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ABSTRACT

We conduct field experiments in a large real-world social network to examine why decision makers treat friends more generously than strangers. Subjects are asked to divide surplus between themselves and named partners at various social distances, where only one of the decisions is implemented. In order to separate altruistic and future interaction motives, we implement an anonymous treatment where neither player is told at the end of the experiment which decision was selected for payment and a non-anonymous treatment where both players are told. Moreover, we include both games where transfers increase and decrease social surplus to distinguish between different future interaction channels including signaling one's generosity and enforced reciprocity, where the decision maker treats the partner to a favor because she can expect it to be repaid in the future. We can decompose altruistic preferences into baseline altruism towards any partner and directed altruism towards friends. Decision makers vary widely in their baseline altruism, but pass at least 50 percent more surplus to friends compared to strangers when decision making is anonymous. Under non-anonymity, transfers to friends increase by an extra 24 percent relative to strangers, but only in games where transfers increase social surplus. This effect increases with density of the network structure between both players, but does not depend on the average amount of time spent together each week. Our findings are well explained by enforced reciprocity, but not by signaling or preference-based reciprocity. We also find that partners' expectations are well calibrated to directed altruism, but that they ignore decision makers' baseline altruism. Partners with high baseline altruism have friends with higher baseline altruism and are therefore treated better.

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"Friendship is one mind in two bodies." – Mencius (3rd century B.C.)

"Friendship is essentially a partnership." – Aristotle (4th century B.C.)

1 Introduction

Friends tend to treat us better than strangers. A significant share of team production therefore evolves around pre-existing social relationships. For example, 53 percent of all start-ups in the US have more than one owner and 23 percent of these jointly owned start-ups have at least one friend as co-owner (Davidsson and Reynolds 2005). Our objective in this paper is to answer the question: how much is it worth to have a friend rather than a stranger make payoff-relevant decisions and what channels make a friend valuable?

While most experimental research has focused on altruism between strangers, it is natural to assume that the strength of altruism varies with social distance. Increased altruism helps align the interests of a decision maker and her partner in an economic relationship. Aside from increased altruism, friendships can be valuable because there is a greater prospect of future interaction with friends compared to strangers. Economic theory suggests at least three mechanisms which induce the decision maker to treat the partner more generously when there is a prospect of future interaction. First, the decision maker can grant favors because she expects the partner to repay them in the future. We call this the *enforced reciprocity* mechanism. Second, the possibility of future interaction gives incentives for the decision maker to *signal* her type to the partner (Benabou and Tirole 2006). Third, psychological game theory has modeled *preference-based reciprocity* where decision makers behave generously because they expect the partner to behave kindly towards them in some future interaction and they derive utility from rewarding kind behavior (Rabin 1993, Dufwenberg and Kirchsteiger 2004).

We use field experiments to (a) disentangle the directed altruism from the future interaction channel, (b) determine the absolute and relative strength of both effects and (c) to pin down the mechanism behind the repeated interaction channel. Our experimental design has two stages. In the first stage we map a large real-world social network. In the second stage we invite a randomly selected sample of subjects from this network to play the role of a decision maker who repeatedly over a period of one to two weeks divides surplus between herself and partners at various social distances plus a "nameless" partner. In our first field experiment, decision makers play modified dictator games with different exchange rates such that in some games passing tokens to the partner increases social surplus and in other games it decreases social surplus. The second field experiment is a novel helping game where decision makers have to choose how much they would be maximally willing to pay to increase the payoff of the partner by a fixed amount. While each decision maker makes multiple decisions, only one of them is randomly selected for payment at the end of the experiment. For each match a decision maker makes both an *anonymous* and a *non-anonymous* decision. In the anonymous treatment, no player is told at the end of the experiment which of the matches was selected for payment, while in the non-anonymous treatment both players are informed about the selected decision maker/partner match and the decision maker's action. The anonymous and non-anonymous treatments allow us to separate directed altruism from future interaction channels. By including both games where giving is efficient and inefficient, we can distinguish the signaling mechanism from reciprocity mechanisms: decision makers motivated by reciprocity should only transfer more surplus under non-anonymity to the socially close partner if giving is efficient. In contrast, decision makers who want to signal their generosity to the partner should always transfer more surplus.

In the anonymous treatment, we find that a decision maker's choice for a named partner is strongly determined by (a) her baseline altruism towards a nameless partner and (b) directed altruism towards socially close partners. In the dictator game experiment each token increase in generosity towards a nameless player is associated with approximately a one token increase in generosity towards any named player. This correlation is remarkable because nameless and named decisions were taken one week apart. Controlling for their baseline altruism, decision makers are substantially more generous towards friends: subjects pass at least 50 percent more surplus to friends compared to strangers when decision making is anonymous. This effect declines for indirect friends but can still be substantial for second-order friends. We do not find that standard demographic variables, such as gender of either the decision maker or the partner have significant effects. We also collect data on partners' expectations of how generous they expect (named) decision makers at various social distances to behave. We find that partners' expectations are well calibrated to directed altruism: their expectations decrease with social distance at approximately the correct rate. However, there is no evidence that a partner takes a decision maker's baseline altruism towards nameless players into account when forming expectations. This is true even if partner and decision maker are socially close. Nevertheless, partners with high baseline altruism are treated substantially better by their friends than subjects with low baseline altruism because baseline altruism of direct social neighbors is positively correlated. It therefore appears that while we seek out friends with similar altruistic preferences as ourselves, we base our beliefs about the decision maker's generosity mainly on social distance.

When we compare non-anonymous and anonymous decision making, we find that transfers to a friend versus a stranger increase by an *additional* 24 percent *only if* such transfers increase social surplus. This is true, for example, in a dictator game where tokens are worth more to the partner than to the decision maker. This means that an important characteristic that distinguishes between the altruistic motivation for giving and the effect of observability within a social network is that the altruistic effect leads to more equitable distributions (that may diminish efficiency), while observability pushes allocations towards efficiency.

Just as in the case of directed altruism the effect declines with social distance and is not affected by demographic characteristics of the decision maker or the partner. We also find that the effect of non-anonymity and directed altruism towards friends are substitutes: the more altruistic the decision maker the *lower* are the extra transfers under non-anonymity. Our experimental findings can be explained by a theory of enforced reciprocity based on Mobius and Szeidl (2006) where the decision maker treats friends under non-anonymity to extra "favors" because she expects them to be repaid in the future. In contrast, the signaling model of Benabou and Tirole (2006) predicts excess transfers to friends across all games even when such transfers decrease social surplus. We cannot use the same test to distinguish the favors mechanism from preference-based reciprocity models which make similar predictions. However, our enforced-reciprocity model also predicts a role for network structure: a measure of local network density - *maximum network flow* between decision maker and partner - determines the decision maker's ability to make the partner repay a favor. Consistent with this model, we find that network flow predicts the decision maker's generosity under non-anonymity even after controlling for social distance. One might expect that in locally dense networks friends see each other more frequently and have more opportunities for reciprocation. As it turns out, our finding is not just an artifact of network flow being a proxy for the amount of time a decision maker spends with a partner. For direct friends, we also collect data on the average amount of time spent together each week. Network flow is essentially uncorrelated with time spent together in our data set and it is network flow rather than time spent together that predicts generosity under non-anonymity suggesting that our results are driven by enforced rather than preference-based reciprocity.

Our paper relates to a rich experimental and theoretical literature on other-regarding preferences and cooperation. Prosocial behavior in the lab of varying magnitudes has been observed in a variety of contexts (see Camerer (2003) for an extensive survey). Our directed altruism channel is a natural refinement of preference-based altruism as modeled by Andreoni (1990) in his "warm glow" model or Fehr and Schmidt (1999), Bolton and Ockenfels (2000) and Charness and Rabin (2002) who focus on preferences over payoff distributions. In the lab, experiments on prosocial behavior with reduced anonymity have typically involved revealing the ethnic group or gender of the partner Fershtman and Gneezy (2001). In subsequent research Goeree, McConnell, Mitchell, Tromp, and Yariv (2007) have adopted the anonymous treatment of our experimental design (standard dictator game) and also find strong evidence for directed altruism in a school network of teenage girls (also see Pablo Braas-Garza, Ramon Cobo-Reyes, Maria Paz Espinosa, Jimnez, and Ponti (2006) for experimental data with European university students). There are very few experimental papers that explicitly rely on subjects' ongoing relationships with their friends. A notable exception is the seminal paper of Glaeser, Laibson, Scheinkman, and Soutter (2000) who also non-anonymously match subjects at various social distances to play a trust game. To the best of our knowledge our design is the first within-subject design which attempts to distinguish between directed altruism and future interaction effects.

In an important methodological advance, our two experiments were completely web-based. This ensured very high participation rates of between 42 percent and 71 percent which was crucial for generating a sufficient number of matches between direct friends during the course of the experiment. Our experiment also pioneers various techniques to conduct social network surveys online which we have already applied to a number of other projects and which we hope will prove useful to other researchers.

The rest of the paper is organized as follows. Section 2 provides a simple theory framework where we review the testable implications of various repeated game mechanisms such as enforced reciprocity, signaling and preference-based reciprocity. The experimental design is described in section 3. In section 4 we summarize the main features of the data. Our empirical results on directed altruism are presented in section 5 and section 6 contains our comparison of decision making under anonymity and non-anonymity.

2 Theory

We start with a simple one-period model of directed altruism and then add a second period in which the partner learns the decision maker's action from the first period and can react to it.

2.1 Directed Altruism Channel

We assume that there is a decision maker M and a partner P who are embedded in a social network which consists of a set of nodes and edges connecting social neighbors. We calculate the social distance D_{MP} between the decision maker and the partner as the shortest path connecting them: for example, two direct friends have social distance 1 while friends of a friend are distance 2 apart.

The decision maker chooses an action x from some set $X = [0, x_{max}]$. This action affects both the decision maker's payoff $\pi_M(x)$ as well as the partner's payoff $\pi_P(x)$. We assume that the decision maker's payoff is decreasing in action x while the partner's payoff is increasing in x - hence we say that the decision is "more generous" if she chooses a higher x. We denote the total social surplus generated by the decision maker's action with $S(x) = \pi_M(x) + \pi_P(x)$ and distinguish three important important types of games:

Definition 1 *Giving is efficient (inefficient) in the game played between decision maker and partner if total surplus is increasing (decreasing) in the action x. Giving is neutral if $S(x)$ is constant.*

For example, in the classic dictator game altruism is neutral. For modified dictator games as studied in Andreoni and Miller (2002) where tokens are worth more to the partner compared to the decision maker giving is efficient. When the tokens are worth less to the partner compared to the agent giving is inefficient.

We assume for now that the decision maker's choice x^*_{MP} remains unknown to the partner - this will correspond to the anonymous treatment in our experiment. We adapt the specification of Andreoni and Miller (2002) to model the action of a rational decision-maker with altruistic utility:

$$x^*_{MP} = \arg\max_x u\left(\pi_M(x), \pi_P(x); \gamma_{MP}\right) \tag{1}$$

We make the technical assumption that $u(\cdot)$ is quasi-supermodular, strictly increasing and concave in the decision maker's own payoff and weakly increasing and concave in the partner's payoff. We interpret γ_{MP} as the decision maker's altruism towards the partner and we assume that $\partial 2u/\partial \pi_M \partial \gamma_{MP} < 0$ and $\partial 2u/\partial \pi_P \partial \gamma_{MP} > 0$ such that the decision maker's action is always increasing with altruism. We also adopt the tie-breaking assumption that if the decision maker is indifferent between two different actions she will choose the action that gives the partner a higher material payoff.

We allow altruism to depend on social distance:

$$\gamma_{MP} = \gamma_1 D_{MP} + \gamma_M \tag{2}$$

We think of γ_M as *baseline altruistic type* of the decision maker M and of γ_1 as the strength of *directed altruism.*[1]

In our experiments we observe for each decision maker/partner match the decision maker's action x^*_{MP} and from our baseline survey we know social distance D_{MP} as well as basic

[1]We do not take a position on whether altruism is the result of "warm glow" as in Andreoni (1990) or arises from preferences over payoff distributions as in Fehr and Schmidt (1999) or Charness and Rabin (2002).

demographic information such as gender of both the decision maker and the partner. We even have a proxy for the decision maker's baseline type since we ask her to make a decision for nameless partner. Since we ask each decision maker for multiple decisions we can use random effects to capture unobserved characteristics of the decision maker. We will estimate variants of the following empirical model

$$x^*_{MP} = \alpha Z + \gamma_1 D_{MP} + \gamma_M + \epsilon_{MP} \tag{3}$$

where Z are the characteristics of the decision maker and the partner and γ_M is a random effect for each decision maker. We use social distance dummies to capture the directed altruism effect whose magnitude we will compare to the average decision towards an anonymous player.

2.2 Future Interaction Channel: Enforced Reciprocity

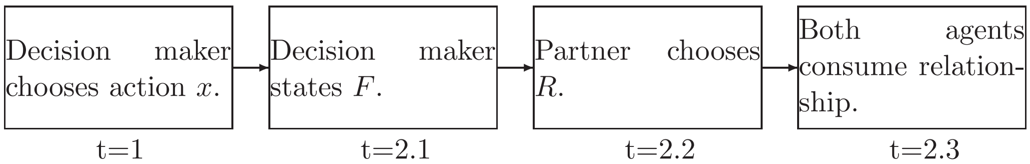
We capture the effects of future interaction between decision maker and partner by adding a second period to our basic model where the partner observes the decision maker's action from the first period and reacts to it. This allows us to examine three mechanisms which provide incentives for the decision maker to increase her action above her preferred choice x^*_{MP}: enforced reciprocity, signaling and preference-based reciprocity. We start out analysis with a simple model of enforced reciprocity based on recent work by Mobius and Szeidl (2006) who provide a tractable model for capturing repeated game effects in social networks.

2.2.1 Basic Enforced Reciprocity Model

We divide the second period into three stages as shown in figure 1. In stage 2.1 the decision maker can state a positive number F which we interpret as "favor" for which the decision maker requests repayment and which satisfies $0 \leq F \leq \pi_M(0) - \pi_M(x)$. Therefore, the decision maker cannot claim favors which are larger than the payment loss from acting generously. In stage 2.2 the partner can either "repay" the favor and transfer $R = F$ to the decision maker or choose not to repay the favor and transfer $R = 0$. In stage 2.3 the decision maker and the partner "consume" their friendship and both receive value V_{MP} from it. We interpret V_{MP} as the present value of the future relationship between decision maker and principal. Not repaying a favor implies that the relationship between decision maker and principal breaks down and both receive 0 - otherwise they receive the full value of the relationship.[2]

[2]We assume that friendships break down automatically if a favor is not repaid. Mobius and Szeidl (2006) give the borrower a choice between breaking off a relationship or continuing. In their model breaking a relationship after non-payment is optimal because it signals to the lender that the borrower no longer values their relationship.

Figure 1: Timing of decision maker's and partner's actions in enforced reciprocity model



We include the payoffs from both periods in the decision maker's altruistic utility function $u(\cdot)$ which we defined in the previous section:[3]

$$u\left(\pi_M(x) + R + I(R,F)V_{MP}, \pi_P(x) - R + I(R,F)V_{MP}; \gamma_{MP}\right) \tag{4}$$

The indicator function $I(R,F)$ equals 1 if $R = F$ and is zero otherwise. For simplicity we assume that the partner has selfish preferences:

$$U_P(x,R) = \pi_P(x) - R + I(R,F)V_{MP} \tag{5}$$

We focus on the unique subgame perfect equilibrium. It is easy to see that the optimal action of the partner in any SPE is to exactly repay a favor and choose $R = F$ when the value of his relationship with the decision maker exceeds F and to pay 0 otherwise. Since a breakdown of the relationship hurts both players the decision maker will only do favors which are paid in equilibrium. The next theorem characterizes the decision maker's optimal action $\tilde{x}^*_{MP}$.

Theorem 1 *In the enforced reciprocity model the following holds: (1) when giving is efficient the decision maker takes action $\tilde{x}^*_{MP}(V_{MP})$ which is increasing in V_{MP} and satisfies $\tilde{x}^*_{MP}(0) = x^*_{MP}$. In the second period the decision maker requests that the partner repays a favor $F = V_{MP}$. Both the decision maker's utility and the partner's utility increase with relationship value V_{MP}. (2) When giving is inefficient the decision maker always chooses the same action x^*_{MP} as under purely anonymous interaction with the partner.*

Proof: see appendix A

We might expect that the decision maker always chooses her action $\tilde{x}^*_{MP}$ such that after accounting for the partner's repayment R she has the same material payoff $\pi_M(x^*_{MP})$ as under

[3] Assuming altruistic preferences for the partner does not affect our qualitative results. If the partner is altruistic as well two complications arise. First, he might repay favors which are greater than V_{MP} because he takes the utility loss of the decision maker from breaking the relationship into account. Second, the partner might repay parts of large favors voluntarily.

anonymous decision-making. However, the decision maker will generally shade down her action because her marginal utility of the partner's consumption decreases when the partner is made better off.

Lemma 1 *Directed altruism and favors are substitutes in the sense that an altruistic decision maker ($x^*_{MP} > 0$) chooses $\tilde{x}^*_{MP} < \overline{x}_{MP}$ where $\overline{x}_{MP}$ is the solution to the equation:*

$$\pi_M(x^*_{MP}) - \pi_M(\overline{x}^*_{MP}) = V_{MP} \tag{6}$$

A perfectly selfish decision maker chooses $\tilde{x}^*_{MP} = \overline{x}_{MP}$.

Proof: see appendix A

In the case of a dictator game where giving is efficient the above result implies that a perfectly selfish decision maker will increase the number of tokens she passes under non-anonymity more than an altruistic decision maker.

2.2.2 Relationship Value and Network Flow

Since we cannot directly observe V_{MP} we proxy for it in our empirical analysis in two ways. First, we expect that relationship value decreases with social distance because a decision maker is more likely to interact with a socially close partner in the future. Therefore we will use social distance as a proxy for relationship value.

Our second proxy for relationship value is the new *maximum network flow* measure between decision maker and partner which was recently introduced by Mobius and Szeidl (2006). In their model the network flow provides an upper limit for amount of money a borrower can informally obtain from a lender in the social network. Formally, the maximum network flow is defined as follows: all direct friendship links are assigned a relationship value of 1. A flow from partner to decision maker is a set of transfers F_{ij} between any two direct neighbors i and j within the network such that (a) no transfer exceeds the value of a link and (b) for any agent other than the partner and the decision maker the individual flows to and from that agent sum up to 0 (flow preservation). The maximum network flow is the maximum value of the net flows to the decision maker across all possible flows.

In our context network flow captures the amount of additional social sanction that can be brought to bear via common friends, which can serve as "collateral" for the favor. That is, the alternative transfer arrangement works as an informal insurance policy for the decision maker: if a partner acts selfishly the decision maker can still extract a payment F through common friends who in turn "punish" the partner by extracting the favor from their direct relationships to the partner. The maximum network flow measure highlights information about the network structure which is not reflected in the "consumption value" of friendship captured by the simple social distance measure. Intuitively, the greater the number of distinct paths connecting the decision maker with the partner the higher the network flow. For example, sharing a large number of common friends will tend to increase network flow. Network flow therefore formalizes a common intuition in the sociology literature on social networks that "dense" networks are important for building trust because they give agents the ability to engage in informal arrangements (Coleman 1988, Coleman 1990). Figure 2 provides a number of examples to illustrate the network flow concept and how it differs from social distance.

We can easily embed Mobius and Szeidl's (2006) model in our framework by adding one more period after the partner has decided whether to return the favor. If the partner fails to repay ($R = 0$) the decision maker can propose an alternative set of transfer F_{ij} involving *all agents* in the social network. The net flow to the decision maker, $\sum_i F_{iM}$, cannot exceed the initial request F. The transfer arrangement needs to be accepted by all affected agents in the social network other than the partner. If any transfer F_{ij} between two agents is not made the relationship between them breaks down. Following Mobius and Szeidl (2006) we say that a set of transfers is "side-deal proof" if the partner cannot propose an alternative set of transfers to a subset of agents in the network which would make her strictly better off and each agent in the network weakly better off.

Theorem 2 *The largest favor the decision maker can request from the partner and secure through a side-deal proof transfer arrangement is equal to the maximum network flow.*

Proof: see Mobius and Szeidl (2006)

The basic network flow measure can include every member of the social network in the alternative transfer arrangement. Surely, for large social networks this assumption is unrealistic. In his empirical analysis of job search networks Granovetter (1974) found that decision makers utilize mostly links which are at most a distance $K = 2$ to $K = 2.5$ away.[4] We interpret K as the "circle of trust" which the decision maker enjoys and use $K = 2$ when we calculate network flow as a proxy of relationship value.

2.2.3 Testable Implications of Enforced Reciprocity Model

We will estimate variants of the following empirical model:

$$\tilde{x}^*_{MP} = \eta Z + \theta x^*_{MP} + \phi V_{MP} + \upsilon_M + \epsilon_{MP} \tag{7}$$

[4] We define the distance of a link ij from an agent k as the average social distance of i to k and j to k.

Table 1: Testable predictions of of enforced reciprocity, signaling and preference-based reciprocity models when estimating the empirical model $\tilde{x}^*_{MP} = \eta Z + \theta x^*_{MP} + \phi V_{MP} + \upsilon_M + \epsilon_{MP}$

	Enforced Reciprocity	Signaling	Preference-based Reciprocity
Greater generosity towards friends ($\phi > 0$) when giving is *efficient*	Yes	Yes	Yes
Greater generosity towards friends ($\phi > 0$) when giving is *inefficient*	No	Yes	No
More altruistic decision makers are relatively less generous towards friends compared to strangers under non-anonymity	Yes	No	Yes[5]
Maximum network flow is a better predictor of treating the partner generously under non-anonymity than social distance.	Yes	No	No

We include a random effect υ_M for each decision maker to control for unobserved heterogeneity in how the decision maker responds to the prospect of future interaction. In table 1 we summarize the empirical predictions of the enforced reciprocity model. Theorem 1 implies that controlling for directed altruism decision makers treat friends more generously than stranger under non-anonymity ($\phi > 0$) only when giving is efficient. We expect this effect to be more pronounced for more selfish agents ($\theta < 0$) and we expect that maximum network flow is a better proxy for relationship value than social distance.

2.3 Future Interaction Channel: Signaling

In recent work, Benabou and Tirole (2006) analyzed a related two-player model where the decision maker is concerned about her reputation for generosity. Their theory can provide an alternative explanation for why decision makers treat friends more generously under non-anonymity compared to strangers. In their framework individuals care that others think they are of an altruistic (rather than greedy) type, hence when their action can be observed they will act more generously in order to generate a good impression.

[5]Assume a selfish and an altruistic decision maker with the same future interaction probability $p(D_{MP})$. Compared to the selfish decision maker the altruist faces a repayment schedule with a flatter slope because the partner is less nice by returning more tokens. At the same time the marginal return to a token decreases - therefore the decision maker will reduce his allocation of tokens.

2.3.1 Basic Signaling Model

In order to adapt Benabou and Tirole's (2006) model to our framework we assume in this section that the decision maker plays a modified dictator game with the partner where tokens have value r_M to the decision maker and value r_P to the partner. We also assume that she has a quadratic utility function:

$$u(\pi_M(x), \pi_P(x); \gamma_{MP}) = \gamma_G(50 - x)r_M + \gamma_{MP}xr_P - k\frac{x2}{2} \tag{8}$$

The new parameter γ_G captures the "greed" of the decision maker. The key feature of Benabou and Tirole's (2006) model is that the preference parameters (γ_G, γ_{MP}) vary between individuals: while the decision maker knows her own preferences the partner can infer her preferences by observing her action in the second period. We will follow Benabou and Tirole (2006) and focus on the case where (γ_G, γ_{MP}) are independently and normally distributed with means $(\overline{\gamma}_G, \overline{\gamma}(D_{MP}))$:

$$(\gamma_G, \gamma_{MP}) \sim N\left(\overline{\gamma}_G, \overline{\gamma}(D_{MP}), \sigma_G 2, \sigma 2_{MP}, \sigma_{G,MP} = 0\right) \tag{9}$$

Note, that we allow partners' mean beliefs about the decision maker's generosity to depend on social distance but the precision of beliefs is independent of social distance. This assumption is vindicated in our empirical analysis where we find that partners (correctly) expect socially close decision makers to be nicer towards them but once we correct for social distance we do not find that partners are any better in predicting niceness of friends compared to predicting niceness of strangers.

The decision maker cares about being perceived as not greedy (low γ_G) by the partner in the second period as well as generous (high γ_{MP}). Her combined first and second period utility is therefore:

$$\underbrace{\gamma_G(50 - x)r_M + \gamma_{MP}xr_P - k\frac{x2}{2}}_{\text{altruistic utility function}} - \underbrace{\mu_G E_P\left(\gamma_G|x, D_{MP}\right) + \mu_{MP} E_P\left(\gamma_{MP}|x, D_{MP}\right)}_{\text{utility from reputation}} \tag{10}$$

The parameters μ_G and μ_{MP} capture the intensity with which the decision maker cares about her reputation, as well as the probability with which their actions are observed by the partner. We would expect that decision makers care more about the beliefs of socially close partners and we therefore expect that both μ_G and μ_{MP} decrease with social distance.[6]

Proposition 2 from Benabou and Tirole's (2006) then yields the optimal action for the

[6] Our test for signaling works equally well if decision makers care less about the beliefs of socially close partners.

decision maker:

$$\tilde{x}^*_{MP} = \underbrace{\frac{r_P \gamma_{MP} - r_M \gamma_G}{k}}_{x^*_{MP}} - \mu_G \chi(r_M, r_P) + \mu_{MP} \rho(r_M, r_P) \tag{11}$$

$\chi(r_M, r_P)$ and $\rho(r_M, r_P)$ are the standard normal signal extraction formulae:

$$\chi(r_M, r_P) = \frac{-r_M \sigma_G 2}{r_M 2 \sigma_G 2 + r_P 2 \sigma_{MP} 2} \quad \rho(r_M, r_P) = \frac{r_P \sigma_{MP} 2}{r_M 2 \sigma_G 2 + r_P 2 \sigma_{MP} 2}$$

The difference in giving under non-anonymity and anonymity is therefore:

$$\tilde{x}^*_{MP} - x^*_{MP} = \frac{\mu_M r_M \sigma_G 2 + \mu_P r_P \sigma_{MP} 2}{r_M 2 \sigma_G 2 + r_P 2 \sigma_{MP} 2} \tag{12}$$

¿From this expression the main prediction of the signaling model follows:

Proposition 1 *In the signaling model decision makers always pass more (fewer) tokens to socially close versus socially distant partner under non-anonymity compared to anonymity if they care more (less) about their reputation with socially close agents.*

We can also note that the effect of non-anonymity (i.e., the excess giving under non-anonymity versus anonymity) is independent of the level of altruism. This is in contrast to the enforced reciprocity model, where altruism and favors are substitutes.

2.3.2 Testable Implications of Signaling Model

Table 1 summarizes the empirical predictions of the signaling model. The main difference to the enforced reciprocity model is that the signaling model predicts that decision makers react similarly in games where giving is efficient and inefficient.

2.4 Future Interaction Channel: Preference-Based Reciprocity

The third channel through which future interaction can affect the decision maker's action are reciprocal incentives: an individual wishes to treat kindly (unkindly) those who have treated/will treat her kindly (unkindly). Since observable actions create the possibility for a future exchange, the decision maker will treat the partner more kindly because she expects the partner to be kind to her and wants to reciprocate the kindness (Dufwenberg and Kirchsteiger 2004).

2.4.1 Basic Preference-Based Reciprocity Model

We adapt Dufwenberg and Kirchsteiger's (2004) model of sequential preference-based reciprocity. As in our enforced reciprocity model we assume that the partner can make a payment R in the second period after observing the decision maker's action x. We assume that the partner can make this payment with probability $p(D_{MP})$ which is an increasing function of the social distance between herself and the partner - we think of p simply as the probability that both agents meet again in the future. The decision maker has the same altruistic utility function as in our enforced reciprocity model but also has "reciprocal incentives"

$$\begin{aligned}(1-p(D_{MP})) \quad &\cdot \quad \underbrace{u\left(\pi_M(x), \pi_P(x); \gamma_M\right)}_{\text{altruistic utility}} + \\ +p(D_{MP}) \quad &\cdot \quad \underbrace{\left[u\left(\pi_M(x)+\hat{R}(x), \pi_P(x)-\hat{R}(x); \gamma_M\right) + \psi\kappa_M(x,\hat{R}(x))\kappa_P(x,\hat{R}(x))\right]}_{\text{altruistic utility } U_M(x,R) \text{ plus reciprocal incentives}}\end{aligned} \tag{13}$$

The parameter ψ captures the strength of reciprocal incentives which we assume to be constant across all decision makers and partners. $\kappa_M(x,\hat{R}(x))$ represents the decision maker's kindness which is a function of her action x and her belief about the partner's repayment $\hat{R}(x)$:

$$\kappa_M(x,\hat{R}(x)) = \max\left[0, \pi_P(x) - \hat{R}(x) - \pi_P(x^*_{MP})\right] \tag{14}$$

The decision maker is kind if her action gives the partner *more* than his reference utility which we define as his payoff under anonymous decision making.[7] Our kindness function is also non-negative which will guarantee uniqueness of our equilibrium. $\kappa_P(x,\hat{R}(x))$ represents the decision maker's beliefs about the partner's intended kindness:

$$\kappa_P(x,\hat{R}(x)) = \max\left[0, U_M(x,\hat{R}(x)) - U_M(x^*_{MP}, 0)\right] \tag{15}$$

The decision maker believes that the partner acts kindly if his action gives the decision maker more than his payoff under anonymous decision making.

We similarly define the partner's reciprocal utility function:

$$\pi_P(x) - R + \psi\kappa_P(x,R)\kappa_M(x,\hat{\hat{R}}(x)) \tag{16}$$

[7] The choice of reference utility is a free parameter in all preference-based reciprocity models. For example, Dufwenberg and Kirchsteiger (2004) calculate the reference utility as the average of the highest payoff and the lowest payoff each of the two agents can secure for the other party (taking beliefs into account). Our particular choice simplifies our analysis considerably.

As in our enforced reciprocity model, we assume the partner has no intrinsic altruism. The partner's intended kindness is $\kappa_P(x, R)$ and he believes that the decision maker's intended kindness is $\kappa_M(x, \hat{\hat{R}}(x))$ where $\hat{\hat{R}}(x)$ is the partner's belief about the decision maker's belief $\hat{R}(x)$.

An equilibrium of the game is an action $\tilde{x}^*_{MP}$ and a schedule $R(x)$ which specifies the partner's optimal repayment for each action of the decision maker.

Proposition 2 *In the preference-based reciprocity model there is a unique equilibrium with a repayment schedule which is increasing in x. When giving is inefficient the decision maker always chooses the same action $\tilde{x}^*_{MP} = x^*_{MP}$ as under anonymous decision making. When giving is efficient and agents are sufficiently reciprocal then the decision maker chooses an action $\tilde{x}^*_{MP} > x^*_{MP}$ in equilibrium which is increasing in the probability of future interaction $p(D_{MP})$.*

Proof: see appendix B

When giving is inefficient, any giving beyond the anonymous level destroys social surplus, and hence at least one of the two must be receiving a utility lower than the anonymous-giving case. Hence mutual positive kindness is not possible. Lowering x would allow the decision maker to replicate any repayment schedule $R(x)$, which would leave the partner's payoff unchanged and increase the decision maker's utility, it would still give her lower utility than the anonymous allocation. However, when giving is efficient the decision maker can "trade" an increase in x for a repayment $R(x)$ which allows both agents to be kind to each other.

2.4.2 Testable Implications of Preference-Based Reciprocity

Table 1 summarizes the empirical predictions of the preference-based reciprocity model. Like the enforced reciprocity model it predicts excess generosity towards friends under non-anonymity only when giving is efficient. However, when we control for the frequency of future interaction (through social distance for example) we do not expect network flow to have an independent effect on excess generosity.

3 Experimental Design

We used two web-based experiments to measure decision making in social networks: a series of modified *dictator games* with different exchange rates and a *helping game*. In all experiments the decision maker repeatedly chooses an action which determines her and the partner's payoffs.

The partner is either a nameless partner (randomly chosen from the population), or a specific named player. Both experiments have two treatments where the decision maker makes his decision either anonymously or non-anonymously. One decision for each decision maker is chosen randomly at the end of the experiment. If the decision is anonymous the players are not told which decision was chosen for payment - otherwise they are told. The main difference between the dictator game experiments and the helping game experiment is the fact that the anonymous and non-anonymous treatments are conducted within subjects in the case of the dictator games and between subjects in the case of the helping game. Moreover, in the dictator experiments we also asked partners about their beliefs about the expected generosity of various named decision makers under anonymous and non-anonymous decision making. We elicited beliefs using an incentive compatible mechanism.

3.1 Measuring Friendship in Web-Based Experiments

Sociologists typically measure social networks by asking subjects about their five or ten best friends. Since all of our experiments were web-based we were concerned that lack of interaction with a human surveyor would lead to more misreported friendships. We therefore developed two simple games which provide incentives for subjects to report their friendships truthfully.

For the dictator game we used the *coordination game* technique. Each subject is told to list her 10 best friends and the amount of time she spends with each of them on average per week (0-30 minutes, 30 minutes to 1 hour, 1-2 hours, 2-4 hours, 4-8 hours or more than 8 hours). The subject is paid some small amount m (in our case, 50 cents) with 50 percent probability for each listed friend who also lists them. The probability increases to 75 percent if subjects also agree on the amount of time they spend together each week. We chose the expected payoff (25 or 37.50 cents) both large enough to give subjects an incentive to report their friends truthfully and small enough to avoid 'gaming'. The randomization was included to avoid disappointment if a subject is named by few friends.

For the helping game we developed the *trivia game* technique. Subjects are also asked to list 10 friends. Over the course of several weeks a computer program randomly selects some of these subject-friend links and sends an email to the friend asking him to select the correct answer to a multiple choice question such as what time he gets up in the morning. Once a subject's friend has answered the question the subject receives an email which directs her to a web page with a 15 second time limit where she has to answer the same multiple choice question about the friend. If the subject and her friend submit identical answers, they both win a prize. The trivia game provides incentives to list friends with whom one spends a lot of time and whose habits one is therefore familiar with.

The coordination game and the trivia game were run at the same university in two consecutive years (December 2003 and December 2004). This allowed us to compare both techniques directly by focusing on 167 subjects who participated in both studies.[8] The 2003 experiment only allowed students to choose friends who lived in two neighboring dormitories which house about 17 percent of the student population. On average a subject listed 3.37 friends in 2004 whom they could have listed as a friend in 2003. Among this pool of friends, 64 percent were actually listed in 2003. 34 percent of all subjects listed all their 2004 friends in 2003 and 77 percent listed at least half of them. This implies that over the course of the year subjects made about one new friend in their dormitory, which we consider plausible.

We defined the social network as follows: two subjects were said to have a direct link if one of them named the other person. We call this type of social network the "OR-network".[9]

3.2 Dictator Game

After measuring the social network we randomly assign each subject the role of decision maker or partner.[10] Each decision maker makes several decisions over a period of several days. For each decision maker only one of her decisions is randomly selected at the end of the experiment and she and her respective partner are paid accordingly and informed by email about their earnings.

At first, each decision maker is invited by email to play modified dictator games with a *nameless* partner who is a randomly selected student in her dormitory. She is asked to make allocation decisions in two *situations*: in the anonymous situation neither decision maker nor partner find out each other's identity and in the non-anonymous situation both players are informed about each other's identity by email at the end of the experiment. In each situation the decision maker divides 50 tokens between herself and the partner. In the first decision each token is worth 30 cents to the partner and 10 cents to herself (e.g. giving is efficient). In the second decision each token is worth 20 cents to both players (e.g. giving is neutral). In the third decision each token is worth 30 cents to the decision maker and 10 cents to the partner (e.g. giving is inefficient); as a result the maximum earnings of a subject are \$15.

A few days after the first round of decisions, all decision makers are invited by email to participate in a second round. In this round they are matched with five different *named*

[8] 569 subjects participated in the coordination game. 1/3 of them were seniors who left university and the participation for the trivia game experiment was about 50 percent.

[9] We get very similar results when we use the "AND-network" where a link exists only if both subjects name each other. The OR-network definition has desirable monotonicity properties: a subject with above average number of friends will have above average number of friends in the measured network even when the network survey truncates his true network. This is not always true for the AND-network.

[10] In the experimental instructions we referred to decision maker and partner simply as player 1 and player 2.

partners: a direct friend, an indirect friend, a friend of an indirect friend, a student in the same staircase/floor who is at least distance 4 removed from the student, and a randomly selected student from the same house who falls into none of the above categories. The decision maker is again asked to make allocation decisions in both the anonymous and non-anonymous situation. In both situations the decision maker makes the same three decisions as in the first round and allocates tokens at exchange rates of 1:3, 1:1 and 3:1.

Note that each decision maker makes 6 decisions for each partner (3 exchange rates and anonymous/non-anonymous treatment) and all together takes 36 decisions which makes it very difficult to identify a match ex-post from one's earnings. A decision maker would need to 'code' each anonymous decision by making some unique allocation decision (such as passing 26 instead of 25 tokens) and then recall these decisions when payments were made. We believe that few subjects in our experiment tried to go to such lengths since we also informed them in advance that payments would take two to three weeks to process.

We measure partners' beliefs in the anonymous treatment by inviting all subjects who play the role of partner once by email. The partner is matched with five different decision makers in the same way as we matched decision makers to partners (see above). The partner knows that each of the decision makers makes three anonymous allocation decisions in modified dictators games with exchanges rates 1:3, 1:1 and 3:1. He knows that *at most* one of the decisions will be implemented. The partner is asked to predict each decision maker's action for each exchange rate. Each mispredicted token (if the decision is implemented) reduces the partner's earnings by 10 cents. Therefore, the partner has incentives to report his *median* belief.

3.3 Helping Game

In the helping game each decision maker is endowed with \$45 and each partner is endowed with \$0. The experimenter secretly chooses a random price between \$0 and \$30. The decision maker is asked to report the maximum price she would be willing to pay so that the partner receives a gain of \$30. If her maximum willingness to pay is below the price chosen by the experimenter the partner gets \$0 and the decision maker gets her endowment.

Effectively, the decision maker in the helping game reveals how much she values \$30 to the partner. As in our dictator design subjects are invited twice to make two rounds of decisions: in the first round they play with a nameless partner while in the second round they face four named partners. However, we chose a between-subjects design: the decisions for the nameless partner in the first round are always anonymous while in the second round decisions are either all anonymous or all non-anonymous. Every subject played the game in both roles, as a decision-maker and a partner. Of course only one decision in one role was selected for payment.

4 Data Description

All experiments were conducted with undergraduates at Harvard University who had at least started their sophomore year.

4.1 Dictator Games

In December 2003 Harvard undergraduates at two (out of 12) upperclass houses were recruited through posters, flyers and mail invitation and directed to a website. A prospective subject was asked to provide her email address and was sent a password. Subjects without a valid email address were excluded. All future earnings from the experiment were transferred to the electronic cash-card account of the student. These prepaid cards are widely used on campus as cash substitute and many off-campus merchants accept the cards as well.

Subjects who logged onto the website were asked to (1) report their best friends using the coordination game technique described in the previous section and (2) fill in a questionnaire asking basic demographic information. Subjects were restricted to naming friends from the two houses where our experiment was conducted. Subjects were paid their earnings from the coordination game plus a flat payment of $10 for completing the survey. Moreover, they were eligible to earn cash prizes in a raffle which added on average another $3 to their earnings.

Out of 806 students in those two houses 569 (or 71 percent) participated in the social network survey. The survey netted 5690 one-way links. Of those, 2086 links were symmetric links where both agents named each other.[11] The resulting OR-network consists of a single connected component with 802 subjects. 51 percent of subjects in the baseline survey were women. 31 percent of subjects were sophomores, 30 percent were juniors and 39 percent were seniors.

The dictator game experiment was conducted in May 2004 over a period of one week. Half of all subjects who participated in the baseline were randomly selected to be allocators. 193 out of 284 eligible subjects participated in round 1 and 181 subjects participated in round 2. The participants were representative of the composition of the baseline sample: 58 percent were women, 28 percent were sophomores, 28 percent were juniors and 44 percent were seniors.

[11] For symmetric links, the two parties' assessment of the time spent together in a typical week differed by not more than one category out of five in 80 percent of all cases (subjects could list 0-30min, 30min-1h, 1h to 2h, 2h to 4h and more than 4 hours).

4.2 Helping Game

Information on social networks was collected through an online Trivia Game at the popular student website `facebook.com` where students post their online profiles with biographic information as well as a list of their on-campus friends. More than 90 percent of Harvard undergraduates are members of `facebook.com`. As Ward (2004) notes, however, users often compile lists of over 100 friends, containing many people with whom they maintain only weak social ties. The trivia game technique provides a particularly convenient method to identify the subset of strong friendships among facebook friends. In December 2004 an invitation to the trivia game appeared for a four-week period on the home page of `facebook.com` after a member logged in. 2,360 students completed the trivia game signup process. Upperclassmen had higher participation rates than freshmen, with only 34 percent of freshman responding, but 45 percent, 52 percent, and 53 percent of sophomores, juniors, and seniors participating, respectively.

There were 12,782 links between participants out of a 23,600 total links and 6,880 of these links were symmetric. In total, 5,576 out of the 6,389 undergraduates at Harvard College had either participated or been named by a participant. The social OR-network of 5,576 individuals contains a single component (i.e. all individuals are connected) having a mean path length of 4.2 between participants.

The helping game experiment was conducted in May 2006 over a period of one week with all Juniors and Seniors who had participated in the trivia game of the previous year. 776 subjects participated in the first part of the helping game, and 695 subjects completed the second part. 58 percent of participants were women. 46 percent were juniors and 54 percent were seniors.

4.3 Summary Statistics

Figure 3 and Table 3 shows the mean actions of decision makers for dictator games and helping game, in both the anonymous and non-anonymous decisions. Two major regularities are immediately apparent: in all games and in both treatments decision makers' generosity towards the partner is decreasing in social distance, and the decision makers' generosity is always higher in the non-anonymous treatment than in the anonymous treatment for any game and at any social distance. Between treatment differences are significant across all social distances in the dictator game, and for social distance 1 and 2 in the helping game. Decision makers' actions are significantly larger for direct friends than all other distances for both games and both treatments.

In the dictator game with an exchange rate of 1:3 the decision maker passes about 19.19 tokens to a friend versus 12.20 tokens to a principal at social distance 4. With an exchange rate of 3:1 the decision maker passes only 8.03 versus 6.15 tokens, respectively. In the non-anonymous treatment the decision maker passes about 5 tokens more when altruism is efficient for all social distances and about 2 to 4 tokens more when altruism is inefficient. In the helping game the average cutoff of 12.77 for a friend decreases to 7.09 for a partner at social distance 4 in the anonymous treatment. Non-anonymity increases the cutoff by about $2.

Curiously, nameless partners are treated more generously than indirect friends in the anonymous treatment of all the dictator games and the helping game despite the fact that the expected social distance of a randomly chosen partner is at least three. In the non-anonymous treatment, on the other hand, the contributions to nameless partners closely track contributions to named partners at distance three.

We can interpret nameless decisions in the anonymous treatment as decision makers' intrinsic and unconditional generosity since the decision maker has no information about the partner. Our data replicates the well-known findings of Andreoni and Miller (2002) and Fisman, Kariv, and Markovits (2005) that individuals are highly heterogenous in their unconditional altruism. In particular, many subjects are perfectly selfish: in the three dictator games we observe 28, 46 and 64 percent of subjects pass zero, while in the helping game 20 percent set a cutoff of zero.

For the dictator games, we also collected the partners' beliefs about decision makers' actions which we report in table 4 and figure 3. Partners' beliefs are reasonably accurate and anticipate the effect of social distance. Beliefs are most accurate when altruism is efficient. When altruism is inefficient partners expect decision makers to be somewhat more generous than they actually are.

5 Directed Altruism

In this section we use data from the anonymous treatments to analyze how decision makers' altruistic preferences vary with social distance. For the dictator game experiment we can also examine to what extent partners can predict decision makers' preferences. Finally, we present evidence that subjects who behave more altruistically in general as measured by their treatment of nameless partners also tend to have more altruistic friends.

Table 2: Relative magnitudes of directed altruism and non-anonymity effects as percentages of all decision makers' average nameless action and as percentages of standard deviation of nameless actions

	Directed Altruism			Effect of Non-Anonymity			
Relative to:	SD1	SD2	SD3	SD1	SD2	SD3	Network Flow
				Dictator Game (1:3)			
Average	52	8	-8	24	18	3	19
Standard dev.	50	7	-7	23	18	3	18
				Dictator Game (1:1)			
Average	52	16	3	21	12	9	10
Standard dev.	47	14	3	19	11	8	9
				Dictator Game (3:1)			
Average	95	49	43	-7	8	-3	-6
Standard dev.	60	31	27	-4	5	-2	-4
				Helping Game			
Average	88	36	12	35	13	19	30
Standard dev.	115	48	16	46	17	25	39

An "Average"-row is calculated by dividing estimates for directed altruism and the effect of non-anonymity by the average nameless decision in the anonymous treatment (see table 3). A "Standard dev."-row is calculated by dividing the same estimates by the standard deviation of the nameless decision in the anonymous treatment. The directed altruism and non-anonymity estimates are taken from tables 5 and 12. For the network flow column we report the estimated effect of a one-standard deviation increase in network flow (equal to 10 units of network flow for "circle of trust" $K = 2$).

5.1 Decision Makers' Actions

In section 2.1 we derived the following specification for estimating the strength of directed altruism:

$$x^*_{MP} = \alpha Z + \gamma_1 D_{MP} + \gamma_M + \epsilon_{MP} \tag{3}$$

Recall that x^*_{MP} is the decision maker's action in the anonymous treatment of one of the three dictator games and the helping games respectively. Since agents' actions are bounded below and above by 0 and 50 in the case of the dictator games and 0 and 30 in the case of the helping game we use Tobit regressions to estimate equation 3. We exploit the fact that we observe multiple actions for each decision maker in the anonymous treatment and control for unobserved heterogeneity in the decision maker's baseline altruistic type γ_M by including random effects.[12] We control for social distance D_{MP} between decision maker and partner by including dummy variables $SD1$ to $SD5$. The omitted categories are $SD4$ for the dictator games and $SD5$ for the helping game. The estimated coefficient on $SD1$ in a dictator game, for example, should therefore be interpreted as the number of extra tokens that the decision maker passes to a direct friend compared to a distant partner in the anonymous treatment while the estimated coefficient on $SD2$ captures directed altruism towards an indirect friend. The estimates of the Tobit regression for all dictator games and the helping games are reported in the odd-numbered columns of table 5.

We also estimate the same specification with additional covariates and report the results in the even-numbered columns of table 5. We include the decision maker's action towards a nameless player in the anonymous treatment as a proxy for the decision maker's baseline altruistic type γ_M. In the helping game we can also control for the partner's nameless decision because all subjects in the helping game played both the role of the decision maker and the partner. Furthermore we add dummy variables for both player's gender, their class (sophomores, juniors or seniors) and whether they share a staircase (dictator game) or a house (helping game).[13]

Result 1 *Baseline altruism and directed altruism are correlated. Subjects who give more to nameless partners also give more to specific named partners.*

The two variables that consistently and strongly predict how generously a decision maker treats a partner in her social network are social distance and generosity towards a nameless partner. For both dictator and helping games each one unit increase in generosity towards a nameless partner is associated with a 0.56 to 1.40 unit increase in generosity towards a named player. Since the elicitation of the nameless decision and the named decisions was one week apart this indicates remarkable stability in decision makers' preferences over time. Because the pass-through from "nameless altruism" towards "named altruism" is fairly close to 1 we view the nameless decision of a decision maker as a useful measure for her intrinsic baseline altruism which strongly influences the decision maker's action towards named players.

Result 2 *Social closeness induces directed altruism. Allocations to friends are substantially higher than allocations to strangers/distant partners.*

Moreover, social distance also matters greatly: decision makers are substantially more generous to direct friends than to partners at greater social distance. Generosity decreases quickly and

[12] Our results are very similar when we instead estimate equation 3 using standard random effects or fixed effects GLS.

[13] Since the participation rate was lower for the helping game a dummy variable for sharing the same entryway is less useful.

monotonically with social distance even though the estimated coefficients on SD2 and SD3 are not significantly different for all games. The distance coefficients are of similar magnitude between the three exchange rates in the dictator game which implies that decision makers are making a greater relative sacrifice in the case of inefficient altruism.

In order to assess the magnitude of directed altruism we compare in table 2 the estimated coefficients on social distance dummies SD1 to SD3 with average generosity towards nameless partners in the anonymous treatment. Directed altruism towards friends equals 52 percent of average nameless generosity for the efficient dictator game and increases to 88 percent in the helping game. When altruism is inefficient the directed altruism effects even exceeds average nameless generosity. Social distance is therefore as important a predictor of a subjects' generosity as her underlying intrinsic baseline altruism.

Another way of evaluating the magnitude of directed altruism is to ask the question how much less selfish a decision maker becomes relative to the fat-tailed distribution of baseline altruism in the population when she makes decisions for socially close partners (Andreoni and Miller 2002, Fisman, Kariv, and Markovits 2005). In table 2 we therefore also report the estimated coefficients on SD1 to SD3 as percentage of the standard deviation of the distribution of nameless decisions. We find that social proximity to the partner moves the decision maker's generosity by at least 0.47 of a standard deviation in the dictator games to 1.15 of a standard deviation in the helping game.

Interestingly, gender and geographic proximity have no significant effect on generosity. However, the signs of the estimated coefficients on gender of the decision maker are consistent with the work of Andreoni and Vesterlund (2001) who found that men are more likely to exhibit social value maximizing preferences: they are more generous in dictator games when giving is efficient and less generous when giving is inefficient. Juniors are somewhat more selfish than both sophomores and seniors - however, most of the coefficients on class dummies are insignificant.

5.2 Partners' Beliefs

We now analyze to what extent partners are aware of either the baseline altruism of the decision maker or of her directed altruism. We simply take the same empirical specification 3 for directed altruism from the previous section but estimate it using partners' beliefs instead of decision maker's action on the left-hand side. We also specify random effects on the partner level rather than the decision-maker level because our experiment provides us with multiple observations for each partner. The odd and even numbered columns in table 6 report our estimates without and with additional covariates. Compared to table 5 we do not list estimates for the helping game because we only asked partners' beliefs for the dictator game experiment.

Result 3 *Beliefs reflect directed altruism. Subjects accurately predict that on average friends will be more generous. However, they overestimate the generosity of indirect friends, and do not predict individual differences in baseline altruism between friends.*

Our first finding is that partners are well aware of the directed altruism of decision makers. The number of extra tokens that partners expect from their direct friends (SD1) is close to decision makers' action. Partners believe that decision makers are slightly more altruistic than they actually are when giving is efficient (exchange rate 1:3) and that they are slightly less altruistic than they actually are when giving is inefficient (exchange rate 3:1). Interestingly, partners expect *indirect* friends (SD2) to be significantly more generous than these decision makers actually behave when giving is efficient or neutral. Decision makers do not treat indirect friends significantly more generously than strangers but our corresponding estimates for partners' expectations are both almost double as large and strongly significant.

Again, none of the other demographic and geographic covariates matter except for the decision maker's gender: partners expect male decision makers to be significantly less generous when giving is neutral and especially when it is inefficient. This is again consistent with Andreoni and Vesterlund's (2001) findings.

Surprisingly, partners' beliefs are completely unaffected by the intrinsic baseline altruism of the decision maker. In contrast, we found in the previous section that each extra token a decision maker passes to a nameless partner increases her contribution to a named partner by a comparable amount. One explanation could be that partners are good at estimating social distance and have learned that decision makers treat friends more generously but they are unable to observe intrinsic preferences. We would then expect that non-anonymity decreases with social distance: partners should be better at observing the preferences of direct friends compared to socially distant agents. Therefore, we re-estimate our empirical model 3 and include an interaction term between the decision maker's nameless decision and social distance SD1. The results are reported in the odd-numbered columns of table 7 (without demographic and geographic covariates). We do not find any evidence that partners are any better in observing the preferences of a socially close versus a distant decision maker: in fact two out of the three estimates of the interaction term are negative.

For 204 out of the 563 matches between a specific partner and a decision maker we also have the actual choice of the decision maker for this partner. For this subset we estimate our empirical model again but now use the decision maker's actual choice rather than her nameless decision as a proxy for her baseline altruism. The estimates are reported in the even-numbered columns of table 7. Again, neither actual choice nor the interaction between actual choice and social distance affect a partner's expectations.

5.3 Correlation in Altruistic Preferences

We next examine whether more altruistic subjects also have more altruistic friends. We separate subjects into (approximate) quintiles based on their dictator game and helping game choices for nameless partners. Tables 8 and 9 present the resulting distribution of friends' generosity for each quintile.

Result 4 *Friends sort by type. Subjects with a high level of baseline altruism tend to have more friends with a high level of baseline altruism, while selfish subjects tend to have more selfish friends.*

First, we find that altruists and selfish subjects have the same number of friends. However, a subject's baseline altruism is correlated with the baseline altruism of her friends (Chi-Square test: DG $p < 0.001$, HG $p < 0.01$). Selfish subjects have more selfish friends, and fewer altruistic friends, while altruists have fewer selfish friends and more altruistic friends. In particular, in the helping game the most altruistic quintile has 25 percent more highly-altruistic friends than any other group; in the dictator game the two most altruistic groups had more than 20 percent more highly-altruistic friends than any other group. Moreover, the mean nameless choice of a subject's friends increases with the subject's baseline altruism. The most altruistic subjects have friends that are 25 percent more altruistic than the most selfish subjects in the dictator game, and 14 percent more altruistic in the helping game. The 3rd, 4th and 5th quintiles are significantly different from the 1st in the helping game, and the 4th and 5th are different from the first in the dictator game (from t-tests). A non-parametric equality-of-medians test rejects that the five quintiles are drawn from distributions with the same median (DG $p = 0.039$, HG $p < 0.026$). Hence, it seems that subjects tend to seek out and/or maintain friendships with others who have similar social preferences.

We confirm this finding in table 10 where we take all pairs of participating friends (including those not matched in our experiment) and regress each subject's baseline altruism on the average baseline altruism of all their friends. As expected, the baseline altruism of a subjects' friends is positively and significantly related to her own baseline altruism in the helping game. Increasing the generosity of a subject's friends by 10 percent would increase the subjects generosity by 2 percent. In the dictator game we have much fewer observations (since we only observed nameless decisions for half the subjects), however the relationship is directionally positive, as we expect. Moreover, the correlation of types is not driven by clustering by gender.

Additionally, it pays to be generous. Table 11 regresses the average allocation to partners in the helping game from decisions made by direct friends in the anonymous treatment on their own baseline altruism: partners with higher baseline altruism have substantially higher earnings. Interestingly, this effect is entirely due to the fact that nicer partners have nicer friends but *not* due to nicer partners being treated more nicely by their friends: we already showed in our directed altruism regressions in table 5 that decision makers do no treat generous partners better. Indeed, when we also control for the average baseline altruism of decision makers in table 11 then the partner's baseline altruism no longer predicts her earnings from friends' decisions.

6 Non-anonymity vs. Anonymity

We now examine how a decision maker adjusts her action for a named partner when she interacts with him non-anonymously. We start with a simple graphical analysis which allows us to "eyeball" the main results which we then confirm by testing the empirical specification from section 2.2. We also discuss which of our three theories - the enforced reciprocity, signaling and preference-based reciprocity models - best fit our findings.

6.1 Graphical Analysis

We plot the extra tokens that a decision maker passes to a specific partner in the non-anonymous treatment relative to the anonymous treatment. Since our helping game was a between-group design we can only perform this exercise for dictator decisions. We divide decision makers into five bins depending on how generously they treated their partner in the anonymous treatment. The most selfish decision makers are those who passed between 0 and 9 tokens in the anonymous treatment. The other bins range from 10 to 19, 20 to 29, 30 to 39 and from 40 to 50. We then plot the average number of extra tokens passed in the non-anonymous treatment vs. the anonymous treatment, $\tilde{x}^*_{MP} - x^*_{MP}$, by bin and by relationship value V_{MP}. For figure 4 we use social distance as a proxy for the relationship value and for figure 5 we use maximum network flow with circle of trust $K = 2$.[14] Since network flow takes values ranging from 0 to 21 in our data set we need to group observations for a meaningful plot - we define "strong relationships" as those with network flow greater than the median value 3 and "weak relationships" as those with network flow less or equal to the median value 3.

[14] Our results are qualitatively very similar for other values of K.

Both figures show that decision makers substantially increase their action under non-anonymity compared to anonymity unless they already behaved very generously in the anonymous treatment.[15] This non-anonymity effect is strongest for selfish decision makers and when giving is efficient: decision makers pass up to 10 extra tokens to the same partner in the non-anonymous treatment. The effect is less than half as large when giving is inefficient and decision makers pass at most 4 extra tokens under non-anonymity.

The main insight we take from both graphs is that the non-anonymity effect declines with relationship strength when giving is efficient and somewhat declines when giving is neutral. However, when giving is inefficient the decision makers' contributions do *not* decrease with social distance for four out of the five bins. This provides some preliminary evidence in support of the enforced and preference-based reciprocity mechanisms but does not support the signaling mechanism.

The two graphs also suggest that directed altruism and the non-anonymity effect are substitutes: when we control for the strength of a relationship by either fixing social distance in figure 4 or network flow in figure 5 we find that the non-anonymity effect decreases monotonically in most cases as decision makers become more generous in the anonymous treatment.

6.2 Tobit Regressions

In section 2.2.3 we derived the following empirical specification for estimating the non-anonymity channel:

$$\tilde{x}^*_{MP} = \eta Z + \theta x^*_{MP} + \phi V_{MP} + \upsilon_M + \epsilon_{MP} \tag{7}$$

Recall that $\tilde{x}^*_{MP}$ is the decision maker's action in the non-anonymous treatment when matched with a specific named partner P in one of the three dictator games and the helping games respectively. We use again Tobit regressions to take account of the censoring of the left-hand side variable and exploit the panel structure of our data to control for unobserved heterogeneity in the decision maker's response to the non-anonymous treatment. We proxy for the strength of the decision maker's relationship with the partner, V_{MP}, by including either social distance dummies or maximum network flow ($K = 2$).[16] The omitted categories are $SD4$ for the dictator games and $SD5$ for the helping game. The estimated coefficient on $SD1$ in a dictator game, for example, should therefore be interpreted as the number of extra tokens that the decision maker passes to a direct friend under non-anonymity compared to the number of extra tokens that she passes to a stranger under non-anonymity. All of our regressions control

[15] Even in this case the majority of decision makers do not decrease their action - the negative averages result from a few decision makers decreasing their contributions substantially in the non-anonymous treatment.

[16] In one specification we include both types measures in the same regression.

for the class of the decision maker and partner because we expect the non-anonymity effect to be smaller for juniors and especially seniors since they are less likely than sophomores to interact with the decision maker in the future. We also include the decision maker's action towards a nameless partner in the non-anonymous treatment on the right-hand side which we use as a proxy for the decision maker's response v_M to non-anonymous interaction with a partner.

Importantly, we control for the decision maker's intrinsic altruism towards the *same* partner P by including her decision in the non-anonymous treatment, x^*_{MP} on the right-hand side of all of our regressions. This poses a problem for the helping game because of its between-group design - for each decision maker/partner match in the non-anonymous treatment we do not observe the action the decision maker would have chosen for that partner in the anonymous treatment. We therefore estimate it by running an auxiliary random-effects Tobit regression with data from the non-anonymous treatment and where we include social distance dummies and the same set of covariates Z (nameless decision, class dummies) as in our empirical specification of the non-anonymity channel.

For each of the three dictator games and the helping game we estimate three variants of our empirical model. We first use only social distance to proxy for the strength of a decision maker's relationship to the partner, then use only maximum network flow and finally use both measures in the same regression. All results are reported in table 12.

Result 5 *The observability of decisions by recipients increases giving more for friends than for strangers. The effect is only induced when giving increases social surplus and it is therefore efficiency-enhancing.*

Our main finding is that, controlling for a decision maker's action in the anonymous treatment, her response to non-anonymity is decreasing with the strength of her relationship to the partner but *only* if giving is not inefficient. This is true regardless of whether we proxy for the strength of a relationship using social distance or maximum network flow. The magnitude of this effect is large and most pronounced in the dictator game with exchange rate 1:3 - a decision maker increases her action by 4.18 tokens when she makes a decision for a friend compared to a socially distant partner and this difference is statistically significant at the one percent level. Moreover, the effect is smaller but still significantly different from 0 at the five percent level for friends of friends (SD2).[17]

In order to compare the magnitude of this non-anonymity effect with directed altruism we compare in table 2 the estimated coefficients on social distance dummies SD1 to SD3 as well

[17] In contrast, when we tested for directed altruism in the previous section we did not find such a strong effect for second-order friends.

as a one-standard deviation increase in network flow with average generosity towards nameless partners in the anonymous treatment. Friends receive an extra transfer of surplus which equals about 24 percent of average nameless generosity for the efficient dictator game and about 35 percent for the helping game. Indirect friends receive an extra transfer of about 18 percent of surplus in the efficient dictator game. We find a similar pattern but slightly smaller magnitudes for the neutral dictator game. All together, the effect of non-anonymity is about half as large as the directed altruism effect.[18] Moreover, the non-anonymity effect is generally weaker for decision makers who are juniors and seniors compared to sophomores: the sign on the junior and senior dummies are consistently negative even though they are not always statistically significant. This is consistent with our model of enforced reciprocity, since the length of the future relationship (and thus its value) is shorter (lower) for upperclassmen.

6.3 Probit Regressions

An alternative way to compare the non-anonymous with the anonymous treatment in our dictator games is to examine when the decision maker passes *strictly more* tokens under non-anonymity. In about 50 percent of all matches between a decision maker and some named partner the decision maker passes the same number of tokens in both treatments. This phenomenon is consistent with all three of our theoretical mechanisms as long as the decision maker attaches zero value to the relationship with the partner.

We therefore estimate our empirical model 7 with a dummy variable on the left-hand side which equals 1 only if the decision maker passes strictly more tokens under non-anonymity. We use random-effects Probit estimation and report the results in table 13 with all estimates interpretable as marginal effects. The Probit approach is consistent with our Tobit estimates. When giving is efficient decision makers are about 91 percent more likely to increase their token allocation when interacting non-anonymously with direct friends compared to doing the same when they interact with socially distant partners. Similarly, each unit increase in network flow raises the probability of passing more tokens by 6.3 percent. Both the social distance and network flow effects disappear when giving is neutral or inefficient.

Interestingly, when we use an analogous Probit regression to test when the decision maker passes *strictly fewer* tokens under non-anonymity there is some evidence that the effect of social distance is reversed (see table 14): decision makers are less likely to pass strictly fewer tokens to direct friends compared to stranger when giving is efficient but are more likely to do so when altruism is inefficient. However, the estimates are only marginally significant and the

[18] The relative comparison of the non-anonymity and directed altruism effects does not change if we instead normalize all estimates by using the standard deviation of the distribution of nameless decisions.

evidence is therefore not conclusive.

6.4 Discussion

We can now review the testable implications which we derived for the enforced reciprocity, signaling and preference-based reciprocity mechanisms in section 2 and summarized in table 1. First of all, we found that when we control for the decision maker's intrinsic altruism towards the partner friends are only treated more generously than strangers under non-anonymity if giving is efficient and to some extent if giving is neutral but not if giving is inefficient. This is consistent with both the enforced reciprocity and the preference-based reciprocity mechanisms but not with the signaling mechanism.

Result 6 *The non-anonymity effect increases with Network Flow.*

In the Tobit table 12 we estimate one specification for each of our four games where we include both social distance dummies *and* maximum network flow on the right-hand side. For both the efficient dictator game with exchange rate 1:3 and the helping game we find that the coefficient on social distance dummies decrease and become insignificant when we add network flow while the coefficient on flow remains significant for the helping game. We find a similar pattern in our Probit table 13.

It is possible that network flow does not proxy for the network's ability to enforce repayment of favors but rather provides a measure for the amount of time that the decision maker spends with the partner. For the dictator games, we collected information on the amount of time subjects spend with their *direct friends* on average each week. We find that this measure is essentially uncorrelated with our network flow measure for direct friends (correlation coefficient is 0.03). In table 15 we re-estimate our empirical model for the non-anonymity channel and include both network flow and time spent together per week. We find that when giving is efficient greater network flow increases the decision maker's generosity towards a direct friend under non-anonymity even when we control for time spent together. Moreover, the estimated coefficient on time spent together is consistently insignificant and *negative*. We interpret these findings as evidence for the enforced reciprocity hypothesis.

Result 7 *The non-anonymity effect and directed altruism are substitutes.*

We also find that the estimated coefficients on the decision maker's anonymous action, x^*_{MP}, are always less than 1 which imply that directed altruism and the strength of the decision maker's response to anonymity are indeed substitutes. This is also consistent with the enforced reciprocity mechanism.

7 Conclusion

Our motivation for this paper was to determine the value of having a friend rather than a stranger make payoff-relevant decisions. We identified two main effects. First of all, directed altruism makes a decision maker on average at least half a standard deviation more generous relative to the distribution of decision makers' intrinsic baseline altruism. If giving increases social surplus and the partner can observe the decision maker's action, generosity increases by another quarter of a standard deviation on average. The latter effect can be well explained by a model of enforced reciprocity which builds on Mobius and Szeidl (2006) to provide a tractable repeated game model in social networks.

We view our findings as a first step towards a theory of *trust* in social networks. The bulk of the experimental and theoretical literature on trust has evolved around one-shot games played between strangers. In particular, the seminal work of Berg, Dickhaut, and McCabe (1995) introduced the investment or trust game. This literature basically asks the question why strangers trust each other (absolute trust). We ask a complementary question: why should we trust some decision makers more than others (differential trust)? Social networks can be measured and therefore provide us with ample data to test and calibrate models of differential trust.

A natural next step in this research agenda is to ask whether partners in fact choose "trustworthy" decision makers. Karlan, Mobius, and Rosenblat (2006) examine this question in a naturalistic field experiment with micro-loans in Peruvian shantytowns. In their design partners ("borrowers") can ask different decision makers ("lenders") to provide them with a loan. The price ("interest rate") for choosing different lenders is exogenously randomized by the experimenter. The lending data can then be analyzed for preference reversals: how much would a partner be willing to pay to replace a socially distant for a socially close decision maker. These estimates can then be compared to the value of friendship which we derived in this paper.

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A Proof of Theorem 1

We assume that giving is efficient. We define $\overline{x}$ as follows:

$$\pi_P(\overline{x}) - F = \pi_P(x^*) \tag{17}$$

The partner gets the same payoff from action $\overline{x}$ and paying F as he gets from the anonymous action x^*. Because giving is efficient the decision maker's payoff satisfies:

$$\pi_M(\overline{x}) + F > \pi_M(x^*) \tag{18}$$

Concavity and quasisupermodularity of the utility function yields the following inequalities:

$$\begin{aligned} u_1(\pi_M(\overline{x}) + F, \pi_P(\overline{x}) - F) &< u_1\left(\pi_M(x^*), \pi_P(x^*)\right) \\ u_2(\pi_M(\overline{x}) + F, \pi_P(\overline{x}) - F) &> u_2\left(\pi_M(x^*), \pi_P(x^*)\right) \end{aligned} \tag{19}$$

Furthermore, we know that x^* maximizes the decision maker's utility under anonymity:

$$u_1\left(\pi_M(x^*), \pi_P(x^*)\right) = u_2\left(\pi_M(x^*), \pi_P(x^*)\right) \tag{20}$$

By combining these inequalities it follows that the marginal utility of the decision maker's own consumption is lower than the marginal utility of the partner's consumption when the decision maker takes action $\overline{x}$ and declares F: hence, the decision maker will optimally increase her action x. Hence it follows that $\tilde{x}^* > x^*$. Using an analogous argument we can show that $\pi_M(x^*) - \pi_M(\tilde{x}^*)0$.

This shows that the decision maker's optimal action will give greater surplus to both players and hence will increase both of their utilities under non-anonymity.

B Proof of Proposition 2

To keep things simple we assume $p = 1$ (our results easily extend to the general case). We start by solving the partner's problem of choosing the repayment R. The partner maximizes:

$$\pi_P(x) - R + \psi\left[U_M(x, R) - U_M(x^*, 0)\right]^+ \kappa_M(x, \hat{\hat{R}}(x)) \tag{21}$$

Differentiating with respect to R and using the fact that in equilibrium $R = \hat{\hat{R}}(x)$ gives us the first order condition for an interior solution:

$$-1 + \psi \frac{\partial U_M(x, R)}{\partial R} \kappa_M(x, R) = 0 \tag{22}$$

Lemma 2 *The unique equilibrium repayment schedule $R(x)$ satisfies $R(x) = 0$ for $x \leq x^*$ and is weakly increasing in x.*

Proof: By definition we have $\kappa_M(x^*, R(x^*)) = 0$ such that the partner would always like to choose a lower R for any $R > 0$. The FOC for an interior solution can be rewritten as:

$$\psi \frac{\partial U_M(x, R)}{\partial R} = \frac{1}{\pi_P(x) - R - \pi_P(x^*)} \tag{23}$$

The LHS of the equation is strictly decreasing in R and strictly increasing in x because we assumed a quasi-supermodular utility function for the decision maker. The RHS is strictly increasing in R and strictly decreasing in x. Therefore, there is a unique interior solution for R and the solution is strictly increasing in x. ♠

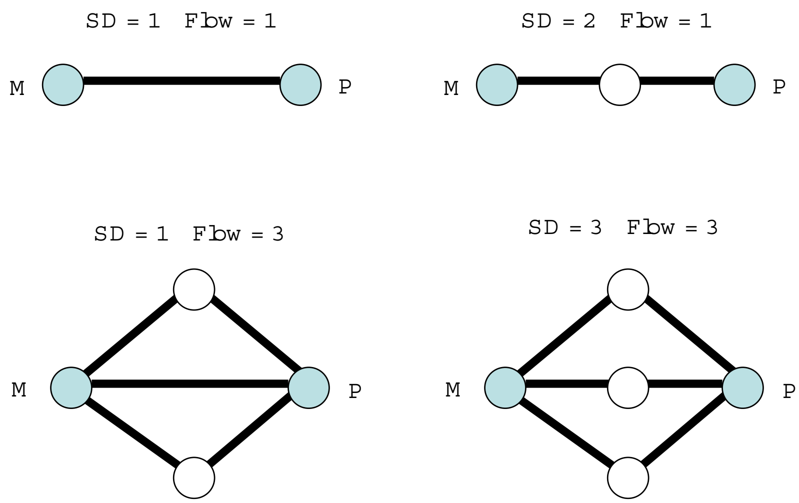
The decision maker's objective function is:

$$U_M(x, \hat{R}(x)) + \psi \kappa_M(x, \hat{R}(x)) \left[U_M(x, \hat{R}(x)) - U_M(x^*_{MP}, 0) \right] \tag{24}$$

Consider her optimal decision when giving is inefficient. By choosing the same decision as under anonymity she can guarantee herself a utility $U_M(x^*_{MP}, 0)$. Any other choice of x will either set $\kappa_M = 0$ or $\kappa_P = 0$ - therefore her utility will be $U_M(x, \hat{R}(x))$ which is lower than $U_M(x^*_{MP}, 0)$.

Next consider the case where giving is efficient and fix some $x > x^*_{MP}$. From the partner's first-order condition we can see that $R(x) \to \pi_P(x) - \pi_P(x^*_{MP})$ as $\psi \to \infty$. Therefore, the decision maker receives almost all extra profits of the partner from increasing her action above x^*_{MP} when both agents are sufficiently reciprocal. The decision maker will hence be strictly better off by choosing x instead of x^*_{MP}. This shows that the optimal action of the decision maker is strictly greater than x^*_{MP}.

Figure 2: Examples to illustrate difference between maximum network flow and social distance



Network flow is calculated between decision maker M and partner P under the assumption that all bilateral relationships have unit value.

Table 3: Summary statistics for decision makers' actions in dictator and helping games

	Anonymous Treatment					
	SD=1	SD=2	SD=3	SD=4	SD=5	Nameless
Dictator Game	(N=206)	(N=286)	(N=312)	(N=97)	(N=4)	(N=193)
Ex. Rate 1:3	19.19	16.80	15.14	12.20	12.50	17.42
	(19.64)	(19.30)	(18.79)	(15.47)	(25.00)	(18.21)
Ex. Rate 1:1	11.96	10.79	9.39	8.79	6.25	11.61
	(13.53)	(12.68)	(11.89)	(10.25)	(12.50)	(12.83)
Ex. Rate 3:1	8.03	7.28	5.66	6.15	0.00	8.31
	(13.55)	(12.88)	(11.10)	(10.72)	(0.00)	(13.23)
Helping Game	(N=876)	(N=149)	(N=73)	(N=181)	(N=78)	(N=776)
	12.77	8.97	7.14	7.68	7.09	9.52
	(8.14)	(7.11)	(6.80)	(7.16)	(6.95)	(7.24)
	Non-anonymous Treatment					
	SD=1	SD=2	SD=3	SD=4	SD=5	Nameless
Dictator Game	(N=206)	(N=288)	(N=313)	(N=99)	(N=4)	(N=193)
Ex. Rate 1:3	24.32	21.67	19.79	14.80	37.50	19.87
	(18.91)	(18.75)	(18.54)	(15.72)	(25.00)	(18.21)
Ex. Rate 1:1	16.33	14.62	13.99	12.16	18.75	13.98
	(12.90)	(12.34)	(12.45)	(10.68)	(12.50)	(12.82)
Ex. Rate 3:1	10.52	9.88	9.18	10.15	0.00	9.62
	(13.56)	(13.17)	(13.18)	(12.77)	(0.00)	(13.80)
Helping Game	(N=876)	(N=149)	(N=73)	(N=181)	(N=78)	
	12.77	8.97	7.14	7.68	7.09	9.52
	(8.14)	(7.11)	(6.80)	(7.16)	(6.95)	

Table shows averages of number of passed tokens (dictator games) and average cutoffs (helping game) by social distance (OR-network). Standard deviations are in parentheses. Nameless refers to matches between decision maker and partner where the identity of the partner is not known to the decision maker.

Table 4: Summary statistics for partners' expectations in dictator games

	Anonymous Treatment				
	SD=1	SD=2	SD=3	SD=4	SD=5
Dictator Game	(N=262)	(N=371)	(N=401)	(N=140)	(N=2)
Ex. Rate 1:3	17.08	13.09	12.64	12.46	25.00
	(15.84)	(14.22)	(14.84)	(12.83)	(14.14)
Ex. Rate 1:1	16.14	13.84	11.15	12.85	22.50
	(12.06)	(11.77)	(11.30)	(11.82)	(3.54)
Ex. Rate 3:1	13.65	11.94	8.86	11.71	22.50
	(14.49)	(13.86)	(12.68)	(14.34)	(3.54)

Table shows averages of number of expected tokens by social distance (OR-network). Standard deviations are in parenthesis.

Figure 3: Average number of tokens passed by decision maker/expected by partner in dictator game (top/bottom) and average cutoff chosen in helping game (middle)

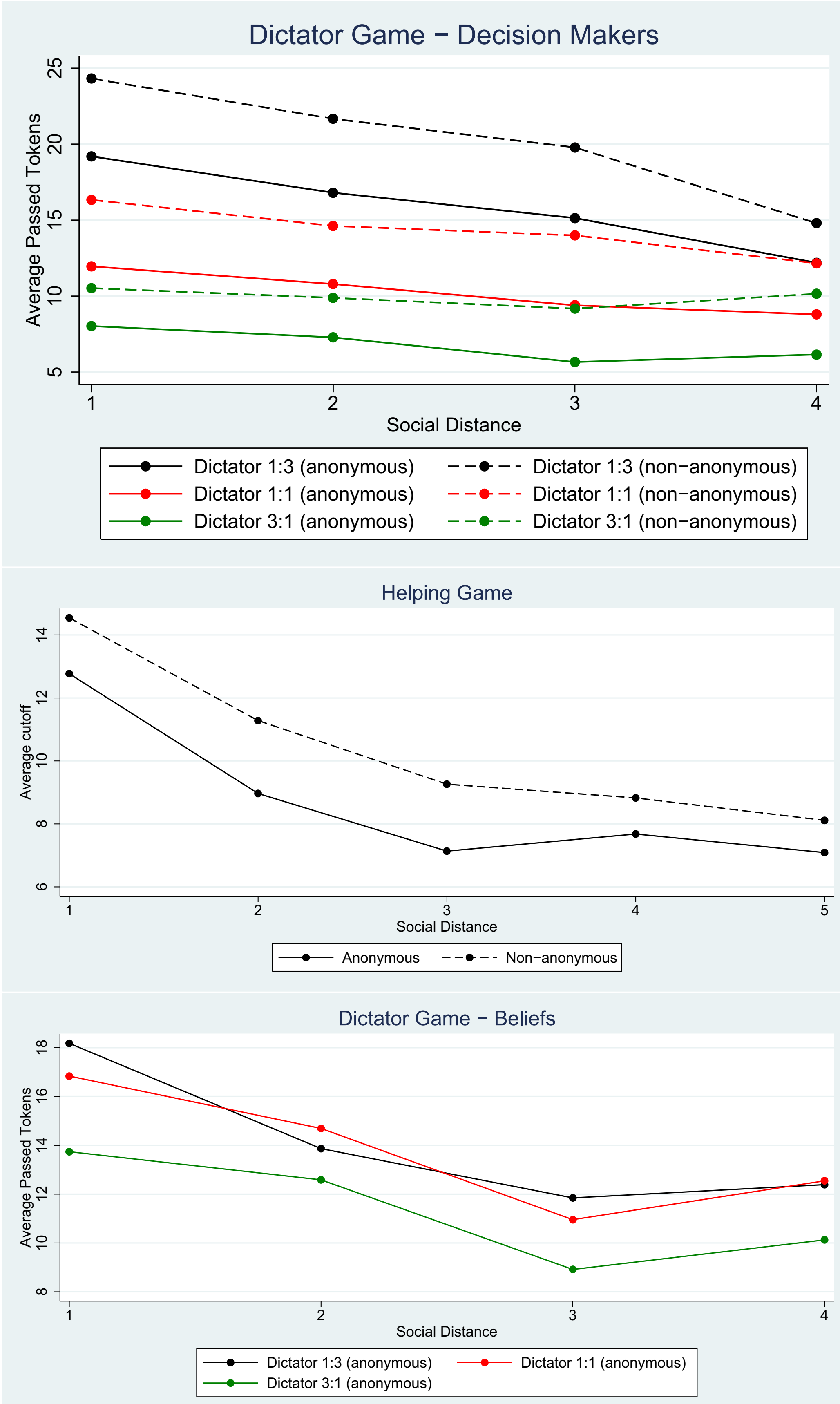


Table 5: Decision makers' actions in anonymous treatment (dictator and helping game) when paired with 5 partners at various social distances

	Dictator-1:3		Dictator-1:1		Dictator-3:1		Helping-Game	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SD1	9.029	9.915	6.010	6.244	7.936	8.838	8.353	8.045
	(2.331)**	(2.357)**	(1.388)**	(1.485)**	(1.935)**	(2.066)**	(0.769)**	(0.824)**
SD2	1.308	1.974	1.819	2.192	4.077	4.623	3.439	3.337
	(2.304)	(2.331)	(1.365)	(1.458)	(1.886)*	(2.014)*	(0.898)**	(0.948)**
SD3	-1.340	-.961	0.366	0.756	3.583	4.337	1.178	1.149
	(2.296)	(2.304)	(1.361)	(1.443)	(1.887)†	(2.002)*	(1.073)	(1.177)
SD4							1.918	1.451
							(0.885)*	(0.933)
Pass to Nameless (DM)		1.384		1.186		1.403		0.564
		(0.136)**		(0.116)**		(0.164)**		(0.056)**
Pass to Nameless (P)								-.039
								(0.029)
Decision maker is male		0.708		-2.833		-5.578		1.241
		(4.547)		(2.779)		(4.052)		(0.822)
Partner is male		-.651		-.024		-.977		-.523
		(1.335)		(0.838)		(1.165)		(0.388)
Same entryway/house		0.732		-.517		0.381		0.574
		(1.376)		(0.877)		(1.223)		(0.451)
Decision maker is Junior		-16.356		-5.507		-6.920		
		(6.196)**		(3.730)		(5.365)		
Decision maker is Senior		-10.614		-5.181		-8.317		0.475
		(5.654)†		(3.415)		(4.917)†		(0.841)
Partner is Junior		0.965		0.802		1.663		
		(1.842)		(1.152)		(1.593)		
Partner is Senior		2.640		0.911		0.536		0.924
		(1.651)		(1.046)		(1.459)		(0.467)*
Const.	4.326	-10.130	-1.838	-9.253	-18.845	-18.679	4.388	-1.658
	(3.813)	(5.680)†	(2.286)	(3.559)**	(3.547)**	(5.000)**	(0.84)**	(1.175)
Obs.	901	836	901	836	901	836	1357	1193

Significance levels: † : 10% ∗ : 5% ∗∗ : 1%

Standard errors are reported in parentheses. The dependent variable is the number of tokens passed by the decision maker in the anonymous dictator games and the maximum cost the decision maker is willing to pay in the helping game. Omitted distance is SD4 (dictator game) and SD5 (helping game). All specifications are estimated as Tobit regressions with decision maker random effects. The coefficients on SD1 are significantly different from SD2 at the 5 percent level for all columns.

Table 6: Partners' expectations in anonymous treatment of dictator game when predicting actions of 5 decision makers at various social distance

	Dictator-1:3		Dictator-1:1		Dictator-3:1	
	(1)	(2)	(3)	(4)	(5)	(6)
SD1	10.808	10.970	5.739	6.001	5.431	6.291
	(1.697)**	(2.310)**	(1.399)**	(1.897)**	(2.020)**	(2.526)*
SD2	4.774	6.433	3.072	3.730	2.777	4.091
	(1.630)**	(2.230)**	(1.346)*	(1.833)*	(1.945)	(2.462)†
SD3	1.675	2.550	-1.026	-.872	-1.125	0.291
	(1.638)	(2.254)	(1.352)	(1.844)	(1.961)	(2.468)
Pass to Nameless (DM)		0.032		0.05		0.048
		(0.035)		(0.043)		(0.057)
Decision maker is male		-1.720		-2.377		-4.311
		(1.215)		(1.000)*		(1.324)**
Partner is male		3.971		-.287		-.668
		(3.013)		(2.079)		(2.989)
Same entryway/house		-1.842		-.922		-2.344
		(1.349)		(1.121)		(1.514)
Decision maker is Junior		-.981		-1.398		-1.284
		(1.839)		(1.539)		(2.066)
Decision maker is Senior		-.099		-1.103		2.651
		(1.722)		(1.418)		(1.911)
Partner is Junior		-5.405		-3.874		-6.223
		(4.062)		(2.811)		(4.026)
Partner is Senior		1.039		-.985		-4.775
		(3.589)		(2.496)		(3.576)
Const.	6.148	4.266	9.422	11.933	3.463	8.372
	(1.972)**	(3.798)	(1.484)**	(2.831)**	(2.204)	(3.958)*
Obs.	855	577	855	577	855	577

Significance levels: † : 10% ∗ : 5% ∗∗ : 1%

Standard errors are reported in parentheses. The dependent variable is the number of tokens expected by the partner in the anonymous treatment of each dictator game. Omitted social distance is SD4. All specifications are estimated as Tobit regressions with partner random effects. The coefficients on SD1 are significantly different from SD2 at the 5 percent level for all columns.

Table 7: Accuracy of partners' beliefs

	Dictator-1:3		Dictator-1:1		Dictator-3:1	
	(1)	(2)	(3)	(4)	(5)	(6)
Pass to Nameless (DM)	0.059		0.071		0.013	
	(0.042)		(0.051)		(0.071)	
Pass to Nameless (DM) * SD1	-.071		-.001		0.119	
	(0.081)		(0.093)		(0.117)	
Pass to Partner		-.115		0.015		-.047
		(0.084)		(0.079)		(0.126)
Pass to Partner * SD1		-.058		-.043		-.114
		(0.131)		(0.14)		(0.205)
SD1	12.722	9.535	5.938	2.701	6.001	-3.993
	(2.717)**	(5.685)†	(2.235)**	(3.746)	(2.867)*	(4.856)
SD2	6.538	2.063	3.558	-1.896	3.972	-8.441
	(2.229)**	(4.555)	(1.829)†	(3.090)	(2.520)	(4.445)†
SD3	2.599	-3.194	-.827	-5.579	-.600	-9.966
	(2.266)	(4.851)	(1.851)	(3.187)†	(2.554)	(4.588)*
Const.	3.192	11.769	7.784	12.288	2.835	10.293
	(2.492)	(4.723)*	(1.943)**	(2.911)**	(2.726)	(4.084)*
Obs.	563	204	563	204	563	204

Significance levels: $\dagger$: 10% $*$: 5% $**$: 1%

Standard errors are reported in parentheses. The dependent variable is the number of tokens expected by the partner in the anonymous treatment for each dictator game. "Pass to Nameless (DM)" denotes the number of tokens the decision maker passed to nameless partners and "Pass to Partner" indicates the actual generosity of the decision maker towards the partner. Omitted social distance is SD4. All specifications are estimated as Tobit regressions with partner random effects.

Table 8: Correlation in baseline altruism among direct friends in the social network (dictator game with 1:3 exchange rate)

Nameless DG Choice	Percent of Subjects	Average # of Friends	Distribution of Friends' Types (percent) [0]	[1, 10]	[11, 15]	[16, 37]	[38, 50]	Avg. Nameless DG Choice of Friends
[0]	35.23	16.75	38.65	11.04	16.56	13.19	20.55	17.02
[1, 10]	15.54	16.97	24.16	24.16	19.46	13.42	18.79	17.76
[11, 15]	13.99	17.44	37.50	20.14	9.72	10.42	22.22	17.19
[16, 37]	13.99	17.19	31.39	14.60	10.95	10.22	32.85	21.21
[38, 50]	21.24	17.83	28.39	11.86	13.56	19.07	27.12	21.39

Subjects are separated into approximate quintiles based on their dictator game (1:3) game choices for nameless partners (anonymous).

Table 9: Correlation in baseline altruism among direct friends in the social network (helping game)

Nameless HG Choice	Percent of Subjects	Average # of Friends	Distribution of Friends' Types (percent) [0]	[1, 5]	[6, 12]	[13, 15]	[16, 30]	Avg. Nameless HG Choice of Friends
[0]	19.61	12.16	20.49	21.79	22.11	26.02	9.59	9.07
[1, 5]	20.39	12.36	19.88	20.77	16.02	32.34	10.98	9.66
[6, 12]	19.35	12.72	20.24	16.07	20.54	30.95	12.20	9.87
[13, 15]	30.13	12.27	15.84	21.58	20.59	31.49	10.50	9.83
[16, 30]	10.52	12.36	15.57	19.53	21.64	27.97	15.30	10.34

Subjects are separated into approximate quintiles based on their helping game choices for nameless partners (anonymous).

Table 10: Regressing subjects' baseline altruism on friends' average baseline altruism

	Dictator Game (1:3)		Helping-Game	
	(1)	(2)	(3)	(4)
Avg. Nameless Decision of Friends	0.266	0.267	0.154	0.143
	(0.17)	(0.17)	$(0.78)^{*}$	$(0.78)^{\dagger}$
Subject is Male		-0.688		-0.308
		(4.09)		(0.60)
Percent Male of Subject's Friends		-0.370		-1.555
		(6.16)		(0.96)
Const.	6.445	6.929	7.115	7.806
	$(3.82)^{\dagger}$	(4.88)	$(0.83)^{**}$	$(0.90)^{**}$
Obs.	186	186	746	746

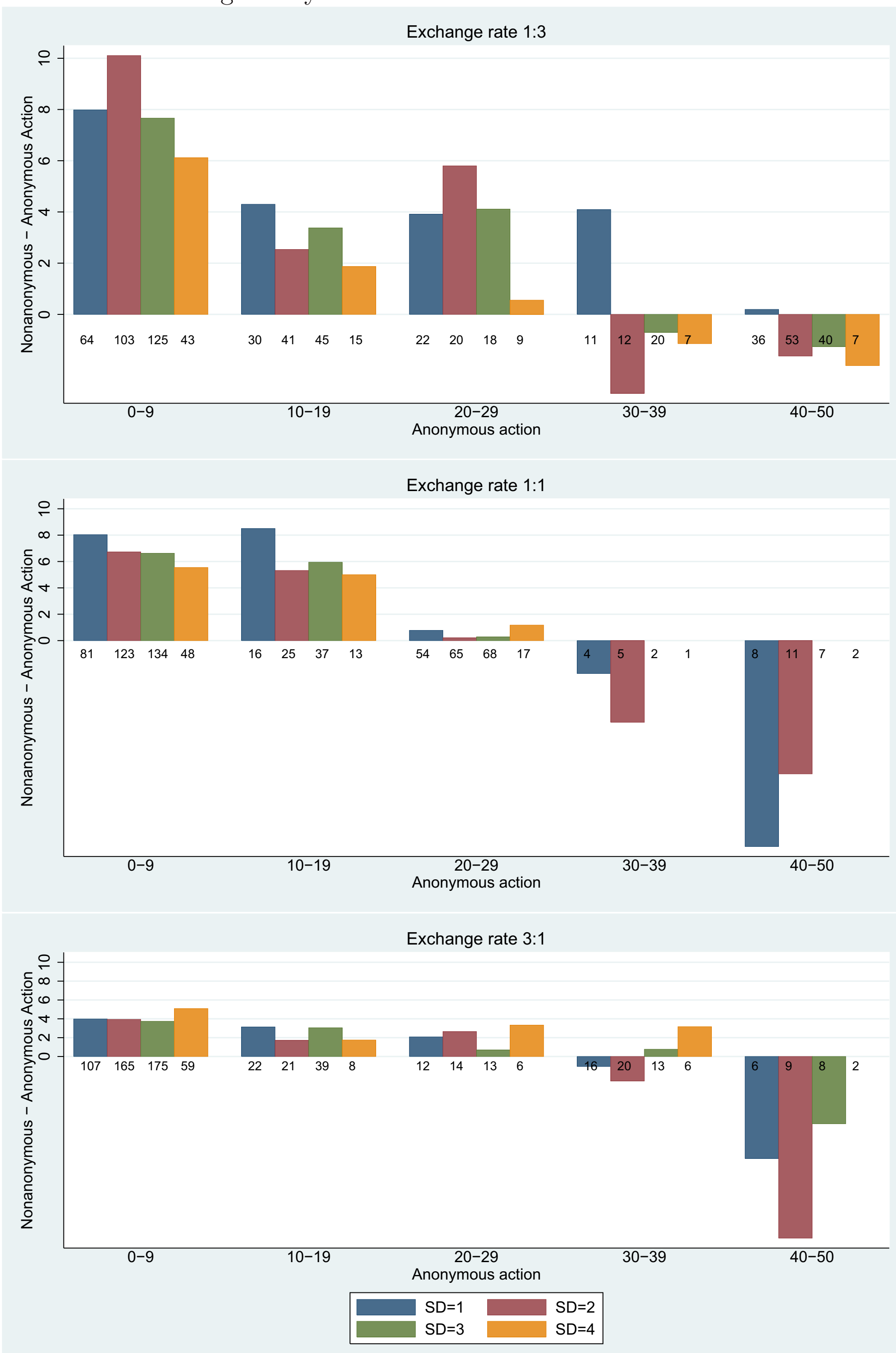
Standard errors are reported in parentheses. Tobit regressions of subjects' baseline altruism (measured by their nameless anonymous decision) on direct friends' average baseline altruism. All possible direct friends pairs are included.

Table 11: Regressing average allocation to partners whose direct friends made decisions for them (anonymous treatment only) on their own baseline altruism and the average baseline altruism of their friends (helping game)

Helping-Game		
	(1)	(2)
Partner's Nameless Decision $\in [1,5]$	1.048	0.357
	(1.02)	(0.96)
Partner's Nameless Decision $\in [6,12]$	3.074	0.545
	$(0.93)^{**}$	(0.91)
Partner's Nameless Decision $\in [13,15]$	4.567	0.521
	$(0.92)^{**}$	(0.98)
Partner's Nameless Decision $\in [16,30]$	5.275	-0.384
	$(1.17)^{**}$	(1.27)
Decision Maker's Nameless Choice		-0.474
		$(0.054)^{**}$
Const.	9.747^{**}	7.679^{**}
	$(0.73)^{**}$	$(0.73)^{**}$
Obs.	549	549

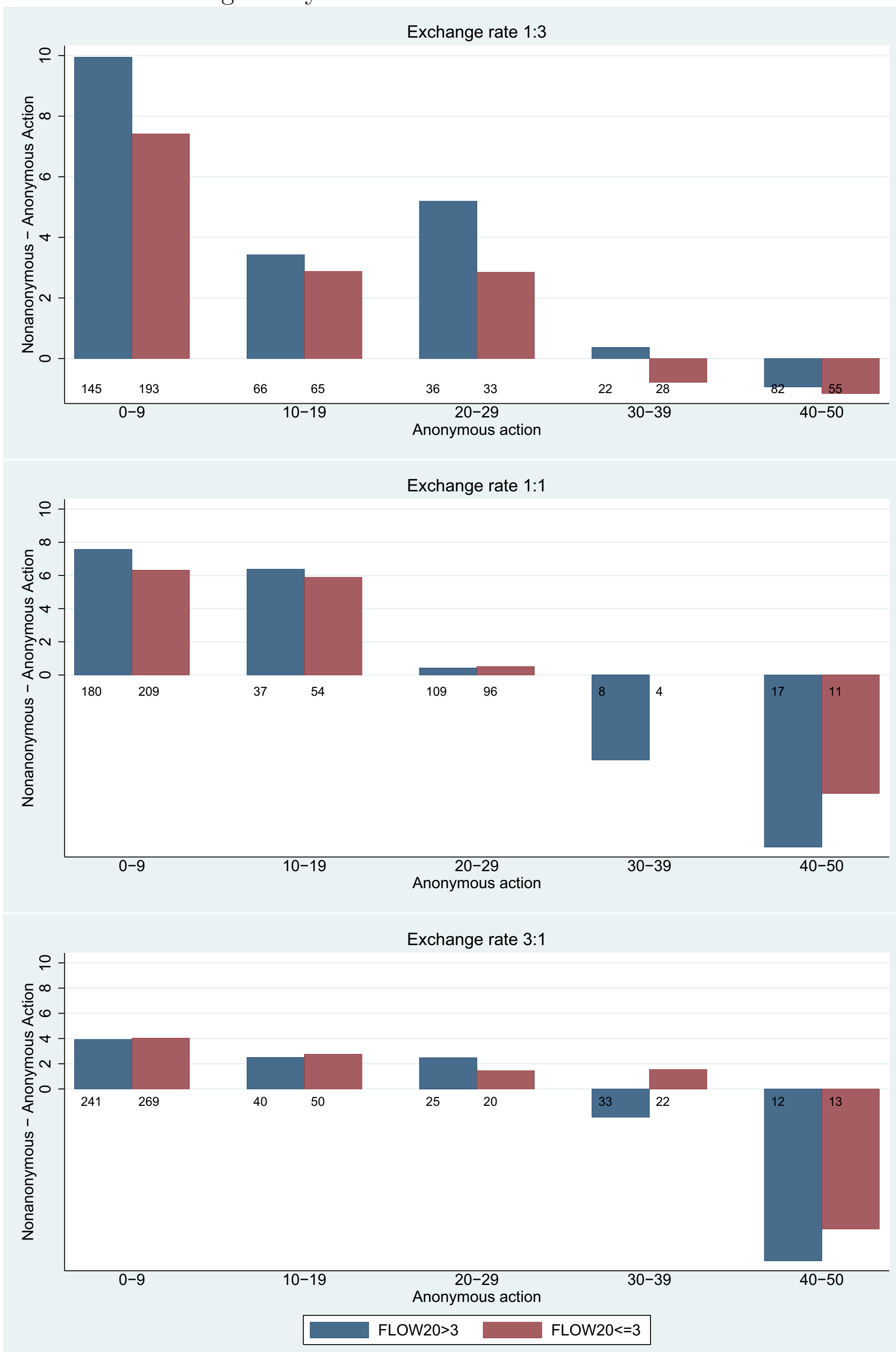
Standard errors are reported in parentheses. The dependent variable is a partner's average allocation in anonymous treatment from decisions made by friends.

Figure 4: Difference between number of passed tokens in the non-anonymous and anonymous treatments in the dictator game by social distance



For each decision maker/partner pair the difference between the number of tokens allocated in the non-anonymous and the anonymous treatments was calculated. Bars show average difference grouped by decision maker's contribution level in anonymous treatment and by social distance.

Figure 5: Difference between number of passed tokens in the non-anonymous and anonymous treatments in the dictator game by network flow



For each decision maker/partner pair the difference between the number of tokens allocated in the non-anonymous and the anonymous treatments was calculated. Bars show average difference grouped by decision maker's contribution level in anonymous treatment and by network flow for circle of trust $K = 2$ (median network flow 3).

Table 12: Comparing non-anonymous and anonymous treatments (dictator and helping games)

	Dictator-1:3			Dictator-1:1			Dictator-3:1			Helping-Game		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Anonymous Action	0.822	0.81	0.814	0.508	0.511	0.508	0.874	0.874	0.874	0.582	0.676	0.652
	(0.047)**	(0.048)**	(0.048)**	(0.05)**	(0.05)**	(0.051)**	(0.064)**	(0.063)**	(0.064)**	(0.648)	(0.116)**	(0.644)
SD1	4.184		1.373	2.470		2.498	-.555		2.815	3.333		0.521
	(1.381)**		(2.675)	(1.175)*		(2.168)	(1.556)		(3.018)	(4.618)		(4.665)
SD2	3.196		1.591	1.445		1.461	0.689		2.604	1.214		0.193
	(1.346)*		(1.876)	(1.141)		(1.540)	(1.503)		(2.100)	(1.679)		(1.696)
SD3	0.513		0.451	1.030		1.031	-.208		-.148	1.809		1.850
	(1.335)		(1.334)	(1.131)		(1.132)	(1.487)		(1.486)	(1.105)		(1.098)†
Network Flow		0.323	0.234		0.115	-.002		-.048	-.278		0.281	0.281
		(0.073)**	(0.191)		(0.061)†	(0.152)		(0.082)	(0.214)		(0.085)**	(0.086)**
Pass to Nameless (DM)	0.544	0.549	0.547	0.193	0.192	0.193	-.038	-.037	-.036	0.335	0.278	0.294
	(0.08)**	(0.08)**	(0.08)**	(0.055)**	(0.055)**	(0.055)**	(0.074)	(0.073)	(0.074)	(0.382)	(0.092)**	(0.379)
Pass to Nameless (P)										0.007	0.018	0.017
										(0.041)	(0.032)	(0.041)
Decision maker is Junior	-1.701	-1.611	-1.651	-5.070	-4.945	-5.071	-7.616	-7.665	-7.745			
	(3.481)	(3.479)	(3.480)	(2.641)†	(2.634)†	(2.641)†	(3.503)*	(3.489)*	(3.503)*			
Decision maker is Senior	-.957	-.878	-.936	-5.214	-5.129	-5.214	-4.262	-4.239	-4.328	-.021	-.148	-.129
	(3.239)	(3.237)	(3.237)	(2.462)*	(2.457)*	(2.462)*	(3.221)	(3.209)	(3.220)	(0.937)	(0.9)	(0.933)
Partner is Junior	1.712	1.615	1.645	-.758	-.814	-.757	0.33	0.366	0.391			
	(1.058)	(1.054)	(1.058)	(0.891)	(0.891)	(0.891)	(1.204)	(1.200)	(1.203)			
Partner is Senior	0.212	0.129	0.2	-.733	-.815	-.733	1.152	1.128	1.174	-.227	-.384	-.330
	(0.97)	(0.962)	(0.969)	(0.817)	(0.815)	(0.817)	(1.096)	(1.089)	(1.095)	(0.76)	(0.51)	(0.755)
Const.	-4.608	-3.961	-4.516	5.447	6.227	5.446	0.009	0.276	-.032	0.944	1.321	0.952
	(3.116)	(2.943)	(3.115)	(2.383)*	(2.221)**	(2.383)*	(3.165)	(2.970)	(3.163)	(1.014)	(0.961)	(1.008)
Obs.	836	836	836	836	836	836	836	836	836	955	955	955

Significance levels: † : 10% $*$: 5% $**$: 1%

Standard errors are reported in parentheses. The dependent variable is the number of tokens passed by the decision maker to a specific partner in the non-anonymous dictator games and the maximum cost the decision maker is willing to pay in the non-anonymous helping game when matches with a specific partner. All specifications are estimated as Tobit regressions with decision maker random effects. "Anonymous Action" denotes the decision maker's action for the specific partner in the anonymous treatment. Because the helping game has a between-group design we first predict the decision maker's action in the anonymous treatment by running an auxiliary Tobit regression with data from the anonymous treatment where we control for social distance, nameless decision and class dummies. Omitted social distance dummies are SD4 and SD5. Network flow is calculated for a circle of trust $K = 2$.

Table 13: Probit estimates (marginal effects reported) for decision-makers passing *strictly more* tokens in the non-anonymous versus anonymous treatments (dictator game only)

	Dictator-1:3			Dictator-1:1			Dictator-3:1		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Anonymous Action	-.057	-.059	-.060	-.116	-.114	-.115	-.048	-.051	-.048
	$(0.011)^{**}$	$(0.011)^{**}$	$(0.011)^{**}$	$(0.017)^{**}$	$(0.017)^{**}$	$(0.017)^{**}$	$(0.015)^{**}$	$(0.015)^{**}$	$(0.015)^{**}$
SD1	0.908		-.088	0.085		0.439	-.046		-.037
	$(0.31)^{**}$		(0.606)	(0.3)		(0.563)	(0.298)		(0.563)
SD2	0.373		-.196	-.068		0.134	0.113		0.117
	(0.3)		(0.426)	(0.294)		(0.4)	(0.291)		(0.4)
SD3	0.152		0.148	-.321		-.318	-.462		-.462
	(0.297)		(0.298)	(0.29)		(0.29)	(0.288)		(0.288)
Network Flow		0.065	0.084		0.019	-.030		0.025	-.0007
		$(0.016)^{**}$	$(0.044)^{\dagger}$		(0.016)	(0.04)		(0.016)	(0.04)
Pass to Nameless (DM)	0.046	0.046	0.047	0.016	0.015	0.016	-.016	-.016	-.016
	$(0.014)^{**}$	$(0.014)^{**}$	$(0.014)^{**}$	(0.014)	(0.014)	(0.014)	(0.016)	(0.016)	(0.016)
Decision maker is Junior	-.778	-.755	-.761	-1.167	-1.166	-1.173	-1.677	-1.706	-1.677
	(0.603)	(0.605)	(0.606)	$(0.652)^{\dagger}$	$(0.645)^{\dagger}$	$(0.654)^{\dagger}$	$(0.784)^{*}$	$(0.778)^{*}$	$(0.784)^{*}$
Decision maker is Senior	-1.095	-1.084	-1.076	-1.721	-1.718	-1.728	-1.036	-1.048	-1.036
	$(0.567)^{\dagger}$	$(0.569)^{\dagger}$	$(0.57)^{\dagger}$	$(0.625)^{**}$	$(0.617)^{**}$	$(0.626)^{**}$	(0.7)	(0.693)	(0.7)
Partner is Junior	0.357	0.331	0.332	0.011	-.002	0.012	0.291	0.303	0.292
	(0.228)	(0.229)	(0.23)	(0.232)	(0.229)	(0.232)	(0.248)	(0.243)	(0.249)
Partner is Senior	-.021	-.022	-.034	-.242	-.221	-.242	0.301	0.313	0.301
	(0.21)	(0.21)	(0.212)	(0.213)	(0.21)	(0.214)	(0.222)	(0.216)	(0.222)
Const.	-.532	-.461	-.513	1.134	0.931	1.126	0.096	-.118	0.095
	(0.561)	(0.511)	(0.565)	$(0.589)^{\dagger}$	$(0.538)^{\dagger}$	$(0.59)^{\dagger}$	(0.662)	(0.624)	(0.662)
Obs.	714	714	714	819	819	819	818	818	818

Significance levels: $\dagger$: 10% $*$: 5% $**$: 1%

Standard errors are reported in parentheses. The dependent variable is a dummy variable which equals 1 if the number of tokens passed to a specific partner in the non-anonymous treatment is *strictly greater* than the number of tokens passed to the same partner in the anonymous treatment and zero otherwise. All specifications are estimated as Probit regressions with decision maker random effects. "Anonymous Action" denotes the decision maker's action for the specific partner in the anonymous treatment. Omitted social distance dummies are SD4 and SD5. Network flow is calculated for a circle of trust $K = 2$. Data point where the decision maker already passes the maximum number of tokens in the anonymous treatment are excluded.

Table 14: Probit estimates (marginal effects reported) for decision-makers passing *strictly fewer* tokens in the non-anonymous versus anonymous treatments (dictator game only)

	Dictator-1:3			Dictator-1:1			Dictator-3:1		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Anonymous Pass	0.054	0.053	0.053	0.049	0.045	0.055	0.013	0.013	0.014
	(0.019)**	(0.019)**	(0.02)**	(0.017)**	(0.017)**	(0.02)**	(0.014)	(0.014)	(0.014)
SD1	-.977		-1.607	0.279		-1.245	0.467		-.754
	(0.55)†		(0.976)†	(0.563)		(0.984)	(0.533)		(0.94)
SD2	-.309		-.667	0.852		-.009	0.322		-.399
	(0.493)		(0.674)	(0.535)		(0.711)	(0.529)		(0.712)
SD3	-.225		-.225	0.358		0.381	0.073		0.071
	(0.47)		(0.472)	(0.546)		(0.576)	(0.528)		(0.528)
Network Flow		-.037	0.051		0.029	0.124		0.044	0.097
		(0.028)	(0.064)		(0.024)	(0.063)†		(0.025)†	(0.061)
Pass to Nameless (DM)	-.028	-.027	-.027	-.037	-.036	-.040	-.0009	-.0009	-.0009
	(0.02)	(0.02)	(0.02)	(0.015)*	(0.015)*	(0.017)*	(0.016)	(0.016)	(0.015)
Decision maker is Junior	-1.717	-1.818	-1.694	0.475	0.492	0.656	-.383	-.345	-.274
	(0.925)†	(0.922)*	(0.932)†	(0.574)	(0.566)	(0.644)	(0.634)	(0.628)	(0.626)
Decision maker is Senior	-1.021	-1.081	-1.029	-.094	-.075	-.107	-.453	-.465	-.447
	(0.674)	(0.67)	(0.68)	(0.522)	(0.516)	(0.578)	(0.526)	(0.525)	(0.521)
Partner is Junior	-.030	0.057	-.039	-.570	-.583	-.669	-.058	-.033	-.038
	(0.422)	(0.405)	(0.426)	(0.41)	(0.401)	(0.451)	(0.417)	(0.422)	(0.423)
Partner is Senior	0.046	0.131	0.057	-.280	-.289	-.305	-.100	-.066	-.045
	(0.39)	(0.365)	(0.392)	(0.355)	(0.342)	(0.38)	(0.354)	(0.357)	(0.359)
Const.	-2.616	-2.817	-2.634	-2.598	-2.213	-2.849	-1.845	-1.864	-1.894
	(0.871)**	(0.781)**	(0.877)**	(0.782)**	(0.6)**	(0.878)**	(0.72)*	(0.618)**	(0.713)**
Obs.	496	496	496	432	432	432	294	294	294

Significance levels: $\dagger$: 10% $*$: 5% $**$: 1%

Standard errors are reported in parentheses. The dependent variable is a dummy variable which equals 1 if the number of tokens passed to a specific partner in the non-anonymous treatment is *strictly smaller* than the number of tokens passed to the same partner in the anonymous treatment and zero otherwise. All specifications are estimated as Probit regressions with decision maker random effects. "Anonymous Action" denotes the decision maker's action for the specific partner in the anonymous treatment. Omitted social distance dummies are SD4 and SD5. Network flow is calculated for a circle of trust $K = 2$. Data point where the decision maker already passes the minimum number of tokens in the anonymous treatment are excluded.

Table 15: Effects of "average time spent per week" and network flow on decision makers' generosity towards direct friends under non-anonymity (dictator game only)

	Dictator-1:3	Dictator-1:1	Dictator-3:1
	(1)	(2)	(3)
Anonymous Pass	0.25	0.238	0.474
	(0.063)**	(0.211)	(0.115)**
Network Flow	0.676	-.024	0.155
	(0.306)*	(0.395)	(0.262)
Average Time Spent per Week	-.328	-.089	-.060
	(0.368)	(0.488)	(0.323)
Const.	12.131	13.946	4.998
	(3.640)**	(5.493)*	(3.286)
Obs.	206	206	206

Significance levels: † : 10% $*$: 5% $**$: 1%

Standard errors are reported in parentheses. The dependent variable is the number of tokens passed by the decision maker to a *direct friend* in the non-anonymous dictator games. All specifications are estimated as Tobit regressions with decision maker random effects. "Anonymous Action" denotes the decision maker's action for the specific partner in the anonymous treatment. Network flow is calculated for a circle of trust $K = 2$. Average time spent per week is a categorical variable which takes the values 0 (less than half an hour per week), 1 (30 min to 1 hour), 2 (1 hour to 2 hours), 3 (2 hours to 4 hours), 4 (4 hours to 8 hours) and 5 (more than 8 hours a week).