E C O N O M I C S B U L L E T I N

How do the poor cope with hardships when mutual assistance is unavailable?

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Abstract

This paper investigates how risk coping strategies differ between idiosyncratic and covariate income shocks using evidence from a nation-wide flood in Bangladesh. It is found that availability of coping strategies significantly depends on the covariate-idiosyncratic characteristic of shocks. The main strategies for idiosyncratic and moderate covariate shocks are interest-free informal credit and additional labor supply for fishing, but they are not utilized to cope with the severe covariate shocks. Instead, people must resort to borrowing with high interest as a last resort.

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1. Introduction

People in the developing world frequently face various shocks such as natural disasters and unemployment. These shocks are categorized into two groups depending on the extent of damages: covariate shocks and idiosyncratic shocks. The former affects the whole community such as villages, while the latter affects individuals or households. Impacts on victims' livelihood could be different between them, implying needs for different policy interventions.

When economic hardships occur in developing countries, people resort to various risk coping strategies to smooth consumption, since formal credit and insurance markets are less developed[1]. However, these strategies still may not work perfectly (Townsend 1994, Kazianga and Udry 2006); negative income shocks could lower consumption significantly, causing transitory poverty[2]. Jalan and Ravallion (1998) show that the poverty in rural China could be halved if transitory poverty is solved through improvement of access to credit and insurance markets. Therefore, it is important to examine how people ensure livelihoods during negative shocks.

This paper aims to reveal differences in risk coping strategies between idiosyncratic and covariate shocks using evidence from Bangladesh. Previous studies claim the importance of examining not only idiosyncratic but also covariate shocks to better understand households' attitude toward risks (Dercon 2002, Skoufias 2003). This would be helpful in suggesting efficient poverty reduction programs, since the government provides safety net programs mainly for covariate shocks. However, most studies investigate only household-level idiosyncratic shocks, and there are few studies that compare covariate and idiosyncratic shocks (Ersado et al. 2003, Handa and King 2003, Takasaki et al. 2004).

This study attempts to contribute to the research on this subject in the following ways. First, this study examines risk coping strategy choice. People in the third world combine multiple strategies depending on the characteristics of households and shocks, but few researchers conduct studies from this perspective (Rosenzweig 2001). This paper bridges the gap in the existing literature by considering five major risk coping strategies. The second contribution is to explicitly reveal the availability and limitation of risk coping strategies in regards to the type of shocks. Interest-free informal credit is used as informal mutual insurance, and it shares a major part of the literature of risk coping strategies (Platteau and Abraham 1987, Udry 1994, Fafchamps and Lund 2003, Fafchamps and Gubert 2007). This study finds that the availability of such credit significantly depends on whether the shock is covariate or idiosyncratic, and people

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[1] Risk coping strategies include, for example, interest-free informal credit, additional labor supply, sales of assets, and so forth (Dercon 2002, 2005; Fafchamps 2003). The literature of risk coping strategies is briefly reviewed in the next section.

[2] Poverty is classified as being either chronic or transitory. If a household is poor in every period, it is chronic poverty. Otherwise, it is transitorily poor (Morduch 1994). Transitory poverty is largely caused by less developed credit and insurance markets.

must borrow with high interest rates when severe covariate shocks occur.

2. The 1998 Flood in Bangladesh and Dataset

Bangladesh is a flood-prone country. The timing of floods is considered exogenous because it depends on the timing and the amount of rainfall. Therefore, it is hard to predict the level of flooding beforehand, exacerbating the damage. Floods are clearly the most important risk for agricultural households in determining the amount of inputs. The nation-wide flood disasters in 1988, 1998, 2004, and 2007 caused severe damage to micro and macro economies.

The flood in 1998 was particularly severe in terms of both damage per household and the number of affected households. It began in the first week of July and continued until the middle of September, affecting 68% of the country. Since it began after the planting period of the main crop for the rainy season, most of the standing crop was damaged (del Ninno, et al. 2001). Although the flood significantly declined households' livelihoods on average, the level of damage varied across villages and even between households within the same village. Therefore, floods affect households as both covariate and idiosyncratic shocks. Damages from the 1998 flood are discussed in detail below with summary statistics.

This study utilizes a micro panel dataset of 757 households, collected by the International Food Policy Research Institute (IFPRI). The dataset was surveyed to study the 1998 flood impacts on households. It covers three waves: December 1998, June 1999, and November 1999. However, this paper only employs the first and third waves of the data to eliminate seasonal effects; in agricultural areas like rural Bangladesh, households' preference of consumption and saving varies according to seasons.

This dataset follows the multistage stratified random sampling methodology for seven districts that were selected depending on their economic status and the severity of the flood damage. In the second stage, one Thana from each district and three unions from each of them were randomly chosen[3]. In the next stage, approximately six villages from each union and two clusters from each of the villages were randomly picked out. Finally, approximately three households from each cluster were chosen depending on the village size (del Ninno et al. 2001).

This dataset has interesting features to examine the covariate shocks and the risk coping strategies. An appropriate estimation of covariate shock impacts requires both large community-sample size and variation in flood damages across communities. To that extent, this dataset is suitable since it includes 126 villages sampled from widely scattered areas. Another advantage of this data is the availability of the flood impacts on the local communities such as

[3] "Thana" and "union" are administration units of Bangladesh; a union consists of some villages, and each Thana includes multiple unions.

damage to infrastructure and access to market.

Summary Statistics and Literature Reviews

Table 1 describes the community-level and household-level damages caused by the 1998 flood. Community-level damages were surveyed from each union. Damage to transportation infrastructure was remarkably severe; around 90% of communities experienced damage to roads and/or bridges. The flood also affected culverts severely, but damages to irrigation and canal infrastructure were moderate; only 30% of communities experienced damage. In terms of household level damages, 89% of agricultural fields were covered with flood water. Also, in 67% of houses, floors were covered with flood water.

Table 2 illustrates declines in labor income during floods and increases in uses of risk coping strategies for the flood damage. Labor income includes agricultural income from plots, agricultural and nonagricultural wage labor income, and nonagricultural self-employment business income. It does not include income from fishing, since price data of fish is not available. Seasonal labor income during the flood was 20% lower than in 1999, one year after the flood. The variance of income was also higher in 1998, implying that vulnerability to disasters varied across households.

To cope with the negative income shock in 1998, people borrowed from various sources: banks, Microfinance, interest-free credit from informal sources such as relatives and neighbors, and informal credit with interest. Interest-free credit is used as informal insurance in village economies (Udry 1994, Fafchamps and Lund 2003, Fafchamps and Gubert 2007). In addition to this, many households borrowed with interest during the flood period. Informal lenders charged around 50% interest rates during the flood, which is much higher than those of formal banks and MFIs. The amount of informal credit with interest was higher during the flood, while interest-free credit was less active at that time than in 1999.

Panel C reports that time allocation for fishing was remarkably high during the flood. Additional labor supply to smooth income is an important risk coping strategy (Morduch 1995; Kochar 1999). Fishing can be considered as an important source of income when agricultural fields are covered with flood water. Although access to agricultural work is lost, it becomes easier to catch fish during floods[4]. The final major coping strategy is dissaving of assets such as livestock and crop storage (Rosenzweig and Wolpin 1993; Udry 1995; Fafchamps et al. 1998; Kazianga and Udry 2006). The table shows that livestock transactions are used less frequently than crop dissaving.

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[4] Takasaki et al. (2004) find that people affected by covariate shocks are more likely to increase time allocation for fishing and to extract common resources such as firewood.

3. Empirical Methodology

This section develops the empirical methodology to examine in risk coping strategies for covariate and idiosyncratic shocks. Although this paper mainly focuses on coping strategies for community-wide covariate income fluctuation, I begin with discussion of household-level idiosyncratic income shock. The following equation based on the full insurance hypothesis test is considered (Townsend 1994, Ravallion and Chaudhuri 1997);

$$\Delta s_{t+1} = \alpha_0 + \alpha_1 \Delta Y_{t+1} + X_t \alpha_2 + Z\alpha_3 + e_{t+1}, \qquad (1)$$

where, Δ indicates the first difference operator, s the amount of each risk coping strategy, Y labor income, and X other control variables for households' heterogeneity in preference, endowment and access to credit market: demographic variables, household head characteristics and size of agricultural fields. Finally, Z is a village fixed-effect variable to control for village-level heterogeneity. In this specification, α_1 indicates the effect of idiosyncratic income fluctuations on coping strategies, since the covariate component of income shock is absorbed in the village fixed effect.

A concern related to the specification is endogeneity of income, since households make decisions regarding coping strategies and income earning activities simultaneously. Suitable instrumental variables must satisfy two conditions. They must be correlated with income fluctuations and orthogonal to the residuals in the risk coping strategies. Exogenous factors to explain production technology would satisfy these criteria.

This study employs the following instrumental variables: flood damage to irrigation infrastructure and fertilizer shops, depth of flood water in agricultural fields, and its square term[5]. Justification of these instruments is based on Paxson (1993), who uses access to irrigation system to control for endogeneity between consumption and income level. The idea is that the access to irrigation and fertilizer affects incomes, but affects coping strategies only through the impact on income. That is, they do not change households' decisions about coping strategies directly. Similarly, the depth of flood water in the fields affects agricultural income, but would not change people's decisions directly. Finally, I use the square term of the flood depth to control for the non-linear effect of inundation on harvest, since moderate floods could increase harvests. I discuss the justification of instruments in detail at the appendix A1.

Table A2 at the appendix shows results from the first stage regression. This study runs the regressions of income level of each year as well as the first difference. They are estimated using cluster-adjusted standard errors to address the correlation of residuals within villages. The bottom of the third column rejects the possibility of the weak instruments.

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[5] This paper uses the number of damaged irrigation systems divided by the number of households living in the Union community as the instrument to control for heterogeneity in community size.

Measuring Covariate Shocks

Equation (1) is not adequate to examine covariate shocks because the covariate component of income fluctuation is absorbed in the village fixed effect. Therefore, this study introduces an alternative approach following Campbell et al. (2001)[6]. More specifically, this study decomposes the fitted value of income fluctuations from the first stage regression in Table A2, $\Delta\hat{Y}_{t+1}$, into union-level and village-level covariate income fluctuations and household-level idiosyncratic fluctuations:

$$\Delta\hat{Y}_{t+1} = E_U\left(\Delta\hat{Y}_{t+1}\right) + \left\{E_V\left(\Delta\hat{Y}_{t+1}\right) - E_U\left(\Delta\hat{Y}_{t+1}\right)\right\} + \left\{\Delta\hat{Y}_{t+1} - E_V\left(\Delta\hat{Y}_{t+1}\right)\right\} \tag{2}$$

where $E_U\left(\Delta\hat{Y}_{t+1}\right)$ and $E_V\left(\Delta\hat{Y}_{t+1}\right)$ denote the average of estimated income fluctuation within each union and village, respectively. Finally, this study estimates the following equation:

$$\begin{aligned}\Delta s_{t+1} = \beta_0 + \beta_1 E_U\left(\Delta\hat{Y}_{t+1}\right) + \beta_2\left\{E_V\left(\Delta\hat{Y}_{t+1}\right) - E_U\left(\Delta\hat{Y}_{t+1}\right)\right\} \\ + \beta_3\left\{\Delta\hat{Y}_{t+1} - E_V\left(\Delta\hat{Y}_{t+1}\right)\right\} + X_t\beta_4 + \varepsilon_{t+1}\end{aligned} \tag{3}$$

This specification illustrates the impact of covariate shocks on coping strategies by comparing β_1, β_2, and β_3. Note that β_1 reflects the effect of more severe covariate shock than β_2 in terms of the extent of affected areas, and β_3 reports impacts of idiosyncratic income fluctuation. If choices of risk coping strategies are not influenced by the covariate-idiosyncratic nature of the shock, these three coefficients should be the same[7]. A potential concern in this approach is associated with the possibility of bias caused by omitted community-level heterogeneity, since it does not include community-level fixed effect variables. This is addressed in detail at the appendix.

4. Estimation Results

This section discusses the estimation results of Equation (3)[8]. I estimate five major risk coping

[6] Campbell et al. (2001) employs this specification to examine the volatility of common stock at the market, industry and firm level.

[7] Fafchamps and Lund (2003) show that the poor in Philippines form small risk-sharing groups with a few members rather than the whole village. This study considers villages as a unit of community because of the unavailability of data for the group formation. Another reason is that the mean income levels of such small groups are considered endogenous, since people endogenously choose the group members (Fafchamps and Gubert 2007).

[8] It might be straightforward to use the Friction Model estimation (Maddala 1986), given that the dependent variables of some observations take the value of zero. However, I employ the Linear Regression model because the sample size of the dataset is small.

strategies: interest-free informal credit, informal credit with interest, labor supply for fishing, saving of crop and livestock assets. Credit transactions from informal sources such as relatives and landlords are categorized as *interest-free informal credit* if interest is not charged or as *informal credit with interest*, otherwise. *Labor supply for fishing* is the seasonal working hours allocated to fishing. *Crop saving* and *livestock saving* indicate the net of purchase, consumption, and sales of paddy and rice, and bullock and cattle, respectively.

Table 3 shows distinctions in the risk coping strategies between idiosyncratic and covariate income fluctuations[9]. First, the first column shows that a decrease in idiosyncratic income is associated with an increase in interest-free credit; people use interest-free credit for idiosyncratic shocks, consistent with previous studies (Udry 1994, Fafchamps and Lund 2003, Fafchamps and Gubert 2007). Coefficients of idiosyncratic shock in the other columns are statistically insignificant, while the signs of parameters are consistent with the consumption smoothing model, implying that interest-free credit is the major strategy to cope with idiosyncratic shocks.

Second, however, interest-free credit is not useful when all community members suffer from flood damage. The absolute value of the coefficient of village-level covariate shocks is smaller than that of idiosyncratic shocks, although it is still marginally significant[10]. Instead, people use other strategies to cope with covariate shocks. The third column shows that affected people increase time allocation for fishing to compensate for the income loss. A 100 Taka (Tk) decline in average income increases the time allocated to fishing by 7.54 hours for the average villager. If an individual had worked as a casual wage laborer during the flood period while the average daily income from casual labor was 38.6 Tk, he would have earned 36.4 Tk in 7.5 hours[11].

Third, when households face union-level severe covariate shocks, they are no longer able to use quasi-credit. People still catch fish to smooth income, but the absolute value coefficient is smaller than that of village-level covariate shock. The decline in fishing activity might be because more people attempt to catch fish under more severe covariate shocks, resulting in a decline in the marginal productivity of fishing and also causing a decline in the market price of fish. This in turn decreases the amount of labor supply, given that the marginal productivity is

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9 Although the original sample size of the data is 757, this study is able to utilize data from 641 households because of missing data mainly for the damage to irrigation infrastructure. A specification without the irrigation damage variable obtains the similar results.

10 The table shows that a 1000 Tk of decreases in idiosyncratic income increases the amount of quasi-credit by 2255 Tk, while that of village-level covariate income increases it by 1733 Tk. Consumption smoothing behavior expects the coefficients range from -1000, if a shock is completely insured using quasi-credit, to zero in case it is not used to smooth consumption at all. The coefficients of point estimate are counter-intuitively large, but the upper-bounds of 90% confidence intervals of idiosyncratic and village-level shocks are -843 and -122, respectively (not reported in tables); both fit in the expected range.

11 It assumes that casual workers work 8 hours per day.

sufficiently low.

Fourth, the coefficient of the union-level covariate shock in the second column indicates that people cope with 65% of the severe covariate shock by utilizing credit with high interest. People borrow with high interest only when the other strategies are costly or unavailable. This is consistent with the finding by Kochar (1995) that credit from moneylenders is a more burdensome strategy than increasing labor supply. Under severe covariate shocks, affected households borrow with high interest rates as a last resort.

Finally, it is tested whether the coefficients of idiosyncratic and severe covariate shocks are the same for each strategy. The table shows statistically significant differences between the two coefficients in the equations of interest-free credit and informal credit with interest, strengthening the robustness of the findings.

5. Discussion and Concluding Remarks

This study reveals differences in consumption smoothing behavior between covariate and idiosyncratic shocks using evidence from the 1998 flood in Bangladesh. While the government provided the poor with safety nets such as food relief and workfare programs, victims still had to take risk coping strategies in order to smooth consumption. I find that while people mainly use interest-free credit to cope with the idiosyncratic shock, in the face of village-level covariate shock such credit transactions become inactive. Instead, people get involved in fishing to compensate for the loss. When more severe covariate shocks occur, people are no longer able to borrow without interest, and fishing activity is reduced perhaps because of declines in productivity. Therefore, people must resort to borrowing from informal lenders with high interest rates.

These findings suggest the importance of credit markets for people to ensure their livelihoods. A possible intervention is the promotion of MFIs, which have been playing an important role in improving access to credit for the poor (Aghion and Morduch 2005; Khandker 2007). An alternative policy is the provision of workfare programs. As this paper finds, people in the face of negative shocks attempt to allocate time resources to additional labor in order to compensate for the income loss. This does not, however, guarantee perfect income recovery under severe covariate shocks, since marginal productivity of labor decreases. If the central government and NGOs provide workfare programs which secure a certain wage level, it would help people overcome community-wide hardships.

Appendix 1: Further Discussion of the Instrumental Variables

As for the choice of instrumental variables, one might argue that floods could decline the marginal productivity of land, affecting collateral value of land assets, which in turn deteriorates access to formal and informal credit markets. If this is the case, the instrumental variables – damage to irrigation, fertilizer shops, and owned fields – would be correlated to the estimation residuals, violating the exclusion restriction. Unfortunately, the standard identification test of instrumental variables is not available because of the decomposition approach in the estimation.

Therefore, I use the change in the price of land assets between flood and non-flood period to address the concern. The dataset records 145 transactions of purchase and inheritance of agricultural plots since 1995. This enables us to examine the dynamics of collateral value of land assets through time. Panel A of Table A1 compares average unit price of fields in 1998 to that of pre-flood period from 1995 until 1997. The mean difference test does not reject the null that average unit prices are the same between the two periods.

One might, however, be concerned by the possibility of sample selection bias in the tests, since land prices are observed only when fields are transacted. If prices of some fields declined, and the land owners avoided selling their land during the floods, the reported statistics overestimate the actual average land price of the floods periods. To address this potential problem, this paper attempts two tests. The first is a mean difference test using only observations of inherited land. Since the timing of inheritance is exogenous, unlike that of purchase, the price dynamics of inherited land are free from the sample selection issue. Panel B shows the results of mean difference tests, and it does not reject the null.

The second attempt is the non-parametric Kolmogorov-Smirnov test (Smirnov 1939, Gail and Green 1976). If the sample selection bias is true, the lower side of density function of unit price would be truncated. Hence, the cumulative density functions would be different between the two periods, even if the mean levels are the same. The Kolmogorov-Smirnov test examines the difference in cumulative density functions between two groups. The table shows that it does not reject the null that the cumulative density functions are the same, strengthening the justification of the instrumental variables.

Appendix 2: Robustness Check: Omitted Village-Level Heterogeneity

This subsection addresses the possibility of biased estimation caused by omitted community-level variables, because Equation (3) does not include community-level fixed effects. Also, the decomposition of income fluctuation might show a biased result if measurement error of community-level average income is significant. Since the dataset includes only six households from each village, there might be a gap between the actual mean income shock and the one calculated from the observations.

Therefore, this subsection attempts estimation of Equation (1) with a village-level fixed effect. Although this specification does not identify impacts of covariate shocks, it consistently estimates impacts of idiosyncratic shocks. If the above-mentioned econometric problems are not crucial, it should show a similar result to the main specification as for the coefficients of idiosyncratic shock. Panel A of Table A3 reports estimated coefficients of idiosyncratic-income fluctuation, α_1. It shows similar findings; again, people mainly use interest-free credit to cope with idiosyncratic shocks. The coefficients in the other equations are insignificant.

Appendix 3: Robustness Check II: Omitted Flood-Damage Variables

The previous specifications investigate only income shocks caused by the flood. However, floods affect households through various aspects such as damage to productive assets and health conditions. Omitting these variables might cause a biased estimation. This section, therefore, shows results from a specification with another covariate: the duration of inundation at home. This affects the households' health condition and productive assets, and therefore controls for the effect of the flood on damage to human and physical assets. Table 1 shows that almost two thirds of houses got inundated with flood water. The results are reported at Panel B of Table A3, and are similar to those in Table 3.

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Table 1: Flood Damage in 1998

Variable	Total Mean	Total Pr(X>0)
Community Level Damage		
Road (km)	15.24 (11.30)	95.1%
Bridge (#)	2.83 (2.07)	85.7%
Culvert (#)	4.69 (5.13)	72.1%
Irrigation/Canal (#)	3.50 (6.05)	30.4%
Fertilizer Shop (days)	27.90 (26.78)	60.9%
Household Level Damage		
Max. Flood Depth at Plot (feet)	5.90 (5.03)	89.3%
Max. Flood Depth at Home (feet)	1.93 (3.04)	67.2%
Days Flood Covered Floor at Home (days)	25.15 (28.66)	66.8%

Standard deviations are in parentheses.

Table 2: Dynamics of Livelihood and Coping Strategies

	Rainy Season in 1998 Mean	Rainy Season in 1998 S.D.	Rainy Season in 1999 Mean	Rainy Season in 1999 S.D.
Panel A: Livelihood				
Seasonal labor income (Tk)	4601.3	(6413.5)	5724.2	(5334.6)
Weight for height ratio				
-Males under 10	0.138	(0.025)	0.166	(0.462)
-Females under 10	0.132	(0.028)	0.143	(0.028)
-Females aged 10 to 29	0.248	(0.049)	0.258	(0.047)
-Females over 30	0.271	(0.037)	0.275	(0.039)
Panel B: Coping Strategies (Credit)				
Interest-free informal credit (Tk)	919.8	(2612.0)	1413.2	(8585.9)
Informal credit with interest (Tk)	624.5	(2117.4)	357.9	(2064.6)
Annual interest rates in informal credit (%)	48.66	(31.68)	51.16	(36.35)
Credit from Banks (Tk)	609.4	(2567.0)	186.0	(1326.4)
Credit from MFIs (Tk)	525.8	(2175.4)	395.4	(1716.0)
Panel C: Other Coping Strategies				
Seasonal time allocation to fishing (Hrs)	128.47	(314.62)	29.86	(83.07)
Crop Saving (Tk)	-2091.22	(4415.63)	-487.23	(2838.24)
Livestock Saving (Tk)	-121.20	(1059.93)	59.82	(1521.15)

Table 3: Coping Strategies for Covariate and Idiosyncratic Shocks: Equation (3)

	Dependent variables: Difference between 1999 and 1998 of				
	Interest-Free Credit (Tk)	Credit with Interest (Tk)	Labor Hours to Catch Fish (Hrs)	Livestock Saving (Tk)	Crop Saving (Tk)
β_1: Union-level severe covariate shock (1000 Tk)	-770.0	-651.5	-58.5	132.4	-608.8
	(943.0)	(305.7)**	(24.0)**	(157.2)	(384.5)
	[1082.7]	[307.9]**	[32.5]*	[146.3]	[554.0]
β_2: Village-level moderate covariate shock (1000 Tk)	-1773.3	-261.6	-75.4	-112.6	-573.0
	(1337.2)	(433.5)	(34.0)**	(222.9)	(545.3)
	[994.5]*	[357.4]	[42.2]*	[160.8]	[1086.7]
β_3: Idiosyncratic shock (1000 Tk)	-2254.6	-10.9	-52.4	105.1	198.3
	(1273.4)*	(412.8)	(32.4)	(212.3)	(519.3)
	[850.5]***	[422.2]	[40.2]	[171.1]	[894.3]
Males aged 16 to 59	1430.5	120.8	11.9	219.3	222.0
	(859.6)*	(278.6)	(21.9)	(350.5)	(143.3)
	[797.1]*	[283.7]	[21.4]	[462.4]	[140.4]
Females aged 16 to 59	-206.7	-240.7	-73.6	855.8	188.4
	(1120.0)	(363.1)	(28.5)**	(456.7)*	(186.7)
	[1339.2]	[339.4]	[37.2]*	[710.5]	[153.1]
Members aged over 60	-580.5	67.2	-6.6	-55.7	48.9
	(1277.7)	(414.2)	(32.5)	(521.0)	(213.0)
	[822.4]	[467.6]	[26.3]	[850.4]	[169.0]
Members aged under 15	-46.1	-146.4	-2.9	5.5	40.0
	(321.5)	(104.2)	(8.2)	(131.1)	(53.6)
	[293.7]	[126.5]	[8.2]	[173.9]	[52.3]
Age of Head	-65.8	-25.4	-2.0	5.3	-6.4
	(46.6)	(15.1)*	(1.2)*	(19.0)	(7.8)
	[43.8]	[12.5]**	[1.1]*	[19.8]	[5.7]
Female Head	-8076.0	389.5	-148.7	19.0	251.2
	(5005.3)	(1622.5)	(127.2)	(2041.1)	(834.5)
	[3418.9]**	[1424.2]	[143.4]	[3454.8]	[582.0]
Educated Years of Head	-275.0	22.1	-9.2	103.8	-8.8

	(333.1)	(108.0)	(8.5)	(135.8)	(55.5)
	[336.9]	[118.0]	[10.1]	[225.1]	[44.4]
Size of Land Assets	-21.5	-0.2	0.0	1.2	-0.4
(Decimal)	(4.7)***	(1.5)	(0.1)	(1.9)	(0.8)
	[5.0]***	[1.1]	[0.1]	[3.1]	[1.7]
Constant	4418.4	1949.8	195.2	400.6	-371.7
	(4333.4)	(1404.7)	(110.2)*	(1767.1)	(722.5)
	[3611.2]	[1392.2]	[126.2]	[2712.7]	[496.7]
H_0: $\beta_1 = \beta_3$	3.01*	3.92*	0.02	1.61	0.02
Observations	641	641	641	641	641

Standard errors based on SURE estimation are in parentheses, and village-level-cluster-adjusted robust standard errors are in brackets.
*** 1% significant, ** 5% significant, * 10% significant, respectively

Table A1: Justification of the Instrumental Variables

	N	Mean	S.E.
Panel A: Purchase and Inheritance			
Non-Flood Period	117	1702	127.2
Flood Period	28	1556	188.4
Mean Difference Test #		0.597	
Kormogorov-Smirnov Test #		0.857	
Panel B: Inheritance			
Non-Flood Period	70	1478	163.2
Flood Period	11	1407	292.7
Mean Difference Test #		0.869	
Kormogorov-Smirnov Test #		0.982	

#: P-values are reported.

Table A2: First Stage Regression

	Dependent Variable: Labor Income in Rainy Season (Tk)			
	In 1998	In 1999	Difference between 1999 and 1998	Sample Mean as of 1998 (S. D.)
Instrumental Variables				
Damage to Irrigation/Canal	-221.4	-241.7	-75.4	0.82
	(140.4)	(113.7)**	(145.2)	(1.51)
Damage to Fertilizer Shop	6.4	-15.2	-16.5	27.90
	(9.6)	(9.5)	(9.7)**	(26.78)
Max. Flood Depth at Plot	-308.1	-175.6	99.5	5.90
	(139.8)**	(124.5)	(124.5)	(5.03)
Squared Max. Flood Depth	4.9	2.0	-2.1	-
at Plot	(5.7)	(5.5)	(5.2)	-
Other Explanatory Variables				
Males aged 16 to 59	1193.6	1651.9	524.8	1.48
	(330.9)***	(303.0) ***	(334.4)	(1.00)
Females aged 16 to 59	1312.8	421.1	-791.0	1.44
	(452.0) ***	(274.7)	(448.6) *	(0.76)
Members aged over 60	1631.3	1079.0	-715.5	0.32
	(440.4) ***	(462.5) **	(585.1)	(0.56)
Members aged under 15	211.8	262.8	-52.3	2.35
	(183.0)	(138.7) *	(171.3)	(1.45)
Age of Head	-4.7	-10.6	-13.2	45.10
	(26.9)	(15.2)	(31.4)	(12.52)
Female Head	1045.0	-2267.7	-3460.9	0.04
	(1431.7)	(566.8) ***	(1397.3) **	(0.20)
Educated Years of Head	348.5	80.4	-243.8	2.58
	(85.5) ***	(58.9)	(73.8) ***	(3.74)
Size of Land Assets	-2.0	-5.6	-3.0	89.46
(Decimal)	(2.5)	(1.5) ***	(2.0)	(165.28)
Constant	889.7	4220.5	3778.7	-
	(1253.9)	(948.8) ***	(1482.9) **	-
Observations	653	651	651	
R^2	0.16	0.14	0.08	
H_0: Coefficients of IVs are jointly zero	5.49***	9.06***	1.99*	

Cluster-adjusted robust standard errors are in parentheses.
*** 1% significant, ** 5% significant, * 10% significant, respectively

Table A3: Coping Strategies for Covariate and Idiosyncratic Shocks: Robustness Check

	Difference between 1999 and 1998 of:				
	Interest-Free Credit (Tk)	Credit with Interest (Tk)	Labor Hours to Catch Fish (Hrs)	Livestock Saving (Tk)	Crop Saving (Tk)
Panel A: Equation (1)					
Idiosyncratic shock	-2810.5	142.3	2.5	284.4	51.5
(1000 Tk)	(1339.2)**	(727.1)	(69.9)	(295.5)	(666.0)
Observations	641	641	641	641	641
Panel B: Equation (3)					
β_1: Union-level severe	-763.3	-632.8	-57.8	-564.1	139.5
covariate shock (1000 Tk)	(938.1)	(303.6)**	(23.6)**	(380.2)	(156.5)
	[1063.8]	[316.4]**	[30.7]*	[540.6]	[150.0]
β_2: Village-level moderate	-2100.6	-229.7	-72.4	-263.4	-68.4
covariate shock (1000 Tk)	(1342.5)	(434.5)	(33.7)**	(544.1)	(224.0)
	[1018.4]**	[346.1]	[42.4]*	[1083.8]	[173.7]
β_3: Idiosyncratic shock	-2366.0	16.6	-51.5	550.0	144.2
(1000 Tk)	(1298.9)*	(420.4)	(32.6)	(526.4)	(216.7)
	[918.9]**	[418.0]	[40.0]	[916.7]	[184.7]
Days Flood Covered Floor	23.1	9.1	-1.3	-15.1	-0.6
of Home during the flood	(16.4)	(5.3)*	(0.4)***	(6.6)**	(2.7)
	[17.3]	[5.7]	[0.5]**	[8.4]*	[2.2]
Test: $\beta_1 = \beta_3$	3.76*	3.94**	0.03	3.11*	0.00
Observations			641		

Standard errors based on SURE estimation are in parentheses, and village-level-cluster-adjusted robust standard errors are in brackets.
*** 1% significant, ** 5% significant, * 10% significant, respectively