides anecdotal evidence of nepotism and favoritism. In general, rehabilitation aid funded by international sources was limited and suspended earlier than had been planned as a part of the war against terrorism.

3.3. Rehabilitation of rural infrastructure

At the time of the second survey, it was found that various government departments in charge of the electricity supply, telephone, post office, etc. had rehabilitated their damaged infrastructure soon after the flood. Other departments had also launched programs to rehabilitate the damaged infrastructure within their respective domains, which were mostly incomplete and delayed due to funding unavailability. Where damages were extensive and impinged upon the livelihood of the people, special cells were established to report and reconstruct the damaged infrastructure. In this regard, the creation of Flood Damages Directorates in the Irrigation and Construction & Works Department (a department otherwise meant to oversee the construction of roads and bridges) by the government of Khyber Pakhtunkhwa can be considered important. The directorates were established to ensure speedy and coordinated reconstruction and rehabilitation.

The sample households reported that some work had been done by the irrigation department in their villages, even as roads remained damaged, save for a partial repair of a link road to Jala Bela village. These actions may reflect the government's priorities that it considers irrigation rehabilitation more important to rural livelihood than the reconstruction of roads. In the road sector, funds were mostly spent to rectify washed-out roads and bridges and roads of national and regional importance.

3.4. Changes in demography and labor force

The village data shows that the number of households residing in the village increased during the previous year, mostly because of an increase in population and the split of households into nuclear families. The household data shows that the average household size increased by 0.35 persons (unweighted) or by 0.41 persons (weighted) during the previous year (Table 2). 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. 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.

4. Correlates of the Recovery Process

4.1. Empirical strategy

Descriptions in the previous sections show that at the time of the second 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 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 3) 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 4 of Kurosaki et al. (2011) 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 et al. (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 Table 10 of Kurosaki et al. (2011). 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, based on Table 17 of Kurosaki et al. (2011). All four aid-receipt variables have insignificant coefficients, probably 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. For this reason, this paper reports regression results without using aid receipts as explanatory variables.

4.2. Correlates of household-level recovery

The regression results are reported in three tables that correspond to different dependent variables. Those in Table 4 correspond to the specification using the recovery level at the end of 2010 as the dependent variable[5]; those in Table 5 show the results one year later (i.e., the recovery level at the end of 2011); and those in Table 6 correspond to the specification using the change in recovery from the end of 2010 to the end of 2011 as the dependent variable.

Regarding initial recovery, Table 4 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 regression results in Table 4 thus confirm that households with

[5] The table is extracted from Table 22 of Kurosaki et al. (2011).

initially fewer assets and those hit by more extensive flood damage were slower to recover.

One year later, had this pattern changed? To address this question, we replaced the dependent variable in Table 4 with a similar variable that corresponded to one year later. The results are reported in Table 5. Since the recovery rates approached 100% in the cases of crops and livestock (so that the variation in the dependent variable is minimal), we estimated the model excluding these categories. A pattern similar to that seen in Table 4 (i.e., pre-flood human capital assets have positive coefficients and flood damage has negative coefficients) is still observed one year later, but with lower levels of statistical significance. 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 damages, 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.

To cleanly identify changes that occurred in the previous year, Table 6 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; more specifically, we do not report regression results for land recovery, because the sample size is as small as 11. The results in Table 6 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.

4.3. Interpretations of results

Does the recovery process characterized by the regression results indicate a recovery to the initial regime of the village economy, 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

[6] This question is motivated by the ecology literature on resilience. For instance, Gunderson and Pritchard (2002) define “engineering resiliency” as the quickness in time required for a system to recover

Tables 4 and 5 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 6 indicate the tendency for the recovery rate of initially rich households to slow down. Furthermore, those households with initially more assets tended to suffer greater damage from floods, and those greater damages make recovery more difficult. In addition, the aid allocation was targeted towards those with lower initial assets, although weakly (Kurosaki et al., 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. At the same time, we cannot deny the possibility that the 2010 floods may have destroyed human and social capital or changed the way human and physical assets translate into household well-being by way of institutional changes. In other words, to address the question above, we should consider a composite asset (called the "livelihood asset" below), which aggregates the vector of various types of human capital, social capital, and physical assets that contribute to household well-being (Carter and Barrett, 2006).

As far as the field observations indicate, however, we find no clear evidence that the 2010 floods destroyed human or social capital or changed the way in which human and physical assets translate into household well-being. Then, our tentative conclusion 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 livelihood assets; instead, the rural economy seems to be recovering to the initial regime.

To support this argument, our analysis using the 1996–99 household panel data from two villages included in the current datasets indicates the existence of two stable equilibrium levels of livelihood assets, one of which corresponds to an income level around the poverty line and the other of which corresponds to a middle-class income level, far beyond the poverty line.[7] In the pilot survey, the pre-flood asset distribution among sample households was consistent with this characterization.[8] It is not surprising, then, to observe that a small turbulence in the

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to the initial regime after turbulence, and "ecological resiliency" as the threshold turbulence above which the system transitions to a new regime.

[7] We estimated a nonparametric regression of the livelihood asset in 1999/2000 on the livelihood asset in 1996/97, using the methodology of Adato et al. (2006). The preliminary result shows an S-curve with two stable equilibriums, the lower of which corresponds to the poverty trap defined by Carter and Barrett (2006). Preliminary results are available on request.

[8] Unfortunately, due to the lack of necessary information on household income/consumption and returns on various types of assets (including human and social capital), we cannot estimate a similar nonparametric regression of the livelihood asset by using data from the two rounds of post-flood pilot

distribution of physical assets was not able to change the long-term distribution of the livelihood asset.

5. Conclusion

This paper analyzed the household-level process of recovering from damage due to floods in Pakistan in 2010, based on a second survey of villages and households one year after a pilot survey had been conducted. With regard to the initial recovery from flood damage, we found that households who had initially fewer assets and faced more extensive flood damage had greater difficulty in recovering. We further found that after one year, overall recovery had been improved, but that 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 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 regime, where the income distribution 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 of a welfare level above the poverty line. This conclusion applies to the long-run and overall 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 the devastating floods.

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

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surveys.

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Table 1: Characteristics of the sample villages and their flood damage during the floods 2010

		Characteristics before the floods			Reported damage caused by the floods:	
	Village name	Total acres (1000)	Irrigation ratio (%)	Number of households (1000)	House damages	Infrastructure damages
1	Tarnab	4.0	100	2.0	Partly affected	Minor damages
2	Masma	0.7	94	0.1	Partly affected	Minor damages
3	Urmar Miana	3.0	50	1.2	Partly affected	Minor damages
4	Mera Kachori	10.0	10	3.5	Partly affected	Minor damages
5	Damane Hindko	6.0	58	1.5	Partly affected	Minor damages
6	Shahi Bala	5.0	64	0.3	Partly affected	Minor damages
7	Jala Bela	1.2	92	0.5	Heavily affected	Major damages
8	Mian Gujar	4.5	78	3.5	Heavily affected	Major damages
9	Budhni	3.5	86	4.5	Partly affected	Minor damages
10	Dag	1.6	75	0.3	Minor damages	Minor damages

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

Table 2: Characteristics of the sample households, Khyber Pakhtunkhwa, Pakistan

Variable	Survey[1]	NOB with positive values	Unweighted statistics			Weighted statistics			Minimum	Maximum
			Mean	(Std.Dev.)	Median	Mean	(Std.Dev.)	Median		
1. Characteristics of household heads at the end of 2010										
Age	1	100	46.8	(13.9)	46.5	47.5	(14.4)	47.0	20	80
Years of formal schooling	1	62	6.88	(6.03)	8.00	6.93	(6.17)	10.00	0	16
2. The number of household members										
End of 2010	1	100	9.45	(5.01)	9.00	9.47	(4.19)	9.00	2	38
Change during 2011	2	37	0.35	(0.98)	0.00	0.41	(1.00)	0.00	-2	3
End of 2011	2	100	9.80	(5.38)	9.00	9.88	(4.55)	9.00	2	41
3. Land and livestock assets before the 2010 floods										
Land ownership (acres)	1	58	3.74	(7.26)	1.00	2.70	(5.83)	0.25	0	40
Value of land owned (Rs.1,000)	1	58	4553.0	(9196.5)	1025.0	4327.3	(10521.1)	690.0	0	60000
Number of large animals[2] owned	1	58	1.41	(2.01)	1.00	1.53	(2.27)	1.00	0	12
Value of all livestock animals[2] owned (Rs.1,000)	1	78	73.9	(150.0)	34.3	71.6	(140.5)	35.5	0	1250
4. Damage due to the 2010 floods (Rs.1,000)										
House buildings	1	87	139.1	(139.8)	127.6	137.4	(124.1)	135.3	0	650
Agricultural land	1	19	57.5	(235.7)	0.0	33.6	(140.8)	0.0	0	2000
Standing crops	1	75	417.1	(1035.3)	67.5	342.9	(941.3)	75.0	0	5250
Livestock	1	28	9.4	(23.1)	0.0	7.2	(21.0)	0.0	0	100
Others	1	7	17.9	(108.9)	0.0	14.1	(100.7)	0.0	0	1000
Total	1	99	641.0	(1188.5)	250.0	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	6.1	(8.6)	0.0	7.2	(9.0)	5.0	0	40
Emergency aid from the government, 2010	1	43	5.3	(7.1)	0.0	4.2	(6.3)	0.0	0	30
Reconstruction aid from NGOs, 2011	2	7	2.6	(12.2)	0.0	4.8	(16.7)	0.0	0	100
Reconstruction aid from the government, 2011	2	4	0.7	(5.1)	0.0	0.4	(1.8)	0.0	0	50
Income transfer through Watan cards	2	42	9.8	(12.6)	0.0	12.7	(14.4)	0.0	0	40

Notes: The number of observations (NOB) is 100 (10 from each village reported in Table 1). "Weighted statistics" use the inverse of sampling probability as the weights.

[1] Survey 1 corresponds to the first round (fiscal year 2010/11) and Survey 2 corresponds to the second round (fiscal year 2011/12).

[2] "Large animals" include buffalo, cattle, horse, and mule. "All livestock animals" in addition include goat, sheep, and chicken.

Table 3: The extent of recovery from the 2010 floods

Type of recovery	Assessment period	NOB with positive flood damage[1]	Frequency distribution of the recovery extent[1]											Unweighted statistics		Weighted statistics	
			0-9%	10-19%	20-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%	90-99%	100%	Mean	(Std.Dev.)	Mean	(Std.Dev.)
Overall	End of 2010	99	3	2	0	3	3	24	4	12	21	6	21	69.0	(25.3)	68.8	(25.5)
	End of 2011	99	0	0	1	1	3	4	3	10	8	17	52	87.3	(18.8)	86.3	(19.8)
House buildings	End of 2010	87	3	0	1	14	3	31	1	10	2	0	22	60.1	(27.8)	57.4	(28.9)
	End of 2011	87	0	0	3	3	1	8	3	3	12	6	48	83.8	(23.3)	84.6	(22.9)
Agricultural land	End of 2010	19	5	0	1	2	0	2	0	0	1	0	8	55.8	(43.8)	59.9	(43.6)
	End of 2011	19	2	0	0	1	0	1	2	0	4	0	9	74.7	(33.4)	74.1	(33.7)
Crops[2]	Rabi 2010/11	75	5	0	0	1	1	6	1	4	2	2	53	84.9	(28.8)	88.1	(26.8)
	Kharif 2011	75	1	0	0	0	0	2	2	1	0	0	69	96.0	(15.2)	97.0	(13.5)
	Rabi 2011/12	75	0	0	0	0	0	0	1	0	4	0	70	98.4	(6.4)	99.5	(3.4)
Livestock	End of 2010	28	14	0	0	0	0	1	0	1	1	0	11	46.4	(48.5)	50.5	(48.1)
	End of 2011	28	0	0	0	0	0	0	0	0	0	0	28	100.0	n.a.	100.0	n.a.

Notes: [1] 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 first column.

[2] 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 4: 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	Crop-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 Table 10 of Kurosaki et al. (2011))						
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 3,5	Full	Village 5,7
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 5: 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 Table 10 of Kurosaki et al. (2011))				
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 4.

Table 6: Changes in recovery from floods, extent of flood damage, and households' initial capital

	Dependent variable: Changes in recovery status in percentage points from the end of 2010 to the end of 2011		
	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 Table 10 of Kurosaki et al. (2011))			
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 4. In this regression, the subsample whose recovery extent was below 100% in the end of 2010 is used.