TCER Working Paper Series

POST-DISASTER INFORMAL RISK SHARING

Yoshito Takasaki

February 2011

Working Paper E-25
http://tcer.or.jp/wp/pdf/e25.pdf

TOKYO CENTER FOR ECONOMIC RESEARCH
1-7-10-703 Iidabashi, Chiyoda-ku, Tokyo 102-0072, Japan

Abstract

Using original household survey data collected in rural Fiji, this paper demonstrates how informal risk-sharing institutions upon which poor people heavily rely in times of illness are vulnerable to natural disasters. First, household private cash and inkind transfers do not serve as insurance against illness in the relief phase (several months after the disaster); they do so only after pooled resources are recovered in the reconstruction phase (a few years later) (i.e., the resource effect). Second, risk-sharing arrangements are dependent on the history of labor-time transfers corresponding to housing damage: Only disaster non-victims are insured against illness, because victims have already received labor help for their rehabilitation from non-victims (i.e., the reciprocity effect). The paper reveals that the resource/reciprocity effects exist not only in endogenously formed networks, but also in pre-formed groups, especially kin and religious ones; in particular, group members with illness contribute less to groups than others do.

Yoshito Takasaki
University of Tsukuba
Graduate School of Humanities and Social Sciences
1-1-1 Tennodai, Tsukuba, Ibaraki
takasaki@sk.tsukuba.ac.jp

Post-disaster informal risk sharing

Yoshito Takasaki[a]
University of Tsukuba

February 14, 2011

[a] Corresponding author. Graduate School of Humanities and Social Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8571 Japan, Tel./fax: +81 29 853 6280. E-mail address: takasaki@sk.tsukuba.ac.jp.

Post-disaster informal risk sharing

Abstract

Using original household survey data collected in rural Fiji, this paper demonstrates how informal risk-sharing institutions upon which poor people heavily rely in times of illness are vulnerable to natural disasters. First, household private cash and inkind transfers do not serve as insurance against illness in the relief phase (several months after the disaster); they do so only after pooled resources are recovered in the reconstruction phase (a few years later) (i.e., the resource effect). Second, risk-sharing arrangements are dependent on the history of labor-time transfers corresponding to housing damage: Only disaster non-victims are insured against illness, because victims have already received labor help for their rehabilitation from non-victims (i.e., the reciprocity effect). The paper reveals that the resource/reciprocity effects exist not only in endogenously formed networks, but also in pre-formed groups, especially kin and religious ones; in particular, group members with illness contribute less to groups than others do.

Keywords: Informal risk sharing; Natural disasters; Illness.

JEL classification: O15; O17.

1. Introduction

Informal risk-sharing institutions are critically important in poor populations (see, for example, Alderman and Paxon, 1994; Dercon, 2002; Morduch, 1999 for reviews of informal insurance). They are particularly important for health shock, because neither health insurance nor public safety nets are available among the poor (see Strauss and Thomas, 1998 for their extensive review of the health-development nexus). Numerous studies have shown that informal risk sharing against idiosyncratic shocks, such as illness, is available in developing areas, although it is far from complete (e.g., Asfaw and von Braun, 2004; Dercon and Krishnan, 2000; Gertler and Gruber, 2002; Kochar, 1995; Townsend, 1994). In contrast, such informal institutions are considered to be ineffective against covariate shocks, such as natural disasters, because shocks are highly correlated over space. Although extant works on risk sharing against natural disasters are relatively scarce, recent empirical studies provide evidence for such arrangements against household-level disaster shocks (e.g., Mozumder et al., 2009; Sawada, 2007; Sawada and Shimizutani, 2008; Takasaki, 2011a). Of course, disaster relief plays a central role as a safety net. Post-disaster management is a time-consuming process, consisting of relief, recovery, and reconstruction phases (de Ville de Goyet, 2008).

This paper addresses a question that researchers have not yet explored but is critically important for post-disaster development and poverty alleviation: How does a natural disaster affect informal risk sharing against illness over time? Although adverse effects of natural disasters on various dimensions of well-being, such as consumption, child nutrition, and public health, have received much attention from researchers (e.g., Noji, 1997; Skoufias, 2003), no previous works explicitly address the link between natural disasters and informal risk sharing against subsequent non-disaster shocks.

I hypothesize two links. First, the degree of sharing cash and inkind (e.g., food) to smooth consumption against illness (*non-labor sharing*) depends on the amount of pooled resources that can be shared among people (i.e., the *resource effect*). In the relief phase right after the disaster, risk sharing against illness is weak or even nonexistent, simply because the covariate disaster shock greatly reduces pooled non-labor resources. As rehabilitation progresses, pooled resources and thus risk sharing make a recovery.

Second, in the risk-sharing arrangement with limited enforceability, current transfers are dependent on the past history of transfers (i.e., the *reciprocity effect*) (Ligon et al., 2002). The simulation analysis of Foster and Rosenzweig (2001, p390) demonstrates that "the existence of binding imperfect commitment constraints implies that households that have made net transfers in previous periods are less likely to provide subsequent transfers, given the current state of the world, than are households that have been net recipients of transfers" (they call this the *transfer asset effect*). La Ferrara (2003) theoretically and empirically examines the reciprocity effect in credit transactions among kin members in Ghana.

Natural disasters can elicit the reciprocity effect as follows. Although a natural disaster is a region-wide covariate shock, it may contain significant idiosyncratic components at a local level; for example, a tropical cyclone may damage some, but not all houses within villages. Imagine a situation where there are disaster *victims* and *non-victims* within villages, and in the relief phase (several months after the cyclone), non-victims help victims' rehabilitation by providing labor time (*labor sharing*); public support for housing rehabilitation becomes available only in the reconstruction phase (a few years later). Even if the resource effect precludes non-labor sharing against the disaster damage, labor sharing can still work unless the disaster significantly lowers labor endowment among villagers (e.g., casualties, disease outbreak, out-migration). The reciprocity effect suggests that victims are less insured against illness than non-victims are in the reconstruction phase.

As such, natural disasters may adversely affect informal risk sharing not only for all contemporaneously, but also for some in a persistent manner; in particular, disaster victims may suffer from a lack of private safety nets against illness over time. Then, even if disaster-induced public-health problems are not a major issue, "hidden" health problems exacerbated by the disaster – through endogenous adjustments in informal risk-sharing arrangements – can be considerable. Using original household survey data collected in rural Fiji, the paper shows that a tropical cyclone has strong resource and reciprocity effects: Sick persons are insured in the reconstruction phase, but not in the relief phase; sick non-victims are insured, but sick victims are not.

To test the resource/reciprocity effects, the paper directly analyzes household private transfers; distinct from many extant studies of risk sharing that focus on consumption smoothing, it thus explores *how* people share risk, in the same spirit as Udry (1994) and Fafchamps and Lund (2003). Although economists have extensively studied private transfers exchanged *among* households within a network (*network-based transfers*) (see, for example, Cox and Fafchamps, 2008 for review), transfers exchanged *directly* with groups to which the household belongs (*group-based transfers*) – such as ritual gifts for kin groups, village communal work, and church donations – have received very limited attention in developing countries; in developed countries, in contrast, transfers to community institutions in general (e.g., charitable giving) have been well studied (see, for example, Schokkaert, 2006 for review). This is a significant lacuna in the literature on risk sharing among the poor, because group-based transfers may contain a significant risk-sharing component, such that group members with adverse shock contribute less than others do. As a unique feature, the Fijian data include comparable household information about these two forms of transfers, enabling their direct comparison; group-based transfers are much greater than network-based transfers, because of significant household contributions to groups for the provision of local public goods (Takasaki, forthcoming-b). Deb et al. (2010) conduct a similar comparison using Indonesian Family Life Surveys, though risk sharing is not their focus. The paper finds resource and reciprocity effects of the cyclone in both transfers.

Although economists often highlight the village as a risk-sharing pool because of its information and enforcement advantages (e.g., Ligon et al., 2002; Townsend, 1994), recent works directly address the question of *among whom* people share risk. Some researchers focus on pre-formed groups other than the village, such as kin, caste, and ethnic groups (e.g., Grimard, 1997; Morduch, 2005; Munshi and Rosenzweig, 2009), while others study the formation of risk-sharing groups and networks (e.g., De Weerdt and Dercon, 2006; Fafchamps and Gubert, 2007; Murgai et al., 2002). The paper examines not only which pre-formed groups serve as risk-sharing groups in group-based transfers, but also how those groups form household transfer networks and what networks serve as risk-sharing networks in network-based transfers. The findings reveal that kin and religious networks and groups are important risk-sharing pools.

The rest of the paper is organized as follows. Section 2 describes the study area, the cyclone, and health shock. Section 3 explains household private transfers. Section 4 develops empirical strategies to test the resource and reciprocity effects, which is followed by the results in Section 5. The last section concludes.

2. Data, cyclone, and health

2.1. Study area and data

On January 13, 2003, Cyclone Ami swept over the northern and eastern regions of the Fiji Islands.[1] Seven native Fijian villages on the coast in the northern region, with distinct environmental and economic conditions, were intentionally chosen for the survey.[2] After being stratified for each of the selected villages by the smallest kin-group unit (defined shortly), as well as by a combination of leadership status (e.g., kin leader) and major asset holdings (e.g., shops), households were randomly sampled in each stratum. Household interviews were conducted between late August and early November 2003, collecting information about demographics, assets, production, income, shocks, relief, and transfers (but not consumption). As such, like other post-disaster surveys (e.g., Morris et al., 2002), the survey collected disaster information retrospectively (I will discuss retrospective errors in Section 5). In July-September 2005, the second wave of the survey was implemented. Analyses in this paper are conducted for 226 households

[1] Ami was the only cyclone in the northern region from 1991 through 2005 (McKenzie et al., 2005). The total cyclone damage across the country is estimated at F$104 million, of which housing damage is F$22 million and crop damage is F$40 million (National Disaster Management Office, 2003).

[2] Two other villages were also surveyed in 2003, but not in 2005. Four and three villages, respectively, are located on Vanua Levu and Taveuni Islands, the second- and third-largest islands in the country, which significantly lag behind the largest island, Viti Levu, where the state capital, two international airports, and most tourism businesses are situated. Fiji is divided almost evenly between native Fijians and Indo-Fijians. The study focuses on native Fijians.

with complete panel data. All monetized values presented in the paper are real values, with 2003 as the base year.

2.2. Cyclone shock

All seven sample villages experienced damage to their structures and facilities, and housing damage and crop damage are the two major damages that individual households experienced. According to respondents' subjective assessments, the cyclone damaged 58% of residents' houses: 9% were completely destroyed and 49% were partially damaged (see Table 1). Households with and without damaged housing did not significantly differ from each other in their crop damage (discussed next), earned incomes, asset holdings, and other household characteristics at the time of interviews in 2003 (nor were they different before the cyclone, Takasaki, 2011b). Thus, the incidence of housing damage is not correlated with poverty. Among households that experienced housing damage, 36% became refugees who stayed in others' residences in the same village (permanent migration was nonexistent). About two thirds of those refugees lived with households in the same kin group; that is, kin networks served as a major risk-sharing pool. Households without damaged housing also helped others' rehabilitation (I return to this below).

Almost all households engaged in cropping (and fishing),[3] and 82% experienced crop damage. The mean value of damaged crops was F$44 per capita (1 Fiji dollar = US$.60), which was 11% of the mean annual crop income at the time of interviews in

[3] Farming and fishing, respectively, accounted for 50% and 27% of total earned income in 2003 and 55% and 14% of total earned income in 2005. Households employ traditional farming practices, using no mechanized equipment or animal traction to produce taro, cassava, coconut, and kava plants, and engage in artisanal fishing, using lines and hooks, simple spear guns, or rudimentary nets.

2003 (crop damage was calculated based on the quantity damaged for each major crop, as reported by respondents).[4] Distinct from housing rehabilitation, households individually rehabilitated cropping by collecting harvestable damaged crops, cleaning fields, and planting seeds with no labor sharing involved. Annual total earned income in 2003 was about half of that in 2005; that is, aggregated resources that could be shared among households were limited after the cyclone.

Variance of the household-level cyclone-damage measures is decomposed into year, village, and household levels by allowing for year-level or time-varying village-level means.[5] Apart from the major contribution of the year-level variance to the total variance for the cyclone-damage dummies, most variance exists at the household level (57-90%). In contrast, the contribution of village-level variance to the total variance is negligible (less than 3%). This is because as the survey covers only the northern region in the small island state, variations in village-level shocks in the study area are limited. As such, although the cyclone is a region-wide covariate shock, household-level cyclone damages in 2003 are largely idiosyncratic within villages, as are health shocks.

2.3. Relief and reconstruction

The Red Cross, other nongovernmental organizations, and governments provisioned relief, and interviews in 2003 were conducted at the end of the relief phase. Almost all households received emergency food aid, and the mean amount per capita was F$95, which was more than twice the mean crop damage; in contrast, only a small

[4] Correlations of housing damage with crop damage and crop-damage value are .041 and .079, respectively, with no statistical significance.
[5] In practice, the year-level variance (percent of total variance) is the R-squared of a regression on a year dummy; the village-level variance is the R-squared of a regression on a full set of village-time dummies, minus the year-level variance.

proportion of victims received tarpaulins that could be used as emergency shelters and for temporary housing repair. At the time of interviews in 2003, refugees were almost nonexistent and about two thirds of households with damaged housing had completed rehabilitation: 12% had built a new house and 52% had completed repairs. As the government provisioned most construction materials from 2004, these housing rehabilitations were accomplished through people's mutual help. By the time of interviews in 2005 in the late reconstruction phase, construction materials had been provisioned to one quarter of households in the sample. Takasaki (2011b, forthcoming-a) details and analyzes allocations of relief and reconstruction funds, respectively.

2.4. Health shock

Public-health problems were not a major issue after the cyclone in the sample villages: Respondents reported no casualties and very limited injuries and illnesses caused directly by the cyclone. As commonly done in household surveys, respondents were asked about each household member's health conditions over the past year. In both 2003 and 2005, about one third of households had one or more sick members – 72% and 84% of those had one or more sick adults, respectively – and 12% of households experienced illness in both years (Table 1). Illness was more common among households with damaged housing than others in 2003 (with a .13 correlation).[6] Hence, although illness was not more pervasive in the cyclone year than two years later, housing damage may have caused some health problems; housing damage did not cause chronic illnesses though, because these two variables were uncorrelated for 2005.

[6] The prevalence of illness was almost the same for refugees and non-refugees. While illness was less common among households with damaged crops than others (with a -.14 correlation), there was no significant correlation between illness and crop-damage value.

3. Household private transfers

3.1. Groups

Apart from the village, kin, religious, and social groups play major roles in Fijians' lives. First, each native Fijian belongs to a lineage of the *vanua-yavusa-mataqali-tokatoka* hierarchy: Vanua consists of several yavusa; yavusa consists of several mataqali; and mataqali consists of several tokatoka (Ravuvu, 1983). Although vanua ranges over several villages, there is just one yavusa in each of the sample villages (i.e., village formation is based on yavusa); mataqali and tokatoka are village subgroups (the sample covers 22 mataqali and 35 tokatoka). Many ritual activities, such as funerals and weddings, are organized by mataqali and yavusa.[7]

Second, Christianity underlies Fijian society, and church donations are quite significant, as shown below. A religious group formed for each church, which often covers more than one nearby village, is available in all villages in the sample – 3.9 church groups per village on average – and almost all households are members.

Third, social groups consist of women's, school, and youth groups in all villages (market-oriented groups such as cooperatives are almost nonexistent). Although membership is fixed for kin and religious groups (without conversion to another religion),[8] participation in social groups is based on individual decisions made prior to

[7] The dominant symbol of Fijian culture is kava (a beverage infused from the root of a pepper plant, *Piper methysticum*), and kava rituals frequently involve exchanges of ceremonial goods, such as food, mats, and bark cloth (Turner, 1987). Kin groups also play important roles in local governance and household income-generating activities: Land is communally owned by mataqali (about 83% of the country's total land is communal), and customary rights for coastal fishing are held by vanua or several yavusa.

[8] Marriage across different kin groups is common. This paper focuses on the kin groups to which households currently belong; if the kin groups to which individuals used to

the cyclone among the eligible – determined by gender, child schooling, and age – and 86% of households belong to at least one pre-formed social group.

3.2. Transfer data

In both 2003 and 2005 surveys, respondents were asked not only about *each* major transfer received from and given to other households, but also about the transfers they contributed to and received directly from *each* kin, religious, and social group to which they belonged, as well as the village, in the past year. Three caveats are noted. First, distinct from extant studies in the Pacific region (Bertram, 1986), overseas remittances are almost nonexistent.[9] Second, although transfer measures capture not only cash and inkind, but also labor time in 2005, labor-time transfer data in 2003 are limited to communal labor contributed to groups. Third, although the transfers that the household offers to groups include all the resources it contributes, those it receives from the group capture only partial benefits, excluding those of local public goods that the group provides, such as social activities and village upkeep. Measuring such benefits is very difficult, because they often include unobservable, non-economic benefits and can be realized over a long time (Clotfelter, 1992). In contrast, the network-based transfer data are balanced in coverage between receipts and giving.

Proportion of participation in and mean amounts of gross annual transfers received and given per capita in each year are reported in Table 2 – cash and inkind in

---

belong prior to marriage are considered, transfer networks concentrate more on own kin groups (especially tokatoka) than what is shown below.

[9] In contrast, according to the household survey conducted in five major towns and nine villages in Viti Levu in 2005 by the World Bank (2006), 26% of 211 native Fijian households had overseas migrants and 34% received overseas remittances. This indicates a potentially significant difference in Fijians' transfer patterns between the main island and other islands and between urban and rural areas (cf. note 2).

panel A and labor time in panel B (labor time is monetized based on men's daily wage in each village, the mean of which is about F$14).[10] Reflecting the imbalance in the group-based transfer data's coverage, transfers given to groups are much more common and greater than those received from groups. Group-based transfers are quite significant, especially in 2005: Cash/inkind and labor-time transfers contributed to groups are 2.8 and 7.4 times, respectively, those given to other households.

3.3. Relief vs. reconstruction phases

A comparison of the relief period 2003 with the reconstruction period 2005 reveals a sharp contrast between cash/inkind and labor-time transfers (Table 2). On the one hand, non-labor resources that could be shared among households were limited: Cash and inkind transfers received from other households and given to groups in 2003 were much less common and smaller than those in 2005 (cash and inkind transfers given to other households were similar over time, mainly because of large transfers made for funerals in 2003). On the other hand, group members contributed significant labor time to rehabilitate group facilities, such as village facilities (e.g., community halls), churches, and schools (i.e., labor sharing against group-level covariate shock): Labor-time transfers given to the village and religious and social groups in 2003 were more common and much greater than those in 2005; the converse holds true for kin groups, as no kin groups owned or managed group facilities, and ritual transfers to them increased in 2005.[11] Although the cyclone significantly reduced pooled non-labor resources, labor-time

[10] Informal loans were much smaller than gifts, and when informal loans are added to private transfers, results are almost the same as those presented here.
[11] Kin-group transfers include those made with yavusa, mataqali, and tokatoka, because comparable data for vanua are lacking for 2003 (transfers with vanua were minor in 2005).

endowment was largely intact, because of no cyclone-induced casualties and permanent migration and limited cyclone-induced diseases. Along with the patterns of housing rehabilitations discussed above, this suggests that network-based labor-time transfers in 2003 were also more common and greater than those in 2005.

3.4. Transfer networks

Respondents were also asked about the characteristics of each household with which transfers were made. Major transfer networks are in-village, kin, and religious ones: Cash and inkind transfers received from other households in the village, in the same tokatoka, and in the same religious group are more common and much greater than those outside the village, in other tokatoka, and in other church groups, respectively, in both 2003 and 2005 (disaggregated data by religion are lacking in 2003); this is also mostly true for labor-time transfers in 2005 (Table 2). Thus, individual households' network formation is directly related to kin and religious groups they cannot choose.

4. Econometric specification

4.1. Base model

I start by estimating the network-based transfer equation using the following standard, fixed-effects specification:

$$y_{it} = \alpha h_{it} + \boldsymbol{\eta X_{it}} + V_t + d_t + u_i + e_{it}, \qquad (1)$$

where y_{it} is household *i*'s net transfer received from other households in time *t*; h_{it} is a dummy for illness among any household members; $\boldsymbol{X_{it}}$ is a vector of time-variant household characteristics that affect transfer decisions, captured by household size;[12] V_t is

[12] In an alternative specification, I use land and fishing capital holdings as additional controls, finding results very similar to those presented below. Though these productive

time-varying village dummies that capture village-level covariate shocks; d_t is a time dummy that controls for region-level covariate shocks and common events or trends; u_i is household heterogeneity; and e_{it} is a time-variant error term that is individually and independently distributed. This base model is the same as equation (1) in Gertler and Gruber (2002), although their focus is not on private transfers. Fafchamps and Lund (2003) derive equation (1) from a full risk-sharing model (Cochrane, 1991; Mace, 1991; Townsend, 1994). The fixed-effects estimator controls for all household and village fixed effects. If private transfers are ex-post, risk-sharing arrangements among villagers with given pooled resources in the village, households with illness receive more transfers on the net, i.e., $\alpha > 0$.

4.2. Resource and reciprocity effects

Theoretically, under imperfect labor and housing market conditions, people seek to smooth utility determined by consumption, leisure, and housing quality, and risk sharing consists of non-labor sharing to smooth consumption against illness (income shock) and labor sharing for the rehabilitation of damaged housing (preference shock) (I add crop damage as another income shock later).

To test the resource/reciprocity effects, I extend equation (1) in the following four steps. First, I add household-level disaster damage, in particular, a dummy for housing damage, s_{it}, as a control.[13] The panel data consist of relief period 1 and reconstruction period 2; in period 1, households are either disaster victims or non-victims, and there is

assets could be endogenous if they are adjusted to shocks (Rosenzweig and Wolpin, 1993), the results suggest that this is unlikely to be the case.

[13] If illness is correlated with housing damage (as found above in Fiji), omitting the latter causes bias in the estimated α. Complete and partial housing damage cannot be analyzed separately because of the small number of completely destroyed houses in the Fijian data.

no disaster in period 2, i.e., $s_{i2} = 0$ for all i (the model developed here can be straightforwardly extended to more than one reconstruction period). Pre-cyclone housing quality, such as construction materials and micro location within villages, which might influence housing damage, may be correlated with household transfer decisions; this fixed effect is controlled for by the fixed-effects estimator. If labor sharing against housing damage among villagers works in period 1, victims receive labor-time transfers from non-victims, i.e., $\beta_1 > 0$, where β_1 is a coefficient of s_{it}.

Second, I allow heterogeneous responses of private transfers to illness across periods, by replacing αh_{it} with $\alpha_1 h_{it}(1-d_t)+\alpha_2 h_{it} d_t$, where d_t is redefined as a dummy for reconstruction period 2 ($d_1 = 0$, $d_2 = 1$). The resource effect suggests that non-labor sharing against illness better works in period 2 than in period 1; it is ineffective in period 1 if pooled resources are sufficiently low, i.e., $0 \leq \alpha_1 < \alpha_2$.

Third, I make transfer responses to shocks in period 1 – cash and inkind transfers to illness and labor-time transfers to housing damage – heterogeneous by adding an interaction term, $h_{it}\, s_{it}$. This captures the contemporaneous link of household-level disaster damage with risk sharing against illness in period 1. Last, to capture the reciprocity effect, I allow transfer responses to illness in period 2 to vary, depending on the disaster damage experienced in period 1, by adding an interaction term, $h_{it}\, d_t s_{i1}$ (s_{i1} is a fixed effect). The final model is

$$y_{it} = \alpha_1 h_{it}(1-d_t)+\alpha_2 h_{it} d_t + \beta_1 s_{it} + \gamma_1 h_{it} s_{it} + \gamma_2 h_{it} d_t s_{i1} + \boldsymbol{\eta X_{it}} + V_t + d_t + u_i + e_{it}\,. \qquad (2)$$

Note that the first, third, and fourth terms of equation (2) appear in period 1 only and the second and fifth terms appear in period 2 only.

This reduced-form specification does not identify how the history of transfers affects the current transfer; a lack of labor-time transfer information in period 1 in the Fijian data precludes a structural-form specification – using y_{i1} as a determinant of y_{i2} with disaster damage s_{i1} as an excluded instrument. Equation (2) assumes that risk sharing against illness in period 2 depends on the outcome of risk sharing against disaster damage, not illness, in period 1; that is, it captures the potential reciprocity effect of disaster damage only. Since researchers cannot observe the complete history of transfers, this empirical strategy is practically attractive if they know what particular shocks can cause the reciprocity effect. An advantage of this reduced-form specification is that the history of risk sharing is inclusive, capturing all forms of mutual help among households, including those that are not measured by standard transfer data, such as co-residence for refugees.

The reciprocity effect suggests that risk sharing against illness in period 2 works better among non-victims than victims, i.e., $\gamma_2 < 0$; the marginal effects of illness in period t are α_t for non-victims and $\alpha_t + \gamma_t$ for victims, and in an extreme case, risk sharing against illness is still ineffective among victims in period 2, i.e., $\gamma_2 = -\alpha_2$. I also estimate equation (2) for the non-victim (N) sample and the victim (V) sample separately (s_{it}, $h_{it}s_{it}$, and $h_{it}\, d_t s_{i1}$ vanish); the reciprocity effect suggests that $0 \leq \alpha_2^V < \alpha_2^N$. Potential selection bias in this subsample analysis is unlikely to be a major concern, because early descriptive findings suggest that housing damage is considered largely exogenous.

I conjecture that the reciprocity effect of housing damage is stronger than that of crop damage, because labor-sharing against housing damage is stronger than that against crop damage (the latter was actually nonexistent in Fiji). Specifically, s_{it} is captured by the housing-damage dummy, the value of crop damage per capita, and their interaction (β_1 and γ_t are vectors). Although unobservable household and village characteristics, such as land quality, farming skills, and market and environmental conditions, which affect household pre-cyclone cropping decisions and thus crop damage, can be correlated with household transfer decisions, most of these unobservable factors are fixed effects. Village-time dummies capture time-variant market and environmental conditions, village-level shocks to housing and crops (which are shown above to be small), damage to village structures and facilities, and relief and construction materials received by the village.[14]

4.3. Cash and inkind vs. labor-time transfers

Ideally, I would conduct complete tests of my conjectures by estimating equation (2) for cash/inkind and labor-time transfers separately, but this is infeasible with the lack of a complete panel of labor-time transfers in Fiji. All I can do is to test the resource and reciprocity effects on non-labor sharing against illness; I cannot test whether labor time is shared against disaster damage in period 1. If the strong reciprocity effect of housing damage is found despite the absence of non-labor sharing against housing damage, however, this gives indirect evidence for strong labor sharing against housing damage in period 1, as I conjecture.

4.4. Group-based transfers

I analyze group-based transfers in a way comparable to the analysis of network-based transfers. If group-based transfers in period 2 – mainly for local public-goods

---

[14] Disaster aids received by individual households are not included as explanatory variables, because they are endogenously determined as part of private risk sharing within villages (Dercon and Krishnan, 2005; Takasaki, 2011b, forthcoming-a).

provisions – are risk-sharing arrangements against illness among group members, those with illness contribute less to groups than others do. If risk-sharing groups are the same as villages, group-level covariate shocks, as well as all time-variant group-level factors, are captured by village-time dummies, and equation (2) can be directly used to test the resource/reciprocity effects on group-based transfers.

The reciprocity effect on group-based cash and inkind transfers can occur in two ways. First, group-based labor-time transfers in period 1 – mainly for group-level rehabilitation – may also serve as risk-sharing arrangements against household-level disaster damage. This reciprocity *within groups* can be tested by estimating equation (2) for gross labor-time transfers given to groups (the panel data of which are available in Fiji). Second, network-based labor-time transfers in period 1 – for housing rehabilitation – may affect non-labor sharing among group members in period 2. This reciprocity *between networks and groups* is likely to occur if household risk-sharing networks significantly overlap pre-formed risk-sharing groups. In Fiji, because major transfer networks consist of kin and religious affiliations, that the reciprocity effect exists mainly in kin and religious networks *and* groups provides evidence for this type of reciprocity; that is, the formation of not only transfer networks in general, but also risk-sharing networks are directly related to these pre-formed groups. When disaggregated transfers are analyzed, alternative specifications are employed to better capture network- and group-level covariate shocks, as detailed in the next section.

5. Estimation results

5.1. Aggregated transfers

The fixed-effects estimates of determinants of annual net cash and inkind transfers received per capita from other households and groups combined are shown in Table 3 (robust standard errors are reported). Results without crop damage as controls are in panel A. When cyclone damage is ignored (equation 1), transfers positively respond to illness, but the result is not statistically significant (column 1). When housing damage is added, the estimated coefficient for illness does not change and housing damage is nonsignificant (column 2); that is, non-labor sharing was ineffective against housing damage, because of reduced pooled non-labor resources. The resource effect strongly holds: Although transfers were insensitive to illness in 2003, they significantly responded to illness in 2005 (the estimated marginal effect is about F$100, or equivalently, about two thirds of the mean gross transfers received) (column 3). The interaction term of illness in 2003 with housing damage yields nonsignificant impacts (column 4); that is, housing damage does not contemporaneously affect risk sharing against illness. In contrast, the reciprocity effect of housing damage is strong: In 2005, transfers responded to illness among households without damaged housing (about F$240 marginal effect), but not among others (column 5).

When crop-damage value and its interaction terms are added (panel B), they are all nonsignificant and none of the remaining results are significantly altered (the null hypothesis that $\alpha_2 + \gamma_2 = 0$ is not rejected for housing damage). These findings are consistent with my working hypothesis that housing damage distinguished between recipients and donors in labor sharing for housing rehabilitation in period 1.

As the reciprocity effect is significant only for housing damage, in the remaining disaggregated analyses I show results using the interaction term of illness in 2005 with the housing-damage dummy only (γ_2 is a scalar) (results without crop damage as controls are similar). Results of the estimated coefficients for illness in 2005 (α_2) and its interaction with housing damage (γ_2) in the whole sample and for illness in 2005 among households without damaged housing (α_2^N) and among those with damaged housing (α_2^V) are reported in Table 4. Results for the aggregated transfers are almost the same as those in column (5) of Table 3, and the subsample analysis confirms that disaster non-victims are insured against illness, but victims are not (panel A1 of Table 4).

5.2. Disaggregated transfers

The resource and reciprocity effects hold not only in network-based transfers, but also in group-based transfers: When these two are estimated separately,[15] results for the two effects are qualitatively the same, and marginal effects of illness in 2005 for non-victims (α_2 or α_2^N) are similar to each other (panel A1).

It also appears that the reciprocity effect on group-based transfers exists between networks and groups, but not within groups, for the following three reasons. First, labor sharing within groups does not serve as risk sharing against housing damage: Gross (monetized) labor-time transfers given to groups are neutral to all household-level shocks (column 6 of Table 3); this is also true for disaggregated groups.

Second, risk-sharing against illness through network-based transfers is mainly arranged in in-village and kin networks: Disaggregated results for in-village and tokatoka networks are similar to those for the aggregated networks, and the estimated marginal

[15] In almost all disaggregated analyses discussed here, most households participate in transfers received or given in either 2003 or 2005 (Table 2); the only exception is transfers with social groups, simply because 14% of households do not belong to them. When transfers with social groups only among members are considered, the results are very similar to those for the whole sample presented here.

effects of illness in 2005 for non-victims are 70-83% of those for the aggregated networks (in proportion to the shares of in-village/in-tokatoka transfers in 2005) (panel A2). Although a similar analysis is infeasible for religious networks (with a lack of disaggregated panel data), the share of in-church transfers in 2005 is at a comparable level (Table 2). Replacing village-time dummies with tokatoka-time dummies for tokatoka networks does not significantly alter the results. Note that tokatoka-time dummies fully capture covariate shocks in the tokatoka networks, including out-of-village ones; in contrast, village-time dummies fully capture covariate shocks in the in-village networks, but not in the aggregated networks, including out-of-village ones.

Third, kin and religious groups are major risk-sharing groups: Although results for the village and kin, religious, and social groups are qualitatively the same as those for the aggregated groups (with the exception that the estimated γ_2 for the village is non-negative), the estimated marginal effects of illness in 2005 for non-victims are considerable only for kin and religious groups (34-50% of those for all groups combined, which is greater than their shares in the aggregated group transfers given in 2005, 25-29%), and only those for religious groups are statistically significant (panel A3). Village-time dummies fully capture covariate shocks in the village, but not other groups. Using tokatoka-time dummies, which fully capture covariate shocks in kin groups (tokatoka is the smallest kin unit), does not significantly alter the results. Similar results for religious groups are obtained under two alternative specifications: one using church-time dummies (three church dummies are defined for Methodist, Catholic, and other small sects combined) and another using village-church-time dummies (they are coarser and finer, respectively, than local church groups, which are formed for each church across nearby villages). It is not straightforward to construct group dummies for social groups that consist of women's, school, and youth groups with overlapping memberships.

I also estimate gross cash/inkind transfers contributed to groups separately, because decisions about transfers received from and given to groups are made by different agents and their coverage in the transfer data is unbalanced, as discussed above. All results are similar to those for net transfers received, with opposite signs (panel B), though the marginal effect for aggregated transfers in the subsample analysis is smaller in magnitude, with weaker statistical significance. Hence, risk-sharing arrangements against illness among group members take place mostly in the form of reduced household contributions to groups, especially kin and religious ones.

5.3. Robustness

Special attention needs to be given to retrospective errors in the post-disaster survey. First, errors in the incidence of housing damage are minimal, because relief officers used the same categories for their damage assessments (and the damage status of each house was common knowledge among villagers). Second, although errors in crop-damage value could be considerable and systematic, that models without crop damage as controls yield almost the same results for the remaining variables suggests that those on housing damage and illness are robust to such errors. Third, although the subjective health measure could contain systematic measurement errors because of heterogeneous definitions of illness among respondents and their systematic misreporting (Strauss and Thomas, 1998), the fixed-effects estimator helps reduce these problems, if such errors are largely constant.

Next, the correlation of recall errors in private transfers with household-level shocks could cause bias. Specifically, a positive (negative) correlation – households with larger shocks tend to report higher (lower) net private transfers received than actual transfers – causes upward (downward) bias. If such a correlation with illness does not change significantly over time, it is controlled for by the fixed-effects estimator, and the estimated positive α_2 (the resource effect) should be robust. The correlation still matters for disaster damage that occurred only in period 1. Unless the correlation is negative and large in magnitude, however, estimated negative γ_2 (the reciprocity effect) should be qualitatively robust; its robustness is further buttressed by consistent results of the subsample analysis.

The small number of households with illness – among those with and without damaged housing – requires caution, because estimations might be driven by outliers. First, I repeat the analyses excluding outliers in the dependent variable (largest and smallest 1% of net transfers received and largest 2% of gross transfers given). Second, to reduce the weight of outliers, I use log of gross transfers given (log of crop-damage value and its interaction terms are used as explanatory variables). Third, I employ parsimonious specifications excluding all shock variables in period 1 (both housing and crop damage) – the first, third, and fourth terms of equation (2) – which all were found to be nonsignificant. Results of these analyses (not shown) are qualitatively the same as those presented above; in particular, the resource/reciprocity effects of housing damage on both network- and group-based transfers are robust.

6. Conclusion

Using original household survey data collected in rural Fiji, this paper demonstrated how informal risk-sharing institutions upon which poor people heavily rely when experiencing illness are vulnerable to natural disaster. First, household private cash and inkind transfers do not serve as insurance against illness in the relief phase; they do so only after pooled resources recover in the reconstruction phase (i.e., the resource effect). Second, risk-sharing arrangements depend on the history of labor-time transfers corresponding to housing damage: Only disaster non-victims are insured against illness, because victims had already received labor help for their rehabilitation from non-victims (i.e., the reciprocity effect).

The paper revealed that the resource/reciprocity effects exist in endogenously formed networks and pre-formed groups, which serve as risk-sharing pools, to a similar degree. Not only do private transfers exchanged among households serve as insurance, as commonly found in the literature, but also, household contributions made directly to groups, not transfers received from groups, contain risk-sharing components against illness, as group members with illness contribute less, especially to kin and religious groups, than others do. The paper also found evidence that risk-sharing network formation is directly related to pre-formed groups, especially kin and religious ones.

These findings lead to the following policy and research implications. First, although it is crucial to better design and implement disaster relief/reconstruction (Amin and Goldstein, 2008) and public-health programs to combat disaster-induced diseases (Noji, 1997), these are not enough to prevent chronic health poverty. Policymakers need to strengthen broad public safety nets as a substitute for weakened private safety nets over extended post-disaster periods. Such efforts are necessary even if public health does not appear to be a major problem after the disaster; in fact, they may be even more necessary then, because available public-health programs are limited in such cases.

Second, it is necessary to augment local safety nets *ex ante* to combat less visible, post-disaster health problems. To this end, a better understanding of informal risk-sharing mechanisms among the poor is crucial. In Fiji, though the scope of informal risk sharing is greater than normally thought, fixed social relations – not only via kinship but also through religious affiliation – underlying local network/group-based institutions need to receive explicit attention (for example, Takasaki, forthcoming-b examines the issue of social hierarchy in network/group-based transfers).

Third, although economists have not paid much attention to informal risk sharing against natural disasters, risk sharing – especially labor sharing – against their idiosyncratic components can be significant, determining subsequent risk-sharing arrangements against non-disaster shocks, such as illness. More research on the dynamic link between natural disasters and informal risk-sharing institutions is needed.

Acknowledgements

I wish to thank my field team – Jonati Torocake, Viliame Manavure, Viliame Lomaloma, and 19 enumerators – for their advice, enthusiasm, and exceptional efforts on behalf of this project. Special thanks are owed to the Fijians of the region who so willingly participated in the survey. The Cakaudrove Provincial Office in Fiji offered valuable institutional support for this project. This paper has benefited from the comments and suggestions of participants at the TCER Conference. This research has been made possible through support provided by the Sumitomo Foundation, the Japan Society for the Promotion of Science, and the Ministry of Education, Culture, Sports, Science and Technology in Japan. Any errors of interpretation are solely the author's responsibility.

References

Alderman, H., Paxon, C., 1994. Do the poor insure? A synthesis of the literature on risk and consumption in developing countries. In: A. B. Atkinson (Ed.), Economics in a changing world: proceedings of the Tenth World Congress of the International Economic Association, Moscow. Macmillan, Houndmills.

Amin, S., Goldstein, M. (Eds.), 2008. Data Against Natural Disasters: Establishing Effective Systems for Relief, Recovery, and Reconstruction. World Bank, Washington, D.C.

Asfaw, A., von Braun, J., 2004. Is Consumption Insured against Illness? Evidence on Vulnerability of Households to Health Shocks in Rural Ethiopia. Economic Development and Cultural Change 53(1), 115-29.

Bertram, G., 1986. Sustainable development in Pacific microeconomies. World Development 14(7), 809-822.

Clotfelter, C. T. (Ed.), 1992. Who benefits from the nonprofit sector? University of Chicago Press, Chicago and London.

Cochrane, J. H., 1991. A simple test of consumption insurance. Journal of Political Economy 99(5), 957-976.

Cox, D., Fafchamps, M., 2008. Extended family and kinship networks: economic insights and evolutionary directions. In: T. P. Schultz, J. A. Strauss (Eds.), Handbook of Development Economics. Elsevier, Amsterdam.

de Ville de Goyet, C., 2008. Information gaps in relief, recovery, and reconstruction in the aftermath of natural disasters. In: S. Amin, M. Goldstein (Eds.), Data Against

Natural Disasters: Establishing Effective Systems for Relief, Recovery, and Reconstruction. World Bank, Washington, D.C., pp. 23-58.

De Weerdt, J., Dercon, S., 2006. Risk-Sharing Networks and Insurance against Illness. Journal of Development Economics 81(2), 337-56.

Deb, P., Okten, C., Osili, U. O., 2010. Giving to Family versus Giving to the Community Within and Across Generations. Journal of Population Economics 23(3), 963-987.

Dercon, S., 2002. Income Risk, Coping Strategies, and Safety Nets. World Bank Research Observer 17(2), 141-66.

Dercon, S., Krishnan, P., 2000. In sickness and in health: risk sharing within households in Ethiopia. Journal of Political Economy 108(4), 688-727.

Dercon, S., Krishnan, P., 2005. Food Aid and Informal Insurance. In: S. Dercon (Ed.), Insurance Against Poverty. Oxford University Press, Oxford and New York, pp. 305-329.

Fafchamps, M., Gubert, F., 2007. The formation of risk sharing networks. Journal of Development Economics 83(2), 326-350.

Fafchamps, M., Lund, S., 2003. Risk-sharing networks in rural Philippines. Journal of Development Economics 71(2), 261-287.

Foster, A. D., Rosenzweig, M. R., 2001. Imperfect Commitment, Altruism, and the Family: Evidence from Transfer Behavior in Low-Income Rural Areas. Review of Economics and Statistics 83(3), 389-407.

Gertler, P., Gruber, J., 2002. Insuring Consumption Against Illness. American Economic Review 92(1), 51-76.

Grimard, F., 1997. Household consumption smoothing through ethnic ties: evidence from Cote d'Ivoire. Journal of Development Economics 53(2), 391-422.

Kochar, A., 1995. Explaining household vulnerability to idiosyncratic income shocks. American Economic Review 85(2), 159-164.

La Ferrara, E., 2003. Kin Groups and Reciprocity: A Model of Credit Transactions in Ghana. American Economic Review 93(5), 1730-51.

Ligon, E., Thomas, J. P., Worrall, T., 2002. Informal Insurance Arrangements with Limited Commitment: Theory and Evidence from Village Economies. Review of Economic Studies 69(1), 209-44.

Mace, B. J., 1991. Full insurance in the presence of aggregate uncertainty. Journal of Political Economy 99(5), 928-956.

McKenzie, E., Prasad, B., Kaloumaira, A., 2005. Economic impact of natural disasters on development in the Pacific: Volume 1 Research report. The University of the South Pacific, Suva.

Morduch, J., 1999. Between the State and the Market: Can Informal Insurance Patch the Safety Net? World Bank Research Observer 14(2), 187-207.

Morduch, J., 2005. Consumption Smoothing across Space: Testing Theories of Risk-Sharing in the ICRISAT Study Region of South India. In: S. Dercon (Ed.), Insurance Against Poverty. Oxford University Press, Oxford and New York, pp. 38-58.

Morris, S. S., Neidecker-Gonzales, O., Carletto, C., Munguia, M., Medina, J. M., Wodon, W., 2002. Hurricane Mitch and the Livelihoods of the Rural Poor in Honduras. World Development 30(1), 49-60.

Mozumder, P., Bohara, A. K., Berrens, R. P., Halim, N., 2009. Private transfers to cope with a natural disaster: evidence from Bangladesh. Environment and Development Economics 14(2), 187-210.

Munshi, K., Rosenzweig, M., 2009. Why is mobility in India so low? Social insurance, inequality, and growth. NBER Working paper 14850, National Bureau of Economic Research, Cambridge.

Murgai, R., Winters, P., Sadoulet, E., de Janvry, A., 2002. Localized and incomplete mutual insurance. Journal of Development Economics 67(2), 245-274.

National Disaster Management Office, 2003. Report on Tropical Cyclone Ami. Ministry of Regional Development, Fiji, Suva.

Noji, E. K. (Ed.), 1997. The public health consequences of disasters. Oxford University Press, Oxford.

Ravuvu, A., 1983. Vaka I Taukei: The Fijian Way of Life. Institute of Pacific Studies, Suva.

Rosenzweig, M. R., Wolpin, K. I., 1993. Credit market constraints, consumption smoothing, and the accumulation of durable production assets in low-income countries: investments in bullocks in India. Journal of Political Economy 101(2), 223-244.

Sawada, Y., 2007. The impact of natural and manmade disasters on household welfare. Agricultural Economics 37(s1), 59-73.

Sawada, Y., Shimizutani, S., 2008. How do people cope with natural disasters? Evidence from the Great Hanshin-Awaji (Kobe) Earthquake in 1995. Journal of Money, Credit, and Banking 40(2-3), 463-488.

Schokkaert, E., 2006. The empirical analysis of transfer motives. In: S.-C. Kolm, J. M. Ythier (Eds.), Handbook of The Economics of Giving, Altruism and Reciprocity. Elsevier, Amsterdam.

Skoufias, E., 2003. Economic Crises and Natural Disasters: Coping Strategies and Policy Implications. World Development 31(7), 1087-1102.

Strauss, J., Thomas, D., 1998. Health, Nutrition, and Economic Development. Journal of Economic Literature 36(2), 766-817.

Takasaki, Y., 2011a. Do the commons help augment mutual insurance among the poor? World Development 39(3), 429-438.

Takasaki, Y., 2011b. Targeting cyclone relief within the village: kinship, sharing, and capture. Economic Development and Cultural Change 59(2), 387-416.

Takasaki, Y., forthcoming-a. Do local elites capture natural disaster reconstruction funds? Journal of Development Studies.

Takasaki, Y., forthcoming-b. Groups, networks, and hierarchy in household private transfers: Evidence from Fiji. Oxford Development Studies.

Townsend, R. M., 1994. Risk and insurance in village India. Econometrica 62(3), 539-591.

Turner, J. W., 1987. Blesses to give and receive: ceremonial exchange in Fiji. Ethnology 26(3), 209-219.

Udry, C., 1994. Risk and insurance in a rural credit market: an empirical investigation in Northern Nigeria. Review of Economic Studies 61(3), 495-526.

World Bank, 2006. at Home & Away: Expanding Job Opportunities for Pacific Islanders through Labour Mobility. World Bank, Washington, D.C.

Table 1. Shocks and household characteristics by housing damage.

	Household means[a]					Variance decomposition[b]		
	2003	2005	2003[c]			2003&2005		
	All	All	Housing undamaged	Housing damaged	Mean/ prop. test (p-value)	Year	Village	House-hold
Shocks:								
Housing damaged dummy	0.58 (0.49)	0.00 (0.00)	0.00 (0.00)	1.00 (0.00)	-	40.8	2.2	57.0
Crop damaged dummy	0.82 (0.39)	0.00 (0.00)	0.80 (0.40)	0.83 (0.38)	*0.537*	69.3	0.8	29.9
Crop damage value per capita (F$)	44 (107)	0 (0)	34 (57)	52 (132)	*0.235*	7.9	2.6	89.5
Illness dummy	0.35 (0.48)	0.32 (0.47)	0.27 (0.45)	0.40 (0.49)	*0.054*	0.1	11.1	88.9
Illness in 2005 dummy[c]	-	0.32 (0.47)	0.32 (0.47)	0.33 (0.47)	*0.843*	-	-	-
Household characteristics:								
Annual earned income per capita (F$)	813 (1045)	1674 (1695)	823 (818)	805 (1186)	*0.900*			
Annual public transfer received per capita (F$)[d]	18 (81)	11 (48)	20 (87)	17 (77)	*0.784*			
Household size	6.5 (2.9)	5.8 (2.7)	6.3 (2.7)	6.6 (3.0)	*0.353*			
Age of household head	50 (14)	51 (14)	51 (14)	49 (13)	*0.228*			
Female head dummy	0.13 (0.34)	0.14 (0.34)	0.13 (0.33)	0.13 (0.34)	*0.939*			
Adult secondary education dummy	0.87 (0.34)	0.81 (0.39)	0.88 (0.32)	0.85 (0.35)	*0.522*			
Land per capita (acre)	0.92 (1.19)	0.69 (1.55)	0.95 (1.13)	0.89 (1.23)	*0.720*			
Fishing capital per capita (F$)	50 (150)	46 (228)	43 (154)	56 (148)	*0.530*			
No. observations	226	226	95	131				

[a] Household means are shown along with standard deviations in parentheses.
[b] These are percents of total variance.
[c] 2005 for illness in 2005 dummy.
[d] Excluding disaster relief and reconstruction funds.

Table 2. Household annual private transfers.

(n=226)	2003 Received Participation	2003 Received Mean amounts (F$ per capita)	2003 Given Participation	2003 Given Mean amounts (F$ per capita)	2005 Received Participation	2005 Received Mean amounts (F$ per capita)	2005 Given Participation	2005 Given Mean amounts (F$ per capita)
A. Cash and inkind transfers								
A1. Aggregated transfers								
Both	45%	43 (246)	87%	110 (172)	95%	145 (215)	100%	232 (262)
Network-based	42%	37 (240)	63%	67 (169)	94%	106 (170)	87%	61 (87)
Group-based	4%	6.0 (58)	68%	44 (61)	33%	39 (85)	99%	171 (235)
A2. Disaggregated network-based transfers								
Location:								
Same village	35%	26 (220)	54%	46 (146)	88%	59 (80)	86%	52 (74)
Other village or city	12%	11 (59)	23%	21 (77)	35%	44 (128)	15%	8.5 (37)
Kinship:								
Same tokatoka	27%	28 (236)	37%	37 (145)	86%	67 (103)	80%	47 (72)
Other tokatoka	22%	9.5 (47)	41%	29 (75)	48%	38 (125)	42%	15 (44)
Religion:								
Same religious group	-	-	-	-	80%	74 (146)	74%	49 (84)
Other religious group	-	-	-	-	26%	32 (97)	21%	12 (40)
A3. Disaggregated group-based transfers								
Village	0%	0.1 (2.1)	42%	16 (40)	12%	4.0 (18)	80%	31 (47)
Kin groups	2%	5.5 (58)	19%	7.1 (22)	31%	29 (72)	81%	42 (69)
Religious groups	1%	0.3 (4.0)	32%	11 (24)	8%	4.8 (25)	96%	49 (84)
Social groups	0%	0.1 (1.1)	36%	10 (27)	5%	1.3 (7.7)	79%	49 (106)
B. Labor-time transfers								
B1. Aggregated transfers								
Both	-	-	-	-	46%	33 (96)	80%	104 (129)
Network-based	-	-	-	-	28%	21 (75)	28%	12 (33)
Group-based	-	-	97%	198 (184)	25%	12 (44)	80%	92 (112)
B2. Disaggregated network-based transfers								
Location:								
Same village	-	-	-	-	26%	14 (41)	28%	12 (32)
Other village or city	-	-	-	-	6%	7.0 (63)	4%	0.7 (5)
Kinship:								
Same tokatoka	-	-	-	-	26%	11 (37)	26%	8.7 (25)
Other tokatoka	-	-	-	-	13%	9.9 (65)	13%	4.1 (16)
Religion:								
Same religious group	-	-	-	-	19%	9.0 (35)	20%	6.5 (20)
Other religious group	-	-	-	-	10%	12 (67)	9%	5.9 (25)
B3. Disaggregated group-based transfers								
Village	-	-	87%	99 (92)	8%	1.8 (7.8)	73%	36 (59)
Kin groups	-	-	19%	8.8 (34)	22%	6.3 (25)	56%	23 (41)
Religious groups	-	-	73%	49 (86)	5%	1.1 (10)	46%	12 (21)
Social groups	-	-	67%	42 (63)	4%	2.6 (23)	43%	21 (46)

Note - Standard deviations are in parentheses.

Table 3. Determinants of household annual private transfers per capita - fixed effects.

		Net cash and inkind transfers received from other households and groups					Gross labor-time transfers given to groups
(n=452)		(1)	(2)	(3)	(4)	(5)	(6)
A. Models without crop damage as controls.							
Illness dummy	α	37.6	38.7				
		(47.9)	(49.5)				
Housing damaged dummy	β_1		-13.1	-8.7	1.5	-72.1	21.3
			(57.6)	(57.5)	(52.9)	(64.9)	(36.9)
Illness in 2003 dummy	α_1			-19.3	0.0	-1.3	7.5
				(70.7)	(141.2)	(139.2)	(46.4)
Illness in 2005 dummy	α_2			104.3 **	103.3 **	240.2 ***	-49.9
				(51.4)	(50.9)	(88.7)	(45.1)
Illness in 2003 × Housing damaged	γ_1				-31.7	-36.5	-62.4
					(139.7)	(138.8)	(57.9)
Illness in 2005 × Housing damaged	γ_2					-239.8 **	9.6
						(99.1)	(60.2)
R squared		0.115	0.115	0.126	0.126	0.147	0.317
F (p-value)		0.000	0.000	0.000	0.000	0.000	0.000
B. Models with crop damage as controls.							
Illness dummy	α		36.2				
			(49.7)				
Housing damaged dummy	β_1		-34.9	-29.9	-20.5	-99.1	31.3
			(66.8)	(66.5)	(64.8)	(75.4)	(42.9)
Crop damage per capita (F$)			-0.34	-0.38	-0.60	-0.60	0.22
			(0.52)	(0.52)	(0.58)	(0.67)	(0.52)
Housing damaged dummy × Crop damage per capita			0.55	0.54	0.61	0.68	-0.27
			(0.53)	(0.53)	(0.59)	(0.67)	(0.54)
Illness in 2003 dummy	α_1			-19.7	-24.2	-12.2	-22.0
				(71.3)	(154.8)	(158.2)	(51.3)
Illness in 2005 dummy	α_2			99.8 *	96.5 *	253.6 **	-87.1
				(52.0)	(52.2)	(119.2)	(65.7)
Illness in 2003 × Housing damaged	γ_1				-30.5	-47.1	-18.8
					(155.1)	(160.0)	(65.0)
Illness in 2003 × Crop damage per capita					0.70	0.44	0.78
					(1.25)	(1.23)	(0.66)
Illness in 2003 × Housing damaged × Crop damage per capita					-0.22	0.06	-0.95
					(1.31)	(1.28)	(0.72)
Illness in 2005 × Housing damaged	γ_2					-285.3 **	25.7
						(133.5)	(84.3)
Illness in 2005 × Crop damage per capita						-0.50	0.95
						(1.33)	(1.08)
Illness in 2005 × Housing damaged × Crop damage per capita						1.40	0.25
						(1.70)	(1.40)
R squared			0.119	0.129	0.134	0.156	0.335
F (p-value)			0.000	0.000	0.000	0.000	0.000

*10% significance, **5% significance, ***1% significance. Robust standard errors are in parentheses. Other controls not shown here are household size, village-time dummies, time dummy, and constant.

Table 4. Effects of illness on annual cash and inkind transfers per capita - fixed effects.

	All		Housing undamaged	Housing damaged
	α_2	γ_2	α_2^N	α_2^V
	(1)	(2)	(3)	(4)
A. Net transfers received				
A1. Aggregated transfers				
Both	237.1 **	-247.7 **	253.4 **	-10.5
	(91.8)	(102.2)	(99.2)	(47.3)
Network-based	129.0 *	-133.5	157.3 *	-4.4
	(77.7)	(87.9)	(82.0)	(33.9)
Group-based	108.1 *	-114.2 *	96.0	-6.2
	(55.0)	(67.4)	(60.5)	(39.7)
A2. Disaggregated network-based transfers				
Same village	91.1	-80.2	111.0 *	14.9
	(62.6)	(76.1)	(64.4)	(26.0)
Same tokatoka	107.7	-110.5	131.1 *	4.7
	(68.4)	(82.7)	(69.5)	(27.5)
Same tokatoka	127.7 *	-115.2	132.2	25.9
(tokatoka-time dummies)	(73.2)	(92.7)	(82.6)	(32.5)
A3. Disaggregated group-based transfers				
Village	12.0	1.5	8.4	14.0
	(11.9)	(15.3)	(12.4)	(9.5)
Kin groups	36.9	-32.0	45.2	-4.5
	(32.9)	(31.7)	(38.2)	(14.6)
Kin groups	28.8	-28.2	41.9	0.1
(tokatoka-time dummies)	(29.0)	(31.0)	(38.3)	(14.2)
Religious groups	39.4 **	-39.2 *	34.4 *	3.3
	(17.2)	(22.5)	(18.0)	(15.3)
Religious groups	38.0 **	-35.0	39.5 **	1.7
(church-time dummies)	(17.6)	(24.0)	(19.3)	(18.6)
Religious groups	31.2 *	-26.6	25.2	-1.1
(village-church-time dummies)	(16.4)	(24.4)	(15.8)	(21.1)
Social groups	19.8	-44.4	8.0	-19.0
	(17.5)	(30.5)	(16.6)	(21.8)
B. Gross transfers given to groups				
All groups	-84.5 *	90.0	-64.5	-0.8
	(45.1)	(61.9)	(46.9)	(40.8)
Village	-10.2	-2.5	-6.6	-12.4
	(10.9)	(14.9)	(10.7)	(9.7)
Kin groups	-22.7	19.0	-23.1	-10.7
(tokatoka-time dummies)	(19.6)	(23.0)	(27.4)	(11.4)
Religious groups	-33.3 **	34.1	-28.4 *	-1.3
	(15.7)	(21.0)	(16.7)	(14.8)
Social groups	-21.3	48.1	-8.7	20.6
	(17.6)	(30.3)	(16.6)	(21.7)

*10% significance, **5% significance. Robust standard errors are in parentheses. Village-time dummies are used to control for village-level covariate shocks unless otherwise noted.