

Natural Disasters, Gender, and Handicrafts

Yoshito Takasaki
University of Tsukuba

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

February 11, 2011

Forthcoming in *Journal of Development Studies*

Acknowledgments

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 to the Fijians of the region who so willingly participated in the survey. Xiaowen Mo undertook the laborious task of data entry and cleaning. Cakaudrove and Macuata Provincial Offices in Fiji offered valuable institutional support for this project. This paper has benefited significantly from the comments and suggestions of Michael Bennett, Keijiro Otsuka, and conference and seminar participants on earlier versions of this work presented to the World Congress of Environmental and Resource Economists, the FASID Hakone Conference, Beijing University, Kobe University, and University of Tsukuba. 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.

Natural Disasters, Gender, and Handicrafts

Abstract

Using original post-disaster household survey data gathered in rural Fiji, this paper explores the disaster-gender nexus. Female-headed households are disadvantaged, not because of bias against them in disaster damage or relief, but because of a newly emerging gendered division of labor for dwelling rehabilitation that tightens their constraints on intra-household labor allocation. Female-headed households with damaged dwellings resort to female labor activities connected with informal risk sharing – augmenting production of handicrafts for kava rituals in exchange for male-labor help. Female-headed households without male-adult members resort to such activities more than those with them, because of their distinctly different decision-making processes.

I. Introduction

Better understanding poor populations' vulnerability to natural disasters is of central importance to policymakers (Skoufias, 2003), especially when this vulnerability affects disadvantaged people, such as women. Although researchers are increasingly paying attention to the disaster-gender nexus (see Wiest et al., 1994; Enarson and Meyreles, 2004 for reviews), research in developing areas is still scant (e.g., Fulu, 2007; Kuppaswamy and Rajarathnam, 2009); in particular, no economic works using micro survey data have yet systematically addressed this issue. Using original post-disaster household survey data gathered in rural Fiji, this paper explores why women are disadvantaged in times of disasters, how they seek to overcome their disadvantage, and how well their distinct coping responses work.

My argument for the disaster-gender link centers on the gendered division of labor that *emerges after the disaster*, not gender bias in disaster damage or relief. When disaster relief is limited, delayed, and/or ineffective, as is common in practice (Amin and Goldstein, 2008), private relief and rehabilitation efforts, such as emergency dwelling repair, are critical labor tasks in men's domain. Although a natural disaster is a region-wide covariate shock, it may contain significant idiosyncratic components at a local level. To be specific, imagine a situation in which there are households with damaged dwellings and those without – with no gender difference – within villages and the latter help the former's rehabilitation by providing male labor time. In such a case, female-headed households may face greater constraints on intra-household labor allocation than those that are male-headed, not only because of their smaller male-labor endowment, but also because of any other distinct factors in the gender sphere.

Although researchers and practitioners often rely on household headship to address gender issues, the blurred operational meaning of self-reported headship in household surveys has been criticized (e.g., Varley, 1996; Posel, 2001): Is the head actually the household's key decision-maker? This paper pays explicit attention to the heterogeneity of female headship by comparing female-headed households with and without male-adult members (all male-headed households have male adults, of course). The operational meaning of the latter's female headship should be much clearer than the former's. As far as in-house male-labor endowment is concerned, female-headed households with no male adults are most disadvantaged in rehabilitation (they must rely completely on other households' labor help); at the same time, the decision-making process for those with male adults is more complicated and can involve greater conflict, particularly between the female head and male-adult members.

How do female-headed households respond to the new gendered division of labor that tightens their labor constraints? How do they depend on male-adult members as a source of both labor and potential conflict? I argue that 1) female-headed households resort to female labor activities in connection with informal risk sharing, and 2) those without male-adult members do so more than those with such members, because of their distinctly different decision-making processes. That is, although the scarcity of male-labor endowment is a disadvantage for female-headed households in rehabilitation compared to male-headed households, its lack may instead become an advantage in female-headed households' coping responses to overcome their disadvantage.

This paper focuses on handicrafts, not only because handicraft making usually is in women's domain, but also because indigenous handicrafts often serve as key

ceremonial goods exchanged as gifts (e.g., Mauss, 1967). If handicraft gifts (in-kind transfers) substitute for labor-time transfers, then handicraft making can serve as ex-post labor-supply responses to shocks, the return of which is realized through risk sharing, but not earned income. Then, even if handicraft production is normally neutral to the household head's gender, a gender difference in responses to shocks can emerge.

Although gender has received considerable attention in the literature on risk (e.g., Kochar, 1999; Dercon and Krishnan, 2000; Doss, 2001; Attanasio et al., 2005), economists have not yet explored how gendered ex-post labor-supply responses can emerge in connection with informal risk sharing, though Rosenzweig (2001) emphasizes the link between self-insurance and mutual insurance as a future research agenda. No previous study has explicitly paid attention to the heterogeneity of female headship in risk coping or examined the potential insurance role of handicrafts.

Fiji is an ideal context to study the disaster-gender nexus with a focus on handicrafts. First, a better understanding of how the rural poor cope with natural disasters in small island states that rely heavily on foreign aid (Bertram, 1986) is strongly demanded; some researchers criticize the deterioration of islanders' indigenous coping mechanisms (e.g., Campbell, 1984). Second, Fiji is a strongly gendered, kin-based society (Aucoin, 1990), and indigenous handicrafts made solely by women play a central role in the kava ritual (Turner, 1986). Following Malinowski's (1922) seminal work on gifts and reciprocity in Melanesia, most related anthropological studies have been conducted in the Pacific region (Hann, 2006), while economic studies using household survey data there are scant.

Analyses of the Fijian data confirm my conjectures. Although there is no gender difference in cyclone damage, relief, and pre-cyclone handicraft production, female-headed households with damaged dwellings – especially those with no male-adult members – augment production for kava rituals to receive male-labor help; the responses of those with male adults are not sufficient to overcome their disadvantage in rehabilitating dwellings.

The rest of the paper is organized as follows. Section II describes the study area, the cyclone, and rehabilitation, clarifying female-headed households' disadvantage in their dwelling rehabilitation. Section III offers descriptive evidence for handicrafts' insurance role for women. Section IV presents the econometric specification to formally test the disaster-gender link, which is followed by the estimation results in Section V. The last section concludes.

II. Study area, gender, cyclone, and rehabilitation

Study area and data

On 13 January 2003, Cyclone Ami swept over the northern and eastern parts of the Fiji Islands (Ami was the only cyclone in the northern region from 1991 through 2005, McKenzie et al., 2005). Nine native Fijian villages on the coast in the northern region were intentionally chosen for the survey. Six and three villages, respectively, are located on the 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. After being stratified for each village by kin group (locally called *tokatoka*, Ravuvu, 1983), as well as

by the combination of leadership status (e.g., kin leader) and major asset holdings (e.g., shops), households were randomly sampled in each stratum ($n = 374$).

Household interviews were conducted between late August and early November 2003. Enumerators visited each household once within this time frame and inquired about production, income, assets, demographics, cyclone damage, and relief; neither consumption nor labor-transfer data were collected. As such, like other post-disaster surveys (e.g., Morris et al., 2002), the survey collected pre- and post-cyclone information retrospectively. I will discuss potential retrospective errors in Section V. The analysis is based on 342 households with complete data (those with no female adults, potential handicraft producers, are dropped).

Gender

According to respondents' self-reports, 42 households in the sample (12%) are headed by females. Although female heads reside in all nine sample villages, the proportion of female-headed households varies significantly across villages – from 5% to 21%. Twenty eight female heads (two thirds) are widows, and five, three, and six are married, divorced, and single women, respectively; i.e., most of them are *de jure* female-headed households. The age of female heads ranges from 33 to 92 years old (59, on average); there is no significant difference in the mean age of female heads across different marital statuses. Headship status did not change over the survey periods; in particular, none of the female heads emerged as a result of male heads' mortality or out-migration after the cyclone.

Gender differences in demographic factors and asset holdings are evident: Female-headed households are older (both head and female adults) and less educated

(both head and female adults), have fewer male adults and children (the number of female adults does not significantly differ), and hold less land and fishing capital per capita than those that are male-headed (before the cyclone) (see panel A of Table 1). Female-headed households thus have weaker capacities for cropping, the most important livelihood activity, earning lower crop income and total income in a per-capita term before the cyclone, though there was no significant gender difference in other income-earning activities (see Table 2).¹ Although some households earn considerable income from permanent wage labor in a stable manner, females' permanent wage employments are rare and they are nonexistent among female-headed households.

Fifteen (36%) of female-headed households – nine widowed, two married, two divorced, and two single women – have no male-adult members, and the remaining 27 have some, mostly one or two. Compared to those with male adults, those without have fewer female adults (as well as male adults), have less educated female adults, and hold less land, earning lower crop income; other characteristics do not differ significantly (results not shown).

Cyclone and relief

The cyclone damaged structures and facilities in all nine sample villages, and dwelling damage and crop damage are the two major damages that individual households experienced. Almost two thirds of residents' dwellings – consisting of a main house and other small, self-standing units, such as a kitchen, a shower, and a toilet, if any – were damaged, and the mean value of total dwelling damage was 70 Fiji dollars per capita (F\$1 = US\$.60) (based on respondents' subjective assessments probed by enumerators in respondents' homes) (panel A of Table 1). Eighty-four percent of households experienced

crop damage, at a mean value of F\$32 per capita, which is about two thirds of the mean monthly pre-cyclone crop income (crop damage was calculated based on the quantity damaged of each major crop, as reported by respondents). Dwelling damage and crop damage were not correlated with each other: Correlations of crop-damage value with dwelling-damage dummy and value are -.03 and .01, respectively.

Provisions of relief – by the Red Cross, other nongovernmental organizations, and governments – were quite distinct. On one hand, almost all households received generous food aid; people received about 10 days worth of food per month, on average; that is, an average household could rely on aid to cover about one third of its food consumption. On the other hand, primitive tarpaulins – to be used as emergency shelters and for temporary dwelling repair – were provisioned to only 11% of households (Takasaki, 2011b details and analyzes allocation of relief).²

There was no significant gender difference in dwelling damage, crop damage, and relief received; the only exception is that crop damage was *less* common among female-headed households, especially those with no male adults. Thus, female-headed households' weaker rehabilitation, if any, must be a result of their distinct coping patterns.

Rehabilitation

Distinct rehabilitation patterns did emerge in the gender sphere: Although mean crop income decreased by over 40% regardless of gender (Table 2), female-headed households were less likely than male-headed households to have completely rehabilitated damaged dwellings – through repair or rebuilding – at the time of interviews (67% vs. 48% among those with damaged dwellings) (panel B of Table 1). This contrast is explained by distinct means of rehabilitation. On one hand, households rehabilitated

cropping individually, without using shared or hired labor. They planted fast-growing crops like sweet potato after receiving seeds as part of the relief, and they began harvesting rehabilitated crops before the interviews. There was no gendered division of labor in cropping. On the other hand, households helped each other rehabilitate dwellings, especially by sharing male labor.

Even though a lack of data on across-household labor-time transfers precludes me from showing how people actually shared labor for dwelling rehabilitation, I obtain supporting evidence as follows. First, the cyclone directly caused no casualties or permanent migration and very limited injuries and illnesses. Thus, the pooled-labor endowment that could be shared among villagers was largely intact. Second, all refugees (almost 40% of households with damaged main housing) stayed in others' residences in the same village, and many lived with households in the same kin group. This clearly indicates that villagers and kin-group members actively engaged in risk sharing. Third, Takasaki (2011b) finds that communal labor, mainly for rehabilitating damaged village facilities (e.g., community halls), involved risk-sharing arrangements against household-level shocks: Households with damaged main housing and with greater crop damage made smaller contributions. Fourth, the government provisioned construction materials more than one year after the cyclone (Takasaki, forthcoming details and analyzes allocation of reconstruction funds). Without people's mutual help, dwelling rehabilitations of the observed level could not have been accomplished.

To sum up, the self-rehabilitation of cropping and the mutual rehabilitation of dwellings were both incomplete, and only the latter, which involved a gendered division of labor, was unequal in the gender sphere. Female-headed households were

disadvantaged not because of any bias against them in damage or relief, but because of their weaker capacity for rehabilitating dwellings through male-labor sharing.

Dwelling rehabilitation is heterogeneous among the 29 female-headed households with damaged dwellings: complete rehabilitation was more common among those without male-adult members than those with (58% of 12 households vs. 41% of 17 households, respectively); although this difference is not statistically significant, rehabilitation among the latter, but not among the former, differs statistically from that among male-headed households. Could households with zero male-labor endowment better overcome their disadvantage because of their distinct handicraft gift production, as I conjecture?

III. Handicrafts and gender

Fijian handicrafts and data

A dominant symbol in Fijian culture is kava (a beverage infused from the root of a pepper plant, *Piper methysticum*, locally known as *yaqona*, Turner, 1986). The kava ritual frequently involves an exchange of ceremonial goods, including indigenous handicrafts made solely by women. The three most important handicrafts are famous Fijian mats (*voivoi*, made of screw pine, *Pandanus thurstonii*), finer mats (*kuta*, made of soft sedge, *Eleocharis dulcis*), and bark cloths (*tapa*, made of paper mulberry, *Broussnetia papyrifera*). Handicraft plants are gathered on communal land and are openly accessible to all villagers, and their extraction is unregulated (people also collect other forest products, such as wild fruits, earning negligible incomes, Table 2). Handicrafts can be made either as a shared ritual duty among kin-group members or for private gift exchanges with other households.³

Evolution of handicraft production

Respondents were asked about handicraft production in each month over the past one year. This generates a four-period panel of pre-cyclone period 1 (October-December 2002) and post-cyclone periods 2-4 (January-March, April-June, and July-September 2003, respectively) (Table 3). Although about 20% of households produced small amounts (per capita per month) of handicraft gifts in periods 1 and 2, both participation and amount significantly increased later (this matches increased demands for ritual gifts in ceremonial meetings); in period 4, in particular, almost 40% of households participated, and the amount was about 3.5 times that in period 1. While post-cyclone total income decreased by almost 30%, handicraft income (gifts and sales combined) reached 13% of total income; because crop incomes in periods 2 and 3 – before the harvest of rehabilitated crops – were much smaller than in period 4, handicrafts' contributions to the total income in periods 2 and 3 also must have been considerable.

There was no significant gender difference in participation in handicraft gift production and amount produced before the cyclone (period 1). That is, handicraft making was neutral to household head's gender; what matters is having craftswomen in the household, not headship. Although participation continued to be neutral to household head's gender after the cyclone, female-headed households – especially those with no male adults – produced greater amounts in periods 2-4 than male-headed households did, earning even higher post-cyclone income from handicrafts than from cropping and fishing (Table 2). Although per-capita handicraft production of female-headed households without male adults – and thus with a small household size – should be higher than those with them, as also seen in period 1, this gap significantly increased after the

cyclone, as only the former greatly augmented production; the difference between them is statistically significant in periods 2 and 3, but not in periods 1 and 4. This is consistent with my conjecture that female-headed households with no male-adult members adjusted handicraft production more strongly.

Cyclone, handicrafts, and rehabilitation

Did female-headed households augment handicraft gift production in response to the dwelling damage they experienced, presumably to receive labor help, as I conjecture? Although formally proving this is a task of the remaining sections, initial evidence is found in the correlations of post-cyclone handicraft production – participation and mean amounts in periods 2-4 – with cyclone damage (see panel A of Table 4). On one hand, among male-headed households, handicraft production is uncorrelated with dwelling damage, but is positively correlated with crop-damage value; on the other hand, among female-headed households, participation and amounts, respectively, are positively correlated with the incidence and values of dwelling damage, but not with crop damage (results for the whole sample combine these two sets of results). Analyzing disaggregated female-headed households is infeasible because of their small sample size and limited variations; in particular, most of those with no male adults (12 out of 15), which greatly augmented post-cyclone handicraft production, experienced dwelling damage.

Handicrafts helped female-headed households' rehabilitation. Dwelling rehabilitation (dummy) among households with damaged dwellings is expected to be negatively correlated with dwelling-damage value, because the greater the damage, the less likely the rehabilitation. This strongly holds for male-headed households, but not for female-headed households (panel B). The transformability of handicraft gifts into male

labor time, however, was not as high, as shown by the *negative* correlation between dwelling rehabilitation and handicraft production, which reflects that households with greater production are those with greater dwelling damages (in contrast, participation, which is uncorrelated with dwelling-damage value, is not strongly related with rehabilitation).

Dwelling rehabilitation is negatively associated with crop-damage value among both male- and female-headed households. This is because households with greater crop damage (adverse income shock) not only had difficulty obtaining construction materials, but also allocated more labor time to their own crop rehabilitation, regardless of gender (as shown by Takasaki, 2011b).

IV. Econometric specification

Base model

Theoretically, under imperfect labor- and housing-market conditions, households seek to smooth utility determined by consumption, leisure, and dwelling quality (a decrease in dwelling quality because of the disaster is a preference shock). Risk sharing consists of non-labor sharing – cash and inkind (e.g., food) – to smooth consumption against crop damage and labor sharing for dwelling rehabilitation. If handicraft gifts substitute for labor-time transfers, handicraft making serves as self-insurance against dwelling damage, the return of which is realized through risk sharing, especially male-labor sharing. The ex-post labor-supply model in the literature captures the income effect: With greater adverse income shocks, households will increase labor supply to smooth income (Kochar, 1999; Rose, 2001). This model can be directly applied to identify how households adjust labor supply for handicraft making in response to shocks as follows.

Rose (2001) offers a theoretical framework for household labor-supply decisions in response to a covariate shock to farm production (regional rainfall). Adding an idiosyncratic shock to her model yields the ex-post labor-supply equation

$$l = l(z, w, x, m),$$

where l is labor supply; z and w , respectively, are adverse household-level idiosyncratic shock and village-level covariate shock; and x and m , respectively, are household- and village-level factors that affect returns to labor, such as productive assets and market prices. The estimating equation using the fixed-effects specification is:

$$y_{it} = \beta_1 z_{it} + \sum_t \delta_t x_{it} + V_t + d_t + u_i + e_{it}. \quad (1)$$

where y_{it} is household i 's labor supply allocated for handicraft gift production in time t ; z_{it} is a dummy for household dwelling damage (crop damage is added later); x_{it} is a series of household-level factors that affect returns to labor, which are detailed below; V_t is time-varying village dummies that capture all village-level factors (both w and m), including village-level seasonality (e.g., change in resource stock) and disaster relief received by the village, as well as village-level covariate shocks; d_t is a time dummy that controls for region-level covariate shocks and seasonality, as well as other common events or trends; u_i is unobservable household heterogeneity; and e_{it} is a time-variant error term that is individually and independently distributed. Relief received by individual households is not included as an explanatory variable, because it is endogenously determined as part of private risk sharing within villages (Dercon and Krishnan, 2005; Takasaki, 2011b). The insurance role of handicraft gift production is captured by $\beta_1 > 0$.

The fixed-effects specification is crucial to identify the effect of z_{it} . Household crop damage is endogenous, because 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 labor-supply decisions. In the Fijian quarterly data, most of these unobservable factors are fixed effects. Labor supply might also be correlated with aspects of pre-cyclone dwelling quality (a fixed effect), such as construction materials and micro location within villages, that might influence dwelling damage.

As many households do not produce handicraft gifts (Table 3), I estimate determinants of the probability of participation using the fixed-effects linear-probability model and those of the combination of participation and intensity using the trimmed least-squares estimator developed by Honoré (1992). The latter fixed-effects model controls for unobservable household heterogeneity u_i with a censored dependent variable and is robust to heteroskedasticity and non-normality (which are other potential sources of bias in random-effects tobit estimates); despite these advantages, this model has rarely been used in previous works on the ex-post labor supply (Takasaki, 2011a is an exception). With a lack of time-allocation information, I use values of handicraft gifts produced (reported in Table 3) as a proxy for labor intensity. The fixed-effects models control for any systematic difference between values and labor inputs caused by unobservable, time-invariant factors, such as skills and resource stocks; village-time dummies control for market prices, which are used for imputing handicraft gifts' values.

In the Fijian quarterly data, household-level factors, x_{it} , are fixed effects that vanish in the fixed-effects estimates. I also employ random-effects linear-probability and tobit models to estimate direct impacts of the following household fixed effects, most of which are shown to be distinct between male- and female-headed households above

(panel A of Table 1): a dummy for female head; number of male adults, female adults, and children; age and schooling years of household head; mean age and highest schooling years of female adults; and per-capita land and fishing capital. Based on earlier descriptive findings, I conjecture that handicraft gift production – both participation and intensity – is neutral to household head’s gender per se (*hypothesis 1*).

Extended models to test gendered responses to cyclone shocks

The emergent gendered division of labor – male-labor sharing for dwelling rehabilitation – tightens gendered constraints on intra-household labor allocation, leading to distinct ex-post labor-supply responses in the gender sphere. My conjecture is that female-headed households’ responses in handicraft production to dwelling damage are stronger than male-headed households’ (*hypothesis 2*); i.e., $\beta_1 + \beta_2 > 0$ and $\beta_2 > 0$ in

$$y_{it} = \beta_1 z_{it} + \beta_2 z_{it} g_i + \sum_l \delta_l x_{itl} + V_t + d_t + u_i + e_{it}, \quad (2)$$

where g_i is the dummy for female head (fixed effect). Equation (2) does not tell which distinct factor in the gender sphere, such as the fixed effects discussed above, is a driving force of the gendered responses captured by β_2 . I conjecture that gendered responses are caused by factors other than labor endowment (*hypothesis 3*); i.e., $\beta_1 + \beta_2 > 0$, $\beta_2 > 0$, and $\beta_3 = \beta_4 = 0$ in

$$y_{it} = \beta_1 z_{it} + \beta_2 z_{it} g_i + \beta_3 z_{it} m_i + \beta_4 z_{it} f_i + \sum_l \delta_l x_{itl} + V_t + d_t + u_i + e_{it}, \quad (3)$$

where m_i and f_i are the number of male and female adults, respectively (fixed effects).

Based on earlier descriptive findings, I expect hypotheses 2 and 3 to hold for the intensity decision, but not for the participation decision.

I also conjecture that gendered responses hold more strongly among female-headed households without male-adult members than those with them, because of gender

factors other than male-labor endowment. Formally testing this by differentiating these two female-headed households by extending equation (3) is infeasible with the Fijian data for the same reason given above; still, pieces of preliminary evidence are offered in the last subsection of Section V.

Two other hypotheses are tested. First, I conjecture that responses in handicraft production to dwelling damage are stronger than those to crop damage, and thus dwelling damage mainly shapes responses to crop damage (*hypothesis 4*). This is because distinct from labor sharing, non-labor sharing is not directly constrained by gender (moreover, crop rehabilitation does not involve labor sharing among Fijians). To capture this across-shock heterogeneity and interaction, I add the value of per-capita crop damage and its interaction with the dwelling-damage dummy, as well as the selected fixed effects, to equations (1)-(3) (β_1 , β_2 , β_3 , and β_4 are vectors); I construct an interaction with the female-head dummy for the latter interaction term (i.e., triple interaction), but not for former crop damage, because hypothesis 3 means that the interaction effect is greater than the direct effect of crop damage. The combination of hypotheses 2 and 4 suggests that even if responses to crop damage were neutral to gender without dwelling damage, gendered responses to crop damage could emerge.

Next, I conjecture that handicraft responses to shocks occurred not only during the emergency period, but also afterward (*hypothesis 5*). This is because for gift production – which takes time – to serve as part of risk sharing to help households with damaged dwellings quickly under a state of emergency, reciprocity needs to take place over time. I conduct two-period analyses using equations (1)-(3) separately for periods 1 and 2, periods 1 and 3, and periods 1 and 4. In the latter two analyses, labor supply in

period 3 or 4 is connected with shocks experienced in period 2. This is a standard practice in analyzing annual survey data that lack information over time within the year. A potential problem is that coping behaviors in the previous post-cyclone period(s) correlated with shocks may affect decisions in the subsequent period as an “unobservable” time-variant factor. I repeat the analyses, constructing dependent variables over periods 2-3 and periods 2-4, respectively, and find similar results.

V. Estimation results

Participation

All results regarding the damage variables’ impacts on participation in handicraft gift production – in all periods – are very weak; even though some estimated coefficients are statistically significant, the marginal effects are almost zero (see columns 1-5 of Table 5). Hence, participation is always insensitive to cyclone damage, regardless of gender.

In the random-effects estimates (only selected results of equation 3 are shown in columns 6-8), larger male-labor endowment (with no interaction term) increases the probability of participation in all periods, and this effect is weakened by crop damage in periods 2 and 3 (the same interaction effect is also significant in the fixed-effects model). Households with greater male-labor endowment can better mobilize female labor, while crop rehabilitation reduces the capacity for gift production, as discussed above. No other household characteristics alter participation in a strong manner (an exception is discussed below). In particular, participation is neutral to household head’s gender with labor endowment controlled for, confirming hypothesis 1. Hence, whether women produce handicraft gifts depends on household male-labor endowment, as well as unobservable qualifications, such as craft skills.

Intensity between female- and male-headed households

Nonsignificant effects of cyclone shocks on participation mean that any significant results on values of handicraft gift production reflect intensity responses to shocks (see Table 6). Let me first discuss results in period 2. When responses to cyclone shocks are assumed to be neutral to gender (column 1), they are nonsignificant; in contrast, once gendered heterogeneity is controlled for (column 2), many results become statistically significant. In particular, female-headed households intensify production in response to dwelling damage; male-headed households' responses are the opposite, but much weaker in magnitude and in a statistical sense. Hence, hypothesis 2 strongly holds. When the interaction effects of labor endowment are controlled for separately, all of them are nonsignificant (column 3), and all significant results in column (2) still hold. Thus, gender factors other than labor endowment are a driving force, confirming hypothesis 3.

A strong interaction between dwelling damage and crop damage weakens the net impacts of dwelling damage among both male- and female-headed households, making the overall impacts of crop damage positive and negative, respectively; in contrast, crop-damage variables with no interactions are nonsignificant. Households (female-headed households in particular) respond more strongly to dwelling damage than crop damage, and as a result, the former mainly shapes the impacts of the latter: Female-headed households intensify production against dwelling damage by reducing production in response to crop damage; the converse holds true among male-headed households to a much weaker degree. Hence, hypothesis 4 strongly holds.

These female-headed households' responses to shocks also are observed in period 3 – that is, hypothesis 5 holds – but not in period 4 (only results of equation 3 are shown

in columns 4 and 5). The jump in handicraft production in period 4 is thus mainly explained by the recovery of demand for handicrafts to be used in rituals. In contrast, male-headed households are insensitive to cyclone damage in both periods 3 and 4.

Estimated coefficients of cyclone shocks in the random-effects tobit (columns 6-8) are relatively similar to the fixed-effects estimates (female-headed households' responses to dwelling damage in period 3 are statistically significant in alternative specifications discussed shortly). Labor endowments – except for male labor size in all periods, as found in the participation equation – and household head's gender are nonsignificant, confirming hypothesis 1 for the intensity decision. Hence, gendered responses in labor intensity to shocks did emerge in the gender-neutral activity.

Robustness

Special attention needs to be given to retrospective errors. First, recall errors in the incidence of dwelling damage should be minimal, because relief officers used similar categories – no damage, partial damage, and complete damage – for their damage assessments, and thus the damage status of each dwelling was common knowledge among villagers. I estimate an alternative specification using dwelling-damage value – the measurement errors of which can be large and systematic though – for the whole sample and for households with damaged dwellings, finding results qualitatively similar to those presented above. Second, although the crop-damage calculation is based on detailed quantity data, as discussed above, measurement errors could be considerable and systematic. I repeat the analyses using the crop-damage dummy, finding qualitatively similar results. Third, as handicrafts are culturally and socially important among Fijians (Turner, 1987), respondents had few problems with recalling production; considerable

errors in timing and amount, however, might still exist and their correlation with cyclone shocks could cause bias. Similar estimation results using combined post-cyclone periods discussed above suggest that such errors in timing are unlikely to be a major concern. Unless such recall errors in amount and their correlations with cyclone shocks are distinct between male- and female-headed households, the qualitative results of gendered responses are unlikely to be significantly biased.

The small number of female-headed households in the sample requires caution, because estimations might be driven by outliers. First, I estimate the participation and intensity equations by excluding two villages where female-headed households are very uncommon (less than 6%). Although this further reduces the number of female-headed households (from 42 to 38), their proportion in this subsample (14%) is higher than the original level (12%). Second, to reduce the weight of outliers while avoiding losing all 0 observations, I repeat the intensity analyses, using log of $(1 + y_{it})$ (log of crop-damage value, land, and fishing capital are used as explanatory variables). Third, I repeat the intensity analyses excluding outliers in the dependent variable (largest 1% of the sample of interest, or equivalently largest 5.0, 4.4, and 3.4% producers for periods 1 and 2, 1 and 3, and 1 and 4, respectively). Results of these analyses (not shown) are qualitatively the same as those presented above; in particular, gendered responses in labor intensity to cyclone shocks are robust. When selected villages are analyzed and the log specification is employed, the negative interaction effects of dwelling damage and male-labor endowment on intensity in period 4 (which is also large in magnitude in Table 6, column 5) are statistically significant. Hence, female-headed households' responses to dwelling

damage are driven by male-adult endowment in period 4; in another words, hypothesis 3 holds in periods 2 and 3 along with hypothesis 2.

Intensity among female-headed households

First, the across-period comparison of gendered responses corresponds well to the heterogeneous production patterns between female-headed households with and without male adults – there is a significant difference between them in periods 2 and 3, but not in period 4 (Table 3). This is consistent with my conjecture that gendered responses to cyclone shocks are stronger among those without male adults than those with them.

Second, the combination of gendered responses to cyclone shocks not driven by male-labor endowment (in periods 2 and 3), and the augmentation of post-cyclone handicraft production by households with no male-labor endowment indicates that male-labor endowment is not a key constraint on female-headed households' coping responses. Last, almost all fixed effects other than male-labor endowment are statistically nonsignificant in the random-effects tobit estimates.⁴ This serves as preliminary evidence that distinct attributes of female-headed households with and without male adults are not a driving force of their (potentially) distinct responses to cyclone shocks. If this is the case, then female-headed households' key constraint must be the availability of male adults per se, which structurally shapes the household decision-making process, as I conjecture.

VI. Conclusion

Using original post-disaster household survey data gathered in rural Fiji, this paper explored the disaster-gender nexus. Female-headed households are disadvantaged, not because of bias against them in disaster damage or relief, but because of a newly

emerging gendered division of labor for dwelling rehabilitation that tightens constraints on intra-household labor allocation.

The econometric analysis revealed that female-headed households with damaged dwellings resort to female labor activities in connection with informal risk sharing – augmenting production of handicrafts for kava rituals, presumably in exchange for male-labor help, though such production is normally neutral to household head's gender. These gendered coping responses are explained by gender factors other than labor endowment. Female-headed households augment handicraft production both during and after the emergency period, as reciprocity in risk sharing takes place over time; they also reduce handicraft production in response to crop damage – against which risk sharing is not directly constrained by gender – so as to facilitate intensification corresponding to dwelling damage (shock-interaction effect).

The paper found evidence that among female-headed households, those without male adults adjust handicraft gift production more strongly than those with them do. At the same time, females in households with greater male-labor endowment are more likely to be handicraft producers and produce a greater amount, regardless of cyclone shocks and household head's gender. Hence, despite their weak capacity, female-headed households with no male adults resort to the Fijian kava ritual as an essential risk-sharing arrangement to overcome their disadvantage in rehabilitation. The responses of female-headed households with male adults, however, are not sufficient to fill the gap in dwelling rehabilitation. Key constraints on female-headed households' coping responses thus are not male-labor endowment; instead, they probably exist in the household decision-making process.

These findings suggest the following policy and research implications. First, even if there is no gender bias in disaster damage or relief, a gender difference can emerge as shocks augment inequalities in household coping capabilities. At the same time, informal risk sharing may significantly help women overcome their disadvantage. Second, the heterogeneity of female headship should receive much more attention. How well informal risk-sharing arrangements help female-headed households depends on their coping responses, and factors shaping their decision-making process can lead to distinct coping outcomes among them. More research on the mechanisms underlying the disaster-gender link is strongly needed. How to overcome constraints imposed by the relatively uncommon female headship in standard household surveys is an empirical challenge.

Notes

¹ Almost all households employ traditional cropping practices (using no mechanized equipment or animal traction and limited purchased inputs) to produce taro, cassava, coconut, and kava plant, and engage in artisanal fishing using lines and hooks, simple spear guns, or rudimentary nets. Enumerators asked questions about the production of major crops and the catch of finfish and other marine products in the past one month, and then monthly production a year before, in comparison with the latest figures. Virtually all land is communally owned and by law cannot be sold. The disposition of fishing capital (privately owned) and the transfer of usufruct of land after the cyclone were nonexistent; indeed, asset holdings changed very little over the previous year. Casual wage labor – a focus of previous studies on the ex-post labor supply – was rare.

² At the country level, total cyclone damage was estimated at F\$104 million, of which residential damage was F\$22 million and crop damage was F\$40 million, and the total

cost of food rations was 20 times that of tarpaulins (National Disaster Management Office, 2003).

³ Although some craftswomen sell their products in local markets and small resort hotels for tourists (values of handicraft gifts were imputed from sales data), gift production was much more common and greater than sales (approximately two times and five times, respectively). Takasaki (2011a) examines the insurance roles of handicraft sales as well as fishing.

⁴ The only exception is that female adults' age positively affects the amount of handicrafts produced in periods 1, 2, and 4 (and participation in periods 1 and 4). This indicates older women's major role in kava rituals because of their seniority, good craft skills, and low opportunity costs of labor. Female adults' age is similar between female-headed households with and without male-adult members.

References

- Amin, S. and Goldstein, M. (eds.) (2008) *Data Against Natural Disasters: Establishing Effective Systems for Relief, Recovery, and Reconstruction*, (Washington, D.C.: World Bank).
- Attanasio, O., Low, H. and Sanchez-Marcos, V. (2005) Female Labor Supply as Insurance against Idiosyncratic Risk. *Journal of the European Economic Association*, 3(2-3), pp.755-764.
- Aucoin, P. M. (1990) Domestic violence and social relations on conflict in Fiji. *Pacific Studies*, 13(3), pp.23-42.
- Bertram, G. (1986) Sustainable development in Pacific microeconomies. *World Development*, 14(7), pp.809-822.

- Campbell, J. R. (1984) *Dealing With Disaster: Hurricane Response in Fiji*. (Honolulu: Pacific Islands Development Program, East-West Centre).
- Dercon, S. and Krishnan, P. (2000) In sickness and in health: risk sharing within households in Ethiopia. *Journal of Political Economy*, 108(4), pp.688-727.
- Dercon, S. and Krishnan, P. (2005) Food Aid and Informal Insurance, in: S. Dercon (ed.) *Insurance Against Poverty*, (Oxford and New York: Oxford University Press), pp. 305-329.
- Doss, C. R. (2001) Is Risk Fully Pooled within the Household? Evidence from Ghana. *Economic Development and Cultural Change*, 50(1), pp.101-130.
- Enarson, E. and Meyreles, L. (2004) International perspectives on gender and disaster: differences and possibilities. *The International Journal of Sociology and Social Policy*, 24(10), pp.49-93.
- Fulu, E. (2007) Gender, Vulnerability, and the Experts: Responding to the Maldives Tsunami. *Development and Change*, 38(5), pp.843-864.
- Hann, C. (2006) The gift and reciprocity: perspectives from economic anthropology, in: S.-C. Kolm and J. M. Ythier (eds.) *Handbook of The Economics of Giving, Altruism and Reciprocity*, (Amsterdam: Elsevier), pp. 207-223.
- Honoré, B. E. (1992) Trimmed LAD and Least Squares Estimation of Truncated and Censored Regression Models with Fixed Effects. *Econometrica*, 60(3), pp.533-565.
- Kochar, A. (1999) Smoothing consumption by smoothing income: hours-of-work responses to idiosyncratic agricultural shocks in rural India. *Review of Economics and Statistics*, 81(1), pp.50-61.

- Kuppuswamy, S. and Rajarathnam, S. (2009) Women, information technology and disaster management: tsunami affected districts of Tamil Nadu. *International Journal of Innovation and Sustainable Development*, 4(2-3), pp.206-215.
- Mauss, M. (1967) *The Gift: Forms and Functions of Exchange in Archaic Societies*. (New York: W. W. Norton).
- McKenzie, E., Prasad, B. and Kaloumaira, A. (2005) Economic impact of natural disasters on development in the Pacific: Volume 1 Research report. The University of the South Pacific.
- Morris, S. S., Neidecker-Gonzales, O., Carletto, C., Munguia, M., Medina, J. M. and Wodon, W. (2002) Hurricane Mitch and the Livelihoods of the Rural Poor in Honduras. *World Development*, 30(1), pp.49-60.
- National Disaster Management Office (2003) Report on Tropical Cyclone Ami. Ministry of Regional Development, Fiji.
- Posel, D. R. (2001) Who are the heads of household, what do they do, and is the concept of headship useful? An analysis of headship in South Africa. *Development Southern Africa*, 18(5), pp.651-670.
- Ravuvu, A. (1983) *Vaka I Taukei: The Fijian Way of Life*. (Suva: Institute of Pacific Studies).
- Rose, E. (2001) Ex ante and ex post labor supply response to risk in a low-income area. *Journal of Development Economics*, 64(2), pp.371-388.
- Rosenzweig, M. R. (2001) Savings behavior in low-income countries. *Oxford Review of Economic Policy*, 17(1), pp.40-54.

- Skoufias, E. (2003) Economic Crises and Natural Disasters: Coping Strategies and Policy Implications. *World Development*, 31(7), pp.1087-1102.
- Takasaki, Y. (2011a) Do the commons help augment mutual insurance among the poor? *World Development*, 39(3), pp.429-438.
- Takasaki, Y. (2011b) Targeting cyclone relief within the village: kinship, sharing, and capture. *Economic Development and Cultural Change*, 59(2), pp.387-416.
- Takasaki, Y. (forthcoming) Do local elites capture natural disaster reconstruction funds? *Journal of Development Studies*.
- Turner, J. W. (1986) "The water of life": kava ritual and the logic of sacrifice. *Ethnology*, 25(3), pp.203-214.
- Turner, J. W. (1987) Blesses to give and receive: ceremonial exchange in Fiji. *Ethnology*, 26(3), pp.209-219.
- Varley, A. (1996) Women heading households: some more equal than others? *World Development*, 24(3), pp.505-520.
- Wiest, R., Mocellin, J. and Motsisi, T. (1994) The needs of women in disasters and emergencies. Report for the UN Development Programme and Office of the UN Disaster Relief Coordinator, University of Manitoba.

Table 1. Household characteristics, cyclone damage, relief, and rehabilitation by gender.

	All	Male head	Female head	Mean/ prop. test (p-value)
A. Household characteristics, cyclone damage, and relief.				
<i>Household characteristics</i>				
Female head dummy	0.12	0.00	1.00	<i>n.a.</i>
Age of household head	49.7 (14.0)	48.4 (13.8)	59.0 (11.6)	0.00
Schooling years of household head	8.7 (3.2)	8.9 (3.1)	6.9 (3.1)	0.00
No. female adults	1.7 (1.1)	1.7 (1.1)	1.9 (1.0)	<i>0.46</i>
No. male adults	1.8 (1.2)	1.9 (1.2)	1.2 (1.2)	0.00
No. children	2.4 (1.9)	2.5 (1.9)	1.6 (1.5)	0.01
Average age of female adults	40.0 (12.6)	38.5 (11.8)	50.4 (13.3)	0.00
Highest schooling years of female adults	10.9 (3.0)	11.1 (2.8)	9.7 (3.6)	0.00
Pre-cyclone land holdings per capita (acres)	0.97 (1.40)	1.04 (1.47)	0.48 (0.47)	0.01
Pre-cyclone fishing capital per capita (F\$)	83 (262)	90 (276)	31 (111)	0.01
<i>Cyclone damage:</i>				
Dwelling damage dummy	0.64	0.63	0.71	<i>0.27</i>
Dwelling damage per capita (F\$)	70 (143)	67 (133)	91 (199)	<i>0.29</i>
Crop damage dummy	0.84	0.86	0.71	0.02
Crop damage per capita (F\$)	32 (49)	34 (50)	23 (40)	<i>0.17</i>
<i>Cyclone relief:</i>				
Tarpaulins receipt dummy	0.11	0.11	0.12	<i>0.91</i>
Food aid per capita per month in period 2 (days)	10.3 (8.8)	10.5 (8.9)	8.8 (8.8)	<i>0.27</i>
Food aid per capita per month in period 3 (days)	9.7 (8.2)	9.7 (8.4)	10.0 (7.1)	<i>0.82</i>
No. observations	342	300	42	
C. Rehabilitation among households with damaged dwelling.				
Dwelling rehabilitation dummy	0.64	0.67	0.48	<i>0.05</i>
Female head with no male adults (n=12)			0.58	<i>0.55</i>
Female head with male adults (n=17)			0.41	0.04
No. observations	215	186	29	

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

Table 2. Household incomes by gender.

	All	Male head	Female head	Mean test (p-value)
<i>Income per capita per month a year ago - pre-cyclone (F\$):</i>				
Cropping	49.6 (78.3)	53.4 (82.2)	22.7 (29.5)	0.02
Fishing	30.5 (56.2)	30.2 (54.7)	32.4 (66.4)	0.82
Handicrafts (gifts and sales) ^a	2.3 (7.4)	2.2 (7.0)	2.8 (9.6)	0.60
Non-handicraft forest products ^a	0.5 (1.7)	0.5 (1.7)	0.3 (0.8)	0.36
Casual wage labor ^a	0.4 (2.7)	0.4 (2.6)	0.8 (2.9)	0.34
Permanent wage labor ^a	8.5 (32.9)	9.2 (34.1)	3.5 (22.6)	0.29
Other ^b	5.2 (34.3)	5.7 (36.6)	1.4 (4.8)	0.45
Total	97.0 (118.1)	101.7 (122.0)	63.9 (77.4)	0.05
<i>Current income per capita per month - post-cyclone (F\$):</i>				
Cropping	29.5 (49.2)	31.8 (51.7)	13.1 (18.9)	0.02
Fishing	18.8 (30.4)	19.4 (31.7)	14.2 (17.1)	0.29
Handicrafts (gifts and sales) ^a	8.7 (20.5)	7.5 (16.1)	17.5 (39.1)	0.00
Non-handicraft forest products ^a	0.5 (2.7)	0.5 (2.9)	0.3 (1.0)	0.66
Casual wage labor ^a	0.8 (4.4)	0.7 (4.5)	1.2 (4.1)	0.50
Permanent wage labor ^a	8.4 (32.8)	9.1 (33.9)	3.5 (22.6)	0.30
Other ^b	2.2 (8.2)	2.3 (8.6)	1.5 (5.0)	0.56
Total	68.8 (71.4)	71.3 (72.0)	51.3 (64.8)	0.09
No. observations	342	300	42	

^a The data in periods 1 and 4 are shown for the pre- and post-cyclone periods, respectively.

^b Other income consists of shop profit, livestock selling, and other self-employment activities like being a middleman.

Note - Household means are shown along with standard deviations in parentheses. Test results are italicized and those with a 5% significance level are bolded.

Table 3. Household handicraft gift production by gender.

	Period 1	Period 2	Period 3	Period 4	No. obs.
<i>Participation (proportion):</i>					
All	0.18	0.22	0.27	0.39	342
Male head	0.18	0.22	0.26	0.39	300
Female head	0.19	0.24	0.29	0.45	42
Female head with no male adults	0.13	0.27	0.33	0.47	15
Female head with male adults	0.22	0.22	0.26	0.44	27
<i>Mean values of production per capita per month (F\$):</i>					
All	1.9 (6.7)	2.3 (7.7)	3.0 (9.1)	6.7 (15.0)	342
Male head	1.8 (6.4)	2.0 (6.5)	2.7 (7.9)	6.2 (14.7)	300
Female head	2.3 (8.7)	4.6 (13.3)	5.0 (15.2)	10.5 (16.2)	42
Female head with no male adults	4.2 (3.7)	10.1 (5.4)	10.4 (6.1)	14.2 (4.8)	15
Female head with male adults	1.2 (0.5)	1.5 (0.7)	2.0 (1.2)	8.5 (2.8)	27
<i>Mean test (p-value):</i>					
Male head vs. Female head	0.70	0.04	0.12	0.08	
Male head vs. Female head with no male adults	0.21	0.00	0.00	0.04	
Male head vs. Female head with male adults	0.62	0.74	0.69	0.44	
Female head with no male adults vs. Female head with male adults	0.30	0.04	0.09	0.28	

Note - Standard deviations are in parentheses. Test results are italicized and those with a 5% significance level are bolded.

Table 4. Correlations of cyclone damage, post-cyclone handicraft gift production, and dwelling rehabilitation.

	Dwelling damaged dummy	Dwelling damage per capita (F\$)	Crop damage per capita (F\$)	Handicraft gift production	
				Participation	Mean values per capita per month (F\$)
A. Handicraft gift production.					
<i>Participation</i>					
Male and female heads (n=342)	0.11 (0.04)	0.03 (0.54)	0.09 (0.09)		
Male head (n=300)	0.07 (0.26)	0.03 (0.65)	0.10 (0.08)		
Female head (n=42)	0.45 (0.00)	0.05 (0.77)	0.06 (0.71)		
<i>Mean values of production per capita per month (F\$)</i>					
Male and female heads (n=342)	0.02 (0.72)	0.10 (0.06)	0.23 (0.00)		
Male head (n=300)	-0.01 (0.88)	0.05 (0.40)	0.28 (0.00)		
Female head (n=42)	0.13 (0.41)	0.28 (0.08)	0.00 (0.99)		
B. Dwelling rehabilitation (dummy) among households with damaged dwelling.					
Male and female heads (n=218)		-0.27 (0.00)	-0.15 (0.03)	-0.13 (0.05)	-0.13 (0.07)
Male head (n=188)		-0.30 (0.00)	-0.14 (0.07)	-0.11 (0.14)	0.00 (0.99)
Female head (n=29)		-0.15 (0.44)	-0.31 (0.11)	-0.19 (0.33)	-0.43 (0.02)

Note - Participation in and values of handicraft gift production are for the post-cyclone periods 2-4. p-values are shown in parentheses and those with a 5% significance level are bolded.

Table 5. Determinants of participation in handicraft gift production.

	Fixed-effects linear probability (n=684)					Random-effects linear probability (n=654)		
	2 (1)	2 (2)	2 (3)	3 (4)	4 (5)	2 (6)	3 (7)	4 (8)
Post-cyclone period								
Dwelling damaged dummy	0.068 (0.045)	0.056 (0.048)	0.083 (0.067)	0.123 (0.086)	-0.051 (0.113)	0.072 (0.071)	0.106 (0.088)	-0.139 (0.099)
Crop damage per capita (F\$)	0.000 (0.000)	0.000 (0.000)	0.002 ** (0.001)	0.001 (0.001)	0.001 (0.002)	0.003 ** (0.001)	0.002 (0.001)	0.001 (0.001)
Dwelling damaged dummy * Crop damage per capita	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)
Dwelling damaged dummy * Female head dummy		0.088 (0.079)	0.097 (0.077)	0.097 (0.098)	0.022 (0.113)	0.064 (0.077)	0.059 (0.106)	-0.014 (0.111)
Dwelling damaged dummy * Crop damage per capita * Female head dummy		-0.001 (0.001)	-0.002 ** (0.001)	-0.002 (0.001)	0.000 (0.002)	-0.001 (0.002)	0.000 (0.002)	0.003 ** (0.001)
Dwelling damaged dummy * Female adult size			-0.023 (0.022)	0.035 (0.031)	0.058 (0.040)	-0.019 (0.024)	0.046 (0.033)	0.077 ** (0.039)
Dwelling damaged dummy * Male adult size			0.000 (0.027)	-0.058 * (0.034)	-0.054 (0.042)	-0.001 (0.026)	-0.063 ** (0.031)	-0.054 (0.036)
Crop damage per capita * Female adult size			0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	0.001 * (0.001)	-0.001 * (0.001)
Crop damage per capita * Male adult size			-0.001 *** (0.000)	-0.001 *** (0.000)	-0.001 (0.000)	-0.001 *** (0.000)	-0.001 ** (0.000)	0.000 (0.000)
Female head dummy						0.042 (0.068)	0.030 (0.066)	0.007 (0.071)
Female adult size						-0.013 (0.023)	-0.031 (0.023)	0.002 (0.025)
Male adult size						0.072 *** (0.023)	0.069 *** (0.022)	0.069 *** (0.022)
Mean age of female adults						0.002 (0.002)	0.000 (0.002)	0.005 ** (0.002)
R squared	0.06	0.07	0.11	0.13	0.19	0.10	0.15	0.18
F/Chi sq. (p-value)	0.040	0.060	0.003	0.000	0.000	0.000	0.000	0.000

*10% significance, **5% significance, ***1% significance.

Note - Robust standard errors are in parentheses. Other control variables not shown here are time dummy, village-time dummies, and constant in all columns; no. children, age of household head, schooling years of household head, highest schooling years of female adults, land per capita, fishing capital per capita, and village dummies in columns (6)-(8).

Table 6. Determinants of handicraft gift production per capita per month.

Post-cyclone period	Trimmed least squares (n=684)					Random-effects tobit (n=654)		
	2 (1)	2 (2)	2 (3)	3 (4)	4 (5)	2 (6)	3 (7)	4 (8)
Dwelling damaged dummy	-0.516 (4.314)	-5.724 * (3.400)	-6.054 (5.733)	18.430 (23.580)	20.840 (17.530)	1.913 (4.548)	10.255 (6.337)	-4.739 (6.805)
Crop damage per capita (F\$)	-0.021 (0.016)	-0.043 (0.045)	0.015 (0.071)	-0.036 (0.169)	0.063 (0.159)	0.065 (0.053)	0.095 (0.077)	0.170 * (0.096)
Dwelling damaged dummy * Crop damage per capita	0.033 (0.054)	0.116 * (0.064)	0.121 * (0.072)	0.236 * (0.124)	0.106 (0.144)	0.021 (0.045)	0.030 (0.062)	0.062 (0.074)
Dwelling damaged dummy * Female head dummy		51.100 *** (15.570)	48.380 *** (16.620)	42.030 *** (13.870)	4.974 (16.300)	14.315 *** (5.113)	10.421 (6.868)	1.703 (7.870)
Dwelling damaged dummy * Crop damage per capita * Female head dummy		-0.302 *** (0.106)	-0.302 *** (0.116)	-0.427 ** (0.169)	-0.224 (0.155)	-0.118 * (0.063)	-0.157 * (0.095)	0.037 (0.114)
Dwelling damaged dummy * Female adult size			1.638 (2.629)	0.123 (4.461)	6.913 (14.460)	0.513 (1.883)	2.996 (2.429)	4.961 * (2.760)
Dwelling damaged dummy * Male adult size			-1.497 (2.292)	-5.990 (5.412)	-13.030 (19.550)	-1.857 (1.426)	-5.457 *** (2.095)	-5.054 ** (2.391)
Crop damage per capita * Female adult size			-0.043 (0.079)	-0.036 (0.094)	-0.233 (0.356)	-0.016 (0.038)	0.036 (0.045)	-0.120 ** (0.061)
Crop damage per capita * Male adult size			-0.018 (0.062)	-0.002 (0.102)	0.093 (0.457)	-0.023 (0.017)	-0.046 * (0.025)	-0.024 (0.026)
Female head dummy						-3.237 (5.490)	-0.751 (5.501)	-3.559 (5.632)
Female adult size						-2.200 (2.011)	-1.945 (1.982)	0.089 (1.995)
Male adult size						4.300 *** (1.485)	3.814 ** (1.482)	3.740 ** (1.560)
Mean age of female adults						0.294 * (0.177)	0.048 (0.160)	0.543 *** (0.166)
Loss function	4272	2530	2417	7600	20051			
Log-likelihood						-710	-820	-1100
Chi sq. (p-value)	0.000	0.000	0.000	0.000	0.000	0.019	0.001	0.000

*10% significance, **5% significance, ***1% significance.

Note - Robust standard errors are in parentheses. Other control variables not shown here are time dummy, and village-time dummies in all columns; no. children, age of household head, schooling years of household head, highest schooling years of female adults, land per capita, fishing capital per capita, village dummies, and constant in columns (6)-(8).