Tsukuba Economics Working Papers
No. 2009-009

Cyclone, Gender, and Ritual

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June 2009

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Running Title:
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June 5, 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 to the Fijians of the region who so willingly participated in the survey. Xiaowen Mo undertook the laborious task of data entry and cleaning. This paper has benefited significantly by 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 Workshop of Development Strategy for Poverty Reduction Program, 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.

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Abstract

This paper demonstrates that the Fijian kava ritual emerges as insurance against cyclone risk, as women's production of ritual handicraft gifts is linked with risk sharing. The cyclone tightens female-heads' constraints on intra-household male labor allocation in the gendered Fijian society. This is because male labor sharing against dwelling damage emerges as a new gendered division of labor, and cyclone relief (food aid) crowds out risk sharing against crop damage, but not against dwelling damage. As a result, even though handicraft gift production is normally neutral to the household head's gender, only female-headed households intensify production against dwelling damage to receive more male labor help and reduce production against crop damage to facilitate intensification against dwelling damage. These gendered responses are caused by gendered constraints other than labor endowment, such as discrimination. The kava ritual protects women with limited coping capabilities, though it is not sufficient to fill the gender gap in dwelling rehabilitation.

1. Introduction

Many gifts are ritualistic in developing societies. Following the seminal work on gifts, reciprocity, and ritual in Melanesia by Malinowski (1922), anthropologists (e.g., Mauss 1967) have highlighted the cultural and social roles of ritual gifts based on their ethnographic field studies, especially in the Pacific Islands (Hann 2006). In contrast, economists rarely consider ritual to be in their domain, and almost no systematic economic works using micro survey data from the Pacific Islands exist. Economists have extensively studied risk sharing, however, as a major motive of private transfers in various contexts (e.g., Kolm and Ythier 2006; Cox and Fafchamps 2008). Using original household survey data gathered in Fiji, this paper explores the potential role of ritual gifts in coping with cyclone risk.[1]

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).[2] The kava ritual frequently involves an exchange of ceremonial goods, including indigenous handicrafts made solely by women. I focus on the *production* of ritual handicraft gifts, but not their exchange. Handicrafts can be gifted either by a kin group or a household. If handicraft gifts substitute for other forms of private transfers, such as cash, other in-kind gifts, and labor, then handicraft making, as a shared ritual duty among kin-group members and for private gift exchange with others, can involve risk-sharing

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[1] Better understanding how the rural poor cope with natural disasters is of central importance to policymakers (Skoufias 2003). This is especially so in small island states that heavily rely on foreign aid (Bertram 1986). Some researchers have criticized the deterioration of islanders' indigenous mechanisms in coping with cyclones because of their increasing dependency on emergency aid (e.g., Campbell 1984).

[2] Yaqona "is used in kinship and chiefship rituals, in the treatment of certain kinds of illness, in the atonement for misdeeds and the repair of social relations, before any major undertaking and after the completion of any joint work, in recognition of arrivals and departures, in all public assemblies, and as a matter of hospitality at social gatherings of all kinds. I can recall only one day in which *yaqona* was not being drunk in some section of the village where I resided." (Turner 1986, p206).

arrangements.[3] Gift production is an ex post labor activity whose return is realized through risk sharing (along with any social benefits, such as securing social status); that is, self-insurance and mutual insurance are directly linked. Rosenzweig (2001) emphasizes this link, in a general sense, as a future research agenda on risk.

In Fiji, female-headed households face greater constraints on intra-household male labor allocation than those that are male-headed, not only because of their smaller male labor endowment, but also because of other gender factors, such as discrimination.[4] In response to dwelling damage caused by the cyclone, males help each other repair and rebuild dwellings. This new gendered division of labor tightens female-heads' labor constraints. As a result, even if handicraft gift production is normally neutral to the household head's gender, gender difference can emerge in response to dwelling damage. Furthermore, even if the response to crop damage, another major damage caused by the cyclone, were neutral to gender without dwelling damage, gendered responses to crop damage could also emerge, if dwelling damage mainly shapes the response to crop damage. Such an interaction effect becomes significant if gift production more strongly responds to dwelling damage than crop damage, because risk sharing against dwelling damage better works than that against crop damage. This is very likely in Fiji, because cyclone relief crowded out risk sharing against crop damage, but not against dwelling

[3] This depends on the transformability of handicraft gifts into other forms of transfers. Economists tend to implicitly assume low transformability, treating risk sharing and ritual separately. Fafchamps and Lund (2003, p280), for example, attribute Philippine households' weak responses of gifts to shocks to ritual: ". . . one possible interpretation is that many recorded gifts are ritual in nature (e.g., gifts at funerals) and are thus insensitive to shocks."

[4] Turner (1992, p291) describes the Fijian hierarchy well: " . . . hierarchy is defined here as the ranking of the elements of a whole (society) in relation to the whole. In this sense, the elements that are ranked are social categories or positions defined in terms of age, seniority of descent, and gender, and the whole in relation to which they are ranked is a social system grounded in ritual. Elder is superior to junior, chief to commoner, and male to female. But while age, rank, and gender differences entail relations of superiority/inferiority among persons, they also create interdependence. . . . These relations of inequality and interdependence (which do not preclude conflict) are expressed and reproduced in the practice of everyday life." Young (1988) discusses gender issues in Fiji.

damage – almost all households in the study area received generous emergency food aid; public support for dwelling damage was almost nonexistent (Takasaki forthcoming).[5] That is, cyclone relief further tightens female-heads' labor constraints.

While gender has received considerable attention in the literature on risk (e.g., Dercon and Krishnan 2000; Attanasio, Low, and Sanchez-Marcos 2005), researchers have not yet explored how gendered coping responses linked with gendered risk sharing emerge. Such an inquiry is important for two main reasons. First, it may reveal new responses that could not be identified otherwise. Second, it leads to a better understanding of distributional consequences of shocks. Not only do adverse shocks augment inequalities in coping capabilities among households, but also public safety-net policies may worsen distributional outcomes.

I explore two other related questions. First, when do people adjust handicraft gift production to shocks, during the emergency period or after? Since people need quick help under a state of emergency, for gift production – which takes time – to serve as part of risk sharing, reciprocity needs to take place over time. Second, do people adjust their participation or intensity to shocks? Gendered responses emerge in only intensity if participation is mainly determined by certain qualifications, such as craftswomen's skills and social status. Previous works on ex post labor supply rarely compare participation and intensity: Rose (2001) focuses on participation, and Kochar (1999) employs Tobit with a constraint that estimated coefficients are the same for both decisions.

[5] Attanasio and Rios-Rull (2000) theoretically demonstrate that public transfer crowds out private transfer in risk sharing, 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 reduces the degree of risk sharing. (They obtain supporting evidence in Mexico's Progresa program, and Dercon and Krishnan 2005 find similar results for food aid in rural Ethiopia.) Also, risk sharing against crop damage, which depends on farmers' pre-cyclone cropping decisions, is often constrained by information problems; risk sharing against dwelling damage is facilitated by its lack of information problems and randomness, as well as its seriousness.

The analysis strongly confirms my conjectures. Only female-headed households intensify ritual handicraft gift production against dwelling damage to receive more male labor help and reduce production against crop damage to facilitate intensification against dwelling damage, both during and after the emergency period; at the same time, participation is independent of shocks and gender. That is, the Fijian kava ritual emerges as insurance against cyclone risk for some women with limited coping capabilities.

The rest of the paper is organized as follows. Section 2 describes the study area and offers descriptive evidence of gendered responses in ritual handicraft gift production. Section 3 provides the theoretical framework that shows how gendered responses to cyclone shocks emerge. Section 4 discusses the econometric specification, which is followed by the estimation results in Section 5 and the robustness check in Section 6. The last section concludes.

2. Study area, cyclone, gender, and handicrafts

On January 13, 2003, Cyclone Ami swept over the northern and eastern parts of the Fiji Islands (Ami was the only cyclone in that year). Nine native Fijian villages on the coast were intentionally chosen for the survey, and households were randomly sampled in each village (n = 374).[6] 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-

[6] 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. In each village, households are stratified by the smallest kin-group unit (defined below), as well as the combination of leadership status and major asset holdings (like shops). Households were randomly sampled in each stratum. Fiji is divided almost evenly between native Fijians and Indo-Fijians. This study focuses on native Fijians who practice the kava ritual (Indo-Fijians also drink kava for recreation).

disaster surveys (e.g., Morris et al. 2002), the survey collected pre- and post-cyclone information retrospectively. 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). The analysis is based on 342 households with complete data (those with no female adults, potential handicraft producers, are dropped).

Cropping is the most important livelihood activity, accounting for over half of the total income before the cyclone (see Table 1). While there is no gendered division of labor in cropping, female-headed households (12% of the sample) have weaker cropping capacities than those that are male-headed: Female-headed households are older (both head and female adults), less educated (both head and female adults), and smaller in the size of male adults (female adult size does not significantly differ), and hold less land per capita (see Table 2).[7] As a result, compared to male-headed households, female-headed households earned less crop income and total income in a per capita term, while there was no gender difference in other income-earning activities (Table 1).[8] Table 3 reports the proportion of households that produced ceremonial handicraft gifts and the mean

[7] Virtually all land is communally owned and by law cannot be sold. The disposition of fishing capital (privately owned) and the transfer of the usufruct of land after the cyclone were nonexistent. Indeed, asset holdings changed very little over the previous year. Table 2 reports pre-cyclone land and fishing capital holdings (a year before the interview).

[8] 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. Most households also engage in subsistence fishing using lines and hooks, simple spear guns, or rudimentary nets, and more commercially oriented fishermen use boats and engines, along with more valuable nets (fishing was the second-most-important activity with a 31% income share before the cyclone). Although female-headed households own smaller fishing capital per capita than male-headed ones, there was no difference in fishing income between them (while in other locales males dominate fishing, female fishers are active in Fiji, Chapman 1987). 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. While casual wage labor was very uncommon, some households earned significant income from permanent wage labor in a stable manner. Other income in Table 1 consists of shop profit, livestock selling, and other self-employment activities like being a middleman.

values of produced gifts per capita per month in each period.[9] Even though only women make handicrafts, there was no gender difference in both participation and values in period 1.

Ami damaged almost two thirds of residents' dwellings (consisting of a main house and other small independent units like a kitchen, a shower, and a toilet, if any), and the mean value of total dwelling damage (*hv*) was 70 Fiji dollars per capita (F$1 = US$.60) (based on respondents' subjective assessment probed by enumerators in the respondents' homes) (Table 2). Crop damage was experienced by 84% of households, and the mean value of crop damage (*cd*) was 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). Provisions of relief – by the Red Cross, other nongovernmental organizations (NGOs), and governments – were quite distinct. On one hand, almost all households received generous food aid; in periods 2 and 3, 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

[9] 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*). These plants (locally known also as *voivoi*, *kuta*, and *tapa*, respectively) are gathered on communal land and are openly accessible to all villagers, and their extraction is unregulated. While voivoi is produced in all nine villages, kuta and tapa are produced in some villages, depending on local environmental conditions. Only kuta is seasonal. Some craftswomen sell their products in local markets and small resort hotels for tourists, and values of handicraft gifts were imputed from sales data. In Table 1, handicraft gifts and sales are combined. Gift production was much more common and larger than sales – approximately two times and five times, respectively, over time. People also collected other forest products, such as wild fruits, earning negligible incomes over time (Table 1).

and for temporary dwelling repair – were provisioned to only 11% of households (the government provisioned construction materials more than one year after the cyclone).[10]

Even though there was no gender difference in crop damage, dwelling damage, and corresponding relief received (Table 2),[11] distinct gendered rehabilitation patterns emerged. While mean crop income decreased by over 40% regardless of gender (Table 1), compared to male-headed households, female-headed households were less likely to have completely repaired damaged dwellings at the time of interviews (Table 2). This contrast is explained by distinct ways of rehabilitation. On one hand, households rehabilitated cropping individually, without using shared or hired labor (they planted fast-growing crops like sweet potato after the provision of seeds as part of the relief, and the harvest of rehabilitated crops started before the interviews). On the other hand, males helped each other rehabilitate dwellings.[12] Hence, the self-rehabilitation of cropping and labor sharing for dwelling rehabilitation were both incomplete, and only the latter, which involved a new gendered division of labor, was unequal in the gender sphere.

[10] The total cyclone damage across the country (mostly in Vanua Levu and Taveuni Islands) is estimated at F$104 million, of which residential damage is F$22 million and crop damage is F$40 million (National Disaster Management Office 2003). Fourteen people were killed (in the sample villages, no casualties and very limited injuries and illnesses were reported). The total cost of food rations in the country was 20 times that of tarpaulins (National Disaster Management Office 2003). Because respondents found it difficult to specify the monetary value of food aid they received, enumerators instead asked the quantity measured in the number of days it would have taken to consume the food in normal periods (not actual duration). 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 60 days food ration for six months (in periods 2 and 3), F$104 per capita, is more than 3 times average crop damage (see Takasaki, forthcoming for details of relief delivery).

[11] Crop damage was less common among female-headed households, but this is mainly because their non-participation in cropping was relatively more common.

[12] Even though a lack of data on across-household labor transfers precludes me from proving that they serve as a form of risk sharing, supporting evidence is obtained as follows. First, all refugees (almost 40% of households with damaged main housing) stayed in others' residences in the same village, and many of them lived with households in the same kin group (defined below). This clearly indicates that both village and kin group served as risk-sharing groups. At the time of interviews, refugees were almost nonexistent. Second, Takasaki (forthcoming) finds that communal labor for rehabilitating damaged village facilities involves risk-sharing arrangements against idiosyncratic shocks: Contributions of communal labor are smaller among households with damaged main housing and with greater crop damage.

While about 20% of households produced very small amounts of handicraft gifts in period 2, as in period 1, both participation and intensity significantly increased later (this matches increased demands for ritual gifts in ceremonial meetings) (Table 3). In period 4, almost 40% of households participated, and the amount was about 3.5 times that in period 1. While total income decreased by almost 30%, handicraft income (gifts and sales combined) reached 13% of total income (Table 1). Since 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 must have been considerable. While there was no gender difference in participation over periods 2-4, female-headed households more strongly intensified production than male-headed households after the cyclone (Table 3), earning even higher income from handicrafts than from cropping and fishing (Table 1). These results give initial evidence of gendered responses to cyclone shocks in handicraft gift production.

3. Theoretical framework

This section provides a simple theoretical framework that shows how gendered responses to cyclone shocks emerge in ritual handicraft gift production. Let us consider a unified household model, in which a household head allocates male and female labor to maximize household utility, determined by household consumption and residential quality (an intra-household bargaining model does not alter the main results on gendered responses). Cropping is a unique income-earning activity, with no gendered division of labor. I assume that a village is the same as a kin group and a household transfer network (this assumption is relaxed later). Only females with certain qualifications (like skills) can make handicraft gifts, either for others as private transfers or as shared ritual duties.

Suppose the household produces some handicraft gifts (I focus on intensity decisions). The household experiences crop damage, an adverse income shock; it may also experience dwelling damage, an adverse preference shock, which directly reduces its residential quality. There are two risk-sharing arrangements to smooth utility: one for non-labor items and another for male labor for repairing damaged dwellings. By contributing more handicraft gifts as part of non-labor sharing, the household can augment not only other forms of net non-labor transfers received, but also net male labor transfers received. How well handicraft gifts compensate for labor sharing depends on the transformability of handicraft gifts into other private transfers and the amount of own gift production relative to others' (considering a gift game does not alter the main results on gendered responses). To receive quick help to repair its damaged dwelling, the household can produce handicraft gifts later. Specifically, net private transfers received are a function of *total* handicraft gifts made over time (that is, credible commitments to future gifting are sufficient to obtain current help). The household balances the marginal return to female labor for gift production with its opportunity cost, the forgone contribution to crop rehabilitation. The household with a damaged dwelling allocates male labor to own dwelling repair and crop rehabilitation, while receiving labor support from others; the household without a damaged dwelling is a donor of male labor transfer.

There are three types of households: *M-household* headed by a male with a damaged dwelling; *F-household* headed by a female with a damaged dwelling; and *N-household* headed by either a male or a female without a damaged dwelling. With greater dwelling damage experienced, the male head of M-household allocates more male labor to own dwelling repair to smooth utility by recovering residential quality and less female labor to gift production (to shift male labor from crop rehabilitation to dwelling repair). These labor supply responses (self-insurance) are weakened by risk sharing, because with greater own dwelling damage, the household can receive more male labor help from others (if labor sharing were complete, own labor supply would be unresponsive to idiosyncratic dwelling damage). The response to crop damage is the opposite: With greater own crop damage, M-household increases gift production to augment net non-labor transfers to smooth utility by maintaining consumption and reduces male labor for repair (these responses are weakened by non-labor sharing).

Suppose the female head of an F-household allocates all male labor to own dwelling repair (i.e., corner solution),[13] or has limited control over male labor for any social reason, and she can thus adjust female labor only. F-household's labor response is distinct from M-household's: The female head intensifies gift production to augment not only net non-labor transfers against crop damage, but also male labor help against dwelling damage (these responses are weakened by corresponding risk sharing). For N-households, male labor for own dwelling repair is nonexistent (i.e., another corner solution), and the head intensifies gift production against crop damage only. To sum up, while crop damage always leads to intensified gift production, M- and F-households experience opposite impacts of dwelling damage.[14]

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[13] This is because female-headed households' male labor endowment is smaller than male-headed households', as seen in the sample.

[14] Dwelling damage and crop damage also indirectly affect non-labor sharing and labor sharing, respectively. These effects work in the opposite manner to those of direct shocks. For example, as greater dwelling damage increases the net non-labor transfer received, M-household lowers handicraft production and augments dwelling repair, and F-household also reduces handicraft production without being able to adjust male labor. To incorporate communal male labor for village rehabilitation as risk sharing (see note 12) is a straightforward extension. With greater dwelling damage or crop damage, male labor contributions to communal labor decrease, thereby helping augment handicraft production and own dwelling repair.

Now, suppose housing damage and crop damage are not independent but interact with each other, and household gift production more strongly responds to dwelling damage than crop damage (because cyclone relief crowds out non-labor sharing, as discussed above). Then, it is possible that housing damage largely shapes the labor response to crop damage. In particular, F-household may rather *decrease* gift production against crop damage in order to receive more male labor help. That is, dwelling damage also makes labor responses to crop damage distinct among M-, F-, and N-households.

The hypotheses regarding handicraft gift production can be summarized as follows: 1) Participation is irresponsive to dwelling damage and crop damage, regardless of gender; 2) M- and F-households have opposite intensity responses to dwelling damage; 3) Dwelling damage mainly determines intensity responses to crop damage, making them distinct among M-, F-, and N-households; and 4) These gendered responses occur over time. To formally test hypotheses 1-4 is a task of the remaining sections.

4. Econometric specification

The theoretical framework discussed in the last section suggests the following ex post labor supply equation for ritual handicraft gift production linked with risk sharing:

$$L = L(z, W, x, M),$$

where L is labor supply; z and W, respectively, are household- and village-level adverse shocks; and x and M, respectively, are household- and village-level factors that affect returns to labor, such as productive assets and market prices. As it is assumed that a village is the same as a kin group and a household transfer network, W is a covariate shock among risk-sharing members, which determines the resources to be shared.

The estimating equation is:

$$L_{it} = \beta_0 + \beta_1 z_{it} + \delta x_{it} + V_{vt} + u_i + e_{it}\,. \tag{1}$$

where i, v, and t stand for household, village, and time, respectively; V_{vt} is village dummies and village-time dummies; u_i is unobservable household heterogeneity; and e_{it} is a time-variant error term that is individually and independently distributed. Village-time dummies fully control for village-level covariate shocks, W_{vt}, including village facility damage and cyclone relief received by the village, as well as any other village-level time-variant factors, M_{vt}. A time dummy is added to capture common events or trends, including seasonality. If handicraft gifts are part of risk sharing, unobservable welfare weights used in risk sharing directly affect household labor-supply decisions. Then, as in the full risk-sharing model (Cochrane 1991; Mace 1991; Townsend 1994), it is crucial to control for household heterogeneity u_i, using fixed-effects estimators. In the Fijian quarterly data, household-level factors, x_{it}, are fixed effects that vanish in fixed-effects estimates; village dummies, which capture fixed village characteristics, such as environmental conditions, also vanish. Equation (1) does not tell how individual households respond to others' decisions, but to do so is not a goal of this paper. Equation (1) is the same as the ex post labor supply equation commonly used in previous works (e.g., Rose 2001); however, the standard income effect – with greater adverse idiosyncratic shocks, the household increases labor supply to smooth income, i.e., $\beta_1 > 0$ – does not apply, because the return of this labor activity is realized through risk sharing.

I consider three specifications for household-level shocks, z_{it}: model A with a combined measure of dwelling damage and crop damage (*hvcd* = *hv* + *cd*); model B with a dummy for dwelling damage (*d_hv*), *cd*, and their interaction term (*d_hv***cd*); and model C with *hv*, *cd*, and their interaction term (*hv***cd*) for the sub-sample of M/F-households ($hv > 0$). Model A, which assumes the same marginal effects of *hv* and *cd*, is a restrictive model. Model B differentiates between M/F- and N-households (simply using *hv* and *cd* does not do so); it does not capture the impacts of *hv*. Potential selection bias in model C is not a major concern, because the incidence of dwelling damage is considered exogenous (households with and without damaged dwellings do not differ significantly from each other in their pre-cyclone income, asset holdings, and household characteristics, Takasaki forthcoming).[15]

Equation (1), which ignores gendered heterogeneity, is restrictive. To test gendered responses (hypotheses 2 and 3), I extend equation (1):

$$L_{it} = \alpha + \beta_1 z_{it} + \beta_2 z_{it} d_i + \delta x_{it} + V_{vt} + u_i + e_{it} \,. \qquad (2)$$

where d_i is a dummy for female head (*fhead*). $z_{it}d_i$ includes *hvcd*fhead* in model A, *d_hv*fhead* and *d_hv*cd*fhead* in model B, and *hv*fhead*, *cd*fhead*, and *hv*cd*fhead* in model C. Model B captures distinct effects of *d_hv* between M- and F-households and of *cd* among N-, M-, and F-households (*d_hv*cd*fhead* captures distinct interaction effects of two shocks between male- and female-headed households).[16] Model C fully differentiates between M- and F-households.

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[15] Household crop damage is potentially endogenous, because unobservable household and village characteristics, such as land quality, farming skills, market conditions, and environmental conditions (e.g., resource stock), which affect pre-cyclone cropping decisions and thus crop damage, can be correlated with ex post labor-supply decisions. Even if the incidence of housing damage is more random, damage loss depends on unobservable initial dwelling quality, which may be correlated with unobservable determinants of ex post labor-supply decisions. In the Fijian quarterly data, all of these unobservable factors are time-invariant factors that are fully controlled for by fixed-effects estimators. Relief received by individual households is not included as an explanatory variable, because it is endogenously determined as part of private risk sharing (Dercon and Krishnan 2005).

[16] In the sample, about 55% and 9% of households, respectively, are M- and F-households, and the remaining 36% are N-households, of which more than 90% are headed by males (Table 2). The limited number of observations of female-headed N-households precludes me from differentiating them from male-headed N-households. I used *cd*fhead* instead of *d_hv*cd*fhead*, treating male-headed N-households as a base case (F-households and female-headed N-households cannot be differentiated). I found almost the same results.

Even if gendered responses (non-zero β_2) are found, equation (2) does not tell which gender constraint matters, labor endowment or other. To directly control for the labor-endowment effect, I extend equation (2):

$$L_{it} = \alpha + \beta_1 z_{it} + \beta_2 z_{it} d_i + \beta_3 z_{it} m_i + \delta x_{it} + V_{vt} + u_i + e_{it}\,. \tag{3}$$

where m_i is labor endowment (the numbers of female and male adults, *fadlt* and *madlt*, respectively).[17] If gendered responses persist in equation (3), it is caused by gendered constraints other than labor endowments.

To capture potentially distinct responses in participation and intensity (hypothesis 1), I estimate the determinants of the probability of participation – the linear probability (LP) model – and the intensity of production *conditional on participation* separately. This is effectively a hurdle model, and its ease of estimating marginal effects is an advantage (all marginal effects reported in the next section are based on this model). An alternative fixed-effects sample selection model (Kyriazidou 1997) is unfeasible with the Fijian data, which lack the identifying instruments required to credibly estimate the selection equation. I also employ the trimmed least-squares (LS) estimator developed by Honoré (1992). Although the constraint that estimated coefficients are the same for participation and intensity decisions is a disadvantage in this fixed-effects censored regression model, its similar results to those of the conditional model on intensity give me confidence about the findings' robustness. With a lack of time allocation information, I use values of handicraft gifts produced (Table 3) as a proxy. The fixed-effects models control for any systematic difference between values and labor inputs caused by unobservable skills and any other fixed factors (market prices are controlled for by village-time dummies).

[17] $z_{it}m_i$ includes *hvcd*fadlt* and *hvcd*madlt* in model A, *d_hv*fadlt*, *d_hv*madlt*, *cd*fadlt* and *cd*madlt* in model B, and *hv*fadlt*, *hv*madlt*, *cd*fadlt* and *cd*madlt* in model C. To control for potential roles of child labor in risk coping, I also considered the number of elder children for m_i, finding no significant results.

I also estimate direct impacts of observable household fixed-effects, such as *fhead*, *fadult*, and *madult*,[18] using three corresponding, random-effects models for participation, intensity conditional on participation, and unconditional intensity (random-effects tobit). A key question is whether gender (*fhead*) does not directly affect labor supply, even if it alters labor responses to shocks. Random-effects estimates are biased if idiosyncratic shocks are correlated with unobservable fixed effects. While the trimmed LS estimator is robust to heteroskedasticity and non-normality, the presence of either of these two also makes random-effects tobit estimates biased.

To test whether gendered responses occur over time (hypothesis 4), I conduct two-period analyses separately for periods 1 and 2, periods 1 and 3, and periods 1 and 4. In the latter two, labor input in period 3 or 4 is connected with the shocks experienced in period 2, and periods 2-3 or periods 2-4 are treated as one post-cyclone period. This is a standard practice in analyzing annual survey data that lack information over time within the year. If private transfers are a function of total handicraft gifts made over post-cyclone periods, gifts made during the period of interest are negatively correlated with those in "unobserved" previous post-cyclone period(s), causing bias. In particular, the positive and negative impacts of dwelling damage and crop damage, respectively, in period 2 causes *downward* and *upward* biases in the estimates in periods 3 and 4.

5. Estimation results

Fixed-effects results are reported in Tables 4-7. All results of model A appear in Table 4 – LP, conditional LS, and trimmed LS in the top, middle, and bottom panels,

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[18] Other fixed factors included are the number of children, the age of household head, the education of household head (schooling years), land per capita, fishing capital per capita, the mean age of female adults, and the highest schooling years of female adults (potential handicraft producers). Village dummies do not vanish in random-effects estimates, of course.

respectively. The results of these three estimators of models B and C appear in Tables 5, 6, and 7, respectively – model B in the top panel and model C in the bottom one. In all these four tables, the first, second, and third sets of three columns show results in periods 1 and 2, periods 1 and 3, and periods 1 and 4, respectively; in each set, the first, second, and third columns report results of equations (1), (2), and (3), respectively. Table 8 shows the random-effects results of equation (3) (models B and C only).[19]

Most results regarding the damage variables' impacts on participation – in all models in all periods – are very weak (even though some estimated coefficients in model C are statistically significant, the marginal effects are almost zero) (Tables 4 and 5). Hence, participation is always insensitive to idiosyncratic shocks, regardless of gender, i.e., hypothesis 1 holds. In the random-effects estimates (Table 8), larger male labor endowment (with no interaction term) increases the probability of participation in all periods. Households with more male labor can better mobilize female labor.[20] No other household characteristics affect participation in a strong manner. In particular, participation is neutral to gender itself with labor endowments controlled for. Therefore, whether females produce ritual handicraft gifts depends on household male labor endowment and unobservable factors, such as craft skills and social status.

Results on intensity responses are summarized as follows (Tables 4, 6, and 7). Most results of the restricted equation (1) are nonsignificant, and almost all statistically significant results in (1) become nonsignificant in the corresponding equations (2) and (3).

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[19] Robust standard errors are reported in all estimation results. One village with almost no handicraft production is dropped for periods 1 and 3 in models A and B and for all periods in model C. The null hypothesis that the random-effects estimates are the same as the pooled estimates (i.e., the absence of individual heterogeneity u_i) is strongly rejected by the likelihood-ratio test in all models.

[20] This effect is weakened by crop damage in periods 2 and 3 (results not shown), indicating that crop rehabilitation reduces the labor capacity for gift production (the same relationship also holds in the fixed-effects models).

Contrarily, once gendered heterogeneity is controlled for in equation (2), many results become statistically significant. Most results in another restricted model A are also nonsignificant. Shock impacts on intensity decisions are mostly opposite to each other by gender and shock, and thus they cancel out each other in these restricted models; ignoring this heterogeneity makes it impossible to identify true impacts.

Let me first discuss detailed results in period 2. According to equation (2), F-households greatly intensify gift production (in both incidence and magnitude) in response to dwelling damage. Results of two fixed-effects models are qualitatively the same, indicating that trimmed-LS results reflect intensity, not participation. The estimated marginal effects are huge: F$15 per capita per month (more than six times mean production) for *d_hv* at means in model B, and .20 for *hv* at means in model C (i.e., a one standard deviation increase in *hv* augments production by more than three standard deviations). In equation (3), all labor-endowment effects are nonsignificant (results not shown), and all significant results in (2) still hold. Thus, gender factors other than labor endowments matter. M-households' responses are the opposite, but much weaker in magnitude and in a statistical sense. These results confirm hypothesis 2.

Strong interaction between dwelling damage (incidence, in particular) 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 (crop damage variables with no interactions are mostly nonsignificant). As clearly shown in model C, households (F-households in particular) more strongly respond to dwelling damage than crop damage, and as a result, the former mainly shapes the impacts of the latter. F-households intensify gift production against dwelling damage by reducing production against crop damage;[21] the converse holds true among M-households to a much weaker degree. These results confirm hypothesis 3.

These female-headed households' responses to shocks also hold in periods 3 and 4 (model B, in particular), while the results are statistically much weaker than in period 2. The estimated coefficients of dwelling damage in periods 3 and 4 are smaller than those in period 2, but they can be biased downward as discussed above; despite the potential downward bias in the estimated coefficients of crop damage in periods 3 and 4, they are similar across periods 2-4. Male-headed households are insensitive to cyclone damage in periods 3 and 4. These results are consistent with hypothesis 4.

The estimated coefficients of cyclone damage in the random-effects models (Table 8) are distinct from corresponding fixed-effects estimates, suggesting bias in the former. In particular, female-headed households' responses to shocks do not hold in a strong manner, especially in the random-effects-tobit estimates. Labor endowments and the gender of household head as fixed effects are nonsignificant in all models. That is, gendered responses to shocks emerged in the gender-neutral activity.

6. Robustness check

This section discusses the robustness of the estimation results presented in the last section. I examine recall bias, consider risk-sharing groups other than village, and provide evidence for the link between gendered responses and risk sharing.

6.1. Recall bias

[21] In models B and C of equation (2), the marginal effects of crop damage with dwelling damage and at the mean dwelling damage value, respectively, are -.10 and -.12 (i.e., a one standard deviation increase in crop damage reduces production by .7 standard deviation). An illustrative finding is that in model C of equations (2) and (3), the estimated coefficients of *cd*fhead* are nonsignificant, but become strongly significant when *hv*cd* and *hv*cd*fhead* are dropped.

Special attention needs to be given to measurement errors in the retrospective data. First, measurement errors in the values of dwelling damage and crop damage can be considerable and systematic. Compared to *hv*, the main house damage index (*hd*)[22] should contain smaller measurement errors, because relief officers used similar categories – no damage, partial damage, and complete damage – in their damage assessments, and thus the damage status of each house was common knowledge among villagers. Measurement errors in the dwelling damage dummy and a dummy for crop damage (*d_cd*) should be minimal. I repeated the analyses using *hd* and *d_cd*, finding qualitatively similar results. The advantage of using *hv* and *cd* is that it is possible to directly compare the impacts of these two shocks and examine aggregate shock *hvcd* for comparison.

Second, because handicraft gifts are culturally and socially important in the kava ritual and they coincide with memorable events like funerals, respondents could recall production reasonably well, but such recollections may still contain considerable errors. While the time dummy fully controls for common memory inaccuracy, the correlation of recall errors in gift production, especially in period 1, with idiosyncratic shocks can cause bias. Specifically, a positive (negative) correlation – households with larger idiosyncratic shocks tend to report higher (lower) pre-cyclone production than the real – causes upward (downward) bias. This potential bias is not a major concern for qualitatively testing gendered responses, because with no a priori reason for different recall errors and their distinct correlations with idiosyncratic shocks among M-, F-, and N-households, their distinct responses should not be a biased result.

[22] Enumerators asked about the severity of main housing damage, using five options: 0 = no damage (47%), 1 = little damage (20%), 2 = some damage (12%), 3 = big damage (13%), 4 = completely destroyed (7%), where the proportions of households are shown in parentheses.

6.2. Risk-sharing groups other than village

Risk-sharing groups other than the village can play a significant role (see, e.g., Fafchamps and Lund 2003; De Weerdt and Dercon 2006 for recent works on risk-sharing networks). First, labor sharing may take place within a village sub-group. In particular, a kin group that plays central roles in ritual gift exchange also serves as a risk-sharing group (see note 12). I repeated the analyses treating the kin group as a risk-sharing group, by replacing village-time dummies with kin-group-time dummies, finding very similar results on idiosyncratic shocks.[23] Second, if non-labor sharing takes place in a space larger than the village, the estimates using village- or kin-group-time dummies may be biased. This is not a major concern for the latter estimates because the data indicate that most across-villages non-labor transfers were made with households belonging to the same kin group (like those in a city).[24]

6.3. Evidence for the link between gendered labor responses and risk sharing

Confirming hypotheses 2 and 3 does not necessarily indicate that gendered responses are caused by their link with risk sharing. Here, as indirect evidence for that link, I report the nonexistence of gendered responses in handicraft selling, which is not part of risk sharing. The same theoretical framework as above shows that 1) all M/F/N-households increase sales against crop damage to earn extra income (this income effect is weakened by non-labor sharing), and 2) M/F-households do not adjust sales to dwelling damage, because to do so does not directly increase labor help. Takasaki (2009) confirms

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[23] The hierarchical kin structure in Fiji 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 mataqlai, and so forth (Ravuvu 1983). While vanua ranges over several villages, yavusa, mataqali, and tokatoka are often formed within the village. The sample contains 15 yavusa, 36 mataqali, and 53 tokatoka (excluding several mataqali and tokatoka consisting of only one household). In this alternative analysis, I treat yavusa, mataqali, and tokatoka as a risk-sharing group separately.

[24] Ex ante risk management is unlikely to be a significant factor. Distinct from other islands in the country, the study area is less prone to being hit by cyclones.

these conjectures: Households augment sales against crop damage, but not dwelling damage, independent of dwelling damage and gender.

7. Conclusion

This paper demonstrates that the Fijian kava ritual emerges as insurance against cyclone risk, as women's production of ritual handicraft gifts is linked with risk sharing. The cyclone tightens female-heads' constraints on intra-household male labor allocation in the gendered Fijian society. This is because male labor sharing against dwelling damage emerges as a new gendered division of labor, and cyclone relief (food aid) crowds out risk sharing against crop damage, but not against dwelling damage. As a result, even though handicraft gift production is normally neutral to the household head's gender, only female-headed households intensify production against dwelling damage to receive more male labor help and reduce production against crop damage to facilitate intensification against dwelling damage. These gendered responses are caused by gendered constraints other than labor endowment, such as discrimination. Gendered responses occur both during and after the emergency period; thus, reciprocity in risk sharing takes place over time. Restricted models that ignore heterogeneity caused by gender and shock yield nonsignificant results, because true impacts are mostly opposite to each other. Participation in gift production, however, is independent of shocks and gender. Only females with sufficient household labor endowment and some unobservable qualifications, such as craft skills and social status, can make ritual handicraft gifts. As such, the kava ritual protects a subset of women with limited coping capabilities, though it is not sufficient to fill the gender gap in dwelling rehabilitation.

These findings suggest the following implications for policy and research. First, the scope of risk coping is broader than usually thought. Ritual can emerge as a rational coping action in certain situations. Second, capturing heterogeneous coping responses (especially opposite ones) is critically important. Heterogeneity may newly emerge as shocks augment inequalities in coping capabilities among households. Third, a better understanding of the effects of public safety-net policies on private mechanisms is strongly needed. Efficient resource allocation across relief types not only better satisfies victims' demands, but also can improve equity when victims' coping capabilities are unequal. Even if this is practically difficult for small developing countries that rely on emergency aid from donors, policymakers can design redistributive relief policies (e.g., subsidizing dwelling rehabilitation for females). As private mechanisms adjust over time, such policies can be effectively implemented even after the emergency period.

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Table 1. Household sectoral incomes by period and gender.

	Pre-cyclone			Post-cyclone			Mean test (p-value)				
							By period			By gender	
	All	Male head (*fhead=0*)	Female head (*fhead=1*)	All	Male head (*fhead=0*)	Female head (*fhead=1*)	All	Male head	Fe-male head	Pre-cy-clone	Post-cy-clone
Cropping	49.6 (78.3)	53.4 (82.2)	22.7 (29.5)	29.5 (49.2)	31.8 (51.7)	13.1 (18.9)	***0.00***	***0.00***	*0.08*	***0.02***	***0.02***
Fishing	30.5 (56.2)	30.2 (54.7)	32.4 (66.4)	18.8 (30.4)	19.4 (31.7)	14.2 (17.1)	***0.00***	***0.00***	*0.09*	*0.82*	*0.29*
Handicrafts (gifts and sales)[a]	2.3 (7.4)	2.2 (7.0)	2.8 (9.6)	8.7 (20.5)	7.5 (16.1)	17.5 (39.1)	***0.00***	***0.00***	***0.02***	*0.60*	***0.00***
Non-handicraft forest products[a]	0.5 (1.7)	0.5 (1.7)	0.3 (0.8)	0.5 (2.7)	0.5 (2.9)	0.3 (1.0)	*0.76*	*0.76*	*0.95*	*0.36*	*0.66*
Casual wage labor[a]	0.4 (2.7)	0.4 (2.6)	0.8 (2.9)	0.8 (4.4)	0.7 (4.5)	1.2 (4.1)	*0.17*	*0.21*	*0.56*	*0.34*	*0.50*
Permanent wage labor[a]	8.5 (32.9)	9.2 (34.1)	3.5 (22.6)	8.4 (32.8)	9.1 (33.9)	3.5 (22.6)	*0.96*	*0.96*	*1.00*	*0.29*	*0.30*
Other	5.2 (34.3)	5.7 (36.6)	1.4 (4.8)	2.2 (8.2)	2.3 (8.6)	1.5 (5.0)	*0.12*	*0.12*	*0.93*	*0.45*	*0.56*
Total	97.0 (118.1)	101.7 (122.0)	63.9 (77.4)	68.8 (71.4)	71.3 (72.0)	51.3 (64.8)	***0.00***	***0.00***	*0.42*	*0.05*	*0.09*
No. observations	342	300	42	342	300	42					

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

Note - Household sample means of incomes per capita per month are shown. Standard deviations are in parentheses. Mean test results are italicized and those with a 5% significance level are bolded.

Table 2. Household characteristics, cyclone damage, relief, and rehabilitation by gender.

	All	Male head (*fhead*=0)	Female head (*fhead=1*)	Mean /prop. Test (p-value)
Household characteristics:				
Female head dummy (*fhead*)	0.12	0.00	1.00	*n.a.*
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 (*fadlt*)	1.7 (1.1)	1.7 (1.1)	1.9 (1.0)	*0.46*
No. male adults (*madlt*)	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***
Land holdings per capita (acres)	0.97 (1.40)	1.04 (1.47)	0.48 (0.47)	***0.01***
Fishing capital per capita (F$)	83 (262)	90 (276)	31 (111)	***0.01***
Cyclone damage:				
Crop damage dummy (*d_cd*)	0.84	0.86	0.71	***0.02***
Dwelling damage dummy (*d_hv*)	0.64	0.63	0.71	*0.27*
Crop damage per capita (F$) (*cd*)	32 (49)	34 (50)	23 (40)	*0.17*
Dwelling damage per capita (F$) (*hv*)	70 (143)	67 (133)	91 (199)	*0.29*
Main house damage index (0-4) (*hd*)	1.2 (1.3)	1.2 (1.3)	1.2 (1.4)	*0.69*
Cyclone relief:				
Tarpaulins in period 2 dummy	0.07	0.07	0.12	*0.22*
Tarpaulins in period 3 dummy	0.04	0.05	0.00	*0.15*
Food aid in period 2 dummy	0.78	0.79	0.69	*0.15*
Food aid in period 3 dummy	0.78	0.78	0.81	*0.66*
Food aid per capita per month in period 2 (days)	10.3 (8.8)	10.5 (8.9)	8.8 (8.8)	*0.27*
Food aid per capita per month in period 3 (days)	9.7 (8.2)	9.7 (8.4)	10.0 (7.1)	*0.82*
Dwelling repair among victims (*d_hv=1*):				
Dwelling repair dummy	0.64	0.67	0.48	*0.05*
No. observations:	342	300	42	

Note - Standard deviations are 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 3. Household handicraft gift production by period and gender.

	Period 1	Period 2	Period 3	Period 4	Mean/prop. test by period: Period 1 vs.		
(n=342)					2	3	4
Participation (proportion):							
All	0.18	0.22	0.27	0.39	*0.25*	***0.01***	***0.00***
Male head (*fhead=0*)	0.18	0.22	0.26	0.39	*0.31*	***0.02***	***0.00***
Female head (*fhead=1*)	0.19	0.24	0.29	0.45	*0.59*	*0.31*	***0.01***
Prop. test by gender	*0.91*	*0.75*	*0.76*	*0.41*			
Mean values of production per capita per month (F$):							
All	1.9 (6.7)	2.3 (7.7)	3.0 (9.1)	6.7 (15.0)	*0.47*	*0.08*	***0.00***
Male head (*fhead=0*)	1.8 (6.4)	2.0 (6.5)	2.7 (7.9)	6.2 (14.7)	*0.81*	*0.16*	***0.00***
Female head (*fhead=1*)	2.3 (8.7)	4.6 (13.3)	5.0 (15.2)	10.5 (16.2)	*0.35*	*0.31*	***0.00***
Mean test by gender	*0.70*	***0.04***	*0.12*	*0.08*			

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

Table 4. Determinants of handicraft gift production - fixed-effects model A.

	Periods 1 and 2			Periods 1 and 3			Periods 1 and 4		
	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)
				Participation - linear probability					
hvcd	-0.0001	-0.0001	0.0003	0.0004 *	0.0004 *	0.0005	0.0000	0.0000	-0.0001
	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0002)	(0.0006)	(0.0002)	(0.0002)	(0.0005)
*hvcd*fhead*		0.0001	-0.0003		-0.0003	-0.0009 **		0.0002	0.0000
		(0.0001)	(0.0002)		(0.0003)	(0.0004)		(0.0003)	(0.0005)
zm	No	No	Yes	No	No	Yes	No	No	Yes
R squared	0.05	0.06	0.07	0.08	0.09	0.11	0.17	0.18	0.19
F (p-value)	0.041	0.049	0.039	0.009	0.015	0.002	0.000	0.000	0.000
No. obs.	684	684	684	600	600	600	684	684	684
				Production per capita per month - conditional on participation					
hvcd	-0.005	-0.009	0.014	0.021	0.021	0.061 *	0.026 *	0.022	0.078 **
	(0.013)	(0.014)	(0.027)	(0.013)	(0.013)	(0.035)	(0.014)	(0.014)	(0.034)
*hvcd*fhead*		0.079	0.074		0.025	0.016		0.047 *	0.026
		(0.059)	(0.060)		(0.055)	(0.053)		(0.027)	(0.027)
zm	No	No	Yes	No	No	Yes	No	No	Yes
R squared	0.14	0.20	0.21	0.15	0.15	0.21	0.27	0.29	0.31
F (p-value)	0.000	0.000	0.001	0.277	0.343	0.035	0.000	0.000	0.000
No. obs.	178	178	178	220	220	220	308	308	308
				Production per capita per month - trimmed least squares					
hvcd	-0.010	-0.013	0.017	0.041 **	0.042 **	0.061 **	0.025	0.020	0.044
	(0.027)	(0.019)	(0.026)	(0.020)	(0.024)	(0.030)	(0.016)	(0.017)	(0.044)
*hvcd*fhead*		0.217	0.205		0.136	0.100		0.039	0.013
		(0.251)	(0.254)		(0.403)	(0.378)		(0.027)	(0.028)
zm	No	No	Yes	No	No	Yes	No	No	Yes
Loss function	4276.8	3786.4	3719.3	9354.9	9221.8	3332.7	21663.3	21503.8	21294.6
Chi sq. (p-value)	0.000	0.000	0.000	0.044	0.111	0.000	0.000	0.000	0.000
No. obs.	684	684	684	600	600	600	684	684	684

*10% significance, **5% significance, ***1% significance.
Note - Robust standard errors are in parentheses. *zm* includes *hvcd*fadlt* and *hvcd*madlt*. Other control variables which are not shown here are time dummy and village-time dummies (and constant for linear models).

Table 5. Determinants of participation in handicraft gift production - fixed-effects linear probability.

	Periods 1 and 2			Periods 1 and 3			Periods 1 and 4		
	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)
					Model B				
d_hv	0.0676	0.0556	0.0831	0.1212	0.1072	0.1092	-0.0302	-0.0394	-0.0511
	(0.0456)	(0.0483)	(0.0681)	(0.0774)	(0.0796)	(0.0982)	(0.0740)	(0.0773)	(0.1139)
cd	0.0001	0.0001	0.0023 **	0.0004	0.0004	0.0009	-0.0011	-0.0011	0.0006
	(0.0003)	(0.0003)	(0.0010)	(0.0007)	(0.0007)	(0.0013)	(0.0010)	(0.0010)	(0.0016)
*d_hv*cd*	-0.0007	-0.0005	-0.0002	-0.0008	-0.0006	0.0005	0.0006	0.0006	0.0008
	(0.0009)	(0.0010)	(0.0006)	(0.0012)	(0.0014)	(0.0011)	(0.0012)	(0.0013)	(0.0014)
*d_hv*fhead*		0.0883	0.0973		0.1066	0.0518		0.0727	0.0223
		(0.0795)	(0.0776)		(0.1037)	(0.1005)		(0.1104)	(0.1147)
*d_hv*cd*fhead*		-0.0010	-0.0021 **		-0.0010	-0.0020		0.0004	0.0000
		(0.0013)	(0.0010)		(0.0015)	(0.0013)		(0.0018)	(0.0020)
zm	No	No	Yes	No	No	Yes	No	No	Yes
R squared	0.06	0.07	0.11	0.08	0.08	0.14	0.18	0.18	0.19
F (p-value)	0.044	0.068	0.004	0.006	0.011	0.000	0.000	0.000	0.000
No. obs.	684	684	684	600	600	600	684	684	684
					Model C				
hv	-0.0003 **	-0.0005 **	-0.0005	0.0005	0.0006 *	0.0008	-0.0002	-0.0003	-0.0009
	(0.0002)	(0.0002)	(0.0004)	(0.0003)	(0.0003)	(0.0007)	(0.0003)	(0.0004)	(0.0010)
cd	-0.0011	-0.0012	0.0021	-0.0001	-0.0001	0.0009	-0.0015	-0.0014	0.0025
	(0.0010)	(0.0011)	(0.0014)	(0.0012)	(0.0013)	(0.0018)	(0.0011)	(0.0012)	(0.0023)
*hv*cd*	0.00001	0.00001 *	0.00001 **	0.00000	-0.00001	-0.00001 *	0.00001 **	0.00001	0.00001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
*hv*fhead*		0.0006 *	0.0011 **		-0.0005	-0.0006		-0.0001	-0.0004
		(0.0003)	(0.0005)		(0.0004)	(0.0007)		(0.0004)	(0.0008)
*cd*fhead*		0.0004	-0.0010		0.0007	-0.0012		-0.0025	-0.0034
		(0.0011)	(0.0008)		(0.0013)	(0.0013)		(0.0024)	(0.0021)
*hv*cd*fhead*		-0.00002 *	-0.00002 **		0.00000	0.00000		0.00006 ***	0.00006 ***
		(0.0000)	(0.0000)		(0.0000)	(0.0000)		(0.0000)	(0.0000)
zm	No	No	Yes	No	No	Yes	No	No	Yes
R squared	0.08	0.09	0.15	0.10	0.11	0.19	0.19	0.21	0.24
F (p-value)	0.169	0.297	0.000	0.042	0.070	0.000	0.000	0.000	0.000
No. obs.	396	396	396	396	396	396	396	396	396

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

Note - Robust standard errors are in parentheses. *zm* includes *d_hv*fadlt*, *d_hv*madlt* (model B), *hv*fadlt*, *hv*madlt* (model C), *cd*fadlt*, and *cd*madlt*. Other control variables which are not shown here are time dummy, village-time dummies, and constant.

Table 6. Determinants of handicraft gift production per capita per month - fixed-effects conditional on participation.

	Periods 1 and 2			Periods 1 and 3			Periods 1 and 4		
	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)
					Model B				
d_hv	-0.002	-2.799	-1.268	4.945	3.430	4.450	0.330	-1.037	6.007
	(2.182)	(2.053)	(4.754)	(4.173)	(4.215)	(8.724)	(4.065)	(4.215)	(7.731)
cd	-0.015	-0.021	0.018	-0.033	-0.035	0.027	-0.052	-0.054	0.036
	(0.013)	(0.015)	(0.040)	(0.047)	(0.048)	(0.109)	(0.034)	(0.035)	(0.090)
*d_hv*cd*	0.017	0.049	0.081	0.060	0.088	0.162	0.092	0.111	0.132
	(0.030)	(0.036)	(0.049)	(0.079)	(0.094)	(0.126)	(0.079)	(0.086)	(0.088)
*d_hv*fhead*		20.518 **	20.953 **		8.537	8.723		11.449 *	10.124 *
		(10.121)	(9.030)		(7.313)	(6.646)		(6.139)	(5.401)
*d_hv*cd*fhead*		-0.129 *	-0.163 **		-0.141	-0.228 *		-0.150	-0.209 **
		(0.071)	(0.072)		(0.097)	(0.131)		(0.091)	(0.098)
zm	No	No	Yes	No	No	Yes	No	No	Yes
R squared	0.14	0.31	0.38	0.17	0.20	0.30	0.27	0.28	0.34
F (p-value)	0.001	0.003	0.020	0.096	0.145	0.060	0.000	0.000	0.000
No. obs.	178	178	178	220	220	220	308	308	308
					Model C				
hv	-0.039 *	-0.053 **	-0.009	0.012	0.012	0.053 **	0.041	0.025	0.042
	(0.023)	(0.025)	(0.043)	(0.010)	(0.010)	(0.020)	(0.032)	(0.032)	(0.054)
cd	-0.029	-0.004	0.053	0.009	0.039	0.338 *	0.046	0.053	0.238 *
	(0.023)	(0.030)	(0.122)	(0.056)	(0.079)	(0.181)	(0.090)	(0.094)	(0.134)
*hv*cd*	0.0005	0.0006	0.0005	0.0003	0.0002	-0.0004	-0.0001	0.0001	0.0003
	(0.0004)	(0.0004)	(0.0007)	(0.0006)	(0.0007)	(0.0006)	(0.0005)	(0.0006)	(0.0006)
*hv*fhead*		0.317 **	0.326 **		0.202	0.227		0.143 **	0.125 **
		(0.127)	(0.125)		(0.184)	(0.162)		(0.066)	(0.056)
*cd*fhead*		0.029	0.021		0.047	-0.079		-0.081	-0.154 *
		(0.145)	(0.158)		(0.348)	(0.303)		(0.078)	(0.089)
*hv*cd*fhead*		-0.003	-0.004		-0.005	-0.006		-0.001	-0.001
		(0.005)	(0.005)		(0.011)	(0.009)		(0.001)	(0.001)
zm	No	No	Yes	No	No	Yes	No	No	Yes
R squared	0.16	0.41	0.45	0.21	0.26	0.46	0.38	0.42	0.49
F (p-value)	0.261	0.150	0.042	0.285	0.339	0.003	0.000	0.000	0.000
No. obs.	114	114	114	144	144	144	198	198	198

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

Note - Robust standard errors are in parentheses. *zm* includes *d_hv*fadlt*, *d_hv*madlt* (model B), *hv*fadlt*, *hv*madlt* (model C), *cd*fadlt*, and *cd*madlt*. Other control variables which are not shown here are time dummy, village-time dummies, and constant.

Table 7. Determinants of handicraft gift production per capita per month - trimmed least squares.

	Periods 1 and 2			Periods 1 and 3			Periods 1 and 4		
	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)	Eq. (1)	Eq. (2)	Eq. (3)
					Model B				
d_hv	-0.516	-5.724 *	-6.054	9.103	4.311	15.790	5.906	3.050	20.850
	(4.314)	(3.400)	(5.733)	(9.842)	(11.810)	(18.270)	(7.985)	(7.271)	(17.530)
cd	-0.021	-0.043	0.015	-0.077	-0.074	-0.025	-0.039	-0.043	0.063
	(0.016)	(0.045)	(0.071)	(0.078)	(0.083)	(0.156)	(0.128)	(0.128)	(0.159)
*d_hv*cd*	0.033	0.116 *	0.121 *	0.106	0.267	0.240 *	0.048	0.077	0.106
	(0.054)	(0.064)	(0.072)	(0.133)	(0.222)	(0.123)	(0.171)	(0.174)	(0.144)
*d_hv*fhead*		51.100 ***	48.380 ***		43.860 ***	34.810 **		24.270 **	4.976
		(15.570)	(16.620)		(15.170)	(15.830)		(11.860)	(16.300)
*d_hv*cd*fhead*		-0.302 ***	-0.302 ***		-0.442 *	-0.396 ***		-0.286 **	-0.224
		(0.106)	(0.116)		(0.240)	(0.152)		(0.137)	(0.155)
zm	No	No	Yes	No	No	Yes	No	No	Yes
Loss function	4271.9	2530.0	2416.5	9165.7	7976.5	7434.1	21736.9	20814.9	20051.4
Chi sq. (p-value)	0.000	0.000	0.000	0.374	0.028	0.014	0.000	0.000	0.000
No. obs.	684	684	684	600	600	600	684	684	684
					Model C				
hv	-0.048 **	-0.078	-0.121	0.026	0.019	0.017	0.060 **	0.032	-0.002
	(0.019)	(0.128)	(0.205)	(0.308)	(0.340)	(0.163)	(0.024)	(0.122)	(0.139)
cd	-0.053	0.022	0.185	0.203	0.316	0.504	0.009	-0.002	0.200
	(0.075)	(0.178)	(0.273)	(9.115)	(8.166)	(1.522)	(0.090)	(0.108)	(0.223)
*hv*cd*	0.0006	0.0007	0.0006	-0.0001	-0.0005	-0.0005	-0.0001	0.0001	0.0002
	(0.0007)	(0.0015)	(0.0012)	(0.0891)	(0.0808)	(0.0019)	(0.0004)	(0.0012)	(0.0007)
*hv*fhead*		0.798 ***	0.878 ***		0.462 ***	0.531		0.283	-0.021
		(0.110)	(0.129)		(0.161)	(0.371)		(0.401)	(0.317)
*cd*fhead*		-0.197	-0.096		0.009	-0.699		-0.540	-0.339
		(0.178)	(0.985)		(11.000)	(2.808)		(0.417)	(0.719)
*hv*cd*fhead*		-0.001	-0.006		-0.012	0.009		0.013	0.006
		(0.007)	(0.030)		(0.335)	(0.112)		(0.020)	(0.025)
zm	No	No	Yes	No	No	Yes	No	No	Yes
Loss function	3791.3	1669.3	1436.1	8063.7	6131.7	3332.7	9532.2	9102.7	8251.1
Chi sq. (p-value)	0.199	0.000	0.000	0.329	0.000	0.000	0.000	0.000	0.000
No. obs.	396	396	396	396	396	396	396	396	396

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

Note - Robust standard errors are in parentheses. *zm* includes *d_hv*fadlt*, *d_hv*madlt* (model B), *hv*fadlt*, *hv*madlt* (model C), *cd*fadlt*, and *cd*madlt*. Other control variables which are not shown here are time dummy and village-time dummies.

Table 8. Determinants of handicraft gift production - random-effects.

	Participation - linear probability			*Production per capita per month - conditional on participation*			*Production per capita per month - tobit*		
Periods	1 & 2	1 & 3	1& 4	1 & 2	1 & 3	1& 4	1 & 2	1 & 3	1& 4
					Model B				
d_hv	0.072	0.111	-0.139	-4.719	-1.866	0.962	0.222	5.318	-6.459
	(0.071)	(0.099)	(0.099)	(5.135)	(6.456)	(6.629)	(3.763)	(5.788)	(6.756)
cd	0.003 **	0.002	0.001	0.068	0.157 **	0.176 **	0.085 *	0.143 **	0.186 **
	(0.001)	(0.001)	(0.001)	(0.058)	(0.078)	(0.089)	(0.049)	(0.071)	(0.094)
*d_hv*cd*	-0.001	-0.001	0.001	0.053	0.090	0.043	9.713 **	1.697	1.027
	(0.001)	(0.001)	(0.001)	(0.057)	(0.100)	(0.096)	(4.205)	(6.540)	(7.939)
*d_hv*fhead*	0.064	-0.004	-0.014	18.068 **	7.148	6.750	-0.006	-0.010	0.041
	(0.077)	(0.107)	(0.111)	(7.360)	(6.005)	(5.168)	(0.039)	(0.057)	(0.071)
*d_hv*cd*fhead*	-0.001	0.000	0.003 **	-0.139 **	-0.190 *	-0.142 *	-0.064	-0.045	0.071
	(0.002)	(0.002)	(0.001)	(0.056)	(0.113)	(0.085)	(0.053)	(0.087)	(0.113)
fhead	0.042	0.033	0.007	0.859	-1.593	-4.389	-1.326	-0.713	-3.298
	(0.068)	(0.077)	(0.071)	(4.664)	(2.653)	(3.194)	(3.146)	(4.391)	(5.253)
fadlt	-0.013	-0.033	0.002	0.612	0.534	0.533	-0.753	-1.777	0.061
	(0.023)	(0.028)	(0.025)	(1.118)	(0.832)	(0.984)	(1.162)	(1.573)	(1.868)
madlt	0.072 ***	0.080 ***	0.069 ***	-0.723	0.212	-0.238	2.326 ***	3.306 ***	3.270 **
	(0.023)	(0.025)	(0.022)	(1.053)	(0.685)	(0.968)	(0.877)	(1.199)	(1.449)
F/Chi sq. (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.000
No. obs.	654	574	654	176	214	298	654	574	654
					Model C				
hv	-0.0003	0.0012	-0.0005	0.000	0.052 ***	0.052	-0.071	0.071 **	0.003
	(0.0004)	(0.0007)	(0.0009)	(0.042)	(0.016)	(0.045)	(0.058)	(0.032)	(0.038)
cd	0.0012	0.0001	0.0020	0.022	0.334 *	0.232 **	0.005	0.168 **	0.256 **
	(0.0015)	(0.0024)	(0.0017)	(0.092)	(0.176)	(0.109)	(0.076)	(0.082)	(0.103)
*hv*cd*	0.00001 **	-0.00001	0.00000	0.001	0.000	0.000	0.101 *	-0.050	-0.099 **
	(0.0000)	(0.0000)	(0.0000)	(0.000)	(0.000)	(0.000)	(0.052)	(0.040)	(0.049)
*hv*fhead*	0.0008 *	-0.0010	-0.0010	0.251 **	0.171	0.144 ***	0.144	-0.030	-0.141
	(0.0004)	(0.0007)	(0.0008)	(0.104)	(0.130)	(0.039)	(0.100)	(0.115)	(0.121)
*cd*fhead*	0.0011	0.0015	0.0004	0.057	-0.007	-0.065	0.001 **	0.000	0.000
	(0.0017)	(0.0018)	(0.0017)	(0.125)	(0.230)	(0.075)	(0.001)	(0.000)	(0.000)
*hv*cd*fhead*	-0.00003 ***	-0.00001	0.00005 ***	-0.003	-0.007	-0.002 **	-0.003	-0.001	0.004 ***
	(0.0000)	(0.0000)	(0.0000)	(0.004)	(0.007)	(0.001)	(0.002)	(0.002)	(0.001)
fhead	0.075	0.137	0.032	-1.146	-1.325	-7.081 **	2.123	6.918	-1.752
	(0.085)	(0.090)	(0.088)	(3.065)	(2.507)	(3.543)	(3.747)	(5.010)	(5.341)
fadlt	-0.027	-0.023	-0.007	1.734	1.845 *	0.069	-0.939	0.445	-0.846
	(0.035)	(0.037)	(0.035)	(1.083)	(1.048)	(0.898)	(1.591)	(2.053)	(2.285)
madlt	0.085 ***	0.070 **	0.081 ***	-1.160	0.797	-0.803	2.249 **	2.857 *	3.639 **
	(0.032)	(0.030)	(0.030)	(0.857)	(0.598)	(0.741)	(1.145)	(1.544)	(1.680)
F/Chi sq. (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.398	0.022	0.000
No. obs.	378	378	378	112	140	190	414	378	414

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

Note - Robust standard errors are in parentheses. Other control variables which are not shown here are *d_hv*fadlt*, *d_hv*madlt* (model B), *hv*fadlt*, *hv*madlt* (model C), *cd*fadlt*, *cd*madlt*, no. children, age of household head, education of household head, land per capita, fishing capital per capita, mean age of female adults, highest education of female adults, time dummy, village dummies, village-time dummies, and constant.