Tsukuba Economics Working Papers
No. 2009-004

Targeting of Cyclone Relief within the Village: Kinship, Sharing, and Capture

by

Yoshito Takasaki
March 2009

UNIVERSITY OF TSUKUBA
Department of Economics
1-1-1 Tennodai
Tsukuba, Ibaraki 305-8571
JAPAN

Targeting of Cyclone Relief within the Village: Kinship, Sharing, and Capture[*]

Yoshito Takasaki
University of Tsukuba

Running Title:
Targeting of Cyclone Relief

Contact Information:
Yoshito Takasaki
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

March 17, 2009

[*] I wish to thank my field team – Jonati Torocake, Viliame Manavure, Viliame Lomaloma, Maria Torocake, and Anaseini Savuiwasa – for their advice, enthusiasm, and exceptional efforts on behalf of this project. Special thanks are owed also to the Fijians of the region who so willingly participated in the survey. Xiaowen Mo undertook the laborious task of data entry and cleaning. I wish to thank Takashi Yamano who encouraged me to study the topic of this paper. Comments provided by two anonymous referees were very useful to improve the paper. This research has been made possible through support provided by Sumitomo Foundation, Japan Society for the Promotion of Science, and Ministry of Education, Culture, Sports, Science and Technology in Japan. Any errors of interpretation are solely the responsibility of the author.

Targeting of Cyclone Relief within the Village: Kinship, Sharing, and Capture

Abstract

This paper investigates targeting of cyclone relief within the village in Fiji. We focus on two issues, the link of relief allocation with informal risk sharing and elite capture, both of which are directly related to kinship. We find the following. First, food aid is first targeted toward kin groups according to their aggregate shocks and then shared among group members. Right after the cyclone when aid supply is scarce, households with housing damaged and greater crop damage are allocated *less* aid within the group. Our conjecture is that they receive greater net private transfers in other forms especially in labor sharing. Consistent patterns are found in village, cropping, and housing rehabilitations. Second, there is no elite capture of food aid in the kin group and traditional kin leaders rather share it for others; contrarily, non-kin-based community leaders capture aid when it is allocated across kin groups. Third, distinct from food aid demanded by all, tarpaulins demanded only by the needed are strongly targeted on individual housing damage at the village level – not kin group – independent of social status. Like food aid, victims with greater crop damage are *less* prioritized. Implications for relief policies are discussed.

1. Introduction

Although timely delivery of relief to victims of natural disaster is critical (Skoufias 2003), inefficient distribution of disaster relief with lack of information of damages and coordination among relief agents is frequently reported (e.g., Banerjee 2007). However, empirical research on targeting of disaster relief is very scant due to paucity of data. As an exceptional study among Honduran victims of Hurricane Mitch, Morris and Wodon (2003) find that the receipt of relief is targeted on pre-shock asset, asset loss, and incidence of housing damage among households but the amount received is not, concluding that "because the bulk of emergency aid consists of food, clothing, and medicine, and because the needs for these goods are relatively *similar* between households, there is only limited scope for providing more relief to those who suffered great." (p1280, italics added).

Recent empirical works on targeting of food aid in Africa reveal similar poor targeting performance. Jayne et al. (2002) find evidence of targeting of aid receipt on income and rainfall shock in Ethiopia – both at the regional level and at the household level within the region – and of lack of targeting of the amount received; "(w)ithin local areas it does not appear that field-level rainfall shocks affect local allocations to households, so that a potential insurance role of food aid is not being used." (p286) Contrarily, using other Ethiopian data, Dercon and Krishnan (2005) show that food aid is shared within the village and this sharing complements weak targeting. Using original household survey data gathered in Fiji, this paper examines targeting of cyclone relief within the village, an issue Morris and Wodon (2003) do not address with their IFPRI data which contain only five households per village.

The paper focuses on two important issues of disaster relief which have been unexplored in the literature. The first is its connection with informal risk sharing. While most empirical works on risk sharing focus on consumption smoothing using the full-risk sharing model (Cochrane 1991; Mace 1991; Townsend 1994), it is not the only concern among victims of natural disasters. In our sample, in addition to crop damage experienced by most households, about half suffered from damages on their houses and common village facilities were also damaged. Theoretically, under imperfect labor and housing markets, people seek to smooth utility determined by consumption, leisure, and housing quality (a decrease in housing quality due to the cyclone is a preference shock). *Risk sharing* consists of *labor sharing* and *non-labor sharing* (we focus on ex post risk sharing as a joint coping mechanism not ex ante risk management). Labor sharing takes two forms: *communal labor* for *village rehabilitation* – repair and reconstruction of village structures and facilities – and *labor transfer* across households for *housing rehabilitation* – repair and rebuilding of household dwellings. Contrarily, *crop rehabilitation* – collecting harvestable damaged crops, cleaning fields, and planting – is individually done without using shared labor. In all cases, hired labor is very rarely used.

Private non-labor transfers (cash and inkind) are made to help households cope with crop damage, help victims purchase construction materials, and contribute to village rehabilitation. Following Dercon and Krishnan (2005), we assume that cyclone relief is shared within the village as part of informal risk sharing.[1] In our study area, while almost

[1] While to develop a theory connecting public transfer (disaster relief) with informal risk sharing is beyond the scope of this paper, the former has two counteracting effects on the latter, a positive effect augmenting resources to be shared and a negative crowding-out effect lowering people's incentive for sharing. Crowding-out occurs because in the risk-sharing arrangement with limited enforceability public transfer that increases the value of autarky relative to the value of staying in the contract will reduce the degree of risk sharing (Attanasio and Rios-Rull 2000; Ligon, Thomas, and Worrall 2002).

all households received generous emergency food aid, only primitive tarpaulins – to be used as emergency shelter and for temporary housing repair – were provided for a small proportion of victims and no support for major repairs or reconstruction was available during our survey periods. We reveal that households who suffered more actually receive *less* food aid. Our conjecture is that they receive greater net private transfers in other forms: in particular, overall risk sharing is mainly driven by labor sharing because whether households experienced housing damage sharply distinguishes their position as a net donor or recipient of labor transfer. To prove this conjecture requires us to compare all major forms of transfers, but we lack key data on labor transfer. Alternatively, we show that communal labor contribution and the outcomes of cropping and housing rehabilitations are consistent with relief allocation patterns.

The second issue we highlight is aid allocation rules and their implementation at the village level about which we know so little (Jayne et al. 2002). As the kin-based hierarchy of the Fijian society is well known among anthropologists (Turner 1992), we shed light on this black box by examining the role of kinship in relief allocation. Our inquiry is directly related to recent studies on the structure of risk-sharing network (e.g., Fafchamps and Lund 2003; De Weerdt and Dercon 2006). Fafchamps and Gubert (2007), for example, attribute their finding of geographical proximity as a major determinant of network formation in Philippines to kith and kin relationships. We show that food aid is allocated to kin groups in the village and then shared within the group.

The significant role played by kin groups as a risk-sharing group in relief allocation leads to a concern about elite capture. Distinct from standard household surveys, our data stratified by kin group allow us to examine how relief allocation is

influenced by individual social status (e.g., kin leaders) and group status (e.g., chiefs' kin groups). Theoretical predictions are ambiguous. On one hand, the political economy literature address elite capture as a drawback of decentralization (Grossman and Helpman 1996; Bardhan and Mookherjee 2000; Platteau and Abraham 2002; Bardhan and Mookherjee 2006). On the other hand, local elites may rather take less relief to maintain their reputation. We also consider other groups than kin groups like women's groups. Development agencies increasingly consider village organizations as essential local partners to implement their community-based development projects (World Bank 2002; Mansuri and Rao 2004). We find that traditional kin leaders share food aid for others and non-traditional community leaders capture it.

To deepen our inquiry about risk sharing and elite capture in relief allocation, we consider different shocks, different relief items, and changes over time. We distinguish crop and housing damages which affect various forms of risk sharing in distinct manners. We compare food aid, a focus of previous studies on targeting, with tarpaulins. While food aid as a positive income shock is demanded by all households, tarpaulins are needed only by those with housing damaged. In developing countries their reliance on emergency aid from outside donors and their limited capability to handle distribution often lead to delayed delivery. Our data of relief provisioned over time within a year allow us to see the evolution of allocation rules.

In general, contrary to extensive anthropological studies, economic studies based on household survey data are almost nonexistent in the Pacific region. To better understand the nature and performance of targeting of disaster relief is of considerable importance in small island states (Bertram 1986) as researchers criticize their increasing

dependency on emergency aid and associated deterioration of indigenous mechanisms (e.g., Campbell 1984). Our findings in Fiji suggest a considerable scope for better targeting of cyclone relief through existing informal institutions in the village.

The rest of the paper is organized as follows. Section 2 describes the study area and data; cyclone damage, relief, and rehabilitation; and kinship and village governance. Section 3 discusses the econometric specification followed by the estimation results in Section 4. Section 5 summarizes major findings and offers implications for relief policies.

2. Study area, cyclone, and village governance

2.1. Study area and data

On January 14, 2003, Cyclone Ami swept over the northern and eastern parts of the Fiji Islands. Differing from other parts of the country, the area is less prone to be hit by cyclones and Ami was the only cyclone in the year. The Red Cross, other NGOs, and governments delivered relief.[2] After visiting many native Fijian villages for initial field assessment early March, we intentionally chose nine costal villages to cover distinct environmental and economic conditions.[3] In each village households were stratified by the smallest kin group unit (defined below) and the combination of leadership status (also defined below) and major asset holdings like shops, and in each stratum households were randomly sampled (n = 374).[4] Interviews were conducted between late August and early

[2] The total cyclone damage across the country is estimated at F$104 million, of which dwelling damage is F$22 million and crop damage is F$40 million (National Disaster Management Office 2003). Fourteen people were killed. In our sample villages no casualties and very limited injuries and illnesses caused by the cyclone were reported.

[3] Six villages are on Vanua Levu Island and three are on Taveuni Island. These second and third largest islands in the country significantly lag behind the first largest island Viti Levu where the state capital, two international airports, and most tourism businesses are situated. Our study does not cover Indo-Fijians.

[4] Households with leadership status and/or major assets were oversampled to guarantee their enough observations. All analyses presented in the paper were conducted with and without considering the stratification and weighting design. All results are very similar to each other while significance levels improve in the former. This paper presents the latter conservative results. As the paper examines aid

November. Pre-disaster information and damage measures were thus retrospectively collected (the next section discusses potential measurement errors in our data).[5]

Among our sample households, cropping counted for over half total income before the cyclone, followed by fishing with a 30% income share (Table 1).[6] About 10% households earned significant income from permanent wage labor – especially in the public and tourism sectors – in a stable manner independent of the cyclone. Contrarily, casual wage labor was very uncommon with negligible contribution to total income.

2.2. Housing damage, tarpaulins, and rehabilitation

According to respondents' subjective assessment, the cyclone damaged more than half of residents' main houses (26 houses or 15% damaged houses were completely destroyed and the rest were partially damaged). Figure 1 depicts the proportion of households with main housing damaged who were refugees in each month. In January almost 40% victims were refugees. Households intensively shared male labor for emergency repair (hired labor was very rare). As more and more houses were repaired, refugees diminished (less than 5% at the time of interviews). Almost all refugees stayed temporarily in others' residence in the same village and about two thirds lived with those in the same clan (defined below). Permanent migration was nonexistent.

---

allocation within the clan (defined below), several clans consisting of only one household in our sample are dropped. Our analysis is based on 333 households with complete data.

[5] In any post-disaster survey conducted several months after the disaster, to gather comprehensive data on labor-time transfer, time allocation, and consumption *right after* the disaster is a daunting task.

[6] Almost all households employ traditional farming practices using no mechanized equipment or animal traction and limited purchased inputs. Main food crops are taro and cassava. Main cash crops are coconut (sold to government-run mills for oil production in addition to own consumption) and kava plant locally known as *yaqona* (a pepper plant used to make a local beverage kava which is a dominant symbol in Fijian culture, Turner 1986). Most households conduct subsistence fishing using lines and hooks, simple spear guns, or rudimentary nets, and more commercially-oriented fishermen use boats and engine along with more valuable nets. Questions about cropping and fishing in the past one month were asked at the interview, and then monthly production a year before was asked in comparison with the latest figures.

About half households in our sample also experienced damages on other independent dwelling units than the main house like kitchen, shower, and toilet (15% households own none of them as they are inside the main house). Housing rehabilitation involved repairing or rebuilding a main house and/or other unit(s), and our data contain the status of rehabilitation only at the time of interviews. About two thirds households completed rehabilitation (16 victims built a new house).[7] In the remaining analyses, we focus on the damage on main housing not other units as the former shock was much severer than the latter relevant only to owners. We call households with main housing damaged and undamaged *victims* and *non-victims*, respectively.

Public supports for housing rehabilitation were limited to the provision of tarpaulins. Figure 1 shows the cumulative proportion of households who received tarpaulins in each month in seven villages excluding the other two which received almost none. Delivery started in February and peaked in March – as we witnessed in the field – *after* most refugees got back to their own residence, followed by minor deliveries until June. Only 16% households got tarpaulins and victims were more likely to receive it than non-victims. All recipients but few received one uniform tarpaulin. Our analysis thus focuses on tarpaulin receipt not amount by June. The government provisioned construction materials more than one year after the cyclone. Thus, housing rehabilitation was determined by labor support and construction materials people could secure.

2.3. Village damage, communal labor, and rehabilitation

[7] Almost all main houses built before the cyclone have metal roof and about two thirds wood wall and floor as primary construction materials. While houses with thatched wall or ground floor covered by mat (no floor construction) were more likely to be damaged by the cyclone than others, no other significant difference exists between damaged and undamaged houses in other construction materials. Among newly built houses after the cyclone only about half and one third have wood wall and floor, respectively, and less preferred materials, metal and thatched walls and ground floor covered by mat, are commonly used. Thus, the quality of rehabilitated housing is likely to be lower than the pre-cyclone level.

All nine villages experienced damages on their structures and facilities but we lack complete information of such village-level damages and corresponding relief. Communal labor – mostly male – played a main role in village rehabilitation. We asked communal labor each household contributed *for any reasons in the past one year* (it includes one prior to the cyclone and for other purposes than rehabilitation). An average household offered 19 days communal labor per adult equivalent.[8] At the time of interviews most facilities were not fully recovered due to lack of construction materials.

2.4. Crop damage, food aid, and rehabilitation

87% households experienced crop damage. The mean value of damaged crops was 35 Fiji dollar per adult equivalent (F$1 = US$.60), or equivalently 57% mean monthly pre-cyclone crop income (crop damage was calculated based on the quantity damaged for each major crop reported by respondents). Crop rehabilitation was individually done without using shared or hired labor. People planted 'catch' crops (which grow fast) after their seeds were provisioned as part of relief and their harvest already started before our interviews. Recovery was still incomplete: the mean post-cyclone crop income was lower than the pre-cyclone level by more than 40%.

Emergency food aid was the largest relief in the region (the total cost of food ration was 20 times that of tarpaulins in the country, National Disaster Management Office 2003). Other relief items like water, clothing, and medicine were almost nonexistent in our sample. The proportion of households who received food aid in each month is depicted in Figure 1. Like tarpaulins the delivery was delayed: by March over three fourths households received aid and by April almost all got some. Accordingly, our

[8] They are almost equally divided into village and community groups (defined below) and only 3% was for kin groups (also defined below). As most facilities are owned and/or used by village or community groups, a significant part of communal labor was probably used for village rehabilitation.

analysis examines aid receipt by March. This first wave of delivery continued until May, and after two months interval the second wave arrived in August and September.[9]

Because the monetary value of food aid received was difficult for respondents to answer, we asked the quantity measured in days it would have taken to consume in normal periods (not actual duration). As foodstuffs in relief were mostly uniform across villages, quality difference is not an issue. Mean amounts of food aid *among recipients in each month*, especially in the months when receipt was common, are mostly in the range of 30-40 days (Figure 1). Our monthly data generate two quarterly data in January-March and April-June and one half year data in January-June. *Recipient* households received about 12 days food per month on average *in each quarter* and the mean amount of food aid received in the six months period among *all* households (including non-recipients in either quarter) was 9.5 days per month (these two measures are used as a dependent variable in our regression analysis). Our sample households could thus rely on aid to cover about 30% food consumption. This is a huge injection: based on the government estimate of the cost of food ration (F$1.73 per person per day, National Disaster Management Office 2003), the value of 57 days ration for six months is equivalent to F$99 per capita, almost three times average crop damage per adult equivalent.[10]

2.5. Correlations of cyclone relief with cyclone damages

The correlations of relief with cyclone damages give us initial evidence of allocation rules (Table 2). Food aid receipt is negatively and positively associated with

[9] Four Vanua Levu villages interviewed from late August through mid-September, earlier than the other five, received almost no food aid in July or later, but they might receive some during the second wave of delivery after we conducted interviews. With the incomplete data in these four, our analysis focuses on the first wave and all descriptive data about food aid after June presented in the paper, including ones in Figure 1, are based on the remaining five villages with complete data of the second wave.

[10] In the five villages with the complete data of the second wave of food aid delivery (note 9), households received about 11 days of food per month over the nine months period from January to September: that is, adding the second wave, total ration becomes almost 100 days food on average.

housing damage in the first and second quarters, respectively (the same pattern also appears in Table 1). Our interpretation is that households who received labor support and contributed less to communal work were less likely to receive aid when its supply was scarce and after the supply augmented this allocation rule was reversed. Food aid receipt is always negatively associated with the incidence not magnitude of crop damage. Our interpretation is that households with crop damage who contributed less to labor sharing for the sake of own crop rehabilitation were less likely to be a recipient. On the other hand, tarpaulin receipt is positively correlated with house damage (and crop damage value), indicating strong targeting. The amounts of food aid received among recipients exhibit no significant correlations. Whether these results and interpretations hold in systematic regression analyses is a question to be examined in the next section.

2.6. Kinship and village governance

Three leaders play an important role in the village governance in Fiji. The first is *clan leaders*. Every native Fijian belongs to a clan (*mataqali*).[11] There are 36 clans in our nine sample villages (2-8 clans per village with no overlap across villages). Land is communally owned by clan, is privately used, and is not allowed to be sold by law (communal land consists of about 83% total land in the country). Some individuals holding a traditionally-assigned permanent leadership position in their clan play a major role in decisions made by the clan and negotiations among clans. Some clan leaders are chiefs with special social status who assume various traditional duties.

[11] The hierarchical Fijian kin structure is well known among anthropologists: the bottom is *tokatoka*, followed by *mataqali*, *yavusa*, and *vanua*, and all native Fijians belong to one tokatoka which belongs to one mataqali, and so forth (Ravuvu 1983). Vanua ranges over several villages, there is only one yavusa in seven out of the nine sample villages, and mataqali and tokatoka are sub-groups within the village. This paper focuses on mataqali which we call *clan*. We repeated our regression analyses using tokatoka as an alternative definition of clan, finding similar results to what are presented here.

The second is *village leaders*. In our sample, village chiefs are shared by clan leaders (village chiefs are not necessarily clan chiefs). The second important village leader next to village chiefs is *gate keepers* (*turaga ni koro*) who handle most matters in connection with the local government. Gate keepers receive information and materials from the government and NGOs, distribute them to villagers, and coordinate village meetings. Nine gate keepers in our sample received relief items delivered to the village and distributed them to villagers (their comprehensive records are unavailable). While gate keepers are a deliverer of relief, how its allocation decision is made is unknown.

The third is *community-group leaders* (community groups are other groups than kin groups in the village). Some groups like church, women's, and school groups received relief through their own network (which cannot be distinguished from relief provisioned to the village in our data). Community leadership is neither permanent nor directly related to kinship. With a limited number of observations of gate keepers and community-group leaders, we combine these two as *non-clan leaders*. Clan and non-clan leaders, respectively, belong to 8% and 5% of our sample households (Table 1).

We also consider potential capture by three elite groups: clans with a clan or village chief (henceforth, *chiefs' clans*), clans with a gate keeper, and clans with community-group leaders. Clan and village chiefs come only from specific clans (we exclude other clan leaders than chiefs because they exist in most clans) and gate keepers are also frequently appointed from certain clans; on the other hand, community-group leaderships are unrelated to clans. In this way, we differentiate kin-based traditional elites and other non-traditional elites at both the individual and clan levels. In our sample, 42-50% households belong to leaders' clans, that is, those leaders come from large clans.

3. Econometric specification

3.1. Empirical models of relief allocation

Extant empirical analyses on targeting focus on cross-section analysis using ""reduced form" specifications in which as little structure is put on the decision rules as possible, because so little is known about these decision rules and their implementation at the village level." (Jayne et al. 2002, p248) To examine relief allocation at the village level, we employ a reduced-form model,

$$y_i = \alpha + \beta_1 X_i + \gamma_1 Z_i + \delta_1 W_i + V + e_i, \quad (1)$$

where y_i is the relief allocated to household i, X_i, Z_i , and W_i, respectively, are vectors of household-level *cyclone shocks*, *social status*, *other pre-cyclone factors* which can determine relief allocation, V is village dummies which fully control for village-level factors including village facility damages and total relief delivered to the village, and e_i is an error term. If relief allocation is independent of informal risk sharing, targeting performance is measured by a positive element of β_1. If relief allocation is part of informal risk sharing among villagers, however, the element of β_1 is unsigned because the opposite allocation rule is possible when households who suffered more receive greater net private transfers in other forms. The capturing and sharing by leaders, respectively, are measured by positive and negative elements of γ_1.

To examine roles of clans in relief allocation, we extend Model 1 to

$$y_i = \alpha + \beta_1 X_i + \gamma_1 Z_i + \delta_1 W_i + \beta_2 X_g + \gamma_2 Z_g + \delta_2 W_g + V + e_i, \quad (2)$$

where X_g, Z_g, and W_g, respectively, are vectors of clan-level cyclone shocks, social status, and other pre-cyclone factors for clan g. If relief is allocated across households only at the village level, the addition of clan-level factors is redundant. In the case where relief

allocation is part of risk sharing, this means that clans do not serve as a risk-sharing group or relief allocation is part of risk sharing only at the village level. Contrarily, the significant impacts of both clan- and household-level shocks suggest that not only the village but also clans serve as a risk-sharing group and relief allocation is part of risk sharing at both the village and clan levels. The element of β_2 is unsigned because clans which experienced greater damage may receive larger net private transfers in other forms. Across-clans allocation rules can be distinct from within-clan allocation.[12]

We conjecture that overall risk sharing is mainly driven by labor sharing because housing damage sharply distinguishes households' position as a net donor or recipient of labor transfer for housing rehabilitation. In particular, we hypothesize that: (1) households with housing damaged (victims) are a net recipient of labor transfer and contribute less to communal work (*hypothesis 1*) and (2) households with greater crop damage intensify own crop rehabilitation and thus contribute less to labor sharing (*hypothesis 2*). Then, households who suffered great can be allocated less relief in exchange for favorable labor-sharing arrangements and relief allocation rules can be distinct between victims and non-victims. We run separate regressions for these two sub-samples. Pre-cyclone income, asset holdings, and other household characteristics are not significantly different between victims and non-victims (Table 1), suggesting that housing damage is considered exogenous and selection bias is not a major concern.[13]

[12] We also estimated models with clan dummies which fully control for clan-level factors (village dummies are excluded). This alternative specification focuses on within-clan allocation. The estimation results of household-level factors did not significantly change. Thus, unobserved clan-level factors in Model 2 are unlikely to cause significant bias in our estimates.

[13] Households with an older head and belonging to leaders' clans are more likely to experience housing damage. Our data show that these households rely more on inferior construction materials discussed in note 7 (because leaders' clans are large clans, this relationship also holds regarding clan size). That is, inequality in construction materials is higher in leaders' clans than the others. Inequality in general in the kin-based traditional society deserves further research.

To analyze aid receipt and amount received separately is important because their determinants are shown to be distinct in extant studies. To examine how allocation rules change over time, we first analyze food aid receipt by March and amount received in January-March among recipients using Probit and OLS, respectively, and then amount received in January-June using OLS. The former hurdle model is commonly used in previous studies (Jayne et al. 2002; Dercon and Krishnan 2005).[14] For comparison, we analyze tarpaulin receipt by June using Probit.

3.2. Covariates

In Model 1, household-level cyclone shocks X_i are captured by a dummy for main housing damaged, the value of crop damage per adult equivalent (log), and their interaction term (which captures their interactions in risk sharing).[15] In the sub-sample analysis for victims and non-victims, only the value of crop damage is used (β_1 is a scalar not a vector). Social status Z_i is captured by two dummies for clan and non-clan leaders. Other pre-cyclone factors W_i include standard variables used in extant works such as income, asset holdings, and demographic factors as detailed in Appendix (descriptive statistics of all covariates are shown in Table 1). Pre-cyclone factors are measured a year before our interviews. Our income measure thus rules out the possibility that income is affected by transfers due to disincentive effects (Clay and Stokke 2000; Barrett 2002).

Contrary to housing damage, crop damage is not random but related with land holdings and pre-cyclone cropping practices. Even though covariates are added to control

[14] An alternative sample selection model is infeasible with our data which lack identifying instruments required to credibly estimate the selection equation.

[15] We do not distinguish houses partially damaged and completely destroyed because the latter are much less common than the former. We repeated our analyses excluding households with housing completely destroyed. The results are almost the same as those presented here. To control for potentially distinct patterns among refugees, we also repeated our analyses excluding them. This mostly further reduced the size of the victim sample. We found no significantly different results.

for these factors and ex ante risk management is unlikely to play a major role in our less-cyclone-prone area, crop damage may be still correlated with unobservable factors affecting relief allocation. Similarly, pre-cyclone income may be also endogenous. To control for the potential endogeneity of crop damage and income requires valid instruments for them which our data lack. We ran regressions excluding them to check the robustness of estimates of other variables, finding no significantly different results.

In Model 2, clan-level cyclone shocks X_g are captured by the proportion of housing damaged in the clan and the clan mean of crop damage per adult equivalent (log). In the sub-sample analysis, two clan means of crop damage *in the whole sample*, one among victims and another among non-victims, are used to allow their potentially distinct effects. In the victim sample, for example, crop damages experienced by other victims and non-victims in the same clan may affect relief allocation in different manners as they play distinct roles in labor sharing. Social status Z_g includes three dummies for chiefs' clan, gate keepers' clan, and community-group leaders' clan. Other pre-cyclone factors W_g are detailed in Appendix. Our clan-mean estimates should be reasonably accurate because on average we sampled about 70% households in each stratum.

3.3. Empirical models of rehabilitation

We test hypotheses 1 and 2 by examining how cyclone shocks affect village, crop, and housing rehabilitations. Since our goal is not to identify impacts of relief allocated to households (which is endogenously determined), we employ the same reduced-form specifications as relief allocation.[16] First, we directly test both hypotheses regarding communal labor using OLS. Next, we test the first half of hypothesis 2 regarding the

[16] If allocation rules were exogenously set by relief agents and were perfectly implemented in the village, household-level relief would appear as an explanatory variable as a determinant of rehabilitation.

intensification of crop rehabilitation. With lack of labor input data, we examine the outcome of crop rehabilitation by employing the first-difference estimator using pre- and post-cyclone crop incomes as a dependent variable. Only time-variant shock variables (plus village-time dummies) appear as covariates (this specification is a direction extension of the full-risk sharing model, Fafchamps and Lund 2003). The effect of household-level crop damage on post-cyclone crop income is the combination of the negative and positive effects of the direct damage and own labor input for rehabilitation corresponding to the damage, respectively. Our null hypothesis is that post-cyclone crop income is insensitive to own crop damage, that is, households intensify rehabilitation *in proportion to* the magnitude of crop damage (this does not necessarily mean that cropping was fully recovered).[17] Then, households with greater crop damage do not necessarily earn less cash at the time of interviews but contribute less to labor sharing (the second half of hypothesis 2). While we directly test the latter regarding communal labor, lack of data precludes us from doing so for labor transfer. Alternatively, we examine the outcome of housing rehabilitation – completed or not – among victims using Probit. Households with greater crop damage should be less likely to complete housing rehabilitation as they receive smaller labor and non-labor transfers including relief.

3.4. Measurement errors

Special attention needs to be given to measurement errors in our retrospective data. First of all, errors in our measure of housing damage reported by individual

[17] We think that households can give a high priority to crop rehabilitation because of the following reasons. First, distinct from housing and village rehabilitations relying heavily on labor sharing, crop rehabilitation is individually done and its benefits are fully captured by cultivators. Second, distinct from housing and village rehabilitations involving costly construction materials, crop rehabilitation can be done only by adjusting own labor supply. Third, with very limited public support for housing and village rehabilitations, extra cash was greatly needed for purchasing construction materials. Fourth, before the supply of food aid augmented, food shortage was a major concern.

households are minimal because relief officers also used three categories – no damage, partial damage, and complete destruction – for their damage assessment and thus the damage status of each house was common knowledge among villagers. Errors in crop damage value may cause bias. We repeated our analyses using a dummy for crop damage the measurement errors in which should be minimal, finding qualitatively similar results. Hence, systematic errors in crop damage value are unlikely to be a major concern.

Even if retrospective errors in aid receipt are small, errors in the timing of receipt and amount received can be considerable. A key question is whether these errors are correlated with the covariates. In particular, households with more damage might tend to feel that the delivery was too late and the amount was too small, causing *downward* bias in our estimates of shock variables. Measurement errors in the timing of tarpaulin and food aid in the six months period are not an issue because it covers all tarpaulins delivered and errors across two waves of food aid delivery are unlikely. Our main concern is errors in the timing between March and April which are mainly caused by households who received aid in either March or April not those who received in both or neither of them. With systematic recall bias, the correlation between aid receipt *in* March and shocks in this sub-sample should be smaller than that of receipt *by* March in the whole sample. This pattern holds for housing damage but not for crop damage dummy or value (Table 2). Thus, recall bias in timing can be a concern for housing damage in the whole sample analysis (it is irrelevant in the sub-sample analysis for victims and non-victims). We cannot tell how serious other recall bias than that caused by the error in timing is in the amount of food aid received. It is important that whenever we interpret negative impacts of adverse shocks on the amount we consider the possibility of bias.

4. Estimation results

We first discuss food aid and rehabilitations regarding cyclone shocks and social status and then compare food aid with tarpaulins. Unless otherwise noted, estimation results for Model 1 in the whole sample and Model 2 in the whole, non-victim, and victim samples are shown in Tables 3 and 4 which report cyclone shocks and social status only;[18] other pre-cyclone factors are reported and discussed in Appendix.

4.1. Cyclone shocks

Results for food aid receipt by March, log amount received per month in January-March among recipients, and log amount received per month in January-June are reported in Table 3. In the first quarter, households with housing damaged are less likely to be a recipient (Columns 1-4) and those with greater crop damage receive a smaller amount (Columns 5-8). The housing damage dummy is jointly significant at least at a 10% significance level, the latter result on amount holds in both sub-samples, and crop damage also negatively affects receipt among victims. These findings are consistent with our conjecture that relief allocation is driven by labor sharing. In the first quarter with scarce aid supply, labor transfer for emergency repair was of critical importance. Once the supply augmented in the second quarter, the allocation rules were reversed so that the allocation for the six months period became neutral to shocks (Columns 9-12).[19]

Results for log communal labor per adult equivalent, log crop income per adult equivalent per month, and housing rehabilitation among victims are reported in Table 4.

---

[18] Robust standard errors are reported for OLS in Model 1. Standard errors are clustered by clan in Model 2. Two exceptions are tarpaulin receipt in seven recipient villages and food aid received in January-March among recipients in the victim-sample, both of which contain a small number of clans.

[19] This is confirmed by estimating the determinants of aid receipt in April-June using the same reduced form specifications either with or without the amount of aid received in January-March as an additional covariate treated exogenous (we cannot control for the endogeneity of this lagged dependent variable).

Consistent with hypotheses 1 and 2, households with housing damaged and greater crop damage contribute less communal labor (except for crop damage among victims probably because victims receiving labor transfer from non-victims cannot lower contribution much) (Columns 1-4). The combined results of crop and housing rehabilitations support hypothesis 2: household post-cyclone crop income is insensitive to own crop damage (Columns 5-8),[20] and victims with greater crop damage are less likely to complete housing rehabilitation (Columns 9 and 10).

Table 3 shows that clan-level cyclone shocks affect food aid allocation as follows. In the whole sample, clans of which members experienced greater crop damage receive a larger amount in the first quarter (Column 6). In the victim sample, clans in which victims experienced greater crop damage are more likely to be a recipient in the first quarter (Column 4); contrarily, in the non-victim sample, such clans receive a smaller amount in the six months period (Column 11). Results for crop damage experienced by non-victims in the clan and housing damage among clan members are weak. These findings indicate that food aid is first targeted toward clans according to their crop damage especially among victims – as victims are prioritized, non-victims are allocated less – and then it is shared within the clan in connection with labor sharing. Labor sharing is thus important among clan members as implied from the co-residence for refugees.[21]

Supportive evidence is found in rehabilitations as follows (Table 4). First, communal labor for village rehabilitation is shared both within the clan and across clans:

[20] Predictions regarding own housing damage are ambiguous: households may intensify cropping to earn extra cash for housing rehabilitation or may downsize cropping to shift labor to housing rehabilitation. Our results show that the former outweighs the latter (the results are statistically insignificant).

[21] This is also supported by our finding that victims in a richer clan are *less* likely to complete housing rehabilitation (see Appendix). If non-labor sharing were relatively important compared to labor sharing in the clan, the opposite relationship would be the case.

non-victims in a clan in which victims experienced greater crop damage contribute more to help those victims; contrarily, in the non-victim sample, clans in which non-victims experienced more crop damage are allowed to contribute less (Column 3). Second, victims in a clan in which housing damage was more common less rehabilitate cropping as they are busy in helping each other (Column 8).[22] Third, households in a clan in which victims – not non-victims – experienced greater crop damage are more likely to complete housing rehabilitation (Column 10). This is possible if each victim receives more support from non-victims, i.e., within-clan labor sharing augments.

4.2. Social status

Social status strongly influences food aid allocation (Table 3). First, clan leaders are less likely to receive aid in the first quarter (the result among victims is insignificant) (Columns 1-4); all other estimated coefficients for household-level social status are insignificant (weak results of non-clan leaders may be because they combine gate keepers and community-group leaders). Second, among victims, chiefs' and gate keepers' clans are less likely to receive aid in the first quarter and receive a smaller amount in the six months period; the converse holds true for community-group leaders' clans (Columns 4 and 12). In the whole sample, qualitatively the same results hold for gate keepers' and community-group leaders' clans in receipt in the first quarter (Column 2).

These findings suggest the following. First, while food aid received by a village is shared by traditional kin leaders, aid received by a community group is captured by its leader's clan not the leader him/herself. In the closely-knit kin society, capturing relief allocated as part of risk sharing within the clan can greatly deteriorate capturer's

[22] Predictions regarding clan-level shocks are ambiguous: households may intensify cropping against damages among clan members to augment non-labor sharing or reduce cropping to shift labor to labor sharing. Regarding housing damage the latter outweighs the former among victims.

reputation among clan members. As this social cost is too high for all elites, there is no capture in the clan. Traditional leaders rather share aid for others to maintain or even augment their reputation in the clan and village. Contrarily, since the status of non-traditional leaders is not directly related to their clan, their social cost of capturing aid allocated among clans is not so high. Non-traditional leaders make use of traditional kin structure for capturing.[23] This finding supports the argument of Platteau and Abraham (2002) that the highly ranked can exercise their authority in other sectors of the village's life. Second, clan status affects aid allocation particularly in the first quarter and among victims, that is, when aid was scarce and greatly demanded (recall that less aid was allocated to victims then). Third, social status largely alters aid receipt not amount received. Put together, the scarcity of food aid augments distinct motives for sharing and capturing among different elites in their decisions about who are recipients.

4.3. Comparison of tarpaulins and food aid

Results for tarpaulin receipt by June are reported in Columns (13) and (14) of Table 3 (only the results in the whole sample in seven tarpaulin recipient villages are shown). Households with main housing damaged are more likely to be a recipient. None of clan-level shocks are significant (the statistical significance of own housing damage and the overall fitness of the model in Model 2 become weaker) and neither social status nor other pre-cyclone factors matter (see Appendix for the latter). These sharp results indicate strong targeting on individual housing damage in the allocation at the village level not clan. This targeting is weakened by individual crop damage: the marginal effect

[23] Victims belonging to community-group leaders' clans are more likely to complete housing rehabilitation (Columns 10 of Table 4). This may be partly because of their capture of food aid. The role of social status in communal labor is straightforward (Columns 1-4): households in chiefs' clans which assume greater traditional roles contribute more (our communal labor data is inclusive) and clan leaders contribute less especially in the victim sample, i.e., communal labor is more common among commoners.

of housing damage diminishes as crop damage augments (the highest marginal effect with no crop damage is about 30% when all other variables take mean values).

We think that the sharp contrast in allocation rules according to cyclone shocks and social status between food aid and tarpaulins is caused by their distinct characteristics and the difference of crop and dwelling damages. On one hand, crop damage is not so observable to other households and food aid is demanded by all. There are thus significant room and demand for capture. Crop damage is relatively observable among clan members who jointly own communal land and labor sharing for housing rehabilitation is probably mainly done among them. As such, food aid allocation among clan members can be tightly linked with their labor sharing.

On the other hand, dwelling damage is well observable to all villagers and only those whose main house and/or independent units were damaged demand tarpaulins. There are thus limited room and demand for capture, resulting in the strong targeting on victims without involving across-clans allocation. As tarpaulin supply is insufficient (much scarcer than food aid), an additional allocation rule is employed according to crop damage: victims who contribute less to labor sharing among villagers – not clan members – are less prioritized (this is consistent with our earlier finding that they are less likely to complete housing rehabilitation). As such, how relief allocation is linked with other forms of risk sharing varies across relief items.

5. Conclusion

Using original post-disaster survey data gathered in Fiji, this paper investigated targeting of cyclone relief within the village. Our focus was on the link of relief allocation with informal risk sharing and elite capture, both of which are directly related

to kinship. We found the following. First, food aid is first targeted toward kin groups according to their aggregate crop damage especially among those who experienced housing damage and then shared among group members. Right after the cyclone when aid supply is scarce and labor help for housing repair is critical, households who suffered more are allocated *less* aid within the group. Our conjecture was that they receive greater net private transfers in other forms: in particular, households with housing damaged and greater crop damage, respectively, are less likely to receive aid and receive a smaller amount in exchange for favorable labor-sharing arrangements among group members. After aid supply augments, this allocation rule is reversed. Although lack of data precluded us from proving our conjecture, we found consistent patterns in communal labor for village rehabilitation and cropping and housing rehabilitation outcomes.

Second, there is no elite capture of food aid in the kin group and traditional kin leaders rather share it for others probably to maintain their reputation in the group and village. Contrarily, non-traditional community leaders capture aid when it is allocated across kin groups, i.e., they make use of kin structure for capturing. Both sharing and capturing mainly occur when recipients of scarce aid are determined. Third, distinct from food aid demanded by all, tarpaulins demanded only by the needed are strongly targeted on individual housing damage at the village level – not kin group – independent of social status. Victims with greater crop damage are *less* prioritized presumably because tarpaulin allocation is linked with the labor sharing among villagers.

These findings lead to the following policy implications. First, while targeting of disaster relief on shocks is important, the performance of broad risk sharing needs to be given greater attention. Contrary to what Morris and Wodon (2003) conclude, the needs

for relief are heterogeneous across households even in the same village and there exists a scope for targeting of both aid receipt and amount received on idiosyncratic shocks through private risk sharing. This self-targeting can complement weak targeting of disaster relief, but existing private mechanisms needs to be better understood first. In particular, the self-targeting may be attained not only by the village itself but also by sub-groups in the village like kin groups. Second, in the kin-based society where social reputation in the kin group and village is a central concern, the risk of elite capture can be rather higher in relief provisioned to non-kin-based community groups than that to the village because the former's reputation-based sharing mechanism is weaker than the latter. Contrary to community development, village organizations may not be good targets or partners in disaster relief management in certain locales. Third, timely delivery of sufficient relief is important not only to better satisfy the demand of the needed but also to reduce elite capture and thus improve self-targeting. Lastly, effective relief policies can be distinct across different shocks and across relief items as how relief and informal risk sharing are related with each other depends on each shock and each item. Policy makers need to design a good combination of shock-and-item-specific policies.

Appendix

This appendix discusses other pre-cyclone factors used as covariates and reports their estimation results (except for the first-difference estimates of crop income). Relief allocation and rehabilitation results, respectively, are shown in Tables A1 and A2 of which the column numbers match with those in Tables 3 and 4.

Household-level other pre-cyclone factors include income per adult equivalent per month (log), land holdings (log), fishing capital (log), a dummy for secondary education

among adults (capturing human capital), household adult equivalent size (log), proportions of children and elderly (capturing labor resources), the age of household head (log), and a dummy for female head. Clan-level other pre-cyclone factors consist of the clan mean of pre-cyclone income per adult equivalent per month (log) and clan population share in the village (based on population not sample) (the mean and standard deviation of the latter are .39 and .21, respectively).

While none of other pre-cyclone factors affect tarpaulin allocation, they significantly alter food aid. In the six months period, households (except for non-victims) with lower pre-cyclone income and more children receive more aid, indicating targeting toward the poor and children. Bigger households (except for victims) receive less aid per capita, indicating the allocation rule not fully reflecting household size (the same finding is obtained by Jayne et al. 2002). Bigger clans receive more, suggesting an important role played by across-clans bargaining in the allocation. In the first quarter, household size and the number of children (only in the whole sample) have qualitatively the same impacts on amount received as those found in the six months period; pre-cyclone income shows no significant effects and clan size only affects receipt in the whole sample. Households holding larger fishing capital receive a smaller amount (except for non-victims), indicating targeting toward the asset poor. The male headed (except for victims) and households with secondary education are more likely to receive aid despite that some educated adults earned secure income from their permanent jobs after the cyclone. This suggests that scarce aid was captured by the educated and males.

Larger households, the female headed (except for victims), households with more children, and households in a larger clan (except for victims) contribute less communal

labor per adult equivalent. Households with educated adults (only in the whole sample) contribute less probably because of their high opportunity cost of labor time and permanent jobs held by some of them. Households in a richer clan (except for victims) also contribute less. This may be because richer clans contribute larger non-labor transfer (for any purposes). Older households, households with educated adults, smaller households, and households with more children are more likely to complete housing rehabilitation probably because seniority is an advantage in securing support, some educated adults hold permanent jobs, household size is positively related with house size, and labor sharing is preferably altered by children as found in communal labor. Communal labor and housing rehabilitation are neutral to pre-cyclone income and assets.

References

Attanasio, O., and J.-V. Rios-Rull. 2000. "Consumption Smoothing in Island Economies: Can Public Insurance Reduce Welfare?" *European Economic Review* 44, no. 7: 1225-58.

Banerjee, A. V. 2007. *Making Aid Work*. Cambridge and London, MIT Press.

Bardhan, P., and D. Mookherjee. 2000. "Capture and Governance at Local and National Levels." *American Economic Review* 90, no. 2: 135-39.

Bardhan, P., and D. Mookherjee. 2006. "Pro-poor Targeting and Accountability of Local Governments in West Bengal." *Journal of Development Economics* 79, no. 2: 303-27.

Barrett, C. B. 2002. "Food Security and Food Assistance Programs." In *Handbook of Agricultural Economics*, ed. Gardner, B. L., and G. C. Rausser. Amsterdam, Elsevier.

Bertram, G. 1986. "Sustainable development in Pacific microeconomies." *World Development* 14, no. 7: 809-822.

Campbell, J. R. 1984. *Dealing With Disaster: Hurricane Response in Fiji*. Honolulu, Pacific Islands Development Program, East-West Centre.

Clay, E., and O. Stokke ed. 2000. *Food aid and human security*, London, Frank Cass.

Cochrane, J. H. 1991. "A simple test of consumption insurance." *Journal of Political Economy* 99, no. 5: 957-976.

De Weerdt, J., and S. Dercon. 2006. "Risk-Sharing Networks and Insurance Against Illness." *Journal of Development Economics* 81, no. 2: 337-56.

Dercon, S., and P. Krishnan. 2005. "Food Aid and Informal Insurance." In *Insurance Against Poverty*, ed. Dercon, S. Oxford and New York, Oxford University Press.

Fafchamps, M., and F. Gubert. 2007. "The formation of risk sharing networks." *Journal of Development Economics* 83, no. 2: 326-350.

Fafchamps, M., and S. Lund. 2003. "Risk-sharing networks in rural Philippines." *Journal of Development Economics* 71, no. 2: 261-287.

Grossman, G. M., and E. Helpman. 1996. "Electoral Competition and Special Interest Politics." *Review of Economic Studies* 63, no. 2: 265-86.

Jayne, T. S., J. Strauss, T. Yamano, and D. Molla. 2002. "Targeting of Food Aid in Rural Ethiopia: Chronic Need or Inertia?" *Journal of Development Economics* 68, no. 2: 247-88.

Ligon, E., J. P. Thomas, and T. Worrall. 2002. "Informal Insurance Arrangements with Limited Commitment: Theory and Evidence from Village Economies." *Review of Economic Studies* 69, no. 1: 209-44.

Mace, B. J. 1991. "Full insurance in the presence of aggregate uncertainty." *Journal of Political Economy* 99, no. 5: 928-956.

Mansuri, G., and V. Rao. 2004. "Community-Based and -Driven Development: A Critical Review." *World Bank Research Observer* 19, no. 1: 1-39.

Morris, S. S., and Q. Wodon. 2003. "The Allocation of Natural Disaster Relief Funds: Hurricane Mitch in Honduras." *World Development* 31, no. 7: 1279-89.

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

Platteau, J.-P., and A. Abraham. 2002. "Participatory Development in the Presence of Endogenous Community Imperfections." *Journal of Development Studies* 39, no. 2: 104-36.

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

Skoufias, E. 2003. "Economic Crises and Natural Disasters: Coping Strategies and Policy Implications." *World Development* 31, no. 7: 1087-1102.

Townsend, R. M. 1994. "Risk and insurance in village India." *Econometrica* 62, no. 3: 539-591.

Turner, J. W. 1986. ""The water of life": kava ritual and the logic of sacrifice." *Ethnology* 25, no. 3: 203-214.

Turner, J. W. 1992. "Ritual, habitus, and hierarchy in Fiji." *Ethnology* 31, no. 4: 291-302.

World Bank. 2002. *Reaching the poor: a renewed strategy for rural development*. Washington, D.C., World Bank.

Table 1. Means of income, cyclone shocks, relief, and rehabiliations, social status, and other pre-cyclone factors per household.

	All (n=333)	Housing undamaged (n=157)	Housing damaged (n=176)	Mean/ prop. test (p-value)
Pre-cyclone income per adult equivalent per month (F$):				
Total	113 (116)	117 (112)	110 (119)	0.57
Cropping	60.4 (90.5)	64.8 (91.0)	56.5 (90.1)	0.40
Fishing	33.7 (40.8)	32.1 (37.4)	35.2 (43.7)	0.50
Permanent wage labor	10.6 (41.8)	12.1 (50.8)	9.3 (31.8)	0.54
Casual wage labor	0.4 (3.0)	0.4 (2.6)	0.5 (3.4)	0.64
Other	7.0 (44.5)	6.6 (21.3)	7.3 (57.8)	0.88
Cyclone shocks:				
Housing damaged dummy	0.53 (0.50)	0.00 (0.00)	1.00 (0.00)	**0.00**
Independent units damaged dummy	0.52 (0.50)	0.31 (0.46)	0.71 (0.45)	**0.00**
Crop damaged dummy	0.87 (0.34)	0.87 (0.33)	0.87 (0.34)	0.93
Crop damage per adult equivalent (F$)	34.5 (44.6)	35.1 (49.2)	34.0 (40.2)	0.82
Cyclone relief:				
Tarpaulin receipt by June dummy (in seven receipient villages)	0.16 (0.37)	0.09 (0.28)	0.22 (0.42)	**0.01**
Food aid receipt dummy				
By March	0.77 (0.42)	0.85 (0.36)	0.70 (0.46)	**0.00**
In April-June	0.79 (0.41)	0.73 (0.44)	0.84 (0.37)	**0.02**
By June	0.95 (0.21)	0.97 (0.16)	0.93 (0.25)	0.07
Food aid per month (days)				
in January-March (recipients only)	12.6 (7.7)	13.2 (8.2)	12.0 (7.2)	0.22
In April-June (recipients only)	11.9 (7.2)	12.0 (7.9)	11.9 (6.7)	0.85
By June (whole sample)	9.5 (6.3)	10.0 (6.2)	9.1 (6.4)	0.22
Rehabilitations:				
Communal labor per adult equivalent in the past one year (days):	18.8 (16.0)	19.9 (17.3)	17.9 (14.7)	0.24
Post-cyclone cropping income per adult equivalent per month (F$)	35.0 (59.4)	38.8 (54.7)	31.5 (63.3)	0.26
Housing rehabiliation completion dummy (among households with main house or independent units damaged)	0.68 (0.47)	0.78 (0.42)	0.66 (0.48)	0.15
Social status:				
Clan leader dummy	0.08 (0.27)	0.10 (0.29)	0.06 (0.24)	0.26
Non-clan leader dummy	0.05 (0.23)	0.04 (0.21)	0.06 (0.24)	0.47
Chiefs' clan dummy	0.43 (0.50)	0.36 (0.48)	0.49 (0.50)	**0.02**
Gate keepers' clan dummy	0.42 (0.49)	0.30 (0.46)	0.53 (0.50)	**0.00**
Community group leaders' clan dummy	0.50 (0.50)	0.42 (0.50)	0.57 (0.50)	**0.01**
Other pre-cyclone factors:				
Land holdings (acre)	4.78 (5.65)	4.60 (5.39)	4.93 (5.89)	0.60
Fishing capital (F$)	473 (1497)	587 (1935)	371 (942)	0.19
Adults' secondary education dummy	0.84 (0.36)	0.83 (0.38)	0.86 (0.35)	0.45
Household size (adult equivalent)	4.93 (2.23)	4.79 (2.09)	5.06 (2.35)	0.26
Proportion of children (<15)	0.32 (0.2)	0.31 (0.2)	0.33 (0.2)	0.43
Proportion of elderly (>65)	0.06 (0.14)	0.07 (0.16)	0.04 (0.13)	0.14
Age of household head	48.3 (13.7)	50.1 (13.9)	46.7 (13.4)	**0.03**
Female head dummy	0.11 (0.31)	0.11 (0.31)	0.10 (0.30)	0.86

Note - Standard deviations are shown in parentheses. t-test and chi-squared tests compare the means and proportions for continuous and dummy variables, respectively. Test results with a 5% significance level are bolded.

Table 2. Correlations of cyclone relief with cyclone damages.

	Housing damaged dummy	Crop damaged dummy	Crop damage per adult equivalent (F$)
Tarpaulin receipt by June dummy (in seven recipient villages)	0.18 **(0.01)**	0.07 (0.31)	0.17 **(0.01)**
Food aid receipt by March dummy	-0.18 **(0.00)**	-0.17 **(0.00)**	0.03 (0.60)
Food aid receipt in April-June dummy	0.13 **(0.02)**	-0.09 (0.10)	0.02 (0.78)
Food aid per month in January-March (among recipients) (days)	-0.08 (0.22)	0.00 (0.95)	0.05 (0.41)
Food aid per month in April-June (among recipients) (days)	-0.01 (0.85)	0.10 (0.12)	0.05 (0.39)
Food aid per month in January-June (in the whole sample) (days)	-0.07 (0.22)	-0.06 (0.28)	0.07 (0.22)
Food aid receipt in March among households who received either in March or April (not both)	-0.25 **(0.00)**	-0.13 (0.06)	0.15 **(0.02)**

Note - p-values are shown in parentheses and those with a 5% significance level are bolded.

Table 3. Determinants of relief allocation.

	Food aid receipt by March (Probit)				Food aid received per month in January-March among recipients (days) (OLS)				Food aid received per month in January-June (days) (OLS)				Tarpaulin receipt by June (Probit)	
	All	All	Non-victims	Victims	All	All	Non-victims	Victims	All	All	Non-victims	Victims	Recipient villages	Recipient villages
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Cyclone shocks:														
Housing damaged dummy	-0.191	-0.090			-0.062	0.002			-0.040	0.008			1.890 **	1.719 *
	(0.407)	(0.442)			(0.104)	(0.123)			(0.145)	(0.162)			(0.865)	(0.917)
Log of crop damage per adult	-0.022	-0.011	0.018	-0.228 ***	-0.087 ***	-0.097 **	-0.091 **	-0.073 **	-0.002	0.003	-0.021	-0.045	0.429 **	0.451 **
equivalent (F$)	(0.101)	(0.122)	(0.155)	(0.071)	(0.030)	(0.037)	(0.040)	(0.035)	(0.042)	(0.054)	(0.051)	(0.034)	(0.216)	(0.229)
Log of crop damage per adult	-0.109	-0.131			0.032	0.019			-0.036	-0.048			-0.396 *	-0.383
equivalent*Housing damaged dummy	(0.126)	(0.154)			(0.037)	(0.037)			(0.051)	(0.056)			(0.236)	(0.248)
Proportion of housing damaged in the		-0.147	-0.212	0.689		-0.053	-0.453	0.465		-0.465	-0.602	0.321		0.816
clan		(0.344)	(1.048)	(0.893)		(0.144)	(0.349)	(0.344)		(0.326)	(0.469)	(0.622)		(0.906)
Clan mean of log of crop damage per		0.350				0.217 **				0.080				-0.665
adult equivalent (F$)		(0.214)				(0.091)				(0.177)				(0.631)
Clan mean of log of crop damage per			-0.079	0.014			0.118	0.078			0.000	0.086		
adult equivalent among non-victims			(0.319)	(0.163)			(0.095)	(0.090)			(0.099)	(0.127)		
Clan mean of log of crop damage per			-0.199	1.214 ***			0.014	0.077			-0.147 **	0.369		
adult equivalent among victims (F$)			(0.160)	(0.276)			(0.061)	(0.197)			(0.059)	(0.254)		
Social status:														
Clan leader dummy	-0.773 **	-0.713 **	-1.126 **	-0.621	0.107	0.092	0.140	-0.005	-0.242	-0.152	-0.180	-0.201	0.267	0.334
	(0.312)	(0.318)	(0.439)	(0.534)	(0.138)	(0.184)	(0.299)	(0.202)	(0.160)	(0.177)	(0.224)	(0.293)	(0.585)	(0.650)
Non-clan leader dummy	0.161	0.207	0.695	0.068	0.024	0.093	0.161	-0.079	0.000	-0.022	0.082	-0.108	0.026	-0.092
	(0.311)	(0.324)	(0.836)	(0.354)	(0.095)	(0.082)	(0.138)	(0.110)	(0.113)	(0.095)	(0.135)	(0.160)	(0.412)	(0.433)
Chiefs' clan dummy		-0.307	-0.106	-0.623 *		-0.129 *	-0.118	-0.190		-0.117	-0.157	-0.364 **		-0.401
		(0.235)	(0.485)	(0.332)		(0.073)	(0.106)	(0.171)		(0.119)	(0.149)	(0.177)		(0.514)
Gate keepers' clan dummy		-0.442 **	-0.209	-1.077 **		-0.099 *	-0.091	-0.233		0.005	0.158	-0.543 *		0.081
		(0.200)	(0.556)	(0.463)		(0.057)	(0.137)	(0.193)		(0.130)	(0.159)	(0.281)		(0.564)
Community-group leaders' clan		0.441 **	0.862	1.303 ***		-0.010	-0.043	0.101		0.123	0.035	0.644 *		0.417
dummy		(0.219)	(0.545)	(0.449)		(0.078)	(0.123)	(0.274)		(0.124)	(0.183)	(0.353)		(0.687)
F/Wald tests (p-value)														
for housing damaged	0.012	0.068			0.670	0.727			0.242	0.277			0.035	0.125
for crop damage	0.294	0.200			0.006	0.027			0.538	0.285			0.117	0.105
F/Chi-squared (p-value)	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.061
R-squared/Pseudo-R squared	0.109	0.121	0.254	0.161	0.425	0.451	0.445	0.567	0.123	0.157	0.208	0.215	0.151	0.178
Log likelihood	-156.9	-154.7	-48.3	-89.1									-83.5	-80.9
No. observations	327	327	153	174	252	252	130	122	327	327	153	174	222	222

*10% significance, **5% significance, ***1% significance. Robust standard errors in (1), (5), (9), (12), cluster-adjusted standard errors in (2)-(4), (6)-(8), (10)-(11), and (14), and standard errors are in the parentheses in Column (13). Other pre-cyclone factors are reported in Table A1. Other controls which are not shown here or in Table A1 are constant and village dummies.

Table 4. Determinants of rehabilitations.

	Communal labor per adult equivalent (days) (OLS)				Crop income per adult equivalent per month (F$) (first-difference)				Complete housing rehabilitation (Probit)	
	All	All	Non-victims	Victims	All	All	Non-victims	Victims	Victims	Victims
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cyclone shocks:										
Housing damaged dummy	-0.400 **	-0.406 **			0.187	0.278				
	(0.195)	(0.177)			(0.474)	(0.366)				
Log of crop damage per adult equivalent (F$)	-0.145 ***	-0.135 ***	-0.115 **	-0.047	0.059	0.063	0.072	-0.028	-0.318 ***	-0.401 ***
	(0.042)	(0.040)	(0.045)	(0.081)	(0.104)	(0.078)	(0.079)	(0.068)	(0.098)	(0.086)
Log of crop damage per adult equivalent*Housing damaged dummy	0.109 *	0.112			-0.101	-0.106				
	(0.064)	(0.072)			(0.135)	(0.086)				
Proportion of housing damaged in the clan		0.128	-0.496	0.395		-0.507	0.032	-1.287 **		0.987
		(0.227)	(0.464)	(0.306)		(0.300)	(0.360)	(0.613)		(0.959)
Clan mean of log of crop damage per adult equivalent (F$)		-0.188				-0.028				
		(0.114)				(0.180)				
Clan mean of log of crop damage per adult equivalent among non-victims			-0.219 **	0.031			0.063	0.091		0.069
			(0.083)	(0.057)			(0.246)	(0.121)		(0.178)
Clan mean of log of crop damage per adult equivalent among victims (F$)			0.106 *	-0.032			0.008	-0.246		1.104 ***
			(0.054)	(0.155)			(0.083)	(0.208)		(0.361)
Social status:										
Clan leader dummy	-0.224	-0.238	-0.141	-0.357 **					-0.543	-0.557
	(0.168)	(0.177)	(0.252)	(0.150)					(0.516)	(0.537)
Non-clan leader dummy	-0.022	-0.040	-0.036	-0.079					-0.565	-0.660 *
	(0.152)	(0.168)	(0.131)	(0.282)					(0.398)	(0.357)
Chiefs' clan dummy		0.375 ***	0.458 **	0.302 **						0.160
		(0.101)	(0.187)	(0.128)						(0.268)
Gate keepers' clan dummy		-0.018	0.042	-0.099						-0.163
		(0.085)	(0.155)	(0.181)						(0.540)
Community-group leaders' clan dummy		-0.261	0.070	-0.249						0.905 *
		(0.167)	(0.176)	(0.247)						(0.533)
F/Wald tests (p-value)										
for housing damaged	0.114	0.018			0.438	0.285				
for crop damage	0.003	0.007			0.754	0.472				
F/Chi-squared (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.000
R-squared/Pseudo-R squared	0.369	0.391	0.492	0.365	0.111	0.116	0.141	0.160	0.143	0.194
Log likelihood									-94.3	-88.7
No. observations	327	327	153	174	324	324	154	170	174	174

*10% significance, **5% significance, ***1% significance. Robust standard errors are in the parentheses in Column (1) and (5), cluster-adjusted standard errors in (2)-(4), (6)-(8), and (10), and standard errors in (9). For OLS and Probit other pre-cyclone factors are reported in Table A2 and other controls which are not shown here or in Table A2 are constant and village dummies. For first-difference other controls which are not shown here are constant and village-time dummies.

Table A1. Determinants of relief allocation unreported in Table 3.

	Food aid receipt by March (Probit)				Food aid received per month in January-March among recipients (days) (OLS)				Food aid received per month in January-June (days) (OLS)				Tarpaulin receipt by June (Probit)	
	All	All	Non-victims	Victims	All	All	Non-victims	Victims	All	All	Non-victims	Victims	Recipient villages	Recipient villages
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Other pre-cyclone factors:														
Log of total income per adult	-0.027	-0.009	0.168	-0.082	0.021	0.033	0.015	0.049	-0.127 **	-0.120 **	-0.076	-0.143 *	0.236	0.195
equivalent per month (F$)	(0.111)	(0.120)	(0.227)	(0.189)	(0.037)	(0.042)	(0.058)	(0.060)	(0.056)	(0.049)	(0.078)	(0.074)	(0.169)	(0.174)
Log of land holdings (acre)	0.129	0.104	0.459 *	-0.020	0.061	0.037	0.109	-0.025	0.104	0.099	0.232 *	0.002	-0.386 *	-0.365
	(0.156)	(0.166)	(0.278)	(0.286)	(0.062)	(0.060)	(0.075)	(0.098)	(0.094)	(0.085)	(0.120)	(0.173)	(0.235)	(0.241)
Log of fishing capital (F$)	-0.022	-0.027	0.060	-0.057	-0.014	-0.017 *	-0.003	-0.046 ***	-0.014	-0.015	0.001	-0.033 *	0.025	0.018
	(0.028)	(0.025)	(0.058)	(0.043)	(0.011)	(0.009)	(0.014)	(0.015)	(0.015)	(0.014)	(0.021)	(0.019)	(0.040)	(0.043)
Adults' secondary education dummy	0.380	0.438 *	0.877 *	0.537 **	-0.069	-0.076	-0.030	-0.203	0.063	0.090	0.211	0.029	-0.063	-0.111
	(0.253)	(0.240)	(0.511)	(0.255)	(0.097)	(0.082)	(0.133)	(0.143)	(0.144)	(0.129)	(0.192)	(0.235)	(0.348)	(0.362)
Log of adult equivalent household	-0.051	-0.046	-0.007	-0.018	-0.415 ***	-0.417 ***	-0.469 ***	-0.274 *	-0.246 **	-0.253 **	-0.409 **	-0.154	0.091	0.118
size	(0.305)	(0.270)	(0.638)	(0.386)	(0.108)	(0.082)	(0.164)	(0.155)	(0.120)	(0.123)	(0.198)	(0.212)	(0.429)	(0.451)
Proportion of children	0.198	0.247	-0.478	0.616	0.430 **	0.437 ***	0.359	0.378	0.380 *	0.428 **	0.358 *	0.566 *	-0.708	-0.752
	(0.486)	(0.449)	(1.078)	(0.565)	(0.173)	(0.146)	(0.321)	(0.236)	(0.226)	(0.192)	(0.205)	(0.286)	(0.628)	(0.656)
Proportion of elderly	-0.157	-0.035	-0.862	0.619	0.208	0.196	0.318	0.335	0.002	0.069	-0.175	0.394	-1.437	-1.409
	(0.706)	(0.765)	(1.010)	(1.278)	(0.263)	(0.349)	(0.652)	(0.365)	(0.291)	(0.325)	(0.469)	(0.628)	(1.540)	(1.511)
Log of age of household head	0.601	0.570	1.645	0.167	-0.040	-0.023	0.082	-0.207	0.127	0.089	0.376	-0.128	-0.243	-0.379
	(0.419)	(0.351)	(1.001)	(0.380)	(0.154)	(0.158)	(0.300)	(0.226)	(0.211)	(0.190)	(0.237)	(0.288)	(0.538)	(0.547)
Female head dummy	-0.657 **	-0.619 **	-1.242 **	-0.440	0.015	0.060	-0.058	0.062	0.031	0.069	-0.078	0.211	-0.131	-0.147
	(0.278)	(0.254)	(0.613)	(0.409)	(0.111)	(0.157)	(0.189)	(0.198)	(0.112)	(0.125)	(0.146)	(0.224)	(0.404)	(0.414)
Clan mean of log of total income per		-0.094	0.031	0.214		-0.013	-0.141	0.412		0.022	0.237	-0.088		0.614
adult equivalent per month (F$)		(0.310)	(0.595)	(0.471)		(0.091)	(0.148)	(0.311)		(0.202)	(0.231)	(0.342)		(0.721)
Clan population share in the village		1.543 ***	-0.588	2.257		0.368	0.545	0.556		1.209 ***	1.229 **	2.320 ***		0.216
		(0.589)	(1.371)	(1.498)		(0.260)	(0.426)	(0.629)		(0.324)	(0.475)	(0.610)		(2.008)

*10% significance, **5% significance, ***1% significance. Column numbers match with those in Table 3.

Table A2. Determinants of rehabilitations unreported in Table 4.

	Communal labor per adult equivalent (days) (OLS)				Complete housing rehabilitation (Probit)	
	All	All	Non-victims	Victims	Victims	Victims
	(1)	(2)	(3)	(4)	(9)	(10)
Other pre-cyclone factors:						
Log of total income per adult	-0.058	-0.052	-0.070	-0.018	-0.109	-0.010
equivalent per month (F$)	(0.055)	(0.052)	(0.077)	(0.078)	(0.159)	(0.174)
Log of land holdings (acre)	-0.022	-0.015	-0.074	0.069	0.148	0.123
	(0.073)	(0.063)	(0.130)	(0.072)	(0.204)	(0.271)
Log of fishing capital (F$)	-0.013	-0.007	0.008	-0.022	0.012	0.026
	(0.015)	(0.017)	(0.030)	(0.020)	(0.039)	(0.036)
Adults' secondary education dummy	-0.174	-0.173 **	-0.136	-0.250	0.552	0.663 **
	(0.131)	(0.085)	(0.172)	(0.157)	(0.361)	(0.319)
Log of adult equivalent household	-0.897 ***	-0.923 ***	-0.839 ***	-0.865 ***	-0.994 **	-0.986 ***
size	(0.151)	(0.109)	(0.201)	(0.141)	(0.404)	(0.365)
Proportion of children	-0.706 ***	-0.724 ***	-0.937 **	-0.845 ***	0.785	0.836 *
	(0.255)	(0.231)	(0.405)	(0.297)	(0.612)	(0.507)
Proportion of elderly	0.116	0.045	0.217	-0.006	-0.267	0.199
	(0.334)	(0.302)	(0.437)	(0.437)	(1.185)	(1.062)
Log of age of household head	-0.282	-0.260	-0.363	-0.279	0.900 *	1.019 **
	(0.201)	(0.251)	(0.428)	(0.254)	(0.509)	(0.499)
Female head dummy	-0.219	-0.305 **	-0.497 **	-0.102	-0.488	-0.337
	(0.145)	(0.144)	(0.225)	(0.139)	(0.390)	(0.433)
Clan mean of log of total income per		-0.332 ***	-0.606 ***	-0.146		-1.176 **
adult equivalent per month (F$)		(0.094)	(0.185)	(0.159)		(0.551)
Clan population share in the village		-0.683 **	-0.996 **	-0.226		-1.807
		(0.299)	(0.401)	(0.601)		(1.564)

*10% significance, **5% significance, ***1% significance. Column numbers match with those in Table 4.

Figure 1. Cyclone refugees and relief over time.