Risk-Sharing Networks in Rural Philippines

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Abstract

Using detailed data on gifts, loans, and asset sales, this paper investigates how rural Filipino households deal with income and expenditure shocks. We find that shocks have a strong effect on gifts and informal loans, but little effect on sales of livestock and grain. Mutual insurance does not appear to take place at the village level; rather, households receive help primarily through networks of friends and relatives. Certain shocks are better insured than others. The evidence is consistent with models of quasi-credit where risk is shared within networks through flexible, zero interest informal loans combined with pure transfers.

Keywords: risk sharing; informal credit; insurance; gifts; consumption smoothing

JEL codes: O12; Q12.

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Risk-Sharing Networks in Rural Philippines

Life in the world's poorest countries is plagued by risk. The vagaries of health, weather, crop pests, and job opportunities create large income variations over time. In addition, households must incur large expenditures such as medical costs and funeral celebration, the timing of which is not always foreseable. With per capita incomes low in even the best times, unmitigated income and consumption shocks can have devastating consequences. A growing body of evidence has shown that, while household income in developing countries varies greatly, consumption is remarkably smooth (e.g., Townsend (1994), Morduch (1991), Paxson (1992), Jacoby and Skoufias (1997)). Given the absence of formal insurance, this suggests that informal institutions allow households to counter the effects of income variation. These studies, however, do not indicate how risk sharing takes place. They also do not account for unforeseable expenditures such as funeral costs and medical bills.

This paper aims at filling these gaps using original data from the rural Philippines. Results indicate that gift giving and informal credit allow households to share risk within confined networks of family and friends (e.g., Ben-Porath (1980), Platteau (1991), Fafchamps (1992)). Risk is shared through flexible, zero interest informal loans rather than gifts. Households with high levels of outstanding informal debt borrow less. Certain types of risk are better insured than others. Finally, shocks do not trigger livestock and grain sales, possibly because these assets are unimportant in the area studied.[1] Financial savings, however, appear to be used to deal with risk, as in Lim and Townsend (1998) and Behrman, Foster, and Rosenzweig (1997). Taken together, the evidence rejects

[1] See Fafchamps, Udry, and Czukas (1998) regarding livestock in West Africa.

models of risk sharing in rural communities as Arrow-Debreu economies with combined credit and insurance markets (e.g., Udry (1994), Townsend (1995)) but is consistent with models of quasi-credit where enforcement constraints limit gift giving (e.g., Kocherlakota (1996), Ligon, Thomas and Worrall (1996), Fafchamps (1999)).

The approach adopted here is closest to that of Udry (1994), with several important differences. First, gifts and transfers are not included in Udry's work; they are included here. Second, Udry (1994) shows that the *repayment* of informal loans is contingent upon shocks affecting debtor and creditor. The primary source of repayment variation behind Udry's results is changes in realized interest rate due to debt postponement (Udry, 1990). Since the magnitude of this variation is small, contingent repayment can only compensate for a small portion of actual shocks. In contrast, we focus on net financial flows and show that loans and gifts themselves vary with shocks; the magnitude of the effects we document is thus much larger. Third, Udry's analysis is potentially subject to selection bias since partners' shocks used as regressors are those affecting *actual* lenders and borrowers; ours relies instead on shocks affecting *potential* lenders and borrowers. Although this approach does not entirely eliminate the possibility of selection bias, it seriously reduces it. Fourth, Udry's analysis does not cover other insurance instruments such as savings and labor market participation; they are included here. Fifth, our coverage of different types of shocks is more comprehensive than Udry's. Last but not least, Udry does not have panel data and cannot therefore control for unobserved household characteristics that are invariant over time but affect the willingness to give and lend to others, such as altruism and affection (e.g., Fafchamps (1999)). In contrast, the work presented here controls for household fixed effects.

In Section 1 we draw upon the works of Mace (1991), Cochrane (1991), Altonji, Hayashi, and Kotlikoff (1992), and Townsend (1994) to motivate a simple empirical model of risk sharing. The data are presented in Section 2. The importance of informal credit and the role that gifts and credit play in dealing with risk are emphasized. The empirical analysis is presented in in Section 3. Conclusions appear at the end.

Section 1. The Testing Strategy

The objective of this paper is to examine the risk sharing behavior of rural households in the Philippines. The starting point of our analysis is that, if risk is shared efficiently, individual consumption should be unaffected by idiosyncratic variations in income. To see why, consider a closed exchange economy without storage. There are N individuals in the economy, each with an uncertain income $y^i_{s_t}$, where $s_t \in S$ stands for the state of nature and $i \in \{1, ..., N\}$. The vector $(y^i_{s_t}, ..., y^N_{s_t})$ denotes the realized incomes of all agents in the economy at time t when $S = s_t$. Agents derive instantaneous utility $V_i(c^i_{s_t,t}, h^i_{s_t,t})$ from consumption $c^i_{s_t,t}$, with at least some agents risk averse. $h^i_{s_t}$ is a preference shock meant to capture the need to cover unusual expenditures such as medical bills, funeral expenses, and school fees. Pareto efficiency requires that ratios of agents' marginal utilities be equalized across states of nature:

$$\frac{V'_i(c^i_{s_t,t}, h^i_{s_t,t})}{V'_i(c^i_{s'_t,t}, h^i_{s'_t,t})} = \frac{V'_j(c^j_{s_t,t}, h^i_{s_t,t})}{V'_j(c^j_{s'_t,t}, h^i_{s'_t,t})} \quad \text{for } all \quad t, i, j, s_t, s'_t \tag{1}$$

By postulating constant absolute risk aversion of the form:

$$V(c, h) = -\frac{1}{\gamma} e^{-\gamma(c-h)} \tag{2}$$

equation (1) can be manipulated to yield a relationship between individual and aggregate consumption (e.g., Mace (1991), Cochrane (1991), Altonji, Hayashi, and Kotlikoff

(1992), Townsend (1994)):[2]

$$c^i_{s_t,t} = h^i_{s_t} - \frac{1}{N}\sum_{j=1}^{N} h^j_{s_t} + \frac{1}{N}\sum_{j=1}^{N} c^j_{s_t,t} + \frac{1}{\gamma}(\log\omega^i - \frac{1}{N}\sum_{j=1}^{N}\log\omega^j) \qquad (3)$$

where ω^i is agent *i*'s implicit welfare weight.

Equation (3) has been used extensively as a basis for testing efficient risk sharing. It implies that, if risk is shared efficiently, individual income should have no effect on individual consumption. Efficient risk sharing can thus be tested by regressing individual consumption on average consumption and individual income and testing whether the income coefficient is non-significant and the coefficient on aggregate consumption is 1/*N*. Tests based on equation (3) -- or its first-difference version -- indicate that risk is pooled to a considerable degree, although efficient risk sharing is often rejected for certain categories of shocks or households (e.g., Mace (1991), Cochrane (1991), Altonji, Hayashi, and Kotlikoff (1992), Townsend (1994), Morduch (1991), Kurosaki and Fafchamps (2001)). These tests, however, provide little information as to how risk is actually shared and what explains departures from full efficiency.

This paper fills this gap using evidence on risk sharing practices among Filipino villagers. Available evidence suggests that gifts and remittances partly serve the purpose of risk sharing (e.g., Ravallion and Dearden (1988), Lucas and Stark (1985), Rosenzweig (1988), Rosenzweig and Stark (1989), Platteau (1991)). Work by Rosenzweig (1988), Platteau and Abraham (1987), Townsend (1995) and Udry (1990, 1994) further indicates that informal credit also plays a role of insurance substitute.[3] Asset sales and purchases

[2] A similar expression in the log of consumption can be derived using constant relative risk aversion instead (see Mace (1991), Cochrane (1991)). A CRRA formulation would not be fruitful here as it results in a log formulation that is not amenable to an analysis of gifts, informal loans, and asset sales. In case utility is not CARA, the equation we estimate can be understood as an approximation. Since we use household fixed effects, the damage done by erroneously assuming CARA is probably very limited (see below).

have also been shown to serve a precautionary role, thereby *de facto* sharing risk among economic agents (e.g., Deaton (1990, 1992), Rosenzweig and Wolpin (1993), Chaudhuri and Paxson (1994), Lim and Townsend (1998), Fafchamps and Pender (1997), Fafchamps, Udry, and Czukas (1998)).[4] This paper investigates whether asset sales, gifts, and informal loans serve to efficiently share risk. Let $g^i_{s,t}$ and $b^i_{s,t}$ denote the net gifts received and net informal borrowing of household i in state s at time t, respectively. Further let $\Delta\, w^i_t$ be shorthand notation for change in household assets. By definition:[5]

$$c^i_{s,t} = y^i_{s,t} + g^i_{s,t} + b^i_{s,t} + \Delta\, w^i_t \tag{4}$$

Equation (4) can then be rewritten:

$$g^i_{s,t} + b^i_{s,t} + \Delta\, w^i_t = \\ -y^i_{s,t} + h^i_{s_t} - \frac{1}{N}\sum_{j=1}^{N} h^j_{s_t} + \frac{1}{N}\sum_{j=1}^{N} c^j_{s_t,t} + \frac{1}{\gamma}(\log\omega^i - \frac{1}{N}\sum_{j=1}^{N}\log\omega^j) \tag{5}$$

To empiricize equation (5), household income $y^i_{s,t}$ is decomposed into a permanent component $y^{iP}_{s_t,t}$ and a transitory component $y^{iT}_{s_t,t}$ with:

$$y^i_{s,t} = y^{iP}_{s_t,t} + y^{iT}_{s_t,t} \tag{6}$$

Together with welfare weights ω^i, the permanent component of income is regarded as a function of a vector of individual characteristics and initial assets X^i_t.[6] Transitory income $y^{iT}_{s_t,t}$ and preference shifters $h^i_{s_t}$ depend on observed individual shocks $z^i_{s_t,t}$. Using observable shocks has two advantages over the alternative of constructing shocks from income

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[3] The role of credit as a smoothing device has long been recognized in the sovereign debt literature (e.g., Eaton and Gersovitz (1991), Kletzer (1984), Grossman and Van Huyck (1988)).

[4] Although precautionary saving does not explicitly pool risk, in equilibrium asset markets serve *de facto* to redistribute risk among agents: those with excess consumption goods, e.g., food, end up exchanging them against real assets, and *vice versa* (e.g., Sargent (1987), Chapter 3).

[5] Both $g^i_{s,t}$ and $b^i_{s,t}$ are cash flow concepts: gifts given are subtracted from gifts received; repayment of past loans and lending out are subtracted from new borrowing to construct net new borrowing $b^i_{s,t}$.

[6] Here we ignore risk coping strategies that work on income directly, such as switching labor supply from on-farm to off-farm work (e.g., Kochar (1999), Imai (2000)) or adjusting labor supply (e.g., Fafchamps (1993)). We revisit this issue in the empirical part.

data (e.g., Paxson (1992), Fafchamps, Udry, and Czukas (1998)). First, it is less subject to measurement error. Second, it makes it possible to incorporate in the analysis consumption shocks as well as income shocks. Unobserved aggregate variables $\frac{1}{N}\sum_{j=1}^{N} h^j_{s_t}$ and $\frac{1}{N}\sum_{j=1}^{N} c^j_{s_t,t}$ can be replaced by village-time dummies V_t.[7] With these assumptions, equation (5) becomes:

$$g^i_{s,t} + b^i_{s,t} + \Delta w^i_t = \alpha_0 + \alpha_1 z^i_{s_t,t} + \alpha_2 X^i_t + \alpha_3 V_t + \varepsilon^i_t \qquad (7)$$

where ε^i_t is a disturbance term. If risk is efficiently shared among all villagers, coefficients on the shock variables $z^i_{s_t,t}$ should all be significant and of the same order of magnitude as the income shortfall or excess expenditure that they entail. Furthermore, shocks affecting a subset of villagers should not influence net flows of funds to household *i* in a way that is not already captured by V_t. Equation (7) can thus be used to test efficiency of risk sharing provided we have data on gifts, loans, changes in assets, shocks, and household characteristics.

Albeit we delve on risk sharing efficiency in the empirical part of the paper, testing efficiency is not our primary goal. Rather, we use equation (7) as starting point for an investigation of how risk is shared. Theory is unclear as to which of the three channels -- transfers $g^i_{s,t}$, loans $b^i_{s,t}$, or changes in assets Δw^i_t -- is most effective in sharing risk. With perfect and complete markets, the choice is irrelevant and indeterminate. But in a world of imperfect markets, the choice of insurance instrument and the achievable efficiency level depend on market imperfections. For instance, if insurance markets are missing (and gift giving is also absent), insurance takes the form of precautionary saving; the

[7] Ravallion and Chaudhuri (1997) argue that the use of village-time dummies in risk sharing regressions is preferable to aggregate measures of consumption because they are less subject to bias.

accumulation and liquidation of assets is the primary way by which households deal with risk Deaton (1991). Agents' ability to use their savings to deal with shocks requires that they have accumulated sufficient wealth (e.g., Deaton (1990, 1992)). If they have insufficient wealth to smooth consumption on their own, their capacity to deal with risk depends critically on their ability to borrow (e.g., Zeldes (1989a, 1989b)). Carroll (1990) has shown that net borrowing is essentially impossible unless contingent repayment is allowed in the form of bankruptcy or excusable default. By extension, risk sharing can take the form of fully contingent credit contracts as in Udry (1994), Townsend (1995).

When households are altruistic, insurance against idiosyncratic shocks can be achieved through informal gifts and transfers, together with income redistribution via transfers and migrant remittances (e.g., Ravallion and Dearden (1988), Foster and Rosenzweig (2001), Lucas and Stark (1985), Scott (1976), Cox (1987), Datta and Nugent (1984), Nugent (1990), Altonji, Hayashi and Kotlikoff (1992)). Self-interested households can also form self-enforcing mutual-help arrangements (e.g., Posner (1980), Kimball (1988), Coate and Ravallion (1993), Fafchamps (1992), and Ligon, Thomas, and Worrall (2000)). With imperfect commitment but no assets, informal risk sharing arrangements are more easily satisfied if straight gifts are combined with contingent credit (e.g., Kocherlakota (1996), Ligon, Thomas and Worrall (2000)). The reason is that credit builds a more direct relationship between giving and reciprocating. Fafchamps (1999), for instance, shows that limited commitment risk sharing contracts combine gifts with zero-interest, contingent-repayment loans. The use of credit together with gifts (e.g., Udry (1990, 1994)), and the apparent preference for informal credit as a means to pool risk (e.g., Rosenzweig (1988), Platteau and Abraham (1987)) are consistent with these ideas. Formal empirical investigation seems to support the idea of imperfect commitment

constraints (e.g., Ligon, Thomas and Worrall (1996), Foster and Rosenzweig (2001)). The interaction between informal risk sharing and individual saving behavior is studied by Ligon, Thomas and Worrall (2000) who show an enhanced storage technology can either improve or diminish welfare. Foster and Rosenzweig (2000) provide some empirical evidence that better opportunities for precautionary saving need not crowd out informal risk sharing.

Regressing $g^i_{s,t}$, $b^i_{s,t}$ and Δw^i_t separately on individual shocks will tell us which of these three possible mechanisms serves an insurance purpose.[8] It should also shed light on what market imperfections are present. The originality of this paper is elsewhere, however. The literature on informal risk sharing has long recognized the role that social networks play in the circulation of gifts and informal loans (e.g., Platteau (1991), Platteau and Abraham (1987)). One possible reason is that transfers and informal borrowing only take place among closely connected individuals, either because altruism must be nurtured by intimate personal contact, or because the prospect of repeated interaction is required for the promise of reciprocity to be credible. The role of social networks has yet to be documented directly. Filling this gap is the primary objective of this paper.

Started long ago in sociology (e.g., Mitchell (1969), Granovetter (1995)), the literature on social networks has recently reached economics and is expanding rapidly (e.g., Bala and Goyal (2000), Kranton and Minehart (2001)). Given that the focus of this paper is empirical, we limit ourselves to a few intuitive observations. Consider an economy in which exchange between two agents can only take place if a social link exists between them. The pattern of social links is taken as given. If economic exchange is frictionless

[8] A similar approach has recently been applied by Imai (2000) for the Indian ICRISAT villages.

(no imperfect commitment, no asymmetric information), allocative efficiency is achieved provided that the network is connected (or open), that is, provided that no individual or group of individual is isolated from the social network. As long as the network is connected, a path exists for all possible exchanges and all opportunities for mutually beneficial trade can be exhausted.[9] The details of network pattern are irrelevant. The fact that households receive gifts and loans from network members is thus not, by itself, evidence that risk is inefficiently shared: efficient risk sharing could be achieved through social networks provided exchange is frictionless and individual networks overlap so that no villagers is left out. In contrast, if we have a series of unconnected (or closed) networks among which exchange is not possible, then risk sharing is limited to members of one's sub-network. In terms of equation (7), this means replacing village dummies with sub-network dummies. This is the approach, for instance, adopted by Morduch (1991) and Townsend (1994) when they examine whether consumption smoothing takes place within village sub-groups such as castes.

Now consider the more general case where the social network is open but there is friction in exchange. Friction may arise because of convex transactions costs, imperfect commitment, asymmetric information, or any other process that limits exchange. With friction, allocative efficiency need not be achieved if agents located 'in between' are unable to intermediate exchange between unconnected agents. To make this clear, suppose there are three agents, *A*, *B*, and *C*.[10] Agent *B* is connected to both *A* and *C* and has

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[9] This is a sufficient -- not a necessary -- condition for efficiency. If opportunities for trade do not exist between certain groups or agents, there is no need for a link between them.

[10] For simplicity of exposition, the discussion that follows abstracts from assets. In the empirical section of the paper, we show that in the study area, assets do not play an important role in dealing with short-term risk.

entered in a mutual insurance arrangement with each of them separately. Suppose *A* is doing poorly and *C* is doing well. If *B* is doing well too , he can then help *A*. But if he is doing poorly, he cannot help *A* directly. If *B* could ask *C* for help on behalf of *A*, there would be no problem: what *A* receives would not depend on the fact that *B* is doing poorly. Suppose instead that *B* cannot ask *C* for help on behalf of *A*, perhaps because of moral hazard or lack of trust (e.g., *C* can observe *B*'s situation but cannot observe *A*'s). Of course, *B* could share with *A* the help he received from *C*, but what he would give to *A* would still be less than if *B* was doing well. The conclusion is that *B* cannot help *A* as much when *B* is himself in trouble: what *A* gets depends on how *B* is doing. This example illustrates that, in the presence of friction, risk sharing depends on shocks affecting one's social network.

These ideas can be empiricized as follows. Suppose each household i is endowed with a network of friends and relatives on which it can rely in case of need. The size p_j of this sub-network is part of the household's social capital and is regarded as predetermined by personal history. Further assume that risk sharing is achieved via gifts and loans, so that assets can be momentarily ignored. If risk is efficiently shared within the confines of the sub-network, then a modified version of equation (7) can be derived as:

$$g^i_{s,t} + b^i_{s,t} + \Delta w^i_t = \alpha_0 + \alpha_1 z^i_{s_t,t} + \alpha_2 z^{p_i}_{s_t,t} + \alpha_3 X^i_t + \alpha_4 X^{p_i}_t + \alpha_5 V_t + \varepsilon^i_t \qquad (8)$$

where $X^{p_i}_t$ stands for network characteristics that control for differences in permanent income and welfare weights. The combined shocks affecting members of i's network are denoted $z^{p_i}_{s_t,t}$ with:

$$z^{p_i}_{s_t,t} \equiv \sum_{j \in p_i} z^j_{s_t,t} \qquad (9)$$

If risk is efficiently shared among all villagers via gifts and loans, then it should be that $\alpha_2 = 0$. If, however, social networks are not frictionless, $\alpha_2 > 0$. This simple observation is the basis for our testing strategy.[11] The size of $-\alpha_2$ relative to α_1 also enables us to indirectly evaluate how much friction exists in the sharing of risk through social networks. Going back to our example, if *B* does not share with *A* funds he received from others, then the coefficients of *A*'s and *B*'s shocks are the same, albeit with the opposite sign: $\alpha_1 = -\alpha_2$. If friction is present but some intermediation takes place, e.g, *B* shares with *A* some of the help he received from others, we have $\alpha_1 > -\alpha_2 > 0$. Finally, if *B* is capable of obtaining funds from others on behalf of *A*, then α_2 tends to 0. The value of α_2 is thus a measure of friction in the circulation of funds for risk sharing purposes.

Equation (9) also enables us to test whether all types of shocks are partially and fully insured via gifts and informal loans: shocks that are at least partially insured in this manner should have a significant coefficient in equation (9). Furthermore, the coefficient of fully insured shocks should be commensurate with the income shortfall or extraordinary expenditure associated with such shock. In the presence of asymmetric information, shocks that are easily and unambiguously observed should be better insured than shocks for which 'false claims' are easier to make (e.g., Fafchamps (1992), Ligon (1998)). The degree to which certain types of shocks are insured should thus depend on their observability. We examine whether shocks that we suspect to be more widely observable are better insured than shocks for which falsification is easier.

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[11] The test could be generalized by adding shocks affecting the members of one's partner's network. In our example, suppose that *B* shares with *A* the help he receives from *C*. If *C* himself is doing poorly, *B* has nothing to share with *A*. How much *A* receives thus depends not only *B*'s shock but also on *C*'s. The same argument can be recursively applied to the entire network. Unfortunately, we do not have data on shocks faced by members of one's partner's network.

We also investigate whether altruism alone can explain risk sharing practices, or whether well understood self-interest motivates gift giving and informal lending. Recent theory suggests that informal risk sharing arrangements subject to voluntary participation constraints are more efficient if they 'remember' past transfers of funds. Building upon the works of Kocherlakota (1996), Foster and Rosenzweig (2001), and Ligon, Thomas, and Worrall (1996), Fafchamps (1999) argues that a natural form for constrained efficient arrangements is zero-interest personal loans with open-ended repayment period, as those documented by Platteau and Abraham (1987) and Udry (1990, 1994). In contrast, if risk sharing is purely based on altruism, informal credit is an unnecessary complication and Pareto efficient risk sharing can simply be achieved via risk pooling -- i.e., via 'memory-less' gifts and transfers.[12] To test this idea, we run all regression equations separately on gifts and loans. If risk sharing is achieved mainly thanks to altruistic feelings, gifts should be the primary -- if not the only -- form of mutual insurance. In contrast, if participation is build upon well understood self interest, informal credit should be the dominant form of risk sharing.

The validity of above test rests on the assumption that gifts are memoryless while loans are not. It is, however, conceivable that individuals keep a precise record of what they have given in the past and condition future help on repayment of previous gifts. To verify this possibility, we also test whether past gifts affect current transfers. Agents who

[12] Strictly speaking, gift exchange as the equilibrium of a repeated game cannot be memoryless: mutual assistance is conditioned upon reciprocity and failure to reciprocate must be punished for participation constraints to be satisfied (e.g., Kimball (1988), Coate and Ravallion (1993)). In equilibrium, therefore, agents must remember past violations of norms of behavior. These norms, however, may either be forgetful or keep track of members' past contributions. In addition, Foster and Rosenzweig (2000) have shown that, in the presence of individual saving, an effect of lagged transfers on current transfers might arise even in the presence of perfect commitment if one does not condition on net changes in the savings of partners.

have borrowed in the past should, on average, repay their debts; outstanding debt should thus have a negative effect on net borrowing. In contrast, past gifts should not affect current gifts or borrowing if gifts are forgotten.

Section 2. The Data

Having presented the conceptual framework and testing objectives, we now describe the data. A survey was conducted by the authors in four villages in the Cordillera mountains of northern Philippines between July, 1994 and March, 1995. A random sample of 206 rural household was drawn after taking a census of all households in selected rural districts. These households are dispersed over a wide area; most can only be reached by foot. Three interviews were conducted with each household at three month intervals between July 1994, just after the annual rice harvest, and March 1995, after the new rice crop had been transplanted. Because the survey was designed specifically to address whether households share risk, the data contain a rich and unique set of variables about each respondents' mutual insurance network.

Since an objective of the survey is to investigate whether respondents borrow or receive less when members of their network face an adverse shock, it is important to define insurance networks in a way that is not endogenous to borrowing or gift giving itself. If insurance networks were defined as the individuals from whom respondents have actually borrowed, we would naturally expect funds to flow from those with excess transitory income to those without. Finding that lenders and gift givers had enjoyed beneficial shocks -- and vice versa -- would hardly constitute evidence of network effects.

To eliminate this bias, *ex ante* insurance networks are defined as follows. At the beginning of the survey, each household was asked to identify a number of individuals on which it could rely in case of need or to whom the respondent gives help when called upon to do so. Respondents listed on average 4.6 individuals, with a minimum of 1 and a maximum of 8. These individuals constitute what we subsequently call the network of insurance partners of each household. Most of these insurance partners are close family members such as children or siblings. Approximately 941 network members were identified during the survey. Of these, 283 or 30% are (members of) households already in the survey. In 168 of these cases, both respondents cite each other as network partners, resulting in 84 identifiable pairs of interlinked households. In the rest of the cases, only one respondent cited the other household as member of their network. This is not too surprising given that our network measure identifies the relationships that are most important to respondents; that A matters to B need not imply that B matters to A. Still, it serves as reminder that our measure does not capture all the relationships that respondents are involved in. The network partners we have identified probably constitute the nucleus of a larger, more diffuse network which is difficult to quantify.

Data were collected on the characteristics of each households and all its network partners, such as cultivated area, household composition, age of head, and professional skills. Respondents were also asked to list all gifts, transfers, remittances, and loans taking place within the last three months of each survey round. Great care was taken to collect data on all possible in-kind transfers and payments, including crops, meals, and labor services. The characteristics of each transaction were recorded. Some, but not all, of these transactions take place with the core network members (see below). Data were collected on a variety of income and consumption shocks, such as crop failure,

unemployment, sickness, and funerals,[13] not only for respondents, but also for their network partners. In addition, we collected an aggregate subjective measure based on respondents' own assessment of their financial situation; responses range from -2 for very good to +2 for very bad. This measure combines many simultaneous shocks and allows respondents to attach their own weight to particular events.[14] A similar subjective measure was collected for each network member.[15] Data are available on each of 206 households for three survey rounds (see Lund (1996) for details).

Survey results show that sample households derive most of their income from non-farm activities (Table 1). There are indeed many skilled artisans in this area, and their wood carvings, woven blankets, and rattan baskets supply a growing tourist and export trade. Unearned income -- mostly land rentals -- is not negligible but very unevenly distributed across households, as is often the case with asset income. Although nearly all households operate their own farm, the majority do not produce enough grain to meet annual consumption needs. In terms of livestock, they only keep a few pigs and some fowl. Sales of crops and livestock account for a minute fraction of total income. Surveyed households are net recipients of gifts and informal loans -- including remittances from migrant workers. Net gifts and informal loans, after deduction of loan repayments, together represent nearly as much as crop income.

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[13] Other ritual events, such as sickness, that require the organization of traditional religious ceremonies are included as well.

[14] For example, one respondent whose spouse had been very sick paradoxically ranked herself better during the survey period than during the preceding one. When questioned, the respondent explained that a child got a new job, and that this happy event far outweighed the costs of her husband's sickness.

[15] Using the observations for which network members are in the sample, we can verify whether self-reported subjective rankings generally agree with those reported for network members. The correlation coefficient is 0.29, which is highly significant. The Pearson $\chi^2(16)$ statistic is 87.8, which strongly rejects independence between the two distributions. Thus, respondents appear to be informed about the situation other households in their network, but only imperfectly so.

Gifts and transfers are extremely common in the survey area (Table 2). The overwhelming majority of transfers come from close family members, some of whom have migrated elsewhere and send remmittances to their home village. The vast majority of rural credit transactions are composed of consumption loans between relatives and neighbors. Borrowing from formal credit institutions is rare: only 7% of loans in the study are from credit cooperatives, banks, or government organizations.[16] Because these loans are larger, however, they account for 22% of new loans in value terms. Formal loans are mostly disbursed for production purposes. Store credit and advances from middlemen account for 21% of all new loans and another 12% of new loan value. The remainder, which we call informal loans, are exchanged between people who know each other well.

In value terms, loans from family and friends represent 71% of new borrowing (Table 2). The majority of gifts and transfers and more than two thirds of informal loans are from relatives; the rest are from neighbors and friends. There is, however, a sharp difference between gifts and loans in that the former are more frequent with close parents while the latter are more common with distant relatives. Over 80% percent of informal lending occurs between households in the same village; virtually all others loans are taken from adjacent villages. About 20% percent of all new loans -- 30% percent of informal loans -- are with insurance network members; the rest are with other households in the village.

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[16] The small percentage of formal sector loans in the study is consistent with other studies of rural credit. Udry (1990, 1994) finds that only 7% of loans in northern Nigeria are from the formal sector. Rosenzweig (1988) reports that 13% of loans in the ICRISAT dataset are from formal institutions. In a study of informal credit in Asia, Ghate (1992) suggests that up to 1/2 of all loans are informal in Thailand, up to 2/3 are informal in Bangladesh, and over 2/3 are from informal sources in the Philippines.

Even when they do not consider each other as part of an insurance network, borrowers and lenders are well-acquainted: in nearly all cases, they describe each other as relatives or friends and in more than 85% of the cases, respondents were able to provide a complete accounting of the wealth holdings and demographic characteristics of *all* their loan partners. Lenders and borrowers can thus be regarded as a 'second tier' network with whom interaction is less frequent and risk sharing takes the form not of gifts but of loans. On average, lenders and borrowers tend to be slightly older and to reside closer to the respondent than network members. The latter are also more likely to have exchanged loans and gifts in the past. The two groups do not, however, differ much in terms income ranking.

Participation in gift giving and informal lending is widespread (Table 3). All households received or gave at least one gift during the 9 months of the survey; 94% received and gave at least once during each round. Only three households in the sample of 206 were not involved in any informal credit transactions over the three survey rounds, while 92% of the households borrowed and 61% lent. Over half of the sample households participated in both borrowing and lending.

Gifts and informal loans are not exchanged on an anonymous basis within a large community or market but rather through a network of personalized relationships. 92% of households have had credit transactions with their current loan partners in the past, and the same number expect to transact again in the future. Over half the households have reversed roles with their loan partners: current borrowers have given loans to their lender in the past and current lenders have received loans from borrowers. The same is true for transfers. Obtaining gifts and credit in the future may thus be a motivation for extending gifts and loans today. Furthermore, repeated interaction seems required to build trust

between network partners: during the interviews, many respondents stressed the role of trust building before gifts and loans can take place.

Most gifts and informal loans are taken for consumption rather than investment purposes.[17] Table 4 indeed shows that the most common reason for accepting a gift or borrowing is to meet immediate consumption needs. Only 3.8% of all gifts and 18.4% of informal loans are used for investment purposes, mostly schooling. This raises the possibility that the primary motivation behind gifts and informal loans is to smooth consumption. The reciprocal nature of transfers is further brought out by the number of gifts motivated by the desire to repay for a previous loan or gift. In addition, respondents explicitly reported that 6% of the loans were taken so that the borrower could give or lend the money to someone else. The fact that households act as intermediaries in transferring loans from one friend to another indicates that informal credit is not exchanged through a market system but rather through a network of personal contacts. The small proportion of relending in total lending nevertheless suggests that loan intermediation is not frictionless; efficient risk sharing would probably require more intermediation than is apparent in the sample. We revisit this issue in detail later.

Informal loans appear quite flexible. None have written contracts, less than 3% specify repayment schedules, and only 1% require collateral. Although 18% of the informal loans repaid during the survey period were not repaid in full, and 6% actually earned a negative return, in only one instance did a lender claim that a default had taken place. In the other cases both lenders and borrowers agreed to forgive part of the loan due to the borrowers' difficult economic circumstances. Both parties insisted that the loan

[17] Loans from banks and credit cooperatives, in contrast, are given for investment purposes only. Kochar (1997) reports similar restrictions on formal lending in India.

obligation had been met in full and future loan transactions would take place. By the same token, in 10% of all loans the borrower repaid *more* than the amount owed. Similar evidence has been reported by Udry (1994) and Platteau and Abraham (1987).[18]

The majority of informal loans, nearly 80%, charge no interest. This feature, which is shared by most loans between friends and relatives around the world (e.g., Ben-Porath (1980), Zeller et al. (1993)), is incompatible with regarding informal loans as market transactions that mix elements of credit and insurance (e.g., Udry (1994), Townsend (1995)).[19] It is, however, in line with viewing such loans as manifestations of informal risk sharing arrangements that must satisfy voluntary participation constraints (e.g., Fafchamps (1999)).

Section 3. Empirical Analysis

To investigate whether gifts and informal loans serve to spread risk, we begin by testing whether gifts $g^i_{s_t,t}$ and net informal borrowing $b^i_{s_t,t}$ rise when households face a severe shock, but fall when their partners face a similar shock. Gifts include transfers received from all sources, both in cash and in kind; transfers given are subtracted. Informal borrowing is calculated as new loans received minus new loans given, plus loan repayments received minus loan repayments paid. Payment and repayment in kind are included as well.

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[18] Given these features, one may wonder whether such transactions should be called loans or something else entirely, such as quasi-credit as in Platteau and Abraham (1987). What is important for our purpose is that respondents draw a sharp distinction between the two in that the obligation to repay an informal loan is regarded as much stronger than the diffuse obligation to reciprocate a gift. Quasi-credit is formalized in Fafchamps (1999).

[19] In an Arrow-Debreu equilibrium with combined credit and insurance, the interest rate should be strictly positive on average as long as agents discount the future. In addition, the period-to-period interest rate should vary with current conditions, i.e., be higher when the current situation is bad and low when it is good (e.g., Udry (1994)). None of these features are observed in the data.

We begin with a simple non-parametric analysis. For this purpose, we construct a summary shock variable for each household that takes the value 1 if the household faced a severe sickness, a funeral, or unemployment of the household head or his/her spouse -- and 0 otherwise. A similar variable is constructed for each network partner. A simple *t*-test is then conducted on $g^i_{s_t,t}$, $b^i_{s_t,t}$, and $g^i_{s_t,t} + b^i_{s_t,t}$. Based upon Tables 2 and 3, one would expect informal borrowing not to depend much on network shocks given that most loans take place with individuals that were not identified as members of respondents' network. In contrast, we expect network shocks to be important determinants of gifts and transfer, given that they predominantly take place with network members.

Results, presented in Table 5, do not fully conform with expectations. Households that faced severe shocks during the survey are shown to have received both more gifts and more informal loans; the difference is statistically significant in each case. Results also show that households whose network has been affected by a severe shock receive fewer transfers and loans. Although the difference is large in both cases, it is only marginally significant for gifts (p-value of 0.13). In other words, informal borrowing appears more sensitive to network shocks than gifts.

The fact that network shocks influence gifts and loans raises suspicion regarding the efficiency of risk sharing: if gifts and loans share risk efficiency at the village level, what happens to one's friends and relatives should not matter. The evidence presented in Table 5 is not, however, fully conclusive: network shocks could be significant simply because they are correlated with village level shocks. The correlation coefficient between network shocks and village average shocks is indeed .11 and is marginally significant.[20] To disen-

[20] Village averages omit own network shocks to avoid spurious correlation.

tangle the effects of these two shocks, multivariate analysis is required. To this we now turn.

As a first step, we regress gifts and informal loans on household and network subjective measures of shocks and a set of village-time dummies which control for aggregate shocks as well as differences in village infrastructure and average income level.[21] The shock variables in the regression analysis are more informative than the crude measure used in Table 5. Data from the three survey rounds are pooled. If gifts and loans serve to smooth consumption, the coefficient of individual shocks should be positive and significant. Furthermore, if gifts and loans efficiently share risk at the village level, network shocks should not matter once we control for aggregate shocks via village-time dummies.

Results, shown in Table 6, are by and large consistent with expectations: even after controlling for village-level shocks through village-time dummies, bad shocks incurred by the household are shown to raise gifts and informal loans received, network shocks to reduce them. The effect of own shocks is significant only for loans. In contrast, network shocks are significant throughout, confirming t-test results. In all three regressions we cannot reject at the 5% level the hypothesis that the coefficients on own and network shocks are equal, but with opposite sign -- a result that is consistent with symmetrical risk sharing among network members.[22]

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[21] The network aggregate is computed as the sum of subjective rankings over all network members. It is centered around 0.

[22] To go back to our earlier example, say B has a mutual insurance agreement with A and C. If A's income is down by 100 but C's income is average, B is expected to give out to A in proportion to 100. If, in addition, C's income is down by 50, B now must helps both A and C; agent B's contribution is thus a function of the total income shortfall of the network, 150. If C was not B's partner, B's contribution would be a function of A's shortfall only. This example illustrates that it is the total shortfall of the network that matters, not the average shortfall. Someone who has many friends may one day be called to help them all.

In Table 7 we estimate similar regressions using crop and livestock sales as well as labor and unearned income as dependent variables. Livestock sales (net of livestock purchases) and crop sales serve as measures of changes in assets Δw_t^i. Labor and unearned income are included as well to investigate the possibility that surveyed households respond to shocks by seeking additional employment or by tapping into other sources of income (e.g., Kochar (1999)). Increasing labor market participation has indeed been shown to constitute a risk coping strategy in certain circumstances, as for instance when farmers facing crop failure migrate to nearby cities in search of work (e.g., Sen (1981), Greenough (1982)). It is similarly conceivable -- although unlikely, given the institutional environment prevailing in the rural Philippines -- that public transfers compensate households for shocks. To investigate whether surveyed households rely on such mechanisms to deal with shocks, we examine whether non-farm earnings and unearned income serve to smooth or amplify shocks.

Results indicate that none of these four variables help surveyed households smooth shocks: of 8 coefficients, 4 have the wrong sign. Only one coefficient, own shocks in the unearned income regression, is significant, but it is negative, suggesting that fluctuations in unearned income contribute to shocks rather than mitigating them. Although we do not have data on the financial savings of surveyed households, we asked them in rounds 2 and 3 whether their savings were lower or higher than before. Their answers serve as the basis for an ordered probit regression in the last column of Table 7. Results indicate that savings fall when households experience negative shocks, a finding in line with the use of financial savings for self-insurance purposes.

Before being taken as conclusive, the results reported in Tables 6 and 7 must be checked for robustness. There are several possible sources of bias. One possibility is that

networks suffer from endogeneity bias because respondents sought help from households who can help, that is, from households who have benefited from a positive shock. By collecting network information at the outset of the survey, without reference to actual gifts and loans, we have minimized the risk of simultaneity bias. But the possibility of self-selection bias remains if shocks are correlated over time. In this case, past (unobserved) shocks could be correlated with network formation and thus with observed network shocks. This would introduce a correlation between regressors and residuals and lead to biased estimates. To investigate this possibility, we compute the autocorrelation coefficients for own and network shock measures: self-selection bias may be present if we observe a high positive autocorrelation. Sample autocorrelation coefficients are -0.25 for own shocks and 0.01 for network shocks, hardly evidence of autocorrelation. To nevertheless correct for this possibility, we reestimate the model with household fixed effects below: with only three time periods, these fixed effects should capture unobserved past shocks that continue to affect lending and gift giving in subsequent periods.

We also compute the contemporaneous correlation coefficient between own shock and network shock: if network partners have been selected to optimally share risk, their shocks should be more negatively correlated with own shocks than non-network members. The sample correlation between own and network shocks is 0.22. By itself, this statistic is not very informative because surveyed households may share common shocks that cannot be insured via risk sharing, even if networks members are selected to maximize mutual insurance.[23] To investigate this possibility, we artificially construct random 'networks' by pairing, within each round, each respondent with five randomly chosen

[23] Or activity selection is used to diversify the income base of a predetermined network, e.g., migration.

households and we compute the corresponding correlation coefficient. After replicating the experiment a thousand times, we obtain correlation coefficients that vary between -.24 and .26 and are, on average, 0 with a standard error of 0.07. Own shocks and network shocks are thus significantly *more* positively correlated than if networks were chosen at random.[24] From this we conclude that network self-selection on the basis of shocks is unlikely to bias estimation in favor of finding network effects.[25]

A second potential source of bias is that shock measures are subject not only to measurement error (only five possible answers were recorded), but also to potential endogeneity bias: households' evaluation of the severity of a shock may be affected by the ease with which they could handle the situation -- and thus by whether or not they could raise money by liquidating assets or through transfers or informal loans. To minimize the resulting bias, we instrument subjective measures of household and network shocks using objective shock measures, village-time dummies, and household fixed-effects. Objective shock measures are listed in Table 8; they include acute and mild sickness, ritual shocks (mostly funerals), unemployment of spouse and dependents (own shocks), and dummies taking the value of 1 if someone has lost or gained a job (network

[24] This does not rule out the possibility of network self-selection (or, equivalently, of income diversification after networks have formed). All this says is that, whatever network selection takes place, it does not achieve more risk sharing than would result from random matching of sample households. The reason for this result may be that close relatives and friends tend to live closeby and to undertake similar activities, so that the potential for self-selection is small. This interpretation is further confirmed by the fact that a large proportion of core network members are close relatives.

[25] There remains the possibility that, due to network self-selection, *unobserved* own shocks are negatively correlated with *observed* network shocks. In this case, the coefficient of network shocks would be falsely negative. Although, by definition, we have no information on unobserved shocks, this possibility is unlikely to account for our results. First of all, our shock measure is, by construction, inclusive, thereby minimizing the probability that own shocks were omitted. Second, even if respondents select their network to optimize risk sharing, there is no reason why *unobserved* own shocks should be more negatively correlated with network shocks than *observed* shocks. Since observed own shocks proved to be more *positively* correlated with network shocks than if network selection was entirely random, it is unlikely that unobserved shocks are negatively correlated. If a bias exists, it pushes the network coefficient toward zero (i.e., less negative).

shocks).[26] Results from the instrumenting equations are shown on Table 9.[27] All coefficients have the expected signs; most are significant. Together, regressors explain more than half the variation in subjective risk measures.

A third possible source of bias is that omitted household characteristics may be correlated both with shocks and with other motives for receiving gifts and loans. Old people, for instance, are more likely not only to fall sick but also to be supported by their children via transfers and, possibly, informal loans. This could lead to a spurious correlation between shocks and gifts (or loans). To control for this possibility, we reestimate the model using household fixed effects.[28] Results are shown on Table 10; shocks measures are instrumented as in Table 9. Shock variables all have the expected sign, and most are significant. The main difference with Table 6 is that the magnitude of the coefficient is much larger -- suggesting the presence of substantial measurement error in subjective shock variables. Own shocks are now significant in the gift regression, while the network shock variable no longer is. Informal borrowing responds more to network shocks than gifts. Results also indicate that gifts respond much more to own shocks than informal borrowing: the coefficient of shocks in the gift equation is 2.3 times larger than that in the loan equation. We cannot reject at the 10% level the hypothesis that own and network shock variables in the gift regression have the same coefficient, albeit with an opposite sign.

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[26] Detailed data were also collected on crop shocks but do not appear in the analysis given that they are controled for by household fixed effects.

[27] OLS results are reported in the Table. Very similar results were obtained using ordered probit instead.

[28] Given that we have only three rounds of data, household fixed effects also control for the autocorrelation of shocks over time (see supra).

The fact that informal lending responds more to network shocks even though most informal loans take place primarily with non-network members is, at first glance, puzzling. It is consistent, however, with the way risk sharing networks operate and it does not invalidate our conclusion. As pointed out in Section 2, our network measure is not exhaustive: to keep the survey manageable, we collected shock data on core network members only. There exist other, less tightly connected network members (e.g., more distant relatives) with whom informal borrowing is possible though not as easily as with core network members. Whenever core members cannot lend because they are negatively affected by shocks, respondents must turn to lesser network members from whom they can borrow less -- hence the negative correlation. Moreover, as we have seen in Section 2, networks are interconnected. When core network members are hit by a shock, they themselves borrow from their own network, which typically includes non-core members of the respondent's own network.[29] Having already helped core network members, these non-core members are less able to help the respondent. As to the low coefficient of network shock on gift giving, one possible interpretation is that many recorded gifts are ritual in nature (e.g., gifts at funerals) and are thus insensitive to shocks affecting network members. This issue deserves further research.

We also reestimate Table 7 using household fixed effects and instrumented shock measures. The results, reported in Table 11, only show minor improvement: coefficients remain non-significant in most regressions, except for the network shock variable which is significant in the crop sales regression but with the wrong sign. In the case of the sav-

[29] Discussion with respondents and close examination of the data indeed reveals that informal borrowing outside the core networks occurs with individuals who are closely linked with core network members, e.g., joint relatives.

ings regression, the coefficient of the own shock variable has the right sign and is just below the 10% significant level -- a surprisingly good result given that, with household fixed effects, the number of degrees of freedom is small. Taken together, the evidence therefore suggests that financial savings, gifts, and informal loans are the primary vehicles through which surveyed households deal with shocks. Moreover, risk sharing is affected by what happens to network members: if they are doing well, respondents find it easy to raise funds informally; if network members are facing serious problems of their own, respondents encounter difficulties raising funds through informal channels.

We also investigate whether flows of funds between households depend on past use of gifts and loans. To do so, we expand the model to include outstanding informal debt and past gifts received. The outstanding debt variable is constructed from repayment information reported by respondents for all outstanding informal loans. Our measure of past gifts received is less convincing: it simply is the net gifts received during the preceding period (i.e., gifts received in round 1 for round 2 and gifts received in round 2 for round 3). This is admittedly not ideal but it is the best we can do, given that we do not have information about gifts and transfers received prior to the beginning of the survey. There also is a risk of endogeneity bias in past gifts but it is attenuated by the use of fixed effects (two periods only, once we lag gifts). Results regarding past gifts should thus be regarded as tentative only.

The results, reported in Table 12 indicate that, outstanding debt reduces net informal borrowing: households' net borrowing is lower presumably because they must repay previous debt. A similar result is obtained regarding past gifts: one hundred pesos of transfers received in the previous period translates in 45 fewer pesos received now. At prima facie, these findings suggest little difference between gifts and loans: both seem to

include a element of future reciprocity, the only difference being that in loans reciprocity is explicit while in gifts it is implicit.

Other features of the results, however, cast some doubt on the robustness of these findings. First, in both cases, estimated coefficients are smaller than one, thereby suggesting that past flows of funds are not fully reciprocated, at least within the time frame considered here. This could be a result of measurement error, however. Second, past gifts received have a positive instead of a negative effect on informal borrowing. Similarly, outstanding informal debt has a positive effect on gifts received. This suggests some kind of 'fungibility' between the two sources of funds: those who have received many gifts in the past now borrow, while those who have borrowed in the past receive more gifts. In both cases the effect is not significant but it is sufficiently pronounced to destroy any systematic effect of past gifts and loans on total flows of funds from informal sources. The reason for this state of affair remains unclear and deserves further investigation if more detailed data become available.

Next, we examine whether different sources of risk are equally shared through gifts and informal loans. To that effect, we reestimate the model with separate shocks instead of our composite subjective shock measures. The results, summarized in Table 13, conform only partially with expectations. Funerals and other rituals associated with bad events appear to trigger massive transfers of funds in the form of both gifts and loans. They represent large financial losses for at least two reasons: loss of earnings of the deceased, and the cost of ceremonies. Funeral indeed are the occasion for well attended -- and expensive -- communal meals. Informal transfers and loans seem to play an important role in helping respondents meet their social obligations.

Unemployment of the head or spouse is also shown to significantly raise informal borrowing and total inflows of funds from informal sources. In contrast, unemployment of dependents has not significant effect. The estimated coefficients of health shocks, in contrast, do not make much sense. Acute sickness has no noticeable effect on inflows of funds while mild sickness has a negatively significant effect. Things are a bit better on the network side. Coefficients have the expected signs in nearly all cases, and the effect is significant in most. Again, net borrowing is shown to be more responsive to network shocks in spite of the fact that most informal loans take place outside networks.

To get a better sense of the extent to which particular shocks are insured, we compare estimated coefficients with actual expenses incurred, on average, by surveyed households. The data on actual expenditures were collected during the pre-survey, a year before the survey proper. They are thus not correlated with current shocks $z^{i}_{s_i,t}$ and $z^{p_i}_{s_i,t}$. Since actual expenditures may depend on households' ability to secure funds through gifts and loans, which depends on risk sharing institutions, the comparison remains subject to endogeneity bias. Still, if the data show that amounts given and borrowed fall far short from actual expenditures, we may conclude that a particular category of risk is not fully insured through gifts and loans.

Results, shown in Table 14, indicate that gifts and loans on average cover the expenses associated with funerals and with the loss of earnings resulting from unemployment of the household head or his spouse. Other shocks appear not to be insured via gifts and loans since their estimated coefficient is negative. To further test full insurance, we compute a *t*-test of equality between the estimated coefficient and the sample average of expenditures and income loss.[30] According to this test, full insurance cannot be rejected

[30] The spirit of the test is the same as that of a *t*-test of the equality of means with equal variance. It is constructed as:

at the 1% level for funerals and for unemployment of the head or spouse, but it can be rejected for all other categories of risk.

Before concluding, we investigate yet another source of bias, namely the fact that informal loans and livestock sales have many zero values. The data indeed show that 36% of informal loan observations and 79% of livestock sales observations are 0.[31] Udry (1994) reports a similar finding for informal lending in Northern Nigeria. These data features signal the possible presence of transactions costs that limit participation to informal lending and restrict the use of livestock sales as consumption smoothing device. Estimating the magnitude of these transactions costs is a valuable objective in itself. Our main motivation is econometrical, however: ignoring the presence of transactions costs results in biased inference because the resulting concentration of observations around 0 tends to 'flatten' the regression line in a manner similar what occurs with truncation or censoring.

We therefore construct an estimator that controls for the presence of transaction costs in informal lending and livestock sales. We present the case of informal loans; livestock sales are handled in a similar manner. Three distinct types of observations are distinguished: net borrowing, net lending, and zero borrowing and lending. An

$$t = \frac{(\bar{X}_1 - \bar{X}_2)\sqrt{N_1 N_2/(N_1+N_2)}}{\sqrt{\frac{\hat{\sigma}_1^2(N_1-1) + \hat{\sigma}_2^2(N_2-1)}{N_1+N_2-2}}}$$

where $\bar{X}_1$ is the average expenditure and income loss, $\bar{X}_2$ is the estimated coefficient of the shock variable, N_1 is the number of observations on expenditures and income loss, N_2 is the number of degrees of freedom of the regression (391), $\hat{\sigma}_1$ is the standard deviation of X_1, and $\hat{\sigma}_2$ is the standard error of the estimated coefficient.

[31] There are 300 observations with positive net informal borrowing, 220 observations with no net informal borrowing, and 98 observations with negative net informal borrowing -- i.e., lending. Regarding livestock, there are 55 observations with net buying, 72 observations with net selling, and 491 observation with no livestock transaction.

econometric model that accounts for these three types of observations is given by:

$$b^i_{s,t} = \alpha_0 + \alpha_1 z^i_{s_t,t} + \alpha_2 z^{p_i}_{s_t,t} + \alpha_3 X^i_t + \alpha_4 X^{p_i}_t + \alpha_5 V_t + \varepsilon^i_t \tag{10}$$

$$\tau^{i*}_t = \tau + \nu^i_t$$

$$b^i_{s_t,t} = \begin{cases} b^{i*}_{s_t,t} & \text{if} \quad b^{i*}_{s_t,t} > \tau^{i*}_t \\ 0 & \text{if} \quad -\tau^{i*}_t \le b^{i*}_{s_t,t} \le \tau^{i*}_t \\ b^{i*}_{s_t,t} & \text{if} \quad b^{i*}_{s_t,t} < -\tau^{i*}_t \end{cases} \tag{11}$$

where $b^{i*}_{s_t,t}$ is latent net borrowing of household *i* in period *t*, $b^i_{s_t,t}$ is observed net borrowing, and τ^{i*}_t is the unobserved transactions cost. Intuitively, if latent borrowing (lending) is below the transactions cost, the household chooses not to borrow (lend); otherwise it borrows (lends).[32] Transactions costs thus set a threshold below which informal lending does not take place (e.g., Besley (1995)). True loan thresholds are unobserved but we assume that they vary across periods and households around their mean τ with error term ν^i_t. No loans are made between the thresholds $-\tau^*_{i,t}$ and $\tau^*_{i,t}$. For $b^{i*}_{s_t,t} < \tau^{i*}_t$, the household is a net lender. The shape of the relationship between net borrowing $b^i_{s,t}$ and individual shock $z^i_{s_t,t}$ is illustrated in Figure 1.

A likelihood function is constructed for model (10- 11) by assuming that disturbance terms ε^i_t and ν^i_t are independent, distributed normally, and have zero mean 0 and constant variances σ^2_ε and σ^2_ν. The likelihood function, derived in Appendix, takes the form:

$$\sum_{i \in N_{nb}} \log\Phi\left\{\left[\frac{b^i_t - \tau}{\sigma_\nu}\right]\frac{1}{\sigma_\varepsilon}\phi\left[\frac{b^i_t - W^{i\prime}_t\beta}{\sigma_\varepsilon}\right]\right\} +$$

$$\sum_{i \in N_{nl}} \log\Phi\left\{\left[\frac{-b^i_t - \tau}{\sigma_\nu}\right]\frac{1}{\sigma_\varepsilon}\phi\left[\frac{b^i_t - W^{i\prime}_t\beta}{\sigma_\varepsilon}\right]\right\} +$$

[32] To be more precise, the magnitude of the transactions cost determines the minimum amount of lending or borrowing that justifies incurring it. Depending on the way the transactions cost is borne by the household, incurring it might not be privately optimal for small loan amounts. Formalizing this point is beyond the scope of the present paper, however.

$$\sum_{i \in N_z} \log \left\{ \int_{-\infty}^{\tau - W_t^{i\prime}\beta} \int_{-\tau - W_t^{i\prime}\beta}^{\infty} f(\varepsilon_t^i + \nu_t^i, \varepsilon_t^i - \nu_t^i)\, d(\varepsilon_t^i + \nu_t^i)\, d(\varepsilon_t^i - \nu_t^i) \right\} \qquad (12)$$

where N_{nb}, N_{nl} and N_z are the set of net borrowers, net lenders, and zero borrowers, respectively. Vectors W_t^i and β are shorthand for all the explanatory variables and parameters in equation (10). Function $f(\varepsilon_t^i, \nu_t^i)$ is the joint normal probability distribution function of the disturbance terms; for estimation purposes, it is approximated by a Taylor approximation suggested in Abramovitz and Stegun (1972), pp. 298-299.

Maximizing the above likelihood function with available software limits the number of explanatory variables that can be included in the estimation. It is not feasible, for instance, to include 206 household fixed effects. Consequently, we replace household fixed effects with a vector of household and network characteristics. These variables control for differences in permanent income $y_{s_t,t}^i$ and welfare weights ω^i across households. Household characteristics include: land value; whether head or spouse has a permanent job; age of the household head; whether household members have special labor skills such as carpentry or wood carving; household size expressed in adult male consumption units; and network size. Network characteristics include: number of members with rice fields; number of members with special labor skills; average age of network members; and their number of dependents. Village-time dummies are included to control for village-level shocks. Individual and network shocks are replaced with their predicted value from Table 6.

Results are presented in Table 15, together with OLS estimates to illustrate the magnitude of the bias resulting from censoring some observations at 0. The Table suggests that, as far as informal loans are concerned, the extent of the bias is small: correcting for

censoring raises the coefficients of own shocks and network shocks by 8 % and 12 %, respectively. These results therefore suggest that ignoring censoring of informal loans in household fixed effect regressions probably does not lead to severe bias. Our qualitative conclusions drawn earlier are thus unaffected. Estimated transaction costs[33] are quite small: 23 Pesos on average, with a standard error of 16 Pesos. The informal loan market thus appears quite fluid.

Results for livestock sales are quite different. Correcting for censoring results in a sixfold increase in the own shock coefficient and in a similarly dramatic improvement in the network shock coefficient. Standard errors remain large, however, so that our qualitative conclusions are unaffected: livestock sales are not an important self-insurance mechanism in the area studied. The estimated transaction cost is extremely large, a finding probably due to the difficult and humid terrain unsuitable for livestock production and the movement of animals to the market. The magnitude of these transactions costs, combined with the difficulty to raise livestock in the area, probably explain why livestock are not used to deal with shocks (e.g., Fafchamps, Udry, and Czukas (1998)).

Conclusions

We have examined data collected during three rounds of interview with 206 randomly selected rural households of the northern Philippines. The data contains detailed information about gifts, loans, asset changes, household and network characteristics, and various income and expenditure shocks. While most of the literature on credit in developing countries studies loans from formal institutional sources for investment purposes, the data in this study reveal that such loans account for only 22% of household

[33] Or, more precisely, upper bound on transaction cost; see footnote above.

borrowing. The vast majority of loans are transacted between friends and relatives living in the same or adjacent villages and are taken for consumption purposes. Most borrowers and lenders have exchanged loans before, and many have switched roles in the transaction. Few loans require collateral or have a set repayment schedule, and loan contracts are rarely interlinked with other contracts. The majority of informal loans -- 80% of them -- carry no interest charge. These descriptive findings are by and large consistent with the quasi-credit model of mutual insurance (e.g., Fafchamps (1999)).

Regression results confirm that consumption smoothing is an important motivation for gifts and informal loans, but gifts and loans appear, by themselves, unable to efficiently share risk at the village level. The reason appears to be that gifts and loans take place not at the village level but within networks of friends and relatives, possibly because of the difficulty for villagers to monitor each other. Not all categories of shock are equally insured, even within networks. Crop and livestock sales do not appear driven by a precautionary motive, nor do households seem to deal with shocks by increasing labor supply or drawing upon other sources of income. Financial savings, on the other hand, responds to shocks. Other studies have found that risk-sharing within poor villages is not fully efficient (e.g., Townsend (1994), Udry (1994), Morduch (1991)). The novelty of this paper is to provide evidence suggesting that risk-sharing takes place primarily within small groups of family and friends.

Taken together, the evidence reject models of risk sharing that portray informal lending as an efficient mix of perfectly enforceable credit and insurance contracts (e.g., Udry (1994), Townsend (1995)): informal loans charge no interest; mutual insurance is largely confined to networks; and not all shocks are insured. The quasi-credit model of informal risk sharing is best capable to account for these features by introducing

constraints that represent the limited enforceability of voluntary *ex post* risk sharing (e.g., Kimball (1988), Fafchamps (1992), Coate and Ravallion (1993), Kocherlakota (1996), Ligon, Thomas, and Worrall (1996)). The bulk of the evidence appears in agreement with the theoretical predictions of such models: risk sharing takes place through repeated informal transactions based on reciprocity; mutual insurance takes place through a mix of gifts and no interest loans; and informal endebtedness reduces borrowing. We therefore conclude that a quasi-credit model in which repeated interaction is limited to networks of friends and relatives fits the data best.

Appendix: Derivation of the Likelihood Function for Informal Borrowing

Observations fall into three categories: net borrowers (300), net lenders (98), and zero net borrowing or lending (220). To each of these categories corresponds a specific likelihood function.

Net borrowers:

If household *i* is a net borrower in period *t*, its contribution to the likelihood of the sample is:

$$Prob(b_t^{i*} = W_t^{i\prime}\beta + \varepsilon_t^i,\ b_t^{i*} > \tau_t^{i*}) = Prob(\varepsilon_t^i = b_t^i - W_t^{i\prime}\beta,\ \nu_t^i < b_t^i - \tau)$$
$$= \int_{-\infty}^{b_t^i - \tau} f(b_t^i - W_t^{i\prime}\beta,\ \nu_t^i) d\nu_t^i$$

Since ε and ν are assumed independent, we obtain:

$$= \Phi\left(\frac{b_t^i - \tau}{\sigma_\nu}\right)\frac{1}{\sigma_\varepsilon}\phi\left(\frac{b_t^i - W_t^{i\prime}\beta}{\sigma_\varepsilon}\right)$$

where Φ(.) and ϕ(.) denote the standard normal cumulative and probability distribution functions, respectively.

Net lenders:

Similarly, if household *i* is a net lender in period *t*, its contribution to the likelihood of the sample is:

$$Prob(b_t^{i*} = W_t^{i\prime}\beta + \varepsilon_t^i,\ b_t^{i*} < -\tau_t^{i*}) = Prob(\varepsilon_t^i = b_t^i - W_t^{i\prime}\beta,\ \nu_t^i < -b_t^i - \tau)$$
$$= \int_{-\infty}^{-b_t^i - \tau} f(b_t^i - W_t^{i\prime}\beta,\ \nu_t^i) d\nu_t^i$$
$$= \Phi\left(\frac{-b_t^i - \tau}{\sigma_\nu}\right)\frac{1}{\sigma_\varepsilon}\phi\left(\frac{b_t^i - W_t^{i\prime}\beta}{\sigma_\varepsilon}\right)$$

Zero net borrowers:

Finally, if household *i* did neither borrow nor lend in period *t*, its contribution to the likelihood of the sample is:

$$Prob(-\tau_t^{i*} \le b_t^{i*} \le \tau_t^{i*}) = Prob(-W_t^{i\prime}\beta - \tau \le \varepsilon_t^i + \nu_t^i, -W_t^{i\prime}\beta + \tau \ge \varepsilon_t^i - \nu_t^i)$$
$$= \int_{-\infty}^{\tau - W_t^{i\prime}\beta} \int_{-\tau - W_t^{i\prime}\beta}^{\infty} f(\varepsilon_t^i + \nu_t^i, \varepsilon_t^i - \nu_t^i) d(\varepsilon_t^i + \nu_t^i)\, d(\varepsilon_t^i - \nu_t^i)$$

using the fact that, since ε_t^i and ν_t^i are jointly normal, so are $\varepsilon_t^i + \nu_t^i$ and $\varepsilon_t^i - \nu_t^i$. Following Abramovitz and Stegun (1972), pp. 298-299. a Taylor approximation to the above can be derived as:

$$\Phi(\eta_2) - \Phi(\eta_1)\,\Phi(\eta_2) - \phi(\eta_1)\,\phi(\eta_2)\left(\rho + \frac{\rho^2}{2}\,\eta_1\,\eta_2 + \frac{\rho^3}{6}\,(\eta_1^2 - 1)(\eta_2^2 - 1)\right)$$

where:

$$\eta_1 \equiv \frac{-W_t^{i\prime}\beta - \tau}{\sqrt{\sigma_\varepsilon^2 + \sigma_\nu^2}}$$
$$\eta_2 \equiv \frac{-W_t^{i\prime}\beta + \tau}{\sqrt{\sigma_\varepsilon^2 + \sigma_\nu^2}}$$
$$\rho \equiv \frac{\sigma_\varepsilon^2 - \sigma_\nu^2}{\sigma_\varepsilon^2 + \sigma_\nu^2}$$

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Table 1. Income, Gifts, and Loans
(over a nine months period)

Sources of Income	**Mean** (pesos)	**Coefficient of variation**
Non-farm earned income	15,178	1.77
Unearned income (1)	1,818	8.80
Value of annual rice harvest	5,596	2.49
of which, crop sales	226	3.45
Net livestock sales	254	11.22
Gifts and Loans		
Gifts received	5,394	1.71
Gifts given	2,569	2.56
Net gifts	2,825	3.72
Net informal borrowing	2,124	2.73
Net gifts and informal borrowing	4,949	2.40
Number of observations	206	

(1) Includes rental income, pensions, and sale of some assets. (2) In terms of number of animals, fowl counts for 68%, pigs for 16%, cattle and goats for 1%, and other animals for 14%. The total average value of livestock is 2,605 Pesos and the corresponding coefficient of variation is 1.85.

Table 2. New Lending and Gifts
(in Pesos per household over the nine months period covered by the three survey rounds)

	Money flowing:	
A. Relationships	**in**	**out**
Gifts:		
With close relatives	4351	1517
With distant relatives	694	866
With friends and neighbors	167	156
With others	122	0
New loans:		
With close relatives	367	61
With distant relatives	2739	657
With friends and neighbors	1174	189
With others	1698	274
Total flows (1):		
With close relatives	4718	1578
With distant relatives	3433	1523
With friends and neighbors	1341	345
With others	1821	274
B. Networks		
Gifts:		
With network members	3565	1076
With non-network members	1769	1463
New loans:		
With network members	1249	153
With non-network members	4730	1029
Total flows (1):		
With network members	4814	1228
With non-network members	6500	2492

(1) Excluding loan repayment.

Table 3. Participation in Gift Giving and Informal Credit

Participation during survey	**Gifts**	**Loans**
Receive gift or loan over the three rounds	100%	92%
Give gift or loan over the three rounds	100%	61%
Receive and give over the three rounds	100%	54%
Receive and give during same survey round	94%	24%
Do not participate over the three rounds	0%	1%
Repeated Interaction		
Repeated gifts or loans between rounds	100%	92%
Switched roles in giving or in lending (*)	100%	52%
Expect to borrow or lend again in future	100%	92%
Number of observations	206	206

Source: Survey data. (*) Switched between gift giving and receiving or between lending and borrowing during the survey.

Table 4. Reason for receiving a gift or loan
(computed on the basis of individual gifts and loans received by respondents in the three survey rounds)

	Reason the gift was received		**Reason the loan was taken**	
	unweighted	*weighted by gift value*	*unweighted*	*weighted by loan value*
Consumption	**57.1%**	**68.2%**	**72.8%**	**55.0%**
To pay for household consumption	36.6%	28.8%	41.5%	23.7%
To pay for medical expenditures	7.9%	11.1%	20.4%	14.2%
To pay for funeral and other ritual expenditures	12.5%	28.3%	10.9%	17.0%
Investment	**3.8%**	**7.7%**	**18.4%**	**33.7%**
To pay for school expenditures	3.4%	5.8%	11.8%	11.5%
To finance a business or farm investment	0.2%	0.5%	5.0%	14.5%
To apply for a job abroad	0.2%	1.4%	1.6%	7.7%
Reciprocity	**34.2%**	**23.0%**	**8.7%**	**11.2%**
To repay another loan or gift	33.0%	22.4%	2.4%	4.2%
To give another gift or loan	1.2%	0.6%	6.3%	7.0%
No reason	4.9%	1.1%	0.2%	0.1%
Number of observations	1078		1144	

Source: Survey data

Table 5. T-Tests on Gifts and Informal Borrowing

A. Net gifts received	**All cases**	**Network had a severe shock:**		**t-test**
		No	Yes	
All cases		1121	446	**1.404**
		454	*164*	*0.1307*
Household had a severe shock:				
No	706	687	759	**0.197**
	447	*331*	*116*	*0.8442*
Yes	1556	2288	-313	**1.845**
	171	*123*	*48*	*0.0683*
t-test	**1.797**	**2.804**	**1.312**	
	0.0728	*0.0053*	*0.1915*	

B. Net informal borrowing	**All cases**	**Network had a severe shock:**		**t-test**
		No	Yes	
All cases		1076	-310	**5.244**
		454	*164*	*0.0000*
Household had a severe shock:				
No	547	863	-352	**4.920**
	447	*331*	*116*	*0.0000*
Yes	1127	1649	-209	**2.683**
	171	*123*	*48*	*0.0000*
t-test	**2.183**	**2.325**	**0.476**	
	0.0294	*0.0205*	*0.6344*	

C. Net gifts and informal borrowing		**Network had a severe shock:**		**t-test**
	All cases	No	Yes	
All cases		2297	135	**3.858**
		454	*164*	*0.0001*
Household had a severe shock:				
No	1253	1550	407	**2.642**
	447	*331*	*116*	*0.0625*
Yes	2685	3937	-522	**2.932**
	171	*123*	*48*	*0.0038*
t-test	**2.699**	**3.701**	**1.119**	
	0.0271	*0.0002*	*0.2648*	

Source: Survey data. Number of observations in each cell given in italics.
Significance value of the t-test is given in italics under the t-statistic.

Table 6. Effect of Shocks on Gifts and Informal Loans

	Net gifts received		**Informal borrowing**		**Net inflows of funds**	
	Coef.	t	Coef.	t	Coef.	t
Own shock	275	0.873	605	**3.450**	880	**2.512**
Network shock	-412	**-2.492**	-234	**-2.545**	-646	**-3.518**
Village-time dummies	Included but not shown.					
Number of observations	618		618		618	
R-squared	0.0333		0.0516		0.0641	
Test whether coefficient of own shock = - coefficient of network shock:						
F statistic	0.15		3.62		0.36	
p-value	0.6971		0.0576		0.5479	

Table 7. Effect of Shocks on Other Sources of Funds

	Livestock sales		**Crop sales**		**Labor income**		**Unearned inc.**		**Saving (1)**	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	z
Own shock	-6	-0.056	20	0.844	250	0.313	-1277	**-2.510**	0.3316	**4.101**
Network shock	33	0.571	-5	-0.384	368	0.878	-2	-0.009	0.0042	0.097
Village-time dummies	Included in the regressions but not shown.									
Nber of observations	618		618		618		618		411	
R-squared	0.0164		0.0185		0.0579		0.0037		0.0684	

(1) Ordered probit: savings takes value 1 if has more saving now than in previous period; 2 if the same; 3 if less; 4 if much less. Data collected only in rounds 2 and 3.

Table 8. Characteristics of Shocks

Own shocks:	**Mean**	**Standard error**	**Minimum**	**Maximum**
Subjective shock index	-0.172	0.809	-2	2
Acute sickness	0.206	0.404	0	1
Other sickness	0.371	0.483	0	1
Ritual	0.065	0.246	0	1
Unemployment of head or spouse	0.050	0.218	0	1
Unemployment of other member	0.121	0.327	0	1
Network shocks (1):				
Subjective shock index	0.024	1.381	-4	6
Acute sickness	0.396	1.086	0	7
Other sickness	0.097	0.495	0	6
Ritual	0.181	0.820	0	6
Less work dummy	0.028	0.262	0	4
New job dummy	0.191	0.465	0	4

(1) Sum over all network members

Table 9. Determinants of Subjective Shock Measures

	Own shock		**Network shock**	
	Coef.	t	Coef.	t
Acute sickness	0.419	**3.628**	0.160	**3.157**
Non-acute sickness	0.191	**2.818**	0.237	**2.147**
Ritual	0.774	**5.205**	0.070	0.446
Unemployment (head/spouse)	0.113	1.101	0.594	**3.540**
Unemployment (other member)	-0.195	-1.140		
Found work			-1.180	**-9.580**
Village-time dummies	Included but not shown.			
Household fixed effects	Included but not shown.			
Nobs	618		618	
R-squared	0.5715		0.5857	

Table 10. Effect of Shocks on Gifts and Informal Loans — Household Fixed Effects

	Net gifts received		**Informal borrowing**		**Net inflows of funds**	
	Coef.	t	Coef.	t	Coef.	t
Own shock	2724	**1.950**	1162	**1.762**	3886	**2.688**
Network shock	-171	-0.442	-1307	**-1.901**	-1478	**-1.721**
Village-time dummies	Included but not shown.					
Household fixed effects	Included but not shown.					
Nobs	618		618		618	
R-squared	0.4150		0.3057		0.3800	
Test whether coefficient of own shock = - coefficient of network shock:						
F statistic	2.74		0.03		2.02	
p-value	0.0988		0.8518		0.1560	

Table 11. Effect of Shocks on Other Sources of Funds — Household Fixed Effects

	Livestock sales		**Crop sales**		**Labor income**		**Other income**		**Saving (1)**	
	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	z
Own shock	88	0.352	4	0.125	2760	1.079	321	0.541	0.366	1.631
Network shock	251	**1.917**	29	1.382	-1115	-0.645	126	0.535	-0.034	-0.215
Nber of observations	618		618		618		618		411	
R-squared	0.2772		0.4647		0.4532		0.4179		0.2884	

(1) Ordered probit: savings takes value 1 if has more saving now than in previous period; 2 if the same; 3 if less; 4 if much less. Data collected only in rounds 2 and 3.

Table 12. Effect of Shocks on Gifts and Informal Loans — Past Gifts and Oustanding Debt

	Net gifts received		**Informal borrowing**		**Net inflows of funds**	
A. With Past Gifts	Coef.	t	Coef.	t	Coef.	t
Own shock	1472	**1.844**	498	0.583	1970	**1.771**
Network shock	-55	-0.136	-2066	**-1.699**	-2121	-1.436
Past gifts	-0.437	**-1.893**	0.243	1.208	-0.194	0.440
Village-time dummies	Included but not shown.					
Household fixed effects	Included but not shown.					
Number of observations	412		412		412	
R-squared	0.637		0.351		0.591	
B. With Outstanding Informal Debt	Coef.	t	Coef.	t	Coef.	t
Own shock	2876	**2.047**	1135	**1.826**	4010	**2.767**
Network shock	-75	-0.191	-1189	**-1.777**	-1265	-1.486
Outstanding debt	0.078	0.588	-0.230	**-2.290**	-0.152	-1.014
Village-time dummies	Included but not shown.					
Household fixed effects	Included but not shown.					
Number of observations	618		618		618	
R-squared	0.4072		0.3555		0.3852	

Table 13. Effect of Specific Shocks on Gifts and Informal Loans

	Net gifts received		**Informal borrowing**		**Net inflows of funds**	
Own shocks:	Coef.	t	Coef.	t	Coef.	t
Acute sickness	-583	-0.712	217	0.460	-367	-0.405
Other sickness	-815	-1.212	-461	-1.632	-1277	**-1.763**
Ritual	3925	**1.856**	1043	**1.753**	4968	**2.382**
Unemployment of other member	-542	-0.547	-682	-0.721	-1224	-0.837
Unemployment of head or spouse	409	0.847	971	**1.954**	1380	**1.911**
Network shocks:						
Acute sickness	-371	**-1.669**	-307	**-2.100**	-679	**-2.429**
Other sickness	235	0.772	-292	**-2.014**	-57	-0.171
Ritual	-424	-1.304	-430	**-2.323**	-855	**-2.404**
Less work dummy	-118	-0.209	-726	**-2.238**	-845	-1.418
New job dummy	-157	-0.300	1444	1.498	1287	1.083
Village-time dummies	Included but not shown.					
Household fixed effects	Included but not shown.					
Nobs	618		618		618	
R-squared	0.4792		0.5000		0.5093	

Table 14. Comparing Estimated Coefficients with Actual Expenditures

Type of shock:	Measurement	Pre-Survey Data: Mean expend.	Std. dev.	No. obs.	Estimated Coefficients: gifts	loans	both	Std. error	t-test
Acute sickness	medical expenses	1905	2727	94	-583	217	-367	906	**13.66**
Mild sickness	medical expenses	402	611	227	-815	-461	-1277	724	**29.38**
Funeral	total expenses	5268	5228	21	3925	1043	4968	2086	**0.57**
Unemployment of head	wage lost	1235	1177	72	409	971	1380	722	**-1.40**
Unemployment of other	wage lost	1848	1143	35	-542	-682	-1224	1462	**12.10**

Source: Pre-survey data and Table 13.

Table 15. Correcting for Censoring Around Zero

	Informal loans				Livestock sales			
	OLS		Maximum likelihood		OLS		Maximum likelihood	
Shocks:	Coef.	t	Coef.	t	Coef.	t	Coef.	t
Own shock (predicted)	1188	**4.169**	1271	**3.567**	91	0.500	595	0.725
Network shock (predicted)	-517	**-4.044**	-577	**-3.603**	4	0.044	-71	-0.215
Household characteristics:								
Land value	1.979	1.417	1.827	1.041	-0.364	-0.408	-1.924	-0.444
Permanent job dummy	454.853	1.361	470.936	1.116	105.329	0.493	778.370	0.829
Age of household head	-6.261	-0.573	-6.800	-0.471	-7.342	-1.051	-34.700	-0.952
Craft skill dummy	337.223	1.222	487.344	1.374	204.185	1.157	915.408	0.988
Household size	54.231	0.762	38.533	0.432	57.246	1.259	259.706	1.345
Network Characteristics:								
Nber of network members	272.005	**2.227**	301.997	**1.910**	-50.308	-0.644	-412.892	-1.082
Nber who own ricefields	162.633	0.336	162.064	0.256	-31.752	-0.103	734.945	0.518
Nber with craft skills	-891.886	-1.517	-896.246	-1.155	288.186	0.767	-223.185	-0.131
Number of dependents	-45.989	-0.532	-66.726	-0.593	-30.585	-0.553	-18.967	-0.070
Average age	-0.720	-0.040	-0.916	-0.040	-17.776	-1.555	-101.605	**-1.778**
Village-time dummies	Included but not shown.				Included but not shown.			
Estimate of threshold			23	**3.276**			28171	**2.963**
Variance of threshold			16	**2.913**			28673	**2.880**
Variance of residuals			3416	**28.510**			3605	**16.187**
Number of observations	618		618		618		618	
R-squared	0.102				0.034			
Log-likelihood value	-5783.37		-4404.13		-5506.76		-1564.58	

Figure 1. Flows of Funds and Income Shocks