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The Value of social networks in rural Paraguay

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THE VALUE OF SOCIAL NETWORKS IN RURAL PARAGUAY

ETHAN LIGON AND LAURA SCHECHTER

ABSTRACT. We conduct field experiments in rural Paraguay to measure the value of reciprocity within social networks in a set of fifteen villages. These experiments involve conducting dictator-type games; different treatments involve manipulating the information and choice that individuals have in the game. These different treatments allow us to measure and distinguish between different motives for giving in these games. The different motives we're able to measure include a general benevolence, directed altruism, fear of sanctions, and reciprocity within the social network. We're further able to draw inferences from play in the games regarding the sorts of impediments to trade which must restrict villagers' ability to share in states of the world when no researchers are present running experiments and measuring outcomes.

1. INTRODUCTION

Accounts of difficulties faced by peasant households in developing countries often revolve around a belief that these households are constrained by market failures, particularly failures in markets for credit and insurance.

Any market involves exchange, and when one says that a particular household has been harmed by market failures, this is simply another way of saying that there existed some feasible exchange which could have benefitted both that particular household and some other, but that something prevented consummation of that exchange.

Much of what is interesting in development economics (and perhaps in economics more generally) involves developing our understanding of what 'things' might impede otherwise mutually beneficial exchanges. We have theoretically satisfactory accounts of some categories of such impediments, including private information and limited commitment.[1]

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[1]We say that accounts of these are "satisfactory" because the impediment to trade can be related to an observable feature of the environment. For example, in some circumstances it may not be possible for the two parties to a labor contract

For other sorts of market failures, we have useful but unsatisfactory models. For example, one might simply impose on one's model an *ad hoc* limit on the total amount of debt one household can accumulate. This may be a perfectly sensible way to proceed; certainly it's generally true that households can't borrow arbitrarily large sums. But while useful, this treatment is unsatisfactory: any account of *why* households are limited in their borrowing would have to appeal to some more primitive impediment to trade (e.g., limited commitment makes default possible in some states of the world). These models are unsatisfactory because they can't be used to predict what would happen if the economic environment were to change—to use the language of Haavelmo (1944), they lack "autonomy" from the conditions of the underlying environment. What if bankruptcy legislation changed the probability of default? A model featuring an arbitrary limit on debt accumulation simply can't tell us anything useful about the consequences of this sort of change in the economic environment.

In this paper we undertake what might be called "structural experimentation" in order to sort out what kinds of mechanisms exist to help the people who live in rural Paraguay overcome various possible impediments to trade. These (unknown) impediments to trade will determine whether or not different motives for transfers can be distinguished within the context of our experiments. We're interested in understanding the importance of reciprocity in the social networks in which these villagers are embedded, and in placing a value (which will depend on these impediments) on reciprocity in the social network. We should note that when we use the word reciprocity in this paper, we are referring to giving motivated by the ability of particular individuals or subgroups or rewarding or punishing behavior. This motive is called 'enforced reciprocity' by Leider et al. (2007), in contrast to 'preference-based reciprocity' in which agents derive utility from rewarding kind behavior regardless of future rewards or sanctions.

To estimate the value of these social networks, our basic strategy is to visit those villages, and then to offer a randomly selected 'treatment' group (i) some money; and (ii) the opportunity to invest some or all of

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to observe the actions of the other, perhaps with the consequence that each can be compensated not according to their labor, but instead only according to the observable output they produce. These constraints are imposed by the physical environment in which those two parties operate—accomplishing the required task may involve each party occupying geographically distant fields. In this case, the introduction of some new technology (say, of binoculars) may make it possible for the two parties to observe each other, and thus eliminate this source of private information from the list of impediments to exchange.

this money with a high expected return, but only on behalf of others in the village.

Our arrival in the village and treatment of a random selection of subjects induces idiosyncratic shocks to the income of selected members of the village. At one extreme, in the absence of any impediments to trade, one would expect the villagers to fully insure against these shocks, along the lines described in Townsend (1994). If the villagers are fully insured, the subjects should invest all of their stake, and the recipients of this largesse should in turn share their bounty with everyone else in the village according to some fixed, predetermined rule. At another extreme, impediments to trade might lead the subjects in our experiments to make no investments at all.

At either of the extreme outcomes it's relatively easy to place a value on the social network. However, as it happens, subjects in our experiments tended not to respond in such extreme ways, and tended to invest some but not all of their initial stakes. This tells us that the Paraguayan villages we investigated do not belong to the Panglossian world imagined by Townsend, but strongly hints that social networks and mechanisms exist in these villages which move the allocations toward the Pareto frontier.

What can we say about the mechanisms that induce the observed levels of investment? We consider several different motives which might lead a subject to make an investment on another's behalf. First, the subject might invest from a motive of undirected general *benevolence*— by making an investment she helps another more than she herself is harmed. Second, in addition to the sort of undirected benevolence, the subject might also invest on a particular other's behalf because she wishes that particular person well. We call this directed *altruism*. In our account altruism is distinguished from benevolence by being directed toward improving the welfare of some particular person.

A third motive for making investments may simply be to avoid *sanctions*. We have every reason to believe that the villagers we study live in a social environment which encourages some sorts of behaviors with rewards, and discourages others with punishments. Though the world described by Townsend (1994), with its sharing and Pareto optimality, has a pleasant sound to it, this sharing and optimality describe only what happens in equilibrium. Extreme punishments for deviations from prescribed behavior may be required to implement the optimal sharing rule. Even in environments without full risk sharing, we might expect there to be rules governing the sharing of income such as the windfalls we provide via our experiments. Deviations from these rules may

be discouraged by any of a variety of punishments, possibly including social exclusion or even physical violence.

If allocations in the villages are less than fully Pareto optimal, then a fourth motive for making an investment on behalf of others may become important. When there's full risk sharing, it will matter how *much* one invests, but it shouldn't matter on *whose* behalf the investment is made: any beneficiary will share the proceeds with the rest of the village in precisely the same way. In contrast, when there's *not* full risk-sharing, the identity of the beneficiary matters. An intuition for this behavior is that the investments observed in the experiments may be efforts to earn 'credit' with selected members of the village. Making such investments might be a simple way for the subject to repay past debts, or to curry favor with selected members of her social network. When the subject cares about *who* is the recipient of her largesse (beyond what can be explained by altruism) and so gives because of the motive of *reciprocity* within the social network, then we regard this as evidence of the importance of the agent's network.

In Section 2 we describe a sequence of models of dynamic risk sharing under different combinations of impediments to trade. We begin with a benchmark model with no frictions; proceed to a simple model which introduces limited commitment; turn to an alternative model which has full commitment but private information; and finally describe a model featuring both limited commitment and private information. In Section 3 we show how to incorporate the random event of our experiment into the dynamic program facing the villagers, and describe the predictions each of our models makes regarding this event and the pattern of transfers observed within our experiment. The data is more fully described in Section 4 and the experiment in Section 5. We then discuss how to separately identify the contributions of benevolence, altruism, punishments, and reciprocity within one's social network to the behavior observed in the experiments in Section 6. We further use the data gathered from the experiment to distinguish among the different models in Section 7. Section 8 concludes.

2. Model

In this section, we sketch a sequence of simple models, each of which generates some distinct hypotheses regarding the allocation of resources within the villages we study. Though we later explain the experimental treatments within the village, the models described in this section do *not* correspond to the different treatments. Rather, the various treatments are designed to winnow the list of models—we will show that

the predictions of some of the models we describe are inconsistent with outcomes observed within the experiment.

We will start with the standard benchmark model of sharing in rural villages, which is the full insurance model of Arrow-Debreu. This model can often be rejected by survey or experimental data. Two models which have previously been used to try to explain deviations from full risk sharing are models with hidden information and limited commitment. Adding hidden information will help us to explain how much dictators in our experiment send and adding limited commitment helps us to explain to whom the dictators choose to send money.

Consider a set of individuals in a village; index these individuals by $i = 1, 2, \ldots, n$. Each individual lives for some indeterminate number of periods. In each period, some state of nature $s \in \mathcal{S} = \{1, 2, \ldots, S\}$ is realized.

Given that the present state of nature is s, then individual i's assessment of the probability of the state of nature being $r \in \mathcal{S}$ next period is given by $\pi_{sr}^i \geq 0$.

At the beginning of the period, each individual i has some non-negative quantity x_i^m of assets indexed by $m = 1, \ldots, M$. Thus, each individual's portfolio of assets is an M-vector, written $\mathbf{x}_i$; conversely, all n individuals' holdings of asset m is an n-vector $\mathbf{x}^m$. The $n \times M$ matrix of all individuals' asset holdings is written as $\mathbf{X} \in \mathcal{X}$.

Each individual i may choose to save or invest quantity k_{ii}^m in asset m on her own behalf. Individual i can also make a non-negative contribution to the assets held by someone else—a contribution by person i of asset m held by person j is written k_{ij}^m, so that, as a consequence, the total investment for person i and asset m is $k_{\cdot i}^m = \sum_{j=1}^n k_{ji}^m$, while the portfolio of investments held by i is $\mathbf{k}_{\cdot i} = [k_{\cdot i}^1 \ldots k_{\cdot i}^M]$. The $n \times M$ matrix of person i's investments (whether made on her own behalf or on others') is written $\mathbf{k}_{i \cdot}$, which is assumed to be drawn from a convex, compact set $\Theta_s^i(\mathbf{X})$ in state s (this allows us to impose restrictions such as requiring non-negative investments or state-dependent borrowing constraints on the problem should we wish). The sum of investments over all n individuals yields another $n \times M$ matrix, written $\mathbf{K} = \sum_{j=1}^n \mathbf{k}_{j \cdot}$. It will sometimes be convenient to consider the sum of all investments *except* for i's; we write this as $\mathbf{K}^{-i} = \sum_{j \neq i} \mathbf{k}_{j \cdot}$.

The $n \times M$ matrix of investments $\mathbf{K}$ yields an $n \times M$ matrix of returns $\mathbf{f}_r(\mathbf{K})$ in state r, which becomes next period's initial matrix of assets $\mathbf{X}$. The function $\mathbf{f}_r$ is assumed to be a continuous function of $\mathbf{X}$ for all $r \in \mathcal{S}$.

Individual i discounts future utility using a possibly idiosyncratic discount factor $\delta_i \in (0, 1)$. Thus, if i's discounted, expected utility in state r is U_r^i, then i's discounted, expected utility in state s can be computed by using the recursion

$$U_s^i = u_s^i + \delta_i \sum_{r \in \mathcal{S}} \pi_{sr}^i U_r^i$$

for all s.

The values of the $\{U_s^i\}$ which satisfy the above recursion depend on the more primitive momentary utilities $\{u_s^i\}$. These, in turn, must be feasible given the resources $\mathbf{X}$ brought into the period and the resources $\mathbf{K}$ taken out. Note that these momentary utilities are flexible enough to include benevolence as well as directed altruism. Given these resources, we denote the set of feasible utilities for all n villagers in state s by $\Gamma_s(\mathbf{X} - \mathbf{K})$. The n-vector of all individuals' momentary utilities is written as $\mathbf{u}$.

Assumption 1. For any $s \in \mathcal{S}$ the correspondence Γ_s maps the set of possible asset holdings $\mathcal{X}$ into the collection of sets of possible utilities $\mathcal{U}$. We assume that the set $\Gamma_s(\mathbf{X}) \in \mathcal{U}$ is compact, convex, has a continuously differentiable frontier, and a non-empty interior for all $s \in \mathcal{S}$ and all $\mathbf{X} \in \mathcal{X}$.

So, given $\mathbf{X}$, $\mathbf{K}$, and the state s, any feasible assignment of momentary utilities must lie within the set $\Gamma_s(\mathbf{X} - \mathbf{K})$. Let $g_s : \mathbb{R}^n \to \mathbb{R}$ be a function describing the distance from a point $\mathbf{u}$ in $\Gamma_s(\mathbf{X} - \mathbf{K})$ to the frontier. Any feasible utility assignment will satisfy $g_s(\mathbf{u}; \mathbf{X} - \mathbf{K}) \geq 0$, while any efficient utility assignment $\mathbf{u}$ will satisfy $g_s(\mathbf{u}; \mathbf{X} - \mathbf{K}) = 0$.

2.1. **Full Risk Sharing.** Now, let us consider the problem facing some arbitrarily chosen individual i in the absence of any impediments to trade.

Problem 1. Individual i solves

$$(1) \quad V_s^i(\mathbf{U}^{-i}, \mathbf{X}) = \max_{\{\{\mathbf{U}_r^{-i}\}_{r \in \mathcal{S}}, \mathbf{u}_s, \mathbf{K}\}} u_s^i + \delta_i \sum_{r \in \mathcal{S}} \pi_{sr}^i V_r^i \left(\mathbf{U}_r^{-i}, \mathbf{f}_r(\mathbf{K}) \right)$$

subject to the promise-keeping constraints

$$(2) \qquad\qquad u_s^j + \delta_j \sum_{r \in \mathcal{S}} \pi_{sr}^j U_r^j \geq \underline{U}^j$$

for all $j \neq i$ where $\underline{U}^j$ is i's promise to j regarding his utility and with multiplier λ^j; subject also to the requirement that assigned utilities be feasible,

$$(3) \qquad\qquad g_s \left(u_s^1, \ldots, u_s^n; \mathbf{X} - \mathbf{K} \right) \geq 0,$$

and that each individual's investments are feasible,

$$\text{(4)} \qquad \mathbf{k}_{j\cdot} \in \Theta_s^j \quad \text{for all } j = 1, \ldots, n.$$

We associate Kuhn-Tucker multipliers $(\underline{\eta}_{ij}^m, \overline{\eta}_{ij}^m)$ with the choice variable k_{ji}^m in (4).

Problem 1 is very like the problem facing a social planner, and like the social planner's problem can be used to characterize the set of Pareto optimal allocations. In one standard special case we might think of individual i's problem as one of allocating consumption across individuals in different states, as in, e.g., Townsend (1994).

Proposition 1. *A solution to Problem 1 exists, and satisfies*

$$\text{(5)} \qquad \lambda_s^j = \frac{\partial g_s / \partial u^j}{\partial g_s / \partial u^i},$$

$$\text{(6)} \qquad \lambda_r^j = \frac{\delta_j}{\delta_i} \frac{\pi_{sr}^j}{\pi_{sr}^i} \lambda_s^j,$$

and

$$\text{(7)} \qquad \frac{\partial g_s}{\partial x_j^m} = \delta_i \sum_{r \in \mathcal{S}} \pi_{sr}^i \frac{\partial g_r}{\partial x_j^m} \frac{\partial \mathbf{f}_r}{\partial k_{\cdot j}^m} + \sum_{l=1}^{n} (\overline{\eta}_{lj}^m - \underline{\eta}_{lj}^m)$$

for some non-negative numbers $\left\{ \lambda_s^j, (\lambda_r^j)_{r \in \mathcal{S}}, \left((\overline{\eta}_{ij}^m, \underline{\eta}_{ij}^m)_{i=1}^n \right)_{m=1}^M \right\}.$

Proof. The payoffs u_s^i are bounded, the discount factor δ_i is less than one in absolute value, and the constraint set is convex and compact, all by assumption, so that Problem 1 is a convex program to which a solution exists. The Slater condition is satisfied and the objective and constraint functions are all assumed to be continuously differentiable in u_s^i and x, so that the first order conditions will characterize any solution. The first order condition associated with the choice object u_s^i is given by (5). Combining the first order conditions for U_r^i with the envelope condition with respect to U_s^i yields (6). $\qquad \square$

2.2. **Hidden Investments.** Let us now add a particular sort of friction to the problem described in Section 2.1. We allow some of the villagers to make *unobserved* investments, introducing an element of private information into the environment.

The addition of private information requires some modification to the model described above. Our basic approach involves manipulating the space of possible states $\mathcal{S}$. Let $\mathcal{S}_1$ denote the subspace of publicly observed states, and assume that the realization of any state $s_1 \in \mathcal{S}_1$

determines the set of *feasible* investments $\Theta^j_{s_1}$ for each the $j = 1, \ldots, n$ agents in the village.

As before, each individual j chooses a matrix of investments $\mathbf{k}_{j\cdot} \in \Theta^j_{s_1}$. Let $\Theta_{s_1} = \{\sum^n_{j=1} \mathbf{k}_{j\cdot} | (\mathbf{k}_{1\cdot}, \ldots \mathbf{k}_{n\cdot}) \in \Theta^1_{s_1} \times \Theta^2_{s_1} \times \cdots \times \Theta^n_{s_1}\}$ be the space of feasible *aggregate* investments when the (sub)space is s_1. Further, let $\Theta = \bigcup_{s_1 \in \mathcal{S}_1} \Theta_{s_1}$ denote the set of aggregate investments feasible in *any* state. This sum of the actual investments made by these agents help to determine the overall state, so that our new, augmented state space can be written $\mathcal{S} = \mathcal{S}_1 \times \Theta$.

We imagine that the first $\bar{n} < n$ agents may have the opportunity to make hidden investments, so that for any $j \leq \bar{n}$, agent j chooses a matrix of investments $\mathbf{k}_{j\cdot} \in \Theta^j_{s_1}$. Note that we assume that the nth agent (and possibly others) do *not* make hidden investments—though n may make investments $\mathbf{k}_{n\cdot}$, his investments are public information (this simplifies our modeling task by allowing us to set up n as the "principal" in a more-or-less standard principal-agent model).

Recall from above that we'd written the sum of all agents' investments as $\mathbf{K}$, and all agents' except agent j's investments as $\mathbf{K}^{-j}$. Now, to focus attention on j's choice of investments taking all other investments as given, we write the sum of all investments as $\mathbf{K} = (\mathbf{K}^{-j}, \mathbf{k}_{j\cdot})$.

We now turn our attention to the problem facing individual n when there's no problem with commitment, but when j can make (or fail to make) a hidden investment which affects the probability distribution of assets in the next period. Individual n, acting as an uninformed principal, can recommend to j that she make some particular investment $k_{j\cdot}$. We assume that all individuals' portfolios x_j are public in every period, so that i knows exactly what investments are feasible, and the exact portfolios which would be held by everyone in the population in any subsequent state—thus the 'state variables' in n's problem are always public. This allows us to avoid the complexity associated with dynamic principal-agent problems in which assets (as opposed to investments) are privately observed (e.g., Cole and Kocherlakota, 2001; Doepke and Townsend, 2006; Fernandes and Phelan, 2000). Instead, individual j takes an investment 'action' which affects her current-period utility, and which also influences the probabilities of next period's state. A complete description of the current state s *including* the investments made by the agent is a triple $s = (s_1, \mathbf{K}^{-j}, \mathbf{k}_{j\cdot})$; that is, the public (sub)state s_1, aggregate investment $\mathbf{K}^{-j}$ by everyone *but* j, and j's investments $\mathbf{k}_{j\cdot}$. Thus, we write the subjective probabilities for j as

$\pi^j_{(s_1,\mathbf{K}^{-j},\mathbf{k}_{j\cdot})r}$. Then incentive-compatibility constraint requires that

$$(8) \qquad (u^j_s, \mathbf{k}_{j\cdot}) \in \operatorname*{argmax}_{(\hat{u}^j_s, \hat{\mathbf{k}}_{j\cdot})} \hat{u}^j_s + \delta_j \sum_{r\in\mathcal{S}_1} \pi^j_{(s_1,\mathbf{K}^{-j},\hat{\mathbf{k}}_{j\cdot})r} U^j_r.$$

such that

$$(9) \qquad \hat{u}^j_s \in \Gamma^j_{s_1}(\mathbf{X} - (\mathbf{K}^{-j}, \hat{\mathbf{k}}_{j\cdot}))$$

and

$$(10) \qquad \hat{\mathbf{k}}_{j\cdot} \in \Theta^j_{s_1}.$$

This model closely resembles the model of Lehnert et al. (1999).

Problem 2. Individual i solves (1) subject to (2), (3), (4), and the incentive compatibility constraints (8).

Assumption 2. (1) For any $(\mathbf{K}, s)$ there exists a $(\hat{\mathbf{K}}, \hat{s})$ such that $f_s(\mathbf{K}) = f_{\hat{s}}(\hat{\mathbf{K}})$, and other observables that depend on the state are unchanged (e.g., $\Gamma_s(X) = \Gamma_{\hat{s}}(X)$).
(2) The probabilities $\pi^j_{sr}(\mathbf{K})$ are strictly positive for all $\mathbf{K}$;
(3) The probabilities $\pi^j_{sr}(\mathbf{K})$ are continuously differentiable for all $(s, r) \in \mathcal{S} \times \mathcal{S}$.
(4) The first order approach is valid.

The first two parts of the assumption amount to a way of requiring that the only way to draw inferences regarding the agent's choice of investment $\mathbf{k}$ is via the observation of realized returns to the investment $\mathbf{f}_r(\mathbf{k})$. The second two parts are necessary to guarantee that the first order conditions associated with Problem 2 (i) exist and (ii) characterize the constrained optimum.

Proposition 2. *A solution to Problem 2 exists, and satisfies*

$$(11) \qquad \lambda^j_s = \frac{\partial g_s/\partial u^j}{\partial g_s/\partial u^i},$$

and

$$(12) \qquad \lambda^j_r = \frac{\delta_j}{\delta_n} \frac{\pi^j_{sr}}{\pi^n_{sr}} (1 + \mu^j_r) \lambda^j_s,$$

for $j \leq \bar{n}$, where the numbers μ^j_r may be either positive or negative.

When we add hidden investment, agent j may have an incentive to invest less than the efficient amount. To offset this disincentive, she can be offered a reward for large *received* transfers (or punished for small ones), both now and in the future. The size of the incentive will depend on how informative the amount received is as a signal of j's investment.

Although this friction does give the agent a reason to send less than the efficient amount, she still does not care who receives the investment, since all resources will be divided according to a predetermined sharing rule.

2.3. **Limited Commitment.** Now, suppose that after any state s any individual j can deviate from the existing agreement. The value of the deviation depends on their portfolio of assets $\mathbf{k}_{.j}$, and is given by $A_s^j(\mathbf{k}_{.j})$. Then for any arrangement to be respected, after any state s the continuation utilities received by j must satisfy

$$(13) \qquad U_r^j \geq A_r^j(\mathbf{k}_{.j}),$$

for all $j \neq i$ and for all r, while for individual i the arrangement must satisfy

$$(14) \qquad V_r^i(U_r^{-i}, \mathbf{f}_r(\mathbf{K})) \geq A_r^i(\mathbf{k}_{.i})$$

for all r. This arrangement assumes that the investment decision k_{ji}^m is public, so that i can tell j to make the investment that maximizes i's discounted, expected utility, subject only to resource constraints, the requirement that i keep his promises, and that *given* the investments chosen or recommended by i that j's continuation payoffs be greater than the payoffs to deviating (after every date-state).

Problem 3. Individual i solves (1) subject to (2), (3), (4), and the limited commitment constraints (14) (with multipliers ϕ^j) and (15) (with multipliers ϕ^i).

This is essentially the model of Ligon et al. (2000), and similar results follow.

Proposition 3. *A solution to Problem 3 exists, and satisfies*

$$(15) \qquad \lambda_s^j = \frac{\partial g_s / \partial u^j}{\partial g_s / \partial u^i},$$

$$(16) \qquad \lambda_r^j = \frac{\delta_j}{\delta_i} \frac{\pi_{sr}^j}{\pi_{sr}^i} \left(\frac{1 + \phi_r^j}{1 + \phi_r^i} \right) \lambda_s^j,$$

and

(17)
$$\frac{\partial g_s}{\partial x_j^m} = \delta_i \sum_{r \in \mathcal{S}} \pi_{sr}^i \frac{\partial g_r}{\partial x_j^m} \frac{\partial \mathbf{f}_r}{\partial k_{.j}^m} + \sum_{l=1}^{n} (\bar{\eta}_{lj}^m - \underline{\eta}_{lj}^m) - \delta_j \frac{\lambda_s^j}{\mu_s} \sum_{r \in \mathcal{S}} \pi_{sr}^i \phi_r^j \frac{\partial A_r^j}{\partial k_{.j}^m}.$$

When an adequate commitment technology is available, Proposition 1 tells us that the 'planning weights' λ_r^j will remain fixed across dates and states. In contrast, when commitment is limited, individuals may sometimes be able to negotiate a larger share of aggregate resources. More precisely, the weights λ_r^j will satisfy a law of motion given by (17). Furthermore, i will do his best to structure asset holdings across the population so as to avoid states in which others can negotiate for a larger share. He can control this to some extent by assigning asset ownership to those households who are least likely to otherwise have binding limited commitment constraints in the next period. This introduces a distortion into the usual intertemporal investment decision, leading to a modified Euler equation given by (18).

When we add limited commitment to the basic model we see that an agent will want to direct his investment so that it will benefit him most. In the best case, this means sending it to someone who will *not* be able to use the proceeds to renegotiate.

2.4. **Hidden Transfers with Limited Commitment.** By combining both hidden investments and limited commitment, we can construct a model which yields predictions both about *how much* and *to whom* dictators will send. This turns into a complicated model since the two frictions may interact.

3. Example

In each of the villages we're considering, one day in the summer of 2007 a *gringa* rolled unexpected into town. The villagers didn't know she was coming. However, they must have known of the possibility that she'd come—they'd seen this *gringa loca* before (Schechter, 2007).

In this section we show how to model the event of *la gringa's* arrival from the viewpoint of the villagers, and how to deal with the probability distribution over different possible future states induced by the experiments conducted by *la gringa loca*.

Partition the state space $\mathcal{S} = \mathcal{S}_1 \cup \mathcal{S}_2$, letting $\mathcal{S}_2$ be the set of states in which *la gringa loca* runs an experiment in the village. Let person i's assessment of the probabilities of transiting between $\mathcal{S}_1$ and $\mathcal{S}_2$ be given by

$$p = \begin{bmatrix} p_{11}^i & p_{12}^i \\ p_{21}^i & p_{22}^i \end{bmatrix}.$$

Note that these don't depend on the particular state within a partition.

Let Σ index the set of possible states within the context of the experiment. In the experiment, we confront the villagers with a randomly chosen state $\sigma \in \Sigma$(e.g. person i is randomly selected to a particular

treatment, and within this treatment a random die roll comes up 1). The experiments we conduct augment the set of states which would otherwise have occurred. Thus, in a period in which the experiment occurs the state space is $\mathcal{S}_2 = \mathcal{S}_1 \times \Sigma$. The probabilities of different states within the experiment are independent of the 'external' state s_1. Let the probability of experimental state σ be given by ρ_σ. Any experimental protocol can be described by the pair (Σ, ρ).

Our experiment was designed to manipulate the incentives that subjects had to make risky investments on others' behalf. The experimental state space Σ includes all possible combinations of three different elements:

- The identity of the 30 households randomly selected to participate in each village;
- The assignment of each household head to one of several possible treatments; and
- The outcomes of a coin flip and several rolls of a die (to determine payoffs from investments $f_r(\mathbf{K})$).

Each possible experimental state was equally probable.

Next we write out the maximization problem associated with each game. Let utility, $u(c)$, be defined over one consumption good. Assume that $u'(c) > 0$ and $u''(c) < 0$ and the Inada conditions hold. In all four games the amount sent is doubled, and a random component is added to it depending on the roll of a die.

3.1. **Chosen Revealed Game.** In the chosen revealed game the dictator chooses the recipient of the investment and the recipient is made aware of the dictator's identity and amount invested. Within the chosen revealed game, and given the set of households playing as dictator, there are six possible states of nature depending on the roll of the die. Consider the special case in which there are a total of three people; only individual 1 plays the game. In this case we have:

$$\mathbf{x} = \begin{bmatrix} 14 + x_1^1 & 0 \\ x_2^1 & 0 \\ x_3^1 & 0 \end{bmatrix}$$

where the first column is the asset normally available in the village (perhaps agriculture) and the second column is the asset which *la gringa* makes available.

The player (individual 1) has to choose a recipient q. He solves the following problem:

$$V_0^1(U_0^{-1}; \mathbf{X}) = \max_q [\max_{\{\{c_0^j\}_{j=2}^3, \{U_r^{-1}\}_{r \in S}, \mathbf{K}\}} [u(c_0^1) + \delta_1 \sum_{r=1}^6 \pi_{0r}^1 U_r^1(U_r^{-1}; f_r(\mathbf{K}; q))]]$$

The player is not allowed to choose to send money to himself; he must choose one of the other individuals. Still, he could choose an individual, and then choose to send that individual nothing (keeping all of the money for himself). Given that the amount sent is doubled and a random component is added to it, the recipient can still expect to receive some money even if the sender does not send any of his endowment.

We can represent the function f_r in the following way. The depreciation or appreciation rate is ρ and $r = 0, ..., 5$ is the roll of the die minus one.

$$f_r(\mathbf{K}; q) = \begin{bmatrix} \rho \sum_{j=1}^3 k_{j1}^1 & 0 \\ \rho \sum_{j=1}^3 k_{j2}^1 & I(q=2)(2k_{12}^2 + 2r) \\ \rho \sum_{j=1}^3 k_{j3}^1 & I(q=3)(2k_{13}^2 + 2r) \end{bmatrix}$$

3.2. **Revealed Game.** This game is quite similar to the previous one except that the player does not choose to whom he wants to give the money and does not know to whom it will be given when he decides how much to send (although he finds out at a later point in time).

In this game, there are the six possible states of nature depending on the roll of the die, crossed with the n states of nature determining which person in the village will be the recipient. The player's value function in the non-chosen revealed game is the following:

$$V_0^1(U_0^{-1}; \mathbf{x}) = \max_{\{\{c_0^j\}_{j=2}^3, \{U_r^{-1}\}_{r \in S}, \mathbf{K}\}} [u(c_0^1) + \delta_1 \sum_{r=1}^6 \pi_{0r}^1 U_r^1(U_r^{-1}; f_r(\mathbf{K}))]$$

The main difference between this maximization problem and the previous one is that the principal no longer maximizes over q and so we now have $f_r(\mathbf{K})$ rather than $f_r(\mathbf{K}; q)$ since the recipient is now part of the state of nature rather than a choice variable.

Let r_1 be the person who is randomly chosen and r_2 be the roll of the die minus one. The matrix f is now as below:

$$f_r(\mathbf{K}) = \begin{bmatrix} \rho \sum_{j=1}^3 k_{j1}^1 & 0 \\ \rho \sum_{j=1}^3 k_{j2}^1 & I(r_1=2)(2k_1^2 + 2r_2) \\ \rho \sum_{j=1}^3 k_{j3}^1 & I(r_1=3)(2k_1^2 + 2r_2) \end{bmatrix}$$

3.3. **Chosen Game.** The chosen non-revealed game basically has the same matrix of returns f as does the corresponding revealed game. The difference is in terms of the information available to each individual which will be evidenced in the maximization problem. One should note, though, that there must be at least two players for the non-revealed game to work (otherwise actions can be inferred). So, the matrix of returns in the chosen non-revealed game with both individuals 1 and 2 acting as dictators is as follows:

$$f_r(\mathbf{K}; q_1, q_2) = \begin{bmatrix} \rho \sum_{j=1}^3 k_{j1}^1 & I(q_2 = 1)(2k_2^1 + 2r_2) \\ \rho \sum_{j=1}^3 k_{j2}^1 & I(q_1 = 2)(2k_1^2 + 2r_1) \\ \rho \sum_{j=1}^3 k_{j3}^1 & I(q_1 = 3)(2k_1^2 + 2r_1) + I(q_2 = 3)(2k_2^1 + 2r_2) \end{bmatrix}$$

where q_i is the choice of receiver made by player i and r_i is the roll of the die minus one for player i.

3.4. **Anonymous Game.** The non-chosen non-revealed game basically has the same matrix of returns f as does the corresponding revealed game. But as in the other non-revealed game we need at least two players. Let r_1 be the person who is randomly chosen and r_2 be the roll of the die minus one for player 1 and let r_3 be the person who is randomly chosen and r_4 be the roll of the die minus one for player 2. The matrix f is now as below:

$$f_r(\mathbf{K}) = \begin{bmatrix} \rho \sum_{j=1}^3 k_{j1}^1 & I(r_3 = 1)(2k_1^2 + 2r_4) \\ \rho \sum_{j=1}^3 k_{j2}^1 & I(r_1 = 2)(2k_1^2 + 2r_2) \\ \rho \sum_{j=1}^3 k_{j3}^1 & I(r_1 = 3)(2k_1^2 + 2r_2) + I(r_3 = 3)(2k_1^2 + 2r_4) \end{bmatrix}$$

4. Data

In 1991, the Land Tenure Center at the University of Wisconsin in Madison and the Centro Paraguayo de Estudios Sociológicos in Asunción worked together in the design and implementation of a survey of 300 rural Paraguayan households in sixteen villages in three departments (comparable to states) across the country. Fifteen of the villages were randomly selected, and the households were stratified by land-holdings and chosen randomly. The sixteenth village was of Japanese heritage and was chosen purposefully due to the large farm size in that village. The original survey was followed up by subsequent rounds of data collection in 1994, 1999, 2002, and, most recently, in 2007. All rounds include detailed information on production and income. In 2002

questions on theft, trust, and gifts were added. Only 223 of the original households were interviewed in 2002.[2]

In 2007, new households were added to the survey in an effort to interview 30 households in each of the fifteen randomly selected villages for a total of 450 households. Villages ranged in size from around 30 to 600 households. In one small village only 29 households were surveyed. These 449 households were given what was called the 'long survey'. This survey contained most of the questions from previous rounds and also added many questions measuring networks in each village.

The process undertaken in each village was the following. We arrived in a village and found a few knowledgeable villagers and asked them to help us collect a list of the names of all of the household heads in the village. We also asked these knowledgeable villagers to tell us the names of a few of the poorest villagers and a few of the richest villagers. Every household in the village was given an identifier. At this point we randomly chose new households to be sampled to complete 30 interviews in the village. (This meant choosing anywhere between 6 and 24 new households in any village in addition to the original households.) These villages are mostly comprised of smallholder farmers. There are no tribes, castes, village chiefs, moneylenders, plantation owners, or the like.

The 'long survey' was carried out with each of these 30 households. Network questions included a) which household would your household go to if you needed to borrow 20,000 Gs, b) which household would go to your household if they needed to borrow 20,000 Gs, c) which households has your household lent money to in the past year, d) which households have lent money to your household in the past year, e) which households have given your household money to deal with health shocks in the past year, f) which households has your household given money to deal with health shocks in the past year, g) which households contain the godparents of the children of the head of your household, h) for which household heads' children is the head of your household a godparent, i) to which households has your household given agricultural gifts in the past year, j) from which households has your household received agricultural gifts in the past year, k) which households contain a child, sibling, or parent of the household head or his spouse, l) with which households were land transactions (renting for a fee, borrowing for free,

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[2]Comparing the 2002 data set with the national census in that year we find that the household heads in this data set were slightly older, which is intuitive given the sample was randomly chosen 11 years earlier. The households in the 2002 survey were also slightly more educated and wealthier than the average rural household, probably due to the oversampling of households with larger land-holdings.

or sharecropping) carried out in the past year. Since we had a list of the names of all of the household heads in the village we could match the answers to these network questions with the identifiers of each household. The surveys provide evidence of large amounts of in-kind exchange.

We invited all of the households which participated in the long survey to send a member of the household (preferably the household head) to participate in a series of economic experiments. These experiments will be described in more detail in the next section. For now, I would like to point out that one of the experiments involved the player choosing another household in the village to whom he wished to transfer money. If the chosen household had not been surveyed previously, then we carried out the 'short survey' with those additional households. 161 households responded to the short survey with a minimum of 0 in a village and a maximum of 18. This shorter survey contained all of the network questions which were asked in the long survey but did not contain the detailed production questions. The short survey also asked the respondents how they would have played in the games if they had participated.

5. Experiment

The majority of experiments run in both the United States and in developing countries are anonymous and involve no partner choice. Experimental economists find evidence of altruism, trust, and reciprocity in such anonymous settings, suggesting that these more behavioral concepts have economic impacts in the real world (Carter and Castillo, 2006). But, many of the real world situations in which these concepts affect outcomes are not anonymous and do in fact involve partner choice. Glaeser et al. (2000) run non-anonymous trust experiments with Harvard undergraduates and allow them to meet to come up with a list of the friends they have in common before they participate in the games. They find that partners who have more common friends and who have known each other longer are both more trusting and more trustworthy. This result could be due either to increased altruism between more connected partners, or due to the possibility for repeated interactions outside of the experimental setting, although the authors are not able to distinguish between the two hypotheses.

In a similar set-up to our own, Leider et al. (2007) conduct a series of dictator games with a group of Harvard undergraduates. Some of the dictator games are anonymous, in some only the giver knows the identity of the recipient, and in some cases both players know are informed

of each other's identity. They do not allow the players to choose their partner, rather they are randomly assigned at varying social distances. They find evidence, to use our vocabulary, of both higher altruism and higher reciprocity when dictators are more closely linked to recipients.

There are two other recent papers in which villagers actually choose their partners in experiments.[3] In work by Barr and Genicot (2008), rural Zimbabweans choose risk-pooling groups with which to play. While pooling risk does not increase payoffs *per se*, it does decrease the riskiness of outcomes. One limitation is that they cannot compare play when villagers choose their own network with play when that network is assigned. In a microfinance program designed by Karlan et al. (2005), participants receive loans sponsored by one of their fellow villagers. Loans sponsored by friends have a higher interest rate than loans sponsored by those further away in the social network. They plan to look at how much lower the interest rate must be to induce a villager to ask for a loan sponsored by someone outside his social network. Thus, they will measure how much a villager is willing to pay to avoid interacting with someone outside of his social network, not the ability of the network to increase returns for its members.

Regarding the experiments we carried out in Paraguay, a day or two after conducting the long survey with 30 households in a village we invited them to send one member of their household, preferably the household head, to participate in a series of economic experiments. The games were held in a central location such as a church, a school, or a social hall. Of 449 households, 371 (83 per cent) participated in the games. This share is quite similar to the 188 out of 223 (or 84 per cent) who participated in the games carried out in 2002. The games carried out in 2002 were different from those carried out in 2007 and so the participants had no previous experience with the specific games in 2007. See the appendix for the full game protocol.

We designed four experiments which are each variants of the dicator game and, together, can be used to measure the value of village institutions and networks and distinguish between four distinct motives for sharing. Each motive has two characteristics. It is either selfish or other-regarding, and it is either diffuse or directed. A person's preferences are other-regarding if an exogenous change in another person's utility causes a change in his own utility. If preferecens are not other-regarding then they are selfish. A motive for sharing is diffuse if the

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[3]Slonim and Garbarino (2008) allow some players to choose characteristics of their partner (age and gender) and find that senders in both the dictator game and the trust game who chose their partner send more than those who did not.

amount the person shares depends, other things equal, on the identity of the person with whom he's sharing. If it does not, then the motive is diffuse.

Combining these two sets of characteristics leads to four motives for sharing. We call the other-regarding diffuse motive benevolence while the other-regarding directed motive is altruism. We call the selfish diffuse motive sanctions while the selfish directed motive is reciprocity. Thus, benevolence is interest in general welfare or "good will toward man," while altruism is like benevolence, but directed at a particular person or subgroup. Sanctions measures the effectiveness of mechanisms to induce costly actions which promote social welfare. This might include mechanisms for contract enforcement and social mechanisms to reward some behaviors and punish others. The main point is that it involves incentives or 'social capital,' rather than preferences. Reciprocity is similar to sanctions, but it is the ability of particular individuals or subgroups to reward or punish behavior. Reciprocity is what we associate with social networks.

The first of the experiments we conduct is the traditional dictator game. In this game a dictator is given a sum of money and must decide how to divide it between himself and an anonymous partner. In the four experiments we conducted, we doubled the money sent by the dictator to his anonymous partner. While only those individuals who showed up for the experiment could act as dictators, any household in the village could be a recipient.

We carried out a version of this game measuring social preferences in an anonymous one-shot setting. The second game was basically the same, but players were warned that when the game was over we would reveal to them who their partner had been. The person receiving the money would also find out the rules of the game and who sent the money. The villagers may have their own (unobserved) system of sanctions and rewards which they can impose on each other after the end of the experiments. Whereas the original dictator game would measure how benevolent a player feels towards his village-mates inherently, the revealed partner dictator game measures the value of the community in which players live given the village institutions of sanctions and rewards which are already in place.

In the third and fourth versions of the game, the dictator could choose to which household he would like to send money. In the third version the recipient was not told who sent him the money and in the fourth version he was told. From this, one can measure the value of sanctions and rewards within the village, as well as the value of being able to direct investments to particular individuals within the village.

5.1. **More Detailed Design.**

Anonymous Game: The dictator chooses how much to send to some anonymous person in the village. Neither the sender nor the receiver ever knows who their partner was. This game measures *benevolence B*.

Revealed Game: The dictator chooses how much to send to an anonymous person in the village. He knows that at the end of the game he will find out to whom he sent the money. He also knows that the recipient will learn the rules of the game and from whom the money came. This measures $B + S$ where S is related to the the value of *sanctions* in the village community, since the dictator can be punished (or rewarded) by the villagers outside the game.

Chosen Game: The dictator chooses how much to send and to which household he would like to send it. The recipient will *not* learn from whom he received the money. (This is obviously difficult to enforce in practice; see below for more details.) This measures $B + A$ where A is directed *altruism*. This does not involve S since the receiver should never find out from whom the money came and so should have no way of punishing the dictator.

Chosen Revealed Game: The dictator chooses how much to send and to which household he would like to send it. The recipient will learn from whom he received the money. This measures $B + S + A + R$ where R is the value of *reciprocity* within the dictator-specific social network.

Although the dictator chooses the recipient in both the chosen revealed and non-revealed games, only one of the two versions is randomly chosen to affect actual payoffs. This step was taken to aid in anonymity in the non-revealed version. In addition, in all four versions, we altered the probability distribution relating the amount of money sent to the amount of money received. For each of the four versions and for each of the dictators we rolled a die. The dictator knew that we were going to roll a die. He did not see the result of the roll in the non-revealed version. On a roll of one, the recipient received an extra 2 thousand Guaranies (KGs; at the time the experiments were conducted, one thousand Guaranies was worth approximately 20 US cents); a roll of two meant an extra 4 KGs; a roll of three meant an extra 6 KGs; a roll of four meant an extra 8 KGs; and a roll of five meant an extra 10 KGs; finally, a roll of six meant that no extra money was added. Thus, the more money a dictator sent, the more money

TABLE 1. Treatments and Motives for Transfers

	Choose	Don't Choose
Two-sided Anonymity		B
One-sided Anonymity	$B + A$	
Non Anonymous	$B + S + A + R$	$B + S$

a recipient would receive on average, but the exact amount received had a random component. This was another step taken to ensure that in the chosen (non-revealed) game the dictator couldn't prove to the recipient that he had chosen him. Lastly, the recipients received all their winnings together. If they were not told, then they would not know if they were receiving money because they were chosen by one of their village mates or because they were randomly chosen by our lottery. Given that they might be receiving multiple winnings at the same time, if they were not told, they could not be sure how much came from each Dictator.

In the short survey we asked respondents how they would have played if they had been invited to participate in the economic experiments. In this case we did not worry about whether the recipient could find out the money was sent by the respondent since all decisions were hypothetical. So, in order to simplify the explanation of the game for the respondents and ease in understanding we did not incorporate the roll of the die and the additional random component received in these questions. This means that the expected amount received by the dictator's partner is 5 KGs less in the hypothetical questions than in the actual games.

A graphical representation of the experiments is shown in Table 1. In the first column the dictator chooses and in the second column he does not choose to whom he would like to send the money. The three rows represent two-sided anonymity, one-sided anonymity (the dictator knows the matching but the recipient does not), and no anonymity.

Note that there are actually two types of non-anonymity. When the dictator chooses his partner in the non-anonymous row he chooses how much money to send after knowing the identity of the recipient (ex-ante non-anonymity). In the non-anonymous row when the dictator does not choose his partner, he does not find out to whom the money is going until after he chooses how much money to send (ex-post non-anonymity).

The game took approximately three hours from start to finish and players were offered 1 KGs extra for arriving on time. We used our vehicle to pick up participants who were not able to get to the game using their own means of transport. In this case they were offered 1 KGs if they were ready when the vehicle arrived at their residence.

The players received no feedback about the outcome in each version until all four sets of decisions had been made. The order of the four versions was randomly decided for each participant. Players may become more or less generous with experience, and this could bias estimation of the value of the network. With four experiments there are twenty-four possible orderings for the experiments. But, we only implemented the 12 orderings which kept the chosen revealed and chosen non-revealed games together. This is because we asked players to which household they wished to send money. Then we asked the two questions (in random order) regarding how much they would send if the recipient would find out their identity and how much they would send if the recipient would not find out. We might ask the revealed version first or the non-revealed version first, but we would never ask the chosen revealed, then ask one of the non-chosen games, and then go back to ask about the chosen non-revealed game.

Dictators were not allowed to choose to send money to their own household, nor could their own household be randomly chosen to receive money from themself. The dictators were given 14 KGs (a bit less than \$3US) in each version of the dictator game. A day's wages for agricultural labor at the time was approximately 15 to 20 KGs. The average winnings for the players (not including the 1 KGs received if the player showed up or was ready on time) was 40.93 KGs with a standard deviation of 21.71. The maximum won by a player was 205 KGs and the minimum was 0. The dictators earned payoffs for three of the four games in which they acted as dictator, and had the possibility of earning payoffs as recipients as well. In addition to the winnings earned by players, many recipients throughout the village also received money.[4]

A self-interested model of preferences would assume that a dictator chooses a recipient for strategic reasons to maximize utility vis-á-vis consumption. This may not be true; a dictator may choose someone to whom he feels altruistically. After participating in the games we asked players two questions. First we asked them why they chose the

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[4]If we consider the sample we have in each village as representative of the village as a whole, we can estimate total village annual income. In this case, the total amount distributed in a village ranged from 0.01% to 0.4% of annual vilage income.

recipient they chose. The options were a) "he is a good friend"; b) "he is a good person"; c) "he needs money now"; d) "he always needs money"; e) "I trust him"; and f) "I owe him a favor." Players could choose multiple motives (and in practice never chose more than two).

We also asked the subjects how they decided the quantity to invest in the two versions of the games for which they chose the recipient. The answers were categorized into one of two possibilities: a) "the person needs the money and I don't care if he knows that it comes from me or not"; and b) "the person will know the money is from me and that was important to my decision making".

6. Estimation

In order to clarify our thinking, it is useful to lay out what size transfer levels will be in each version of the dictator game under the four different assumptions about the state of the world. What sharing motives are identifiable depends on the state of the world.

In the basic full insurance model there is a fixed sharing rule. In this case people may be benevolent or altruistic, and there may be social sanctions imposed by the village collectively or by individuals in the social network for failing to make a socially efficient investment. But, transfers in all four games will be the same and we won't be able to distinguish between these four motives. We will expect to see transfers since it is socially efficient, but there would not be any variation in the transfers across the four games.

If, instead, the reality is a world of hidden investments, then the private information that we induce via the experiment may tempt the dictator to send less and misrepresent the size of his transfers. In the two private information games (the Anonymous and Chosen games) one can never infer exactly how much the dictator actually sent. We assume the amounts received by the recipients are public and so they are informative as to the amount sent by the dictator. In the two full information versions of the game (the Revealed game and the Chosen Revealed game) outcomes are more informative and so we would expect the dictator to send more.

Keep in mind that since the amounts received are assumed to be public information, they won't particularly benefit any specific recipient. Thus, we would not expect there to be any difference in the amount sent between the two private information games, or between the two full information games. The Dictator does not care who receives his transfer. In this environment we can not learn anything about other-regarding

TABLE 2. Relative size of transfers

	Anonymous	Revealed	Chosen	Chosen -Revealed
Basic Model	τ	τ	τ	τ
Hidden Inv.	τ_1	τ_2	τ_1	τ_2
Limited Comm.	τ_1	τ_1	τ_2	τ_2
LC. & HI	τ_1	$\tau_{2|3}$	$\tau_{3|2}$	τ_4

$\tau_j < \tau_{j+1}$ and comparisons should only be made across rows.

preferences or about reciprocity within a social network, but we can learn something about the power of community-wide social sanctions.

Our third model is one of limited commitment but no private information. In this case the Dictator will send his investments to whomever is least likely to have his bargaining position strengthened by the transfer. Conversely, the dictator will be tempted to invest less than the efficient amount only if the stakes are large enough to improve his own bargaining position so that he can claim a larger share of village resources, both now and later. Whether or not the Dictator is revealed is unimportant in this environment. Transfers will be equal under the Anonymous and Revealed games. Transfers will be (weakly) larger under both the Chosen and Chosen Revealed games, but won't differ across these two.

It's only with both hidden information and limited commitment that all four of our different motives for sharing can be identified. We'd expect the Anonymous game to feature the lowest transfers, depending only on benevolence. Transfers in the Revealed game depend on benevolence and sanctions and so should be larger than in the anonymous game. Transfers in the Chosen game will not depend on sanctions, but will depend on directed altruism, and so will probably be larger than in the Anonymous game. It's not possible to say whether transfers in the Chosen game will be larger than in the Revealed game or not. All four motives for making transfers affect the Chosen-Revealed game, so transfers should be largest in that game. This can be summarized in Table 6.

7. RESULTS

Table 3 shows the average amount sent and its standard deviation in each game. We find that the exact same pattern in Table 6 which characterizes the case of a model with both limited commitment and hidden infromation fit the data. It might be the case that the average behavior

is masking the fact that different villages are in different regimes and so we also look village by village (combining the real games with the hypothetical questions). Due to the smaller sample sizes, fewer of the differences are significant. On the whole, the patterns look similar to the overall result resembling a world with both limited commitment and hidden information.[5]

Thus, given that we are in a world with hidden investments and private information we can calculate the quantities B, S, A, and R. For now, we are crude and assume that a transfer from the dictator is just the sum of different motives. additivity and that they are directly measurable vis-á-vis the amount sent as in Table 1. We measure these quantities for two groups of people: the people who actually participated in the games (shown in Table 4), and the people who were chosen by the dictators and were then asked hypothetical versions of the games (shown in Table 5).[6]

When looking Table 3, one should remember that B is benevolence, S is sanctions, A is directed altruism, and R is reciprocity in the social network. "Motive - poverty" means that one of the motives for choosing the recipient was that he needs the money now, or he needs the money always. "Motive - friend" means that one of the motives for choosing the recipient was that he is a good person, a good friend, I trust him, or I owe him a favor. Some observations could be classified in both categories since people were allowed to choose more than one motive. "Choose - will know" means the dictator cares that the recipient will know who chose him. "Choose - won't know" means the dictator says the receiver needs the money and so the dictator doesn't care if the receiver knows who chose him. This was not asked in the hypothetical set of questions.

To calculate means and standard errors in the first row of Tables 4 and 5, one can run the following regression, clustered at the individual level:

$$y_{ij} = B + ST_2 + AT_3 + (S + A + R)T_4 + \epsilon_{ij}$$

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[5]One could suggest that villages 1 and 10 look like they might have only limited commitment, while villages 5 and 6 have only hidden information. For all villages except 1 and 15 we can reject full insurance. For all villages except 1, 10, and 15 we can reject limited commitment alone. For all villages except 1, 5, 6, 7, 8, 9, and 15 we can reject hidden information alone.

[6]We also experiment with including or excluding games run by "Charles", an enumerator who misbehaved. He encouraged players to send less money so that they could win more. (Respondents to the hypothetical questions in the short surveys conducted by Charles also send less money. Perhaps he wanted the results in his surveys to 'match' the results from the actual games he conducted.)

Table 3. Averages Sent

Setting (Obs.)	Anonymous (1)	Revealed (2)	1=2	Chosen (3)	1=3	2=3	Chosen Revealed (4)	1=4	2=4	3=4
Real Games (371)	5084 (2695)	5466 (2687)	***	5394 (2679)	***		5927 (2840)	***	***	***
Hypothetical (173)	6601 (3445)	7173 (3359)	**	7075 (3224)	**		8098 (3295)	***	***	***
Village 1 (34)	6000 (3200)	6324 (3674)		6706 (3353)			6765 (3774)			
Village 2 (40)	4150 (2646)	4550 (3038)		4375 (2047)			5775 (3182)	***	***	***
Village 3 (36)	4528 (2348)	4639 (2307)		4778 (2140)			5667 (2586)	***	***	**
Village 4 (30)	4200 (2310)	4200 (2203)		4367 (1650)			5367 (3189)	*	**	**
Village 5 (41)	5585 (2958)	6512 (3377)	**	5610 (2519)		*	6927 (2715)	***		***
Village 6 (45)	6978 (3151)	7244 (3248)		6956 (3470)			7622 (7622)	*		*
Village 7 (34)	4559 (3027)	5471 (3028)		5235 (2742)			5853 (3500)	***		*
Village 8 (39)	6641 (3256)	7333 (2548)		6949 (2733)			7923 (3012)	**		**
Village 9 (32)	7031 (3450)	8000 (3501)	*	7875 (3260)			7656 (3442)			
Village 10 (32)	6500 (3282)	7000 (2553)		7344 (3488)	**		7438 (2782)	**		
Village 11 (45)	6089 (2999)	5533 (2473)		5600 (2911)			6444 (2841)		**	**
Village 12 (25)	4560 (2083)	5400 (2121)	***	5640 (2675)	**		6120 (3180)	***		
Village 13 (42)	5048 (2641)	5214 (2435)		5143 (2193)			6167 (2938)	**	**	***
Village 14 (41)	5756 (3064)	6634 (2727)	**	6659 (3030)	*		7390 (3024)	***	*	**
Village 15 (28)	5107 (2587)	5679 (2855)		5643 (3234)			5393 (2529)			

Numbers in parentheses are standard deviations.
Averages are *-90%, **-95%, and ***-99% significantly different from one another using a *t*-test.

TABLE 4. Real games

Categories (Players in Category)	B	S	A	R
Everyone	5084***	383***	310**	151
(371)	(140)	(120)	(119)	(159)
No Charles	5390***	455***	255*	23
(310)	(153)	(130)	(130)	(174)
Motive - poverty	5229***	549***	529***	0
(153)	(223)	(187)	(196)	(257)
Motive - friend	4983***	261*	130	270
(230)	(172)	(149)	(142)	(193)
Choose - not know	5189***	365***	389***	-35
(285)	(155)	(137)	(131)	(173)
Choose - know	4733***	442*	47	767**
(86)	(319)	(252)	(274)	(367)

Numbers in parentheses are standard errors.
*-90%, **-95%, and ***-99% significantly different from 0.

TABLE 5. Hypothetical questions

Categories (Players in Category)	B	S	A	R
Everyone	6601***	572**	474**	451
(173)	(263)	(235)	(237)	(284)
No Charles	6896***	539**	474*	578*
(154)	(281)	(255)	(261)	(302)
Motive - poverty	7258***	-48	210	1129***
(62)	(425)	(336)	(359)	(413)
Motive - friend	6252***	928***	622**	18
(111)	(329)	(311)	(310)	(370)

Numbers in parentheses are standard errors.
*-90%, **-95%, and ***-99% significantly different from 0.

where T_2, T_3, and T_4 are dummies for the revealed game, the chosen game, and the chosen revealed game respectively. The player's subscript is i and the game's subscript is j. In the subsequent rows, we run additional regressions including dummy variables for not being in the category of interest (e.g. not having a motive of poverty) interacted with each of the treatments. Each row of the tables represents a separate regression.

There are some interesting things to note about these two tables.

(1) All four variables are positive on average.
(2) The value of sanctions S seems to be larger than the value of directed altruism A (as well as larger than the value of reciprocity in the social network R).
(3) In the real games, the value of reciprocity in the social network is greater when players state that the motive behind choosing the person did not have to do with poverty, while directed altruism is higher when the dictator claims to have chosen the recipient due to poverty. Related, dictators who say that they care whether or not the recipient knows the money is from them have a higher value of the network. Dictators who claim not to care if the recipient knows who the money comes from have a higher value for directed altruism. (Actually, and quite interestingly, dictators who choose a recipient based on the recipient's level of poverty, and who don't care if the recipient knows where the money is coming from also have higher values of benevolence (and are wealthier).)

The results from the hypothetical games on this seem to be the exact opposite. This seems to be due to the fact that the value of sanctions is so much higher for this group of people. Since, in some senses, the value of reciprocity in the social network is the residual after accounting for all other three motives, this makes reciprocity lower. Perhaps the interesting question is not, why do people in the short survey who don't choose recipients based on poverty have such low values of reciprocity, but rather why do they have such high values of sanctions.

One might worry that the order in which these four versions are presented to the players is important. We control for order effects estimating the regression discussed above, clustered at the individual level but adding additional right hand side variables which represent order effects (as well as a dummy for whether the data was collected by Charles). In this way we predict how much would have been sent in each version of the game if it had been the first game played and if it had not been conducted by Charles.

Let us number the anonymous game 1, the revealed game 2, the chosen game 3, and the chosen revealed game 4. The 12 orders possible were {1,2,3,4}, {1,2,4,3}, {1,3,4,2}, {1,4,3,2}, {2,1,3,4}, {2,1,4,3}, {2,3,4,1}, {2,4,3,1}, {3,4,1,2}, {4,3,1,2}, {3,4,2,1}, and {4,3,2,1}. Games 1 and 2 may be separated, but games 3 and 4 were never separated.

TABLE 6. Real games: Controlling for order and Charles

Category (Players in Category)	B	S	A	R
Everyone	5747***	240	305	199
(371)	(189)	(270)	(253)	(417)
Motive - poverty	5869***	413	562*	68
(153)	(244)	(302)	(291)	(476)
Motive - friend	5657***	131	116	316
(230)	(220)	(287)	(269)	(418)
Choose - not know	5806***	236	388	20
(285)	(200)	(288)	(259)	(429)
Choose - know	5515***	291	3	854*
(86)	(329)	(324)	(339)	(515)

Numbers in parentheses are standard errors.
*-90%, **-95%, and ***-99% significantly different from 0.

As explanatory variables representing order effects, we include an indicator for whether game 2 came before game 1 multiplied by a treatment 1 indicator, an indicator for whether game 2 came before game 1 and the two games were separated from one another multiplied by a treatment 1 indicator, an indicator for whether game 1 came before game 2 multiplied by a treatment 2 indicator, an indicator for whether game 1 came before game 2 and the two games were separated from one another multiplied by a treatment 2 indicator, indicators for whether game 3 came before came 4 multiplied separately by treatment 3 and 4 indicators, and indicators for whether game 1 was separated from game 2 multiplied separately by treatment 3 and 4 indicators. We also include indicators for whether Charles ran the experiment interacted with each treatment indicator. These regressions were run separately for both the actual games and the hypothetical questions.

Because the order effects were mostly insignificant in the regressions using the hypothetical data, we also employ the same techniques as above, but controlling only for Charles and not for the order effects. This should decrease noise in the predicted amount sent in the hypothetical data.

In Table 6 one can see that the values still tend to be positive. The value of sanctions still seems to be higher than the value of directed altruism. On the other hand, benevolence and the value of reciprocity in the social network are both higher after controlling for order effects, while sanctions and directed altruism are both smaller. It is still the case that the value of reciprocity in the social network is greater when

TABLE 7. Hypothetical questions: Controlling for order and Charles

Category (Players in Category)	B	S	A	R
Everyone	6809***	1147**	682	-529
(173)	(367)	(506)	(441)	(708)
Motive - poverty	7423***	706	427	39
(62)	(482)	(531)	(496)	(763)
Motive - friend	6365***	1542***	915*	-933
(111)	(408)	(544)	(490)	(742)

Numbers in parentheses are standard errors.
*-90%, **-95%, and ***-99% significantly different from 0.

TABLE 8. Hypothetical questions: Controlling for Charles but not order

Category (Players in Category)	B	S	A	R
Everyone	6896***	539**	474*	578*
(173)	(281)	(255)	(261)	(302)
Motive - poverty	7563***	-84	209	1261***
(62)	(426)	(336)	(371)	(426)
Motive - friend	***6544	894***	621*	145
(111)	(341)	(332)	(333)	(381)

Numbers in parentheses are standard errors.
*-90%, **-95%, and ***-99% significantly different from 0.

players state that the motive behind choosing the person did not have to do with poverty and that they care whether the recipient knows that the money came from them. Directed altruism and benevolence are still lower in these cases. So, the main results which held previously continue to hold when controlling for order effects.

The results from the hypothetical games controlling for order and Charles in Table 7 and controlling for Charles but not order in Table 8 also don't change qualitatively. Those who chose a recipient because they were poor continue to unexplainably have a higher value of the social network and a lower value of directed altruism. These strange results could be due to noise since these questions were asked hypothetically. It also could be due to the fact that these people do not constitute a random sample as do the people who participated in the actual games. The people answering the hypothetical questions are

TABLE 9. Correlates of motives

	B	S	A	R
	(1)	(2)	(3)	(4)
Player Age	-7.606	4.908	5.047	-21.685**
	(8.690)	(7.763)	(7.723)	(10.056)
Player Male	297.769	-227.064	-221.318	530.965
	(301.668)	(269.482)	(268.083)	(349.081)
Log(Income)	371.033*	-51.371	-45.531	-42.217
	(200.259)	(178.892)	(177.964)	(231.733)
Family Size	55.013	-78.116	-44.413	87.280
	(67.701)	(60.477)	(60.164)	(78.341)
# Adult Males	-218.709	182.735	51.288	-355.515*
	(176.348)	(157.533)	(156.715)	(204.065)
Hhs w/ Close Relatives in Village	-48.671	5.606	59.480	59.961
	(67.457)	(60.260)	(59.947)	(78.059)
Const.	1842.500	917.991	638.485	1145.976
	(1926.704)	(1721.136)	(1712.205)	(2229.521)
Obs.	369	369	369	369

Village fixed effects included.

Standard errors in parenthesis.

*-90%, **-95%, and ***-99% significant.

those who were chosen to be recipients by some household playing in the actual games. This leads to selection issues (which the theory may be able to say something about). An additional surprising and unexplained characteristic of Table 7 (but not Table 8) is that in this table the value of the network tends to be negative.

We also run regressions to look at correlates of each of the four motives in Table 9. We find that wealthier people are more benevolent. With regards to the value of the social network, according to the limited commitment model, a sender will keep more in the chosen revealed game, and have a lower level of reciprocity, R, if his incentive compatability constraint binds. This means that someone who finds autarky relatively appealing will send less in the chosen revealed game, and someone who has a higher surplus from the social network will send more. Elderly people, households in a lot of debt, households with many adult males, and households with few social connections in their village should all send less. Table 9 shows that older people and households with more adult males are less reciprocal, as suggested by the model. Households living in the same village with more households

TABLE 10. Correlates of motives

	B	S	A	R
	(1)	(2)	(3)	(4)
Player Age	-7.586	4.938	5.102	-21.752**
	(8.696)	(7.756)	(7.670)	(10.000)
Player Male	310.244	-208.226	-186.762	489.576
	(302.282)	(269.603)	(266.630)	(347.636)
Log(Income)	387.083*	-27.133	-1.071	-95.471
	(201.463)	(179.683)	(177.701)	(231.690)
Family Size	60.222	-70.250	-29.983	69.996
	(68.079)	(60.719)	(60.049)	(78.293)
# Adult Males	-209.556	196.556	76.642	-385.882*
	(176.854)	(157.735)	(155.995)	(203.388)
Hhs w/ Close Relatives in Village	-41.807	15.971	78.494	37.187
	(68.085)	(60.725)	(60.055)	(78.301)
OR-degree	-29.337	-44.301	-81.264**	97.336**
	(38.180)	(34.053)	(33.677)	(43.909)
Const.	1830.047	899.186	603.991	1187.294
	(1927.907)	(1719.487)	(1700.522)	(2217.166)
Obs.	369	369	369	369

Village fixed effects included.
Standard errors in parenthesis.
*-90%, **-95%, and ***-99% significant.

containing close relatives (children, parents, or siblings) are no more reciprocal than those with fewer households containing close relatives.

In Table 10 we add in the OR-degree. In the survey, respondents were asked to whom they lent money, lent land, gave gifts, gave remittances, and helped out with health costs in the last year. They were also asked from whom they borrowed money, borrowed land, received gifts, received remittances, and received help with health costs in the last year. They were also asked who they would go to and who would go to them if they needed 20,000 Guaranies. The degree is the number of households within the village with whom they are linked in such a way. It is called an OR-link because we assume there is a link either if i says he is linked with j OR j says he is linked with i, or both.[7] The same results still hold as before. Now though, in addition, the more

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[7] If i and j are both in our sample then there is a link if either or both say they are connected. If i is in our sample but j is not, then there is only a link between i and j if i claims the link exists. We do not have data on j's perception if he is not in our sample.

connected an individual is, the more valuable the social network is for him and the less he gives for reasons of directed altruism. That well-connected people gain more social surplus from cooperating and are less likely to have their incentive compatability constraint bind, and so send more is predicted by the model.

Finally, in Table 11 we add in variables related to borrowing and lending as well as giving and receiving both within the village and with other households outside the village. We are not including borrowing from financial institutions, only from households. Also, these villages do not contain individuals whose profession is money-lending. Many individuals are involved in both lending and borrowing, although no interest seems to be charged.

When controlling for so many other variables, the fact that richer households are more benevolent loses significance. The elderly and households with more adult males are still more reciprocal. As suggested by the theory, households who have borrowed more from their village-mates have less to lose from reverting to autarky (since in autarky they would not have to pay back their debt) and so they are less reciprocal. Likewise, households which gave more gifts to their village-mates are more reciprocal. Perhaps they are hoping that their greater gift-giving will be returned in the future.

We have also included information on lending and giving to households outside the village. None of these variables are significant, reaffirming our belief that the significance of the previous variables was due to the social network within the village. Also, it is worth noting that gift giving is only correlated with the reciprocity variable. It is not the case that people who give more gifts are more benevolent or altruistic, these are people who give due to reciprocity in the social network.

7.1. **Do people choose a recipient they think can't punish them?** One might think that the dictator may specifically choose a recipient who is not part of his social network (i.e., who can't punish him) in order to be able to keep more of the endowment and send less money. Such a person would send more to the randomly chosen revealed recipient than to the person he chose himself when identities are revealed. Out of the 371 participants in the actual games, there are 87 (or 23%) of the players who do just that. Of the 173 people asked the hypothetical questions in the survey, 33 (or 19%) of the people do that.[8]

We could compare characteristics of these dictators who seem to choose recipients they are not afraid of (and don't benefit from?). These

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[8]The results are similar when looking at the predicted amount sent when controlling for order and Charles, or just for Charles.

TABLE 11. Correlates of motives

	B	S	A	R
	(1)	(2)	(3)	(4)
Player Age	-6.145	3.102	5.513	-20.955**
	(8.903)	(7.933)	(7.896)	(10.264)
Player Male	294.830	-245.035	-205.960	522.588
	(304.899)	(271.684)	(270.406)	(351.525)
Log(Income)	344.372	40.790	95.473	-200.190
	(212.684)	(189.515)	(188.623)	(245.208)
Family Size	59.263	-80.388	-47.394	95.067
	(68.599)	(61.126)	(60.838)	(79.090)
# Adult Males	-201.813	196.160	43.145	-386.135*
	(179.928)	(160.327)	(159.572)	(207.442)
Hhs w/ Close Relatives in Village	-42.894	-2.515	36.655	78.413
	(69.745)	(62.147)	(61.854)	(80.410)
Log(Amt Lent in Village)	-4.273	-29.005	-29.633	60.561
	(63.707)	(56.767)	(56.500)	(73.449)
Log(Amt Borrowed in Village)	-45.349	57.485	70.005	-136.161*
	(69.912)	(62.296)	(62.003)	(80.604)
Log(Gifts Given in Village)	-30.799	-77.603	-38.043	111.565*
	(55.594)	(49.538)	(49.305)	(64.096)
Log(Gifts Received in Village)	63.436	-57.270	9.545	9.991
	(58.276)	(51.927)	(51.683)	(67.188)
Log(Amt Lent outside Village)	-111.778	.694	1.273	5.930
	(99.028)	(88.240)	(87.825)	(114.171)
Log(Amt Borrowed outside Village)	52.395	-58.229	-33.961	53.480
	(100.271)	(89.348)	(88.927)	(115.605)
Log(Gifts Given outside Village)	60.366	-33.668	-85.054	33.749
	(62.059)	(55.298)	(55.038)	(71.549)
Log(Gifts Received outside Village)	-92.040	40.214	-35.952	-17.264
	(73.996)	(65.935)	(65.625)	(85.312)
Const.	2000.915	520.403	-357.415	2209.902
	(2026.545)	(1805.780)	(1797.279)	(2336.449)
Obs.	369	369	369	369

Village fixed effects included.
Standard errors in parenthesis.
*-90%, **-95%, and ***-99% significant.

dictators are wealthier than the average dictator. In the real games their average wealth is 201,000 KGs compared to 91,300 KGs for those who do not play that way. This is not true in the hypothetical games, where average wealth of those who send more in the revealed game than the chosen revealed game is 20,800 KGs rather than 46,200 KGs.

Since we also know something about the characteristics of the chosen recipients as individuals, as well as characteristics regarding how they are linked in the social network to the dictator, we could possibly say something interesting about this group of people by comparing characteristics of the recipients they choose in comparison with the characteristics of the recipients that other people choose. We could look at individual characteristics, characteristics regarding the way in which the two individuals are linked, and characteristics of the individuals' position in the network.

One thing we have not yet examined is the wealth level of the chosen recipient. In the real game, these people do choose poorer recipients (average wealth of 38,300 KGs rather than 45,900 KGs). For the hypothetical questions this is also the case (average wealth of 25,900 compared with 176,000 KGs).[9] These results make sense if we equate recipient wealth with that recipient's usefulness in the network.

Tables 12 and 13 show the proportion of players sending more money in one treatment than another in the real games and hypothetical questions respectively. (The numbers do not sum to 1 due to players who send the same amount in both treatments.) The intuition from our model does not tell us whether people should send more in the revealed (sanctions) treatment or in the chosen (directed altruism) treatment, so we have no predictions about the value of the (2,3) or (3,2) elements of the figure. But, we do predict that people should send the least in the anonymous (benevolence) treatment and the most in the chosen revealed (reciprocity) treatment. This would predict that the numbers on the left and bottom sides would be close to 1, while the numbers on the right and top should be 0. Although the shares do not border on 1 and 0, it is the case that most people behave as predicted. There is still a large proportion of people which exhibits unexpected behavior.[10]

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[9]The results on recipient wealth levels for the hypothetical questions should be taken with a grain of salt because more than half of the observations are missing. People who were chosen as recipients in the hypothetical questions in the short survey were not then given their own short survey so we only have data on these recipients if they happened to be in our long or short survey already.

[10]Taking into account order effects does not change the main results in these table, although it does increase the share of people who are considered to not send the same amount in any two versions.

TABLE 12. Real games: Proportions sending more

	Anonymous	Revealed	Chosen	Chosen Revealed
Anon	●	0.24	0.27	0.20
Rev	0.40	●	0.34	0.23
Chosen	0.35	0.29	●	0.21
Chos-Rev	0.46	0.37	0.42	●

Numbers represent the proportion of subjects who sent higher transfers under the row treatment than the column treatment.

TABLE 13. Hypothetical questions: Proportions sending more

	Anonymous	Revealed	Chosen	Chosen Revealed
Anon	●	0.27	0.24	0.18
Rev	0.38	●	0.32	0.19
Chosen	0.39	0.34	●	0.12
Chos-Rev	0.51	0.45	0.44	●

Numbers represent the proportion of subjects who sent higher transfers under the row treatment than the column treatment.

8. CONCLUSION

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Appendix A. Game Protocol

Thank you very much for coming today. Today's games will last two to three hours, so if you think that you will not be able to remain the whole time, let us know now. Before we begin, I want to make some general comments about what we are doing and explain the rules of the games that we are going to play. We will play some games with money. Any money that you win in the games will be yours. Laura Schechter will provide the money. But you must understand that this is not Laura's money, it is money given to her by her university to carry out her research.

All decisions you take here in these games will be confidential, or, in some cases, also known by your playing partner. This will depend on the game and we will inform you in advance whether or not your partner will know your identity.

Before we continue, I must mention something that is very important. We invited you here without your knowing anything about what we are planning to do today. If you decide at any time that you do not want to participate for any reason, you are free to leave, whether or not we have started the game. If you let me know that you are leaving,

I'll pay you for the part of the game that you played before leaving. If you prefer to go without letting me know, that is fine too.

You can not ask questions or talk while in the group. This is very important. Please be sure that you understand this rule. If a person talks about the game while in this group, we can not play this game today and nobody will earn any money. Do not worry if you do not understand the game well while we discuss the examples here. Each of you will have the opportunity to ask questions in private to make sure you understand how to play.

This game is played in pairs. Each pair consists of a Player 1 and a Player 2 household. Laura will give 14,000 Guaranies to each of you who are Player 1s here today. Player 1 decides how much he wants to keep and how much he wants to send to Player 2. Player 1 can send between 0 and 14,000 Gs to Player 2. Any money sent to Player 2 will be doubled. Player 2 will receive any money Player 1 sent multiplied by two, plus an additional contribution from us. Player 1 takes home whatever he doesn't send to Player 2. Player 1 is the only person who makes a decision. Player 1 decides how to divide the 14,000 Gs and then the game ends.

The additional contribution is determined by the roll of a die. The additional contribution will be the roll of the die multiplied by 2 if it lands on any number between 1 and 5. If it lands on 6, there will be no additional contribution. Thus, if it lands on 1 there will be 2,000 additional for Player 2, if it lands on 2 there will be 4,000 additional for Player 2, if it lands on 3 there will be 6,000 additional for Player 2, if it lands on 4 there will be 8,000 additional for Player 2, and if it lands on 5 there will be 10,000 additional for Player 2. But if it lands on 6 there will not be any additional contribution for Player 2.

Now we will review four examples. [*Demonstrate with the Guarani magnets, pushing Player 1's offer to Player 2 across the magnetic blackboard.*]

(1) Here are the 14,000 Gs. Imagine that Player 1 chooses to send 10,000 Gs to Player 2. Then, Player 2 will receive 20,000 Gs (10,000 Gs multiplied by 2). Player 1 will take home 4,000 Gs (14,000 Gs minus 10,000 Gs). If the die lands on 5 , Player 2 will receive the additional contribution of 10,000 Gs, which means he will receive 30,000 total. If the die lands on 1, Player 2 will receive the additional contribution of 2,000 Gs, which means he will receive 22,000 total.

(2) Here is another example. Imagine that Player 1 chooses to send 4,000 Gs to Player 2. Then, Player 2 will receive 8,000 Gs

(4,000 Gs multiplied by 2). Player 1 will take home 10,000 Gs (14,000 Gs minus 10,000 Gs). If the die lands on 3, Player 2 will receive the additional contribution of 6,000 Gs, which means he will receive 14,000 total. If the die lands on 6, Player 2 will not receive any additional contribution, which means he will receive 8,000 total.

(3) Here is another example. Imagine that Player 1 chooses to allocate 0 Gs to Player 2. Then, Player 2 will receive 0 Gs. Player 1 will take home 14,000 Gs (14,000 Gs minus 0 Gs). If the die lands on 2, Player 2 will receive the additional contribution of 4,000 Gs, which means he will receive 4,000 total.

(4) Here is another example. Imagine that Player 1 chooses to allocate 14,000 Gs to Player 2. Then, Player 2 will receive 28,000 Gs (14,000 Gs multiplied by 2). Player 1 will take home 0 Gs (14,000 Gs minus 14,000 Gs). If the die lands on 4, Player 2 will receive the additional contribution of 8,000 Gs, which means he will receive 36,000 total.

That's how simple the game is. We will play four different versions of this game. Player 2 will always be a household in this community.

1.) In one version, Player 2's household will be chosen by a lottery. The same family can be drawn multiple times. It could be someone who is participating in the games here today, or it could be another household in this company. It can not be your own household. You will not know with whom who you are playing. Only Laura knows who plays with whom, and she will never tell anyone. They may be happy to receive a lot of money but can not thank you, or they may be sad to receive a little money but they can not get angry with you, because they are never going to know that this money came from you. You will not know the roll of the die in this version of the game.

2.) In another version, Player 2's household will also be chosen by a lottery. The same household can be drawn multiple times. In this version you will discover the identity of Player 2 after all of the games today, and Player 2 will also discover your identity. After the games we'll go to the randomly drawn Player 2's house and we will explain the rules of the game to him and we will explain that John Smith gave so much money and then the die landed in such a way, but that when John Smith was deciding how much to give he did not know who the money was going to. They may be happy to receive a lot of money, and will be able to thank you, or they may get angry with you if they receive little money, because they will know that the money was sent by you.

3 and 4.) In the next two versions, you can choose the identity of Player 2. You can choose any household in this village and we will give the money to someone in that household who is over 18. There will be two versions of this game, only one of which will count for your earnings today. You must choose the same household as recipient in these two games, and you can not choose your own household.

3.) In one version, we will not tell Player 2's household that you chose them and we will make it difficult for them to figure out your identity. That person will never know that you were the one who sent the money. They may be happy to receive a lot of money, or sad to receive little money, but they have no way of figuring out that the money came from you. Even if you go to them afterwards and tell them that you chose them and sent them money, they may not believe you. You will not know the exact amount they received because we add the additional contribution to the amount sent and also because they will receive all their earnings together at the same time as some amount X. They will not know which part of it comes from whom, or if they were chosen by a Player 1, or chosen by the lottery.

4.) In the other version we will tell Player 2's household that you chose him to send money to and you will both know the roll of the die. He can be angry with you if you send little or thank you if you send a lot.

After all of you play all four versions, I will toss a coin. If the coin lands on heads, the Player 2 household you chose will know who chose them. I will go to their house and give them the money, and explain the rules of the game to them, and I will tell them that you chose them and tell them how much money you sent them. If the coin lands on tails, the Player 2 household you chose will not know who sent them the money. We will not tell them that the money came from you, and they will not be able to find out. Remember, you decide how much you want to send when you choose the household and they know that the money comes from you, and how much you want to send when the household won't find out where the money comes from. But in this village only one of these two versions will count for money, depending on the toss of a coin. I will toss the coin in front of you after you have all played.

We now are going to talk personally with each of you one-on-one to play the game. You will play with either Laura or Vicente in private. We will explain the game again and ask you to demonstrate your understanding with a couple of examples. You will play the game with real money. Please do not speak about the game while you are waiting to play. You can talk about soccer, the weather, medicinal herbs, or

anything else other than the games. You also have to stay here together; you can not go off in small groups to talk quietly. Remember, if anyone speaks of the game, we will have to stop playing.

Dialogue for the Game

Suppose that Player 1 chooses to send 7,000 Gs to Player 2. In this case, how much would Player 1 take home? [*7,000 Gs*] How much would Player 2 receive? [*14,000 Gs*] What if the die falls on 3, what would the additional contribution be? [*6,000 Gs*] So how much would Player 2 receive in total? [*20,000 Gs*] What if the die falls on 1, what would the additional contribution be? [*2,000 Gs*] So how much would Player 2 receive in total? [*16,000 Gs*]

[*The order of playing these games is randomly chosen for each player.*]

Here I give you four small stacks of 14,000 Gs each, for a total of 56,000 Gs.

- Now we will play the game in which neither you nor Player 2 will know each other's identity. They may be happy to receive a lot of money but they can not thank you, or they may be sad to receive little money but they can not get angry with you. This is because they are never going to know that this money came from you. Take one of the stacks of 14,000 Gs. Please give me the amount you want me to give to Player 2's household, or if you do not want to give anything then don't hand me anything. I will double any money you give me and add the additional contribution to it and give it to a randomly chosen household in your village.
- Now we will play the game in which you and Player 2 will know each other's identity after the end of the games today. They may be happy to receive a lot of money, and will be able to thank you or they can get sad when receiving little money, and will be able to get angry with you. This is because they will know that the money was sent by you. Take one of the stacks of 14,000 Gs. Please give me the amount you want me to give to Player 2's household, or if you do not want to give anything then don't hand me anything. I will double any money you give me and add the additional contribution to it and give it to a randomly chosen household in your village and inform them of the rules of the game and explain how much you sent and that you sent it without knowing to whom you were sending.

- In the next two games you choose the household to which you want to send money. Now, tell me which household do you want to send money to?
- Now we will play the game in which the recipient household is not going to know that you chose them. Take one of the stacks of 14,000 Gs. Please give me the amount you want me to give to [*name*], or if you do not want to give anything then don't hand me anything. I will double any money you give me and add the additional contribution to it. They are not going to be able to figure out who chose them. They may be happy to receive a lot of money, or sad to receive little money, but they have no way of figuring out that the money came from you. Even if you tell them that you chose them and sent them money, they may not believe you. You will not know the exact amount they received because we add the additional contribution to the amount sent and also because they will receive all their earnings together at the same time as some amount X. They will not know which part of it comes from which person, or if they were chosen by a Player 1, or chosen by the lottery.
- Now we will play the game in which the recipient household will know that you chose them. Take one of the stacks of 14,000 Gs. Please give me the amount you want me to give [*name*], or if you do not want to give anything then don't hand me anything. I will double any money you give me and add the additional contribution to it and give it to Player 2's household and tell them the rules of the game and explain that you chose them and explain how much you sent. They can be angry with you if you send little or thank you if you send a lot.

Now you must wait while the rest of the players make their decisions. Remember that you can not talk about the game while you are waiting to be paid. Please go outside to chat a bit with Ever before exiting.

The End
[*After all participants have made their decisions, talk to them as a group one last time.*] Now I will flip a coin. [*If heads:*] The coin landed heads, which means that the Player 2 household you chose will know who chose them and how much money they sent. [*If tails:*] The coin landed tails, which means that the Player 2 household that you chose will not discover who sent them money. Now I will speak with you one at a time one last time to give you your winnings and to tell you who

was drawn in the lottery to receive money from you in the revealed version of the game.

[*Call players in one at a time.*] In the anonymous game you kept [*X Gs*]. In the game in which you will discover who you sent the money to, you kept [*Y Gs*] and [*name*] received [*M Gs*] since their name was chosen in the lottery. In the game in which you chose your partner and [*if the coin landed heads*] he will know who sent him the money [*or if the coin landed tails*] he will not find out who sent him the money, you kept [*Z Gs*], [*and if the coin landed heads*] so Player 2 received [*M Gs*].

[*If received in anoymous game or chosen game:*] You also received [*G Gs*] from an anonymous Player 1. [*If received in revealed game:*] You also received [*H Gs*] from a Player 1 who did not know he was playing with you and his name is [*name each*] and he sent you this amount [*M*] which was doubled and then the die landed on [*D*]. [*If received in chosen revealed game:*] You also received [*J Gs*] in total from a Player 1 who chose you and their name is [*name each*] and and he sent you this amount [*M*] which was doubled and then the die landed on [*D*].

That means you have won a total of [*X + Y + Z + G + H + J Gs*]. Thank you for playing with us here today. Now the game is over. After we finish handing out the money here, we will go to the households of the appropriate Player 2s to give them their winnings.

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