An Experimental Investigation of Why Individuals Conform*

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Abstract

Social interdependence is believed to play an important role in individual choice behavior. I first outline a simple model constructed on the premise that people are motivated by their own payoff and by how their action compares to others in their reference group. I show that conformity in actions may arise from learning about the descriptive norm, or from image-related concerns. In order to empirically disentangle the two, I use the fact that image-related concerns can only be present if actions are publicly observable. The model predictions are then tested in a charitable contribution experiment in which the actions and identities of the subjects are unmasked in a controlled and systematic way. Both learning about the descriptive norm (i.e., what others are doing) and image-related concerns play an important role in the choices of the subjects. Individuals indulge in social comparison and change their contributions in the direction of the social norm even when their identities are hidden. Once identities and contribution distributions of group members are revealed, individuals conform to the choice of other group members. Moreover, I find that social ties (defined as subjects knowing each other from outside the lab) affect the role of social influence: Subjects only respond to the choices of group members they are friends with. In particular, a low contribution norm evolves that causes individuals to contribute less in the presence of friends. This suggests that social comparison and image-related concerns may not always lead to higher contributions.

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"We do not live exactly as our parents lived but whatever we do now is only a modification of what was done before. It could hardly be otherwise. Very little of our public behavior is innate; most of us have only very limited creative originality. We act as we do because, one way or another, we have learned from others that this is the way we ought to behave." (Leach 1982: 128)

1 Introduction

Social interactions have been an active area of economic research for some time now with studies focusing on a wide range of empirical settings including teenager experiments with illegal drugs (Duncan et al., 2005), conforming to the behavior of peers at school (Sacerdote, 2001; Cooley, 2006), and coordinating fertility practices (Kohler et al., 2001; Munshi and Myaux, 2006). A positive correlation between an individual's choice with that of his reference group is consistent with either the individual: (1) learning about that particular choice through the experiences of others, and hence making that choice (social learning), (2) getting a utility gain by simply making the same choice as one's reference group (social comparison), or (3) sticking to the norm because of image-related concerns.[1] This distinction is important for at least two reasons. First, it is relevant for our theoretical understanding of the specific processes through which individual choices are made. Second, it is crucial to determine the appropriate public policy. For example, if in a given context, social learning is the underlying mechanism leading to conformity, then the appropriate policy would be dissemination of knowledge. Instead, if conformity arises because of social comparison, then there is need for an intervention that coordinates on good outcomes. Finally, if conformity arises because of image-related concerns, then neither policy may be optimal. Most empirical studies focus on measuring the extent of social interactions, and very little attention has been given to studying the mechanisms through which they are generated. This paper focuses on highlighting some of the mechanisms that may lead to conformity in a stylized setting.[2]

I first develop a simple and general model constructed on the premise that people are motivated by their own payoff, and by how their action compares to that of others in their reference group. Individuals compare their actions to others' choices because they either believe that the choices of others provide a stronger indication as to what the correct course of action is (as in the case of Banerjee, 1992, and

[1] A fourth possible explanation is the genetic transmission of preferences and beliefs (Bisin and Topa, 2003). However, this is not the focus of the current study.

[2] The term *conformity* is used to imply different (social) phenomenon in the economics and psychology literature (Bardsley and Sausgruber, 2005). In this paper, whenever I use the term *conformity*, it simply means convergence between one's action and that of their reference group. It could be driven by rational imitation, information cascades, or an intrinsic taste to follow others; I don't mean to imply any particular mechanism when I use the term.

Bikhchandani et al., 1992), they get a utility gain by making the same choice as their peers even when there is no uncertainty about the *intrinsic* utility maximizing choice (Cialdini, 1993), or they want to avoid the discomfort of being different from others (Asch, 1958).

Learning about the descriptive norm (i.e., what others are doing) and image-related concerns may both generate the same empirical facts. In order to disentangle the two channels empirically, I exploit the fact that conformity in actions arises from image-related concerns only if the individual's actions are observable to other people. To this end, I design and conduct an experimental investigation of a charitable contribution game that unmasks subjects' choices in a systematic way. Even though an individual is assigned to a group, his payoff only depends on his own actions, i.e., there are no externalities in the compensation scheme across group members. This feature of the experimental design allows me to rule out reciprocity or strategic considerations as possible determinants of behavior. Moreover, since the Red Cross (a well-known charity with large revenues) is chosen for the experiment, conformity arising from learning about the charity quality is also eliminated as a possible explanation. Therefore, the framework is one in which learning and reciprocity are absent. The experimental setting, besides providing an environment that provides clean evidence on these mechanisms, also allows me to overcome the difficult identification problems in measuring social interactions in real-world settings (Manski, 1993, 2000; Moffitt, 2001).

The empirical results show that both social comparison and image-related concerns lead to conformity. In the absence of any social information, actions of individuals are correlated with their beliefs about the group action. Conformity in actions arises when individuals are informed about some statistic of the contribution of other group members. In particular, upon learning the mean contribution of others, overly generous subjects hold back even though what they donate is effectively private information. Though several studies have shown that informing subjects of others' decisions can change subjects' behavior even when those decisions will not influence the subjects' own payoffs (Cason and Mui, 1998; Bardsley and Sausgruber, 2005; Krupka and Weber, forthcoming; Bicchieri and Xiao, 2009), the current study not only identifies the precise mechanisms that causes subjects to alter their behavior, but the within-subject design also allows me to quantify the change in behavior that is attributable to each of the underlying mechanisms. Some field and lab experiments have studied how charitable contributions change in response to news about others' behavior (see, for example, Frey and Meier, 2004; Landry et al., 2006; Croson and Shang, 2008; Shang and Croson, 2008); however, results in those studies are consistent with at least two theoretical approaches: People may want to conform to a social norm, or contributions by others may serve as a signal of the quality of the charity. Moreover, these studies only provide a very limited statistic (such as the mean, median, or a particular percentile) of others' contributions. In real world instances, individuals can choose what information to seek and what information

to respond to; the experimental design tries to mimic such scenarios by revealing the entire contribution distribution at certain stages.

This paper also adds to recent empirical literature that shows that image-related concerns (i.e., the desire to be well-liked by others) is a driver in prosocial behavior (Benabou and Tirole, 2006; Andreoni and Bernheim, 2007; Ariely et al., 2009). I find that, once identities are revealed, individuals contribute at least as much as they do in the case where their identities are hidden. In particular, least generous subjects give more once identities are observable. In real-world settings, it is likely that the nature of social ties between an individual and his reference group affects one's desire to be well-liked by others. A novel feature of the experimental design is that it explores how social ties (i.e., individuals being acquaintances with other group members in the real world) affect contribution behavior. One would expect the desire to be well-regarded by *others* to depend on how well one knows the other subjects participating in the experiment. In fact, this is exactly what I find: Once exact group membership is observable to an individual, the effect of image-related concerns varies by the nature of social ties in the group. In particular, individuals only change their contribution behavior in response to the choices of group members they are *friends* with. Moreover, a low contribution norm evolves that causes individuals to contribute less in the presence of friends. Few experimental studies have attempted to study the economic significance of social ties (exceptions include Abbink et al., 2006; Haan et al., 2006; Reuben and van Winden, 2007), mainly because of concerns about the potential loss of control over the social environment (Charness and Gneezy, 2008). To my knowledge, no experimental study has analyzed the role of social ties in settings where there are no externalities arising from the monetary incentive scheme across individuals.

This paper is organized as follows: Section 2 describes the literature on the mechanisms that may lead to conformity. Section 3 describes a general theoretical model in which conformity arises from learning about the norm,[3] and image-related concerns. The purpose of the model is to provide some predictions that are then tested in an experimental setup that is outlined in Section 4. The empirical analysis is presented in Section 5. Finally, section 6 concludes.

2 Literature Review

Since the classic work on conformity in the experiment conducted by Asch (1946), social psychologists have developed several theories of conformity (see, for example, Deutsch and Gerard, 1955, and Cialdini, 1993). One of the earlier theoretical economic works on conformity is Jones (1984). He presents a model of exogenous conformism in which a penalty is added to the utility function that depends on the

[3] I use the term *norm* to refer to the descriptive norm (i.e., what others do) and not the injunctive norm (i.e., what should be done).

distance between the individual's choice and that of all the other group members. Bernheim (1994) derives conformity endogenously. His main assumption is that individuals, in addition to consumption, care about status, which is inferred from their actions.

Empirically, economists have increasingly been interested in investigating "peer effects". However, the goal of these studies has mostly been to measure the strength of these social interactions, and very little is known about why conformity may arise. Depending on the context, conformity may arise through the following channels: (1) social learning, (2) social comparison, (3) strategic complementarities, and (4) image-related concerns.

Conformity through social learning may arise if one's private signal/information is not a sufficient statistic, and more information about the correct action may be learned through the choices of others. An example of this is the investigation of the role of social learning in the diffusion of a new agricultural technology in Ghana (Conley and Udry, 2005). There is extensive theoretical literature on conformity arising because of herding (Banerjee, 1992) and information cascades (Bikhchandani et al., 1992).[4] Conformity through social learning will arise even if the individual's identity stays private, but requires that there be uncertainty about the utility maximizing action.

Social comparison may lead to conformity if agents use the behavior of others as a reference point for decisions (Cialdini, 1993; Cason and Mui, 1997; Messick, 1999). This would arise even in settings where there is no uncertainty about the utility maximizing action. Bardsley and Sausgruber (2005) refer to this form of social interaction as conformity in their public good provision setup.

Conformity may also arise because of strategic complementarities. An example of this is Sweeting (2006) who shows that radio stations coordinate the timing of commercial breaks so that fewer listeners avoid commercials and the value of advertising time is increased. This channel has also been investigated in experimental public provision good games in which subjects receive information about others' choices (Brandts and Fatas, 2001; Keser and van Winden, 2000). In these experiments, a subject's payoff depends both on his choice, as well as on the choice of others. In the presence of this strategic interdependence, it is hard to discern how much of the change in a subject's behavior (after he observes others' choices) is due to social interactions, and how much is due to the subject's attempt to increase his own payoff.

Another possible explanation for conformity is image-related concerns. Mas and Moretti (2006) find strong evidence of positive productivity spillovers from the introduction of highly productive personnel into a shift. More interestingly, they find that a worker's effort is positively related to the presence and speed of workers who physically face him, but not the presence and speed of workers whom he faces (and who do not face him). This implies that workers do not like it when faster colleagues are looking at

[4] Also see Anderson and Holt (1997), and Goeree and Yariv (2006) for experimental investigations of this.

them, either because they fear being accused of slacking off, or because they feel inferior or stigmatized even without accusation. Moreover, workers respond more to the presence of co-workers with whom they frequently interact. These patterns suggest that image-related concerns may play an important role in explaining conformity. However, image-related concerns may only lead to conformity if both the individual's identity and actions are observable to his reference group. The role of revealing identity has been studied in experimental settings: Andreoni and Petrie (2004) and Rege and Telle (2004) find that revealing identities increases contributions significantly in public good games. In a dictator game setup, Bohnet and Frey (1999) find that the number of equal offers is substantially higher in the treatment where players can identify one another. Since, in these studies, identification and the possibility of reciprocity are closely intertwined (Hoffman et al., 1999), it is not clear how much of the behavior change is attributable to identification and how much is because of increased reciprocity concerns. For purposes of clean identification of the underlying mechanisms, this paper considers a framework where reciprocal motives are absent. The design employed in this study does not have any complementarities in the payoff structure since, for reciprocal motives, it must be the case that others' behavior matters through its effect on the individual's payoff.

I only focus on social-signaling, i.e., perception of oneself by others as a determinant for prosocial behavior. However, people may also care about their *self-image*, i.e., one's behavior could be distorted by a desire to manage an impression of oneself. This could be the case if one cannot perfectly introspect the motivation for one's own behavior (Bodner and Prelec, 2003), or if one wants to influence beliefs of a future self who cannot recall the original motivation for a past behavior (Benabou and Tirole, 2006). While self-signaling may be an important determinant of prosocial behavior, I do not focus on it in this paper. Distinguishing between self-signaling and social-signaling requires an experimental setup that manipulates the observability of one's environment and of one's own actions (Grossman, 2010). The experimental design used in this paper manipulates the observability of others' and own choices (which is useful for decomposing social-signaling), but does not manipulate the observability of one's choice environment sufficiently enough to identify self-signaling from social-signaling. Moreover, since the focus of the paper is on identifying the underlying channels which lead to conformity, how self-signaling would contribute to that is not very clear.

The goal of this paper is to disentangle some of the mechanisms that lead individuals to conform. For this purpose, I consider a framework in which learning and reciprocity are absent. Thus, any conformity that may arise is attributable to social comparison and image-related concerns. This paper contributes to the literature on social norms by disentangling and quantifying the role of the two mechanisms. A second contribution of this paper is that it investigates inside the "black box" of image-related concerns by studying how such concerns are affected by the nature of social ties between the subjects.

3 Model of Charity Contribution

This section outlines a simple model of charitable contribution under different environments. The goal is to come up with some general predictions that can be tested in an empirical setting. The empirical setting does not exactly mirror the theoretical setup, and differences between the two are outlined in section 4.2.

3.1 No Information Case

Consider an environment consisting of many agents, each of whom has an endowment normalized to 1. The agent selects $x \in [0, 1]$ which is given to a charity. The agent has intrinsic preferences over what he keeps $(1 - x)$ and, depending on his type, may have preferences over what is given to the charity. Moreover, the choice is only observed by the agent himself and is not publicly observable. A *self-interested* agent will keep his entire endowment for himself since he gets no utility from contributing to the charity. On the other hand, an individual may donate to a charity because of pure altruism or warm-glow. A pure *altruist* cares about the payoff to himself as well as the total amount the charity receives, while an individual motivated by *warm-glow* gets utility from the mere act of contributing.[5,6] I define the different types of agents as follows.

Definition 1 *An agent i is self-interested if his utility function has the form $u(1 - x_i)$, is induced by altruism if his utility function looks like $u(1 - x_i, \sum x_j)$, and is motivated by warm-glow if the utility function has the form $u(1 - x_i, x_i)$.*

The utility function for an agent is twice continuously differentiable, and strictly increasing and concave its arguments.[7] A self-interested agent will contribute zero. Depending on the exact functional form of the utility function, an agent motivated by warm-glow will donate $x_i \in (0, 1]$, and an agent motivated by altruism will donate $x_i \in [0, 1]$. Therefore, an agent contributing zero could be one who is selfish or motivated by pure altruism; an agent contributing a positive amount could be one motivated by altruism or warm-glow. Let x_i^* be the choice that maximizes the agent's intrinsic utility function. Based on this definition, observing the contribution of an agent does not allow the researcher to fully infer his type.

[5] See Andreoni (1990) for a theoretical model of warm-glow giving, and Anderson et al. (1998) for a theoretical analysis of altruism.

[6] There could be a fourth kind of agent: An impure altruist (Andreoni, 1990). His utility function would be of the form $u(1 - x_i, \sum x_j, x_i)$. A purely altruistic agent and an agent motivated by warm-glow are special cases of this.

[7] I am somewhat sloppy with the notation in the sense that the function $u(.)$ in $u(1-x_i)$, $u(1-x_i, x_i)$, $u(1-x_i, \sum x_j, x_i)$ is actually a different function in each of these cases.

3.2 Limited Information Case

Next I look at how contributions of the different types of agents are affected by receiving some limited information, for example, the group average of the previous round contributions. The key feature of the limited information environment is that the identities of the group members remain private, and so concerns for image and prestige are absent. Information about the contribution of others may serve as a signal of the quality of the charity (Vesterlund, 2003), but this channel is eliminated in the empirical setup. Revelation of some additional information will alter the contributions of an agent if he engages in social comparison by using the behavior of others as a reference point for decisions (Cialdini, 1993; Cason and Mui, 1997; Messick, 1999). The utility function is now modified to include a loss term that depends on some distance metric between agent i's choice, x_i, and the observed group choice, s_{-i}. The group choice is simply defined as the statistic of others' contributions which is provided to the agent. Each agent differs in the importance he places on how his choice compares to the social norm, and this is indicated by the parameter $t \in [0, \overline{t}]$. The value of t is an agent's private information. I now write the utility function as:

$$U(x_i, t_i) = \mathbf{1}_{SI} * u(1 - x_i) + \mathbf{1}_A * u(1 - x_i, \sum x_j) + \mathbf{1}_{WG} * u(1 - x_i, x_i) + t_i G(x_i, s_{-i}),$$

where $\mathbf{1}_{SI}$, $\mathbf{1}_A$, and $\mathbf{1}_{WG}$ are indicator functions that equal one if the agent is self-interested, altruistic, or motivated by warm-glow, respectively. $G(x_i, s_{-i})$ is the penalty function for not conforming to the group choice, s_{-i}. Agent i cares about his own choice, x_i, and may care about how his choice compares with the group choice, s_{-i}. The parameter t captures the extent to which the agent cares about social comparison.

The size of the penalty function depends both on the form of the penalty function $G(.)$ and the form of the loss function relating x_i and the group choice, s_{-i}. I define the following metric to capture the distance between the agent's choice and the observed group choice:

$$\frac{|x_i - s_{-i}|}{\sigma_{-i}},$$

where x_i is individual i's choice, and s_{-i} is some statistic of the distribution of choices of the other group members. The distance from the group choice is normalized by the standard deviation in the choices of other agents, σ_{-i}, to capture the fact that when choices have a large dispersion, individual i

feels less pressure to conform (Messick et al., 1983).[8] The utility function is now:

$$U(x_i, t_i) = \mathbf{1}_{SI} * u(1 - x_i) + \mathbf{1}_A * u(1 - x_i, \sum x_j) + \mathbf{1}_{WG} * u(1 - x_i, x_i) + t_i G(\frac{|x_i - s_{-i}|}{\sigma_{-i}}).$$

The penalty function $G(.)$ is continuous, strictly concave, twice differentiable, and $\arg\max G(.) = 0$ ($G'(s) < 0$ and $G''(s) < 0$ for $s > 0$).

I first consider the case where social comparison concerns are absent, i.e., $t_i = 0$.

Claim 1 *In the absence of social comparison, upon receipt of some information about others' contributions, the contribution of a self-interested agent and that of an agent motivated by warm-glow will be unaffected, while that of an altruistic agent may change (relative to the no information case).*

Proof. In the absence of social comparison $t_i = 0$. The utility functions of a self-interested agent and an agent motivated by warm glow are functions of own contributions only; their contributions will stay unaffected since $\arg\max\ U(x_i, t_i) = x_i^*$. Conversely, even in the absence of concerns for social comparison, an agent motivated by altruism cares about the total amount contributed to the charity, and hence the contribution of others shows up in his utility function; depending on the specification of the utility function, receipt of information about the contribution behavior of the group may cause him to change his own contribution. ■

Now consider the case where concern for the social norm may be present. Given the concavity assumptions, the best choice is unique. Let $x^{**}(t)$ denote the private optimum. I drop the i subscript in the analysis that follows. So, for example, I use s instead of s_{-i}.

Proposition 1 *For a given s, $\forall t$, $x^{**}(t) \in [0, s)$ for a self-interested agent, and $x^{**}(t) \in [0, 1]$ for an agent motivated by altruism or warm-glow.*

Proof. See Appendix D. ■

This proposition states that, in the presence of social comparison concerns, a self-interested agent would contribute less than the group choice. However, an agent motivated by altruism or warm glow could contribute an amount in the entire range. I next show some comparative statics.

Proposition 2 *(a) In the case of a self-interested agent (or an agent motivated by altruism or warm-glow and $x^{**}(t) < s$), $x^{**}(t)$ is:*

(1) weakly increasing in t

(2) increasing in s,

[8] In cases where σ_{-i} is zero, the distance can be normalized by the minimum increment possible in x_i.

(3) decreasing in the dispersion, σ, of the contributions of others.

(b) In the case that $x^{**}(t) \geq s$, and the agent is motivated by altruism or warm-glow, $x^{**}(t)$ is:

(1) weakly decreasing in t

(2) increasing in s,

(3) increasing in the dispersion, σ, of the contributions of others.

Proof. See Appendix D. ■

The results are intuitive. In a regime where $x^{**}(t) < s$, higher types (defined by a higher t) choose a higher value of x. The choice is increasing in the group choice, and decreasing in the dispersion of others' contributions. This is a consequence of the way the conformity index was defined, since the degree of conformity decreases if the choices of other agents are more dispersed. In a regime of full conformity, $x^{**}(t) = s$, increases in s and σ have no effect since the conformity term no longer matters.

From proposition 1, we know that $x^{**}(t) \geq s$ only for an altruistic agent or one motivated by warm-glow. In the regime $x^{**}(t) \geq s$, a higher type (one who cares more about the social norm) will choose a lower value of x in order to be closer to s. The choice is increasing in the group choice, and in the dispersion of the contributions. The empirical section tests the following two claims which follow directly from Propositions 2:

Claim 2 *In the limited information case, if social comparison concerns are present, contributions should move closer to the observed group choice, s.*

Claim 3 *In the limited information case, contributions are increasing in the observed group choice.*

3.3 Full Information Case

I now consider the full information case, i.e., an environment where the individual receives information about choices of group members as well as their identities. Under a full information case, incentives that can be important for contributing are social comparison, prestige (Harbaugh, 1998a, 1998b), and social approval. For prestige or social approval to be a motivation, identification of one's contribution by other group members is necessary. Individuals motivated by social comparison care about how their contribution compares to that of the other group members. Individuals looking for prestige or social approval try to take actions that are defined as good based on social norms (Akerlof, 1980), and are concerned about how their contributions will be perceived by other group members.[9] I now modify the utility function to include the effect of image-related concerns and social approval. Each agent now also cares about his image, p. Thus, the utility function is:

[9] Social approval does not mean that the agent is concerned about other people knowing how much he contributes, but instead that the agent is concerned about how other people evaluate his contribution.

$$U(x_i, t_i, p_i) = \mathbf{1}_{SI} * u(1 - x_i, p_i) + \mathbf{1}_A * u(1 - x_i, \sum x_j, p_i) + \mathbf{1}_{WG} * u(1 - x_i, x_i, p_i) + t_i G(\frac{|x_i - s_{-i}|}{\sigma_{-i}}).$$

I assume the utility is twice differentiable, strictly increasing and concave in image, p. An agent's image depends on how his type is perceived by others. I assume that image is an increasing and continuous function of one's type, i.e., conformists (or agents who take actions more similar to those of their group members) are perceived to have higher prestige. The idea here is that prestige or social approval comes from conforming to the descriptive norm (i.e., what others are doing) and not what one should do (i.e., the injunctive norm). Therefore, social approval or prestige depends on the norms prevalent in one's social context; in a group where no one donates, low donations would earn an individual prestige, while in a group with a high-contribution norm, high contributions would earn an individual prestige. I first consider the case when types are observable. In that case, perception p of an agent who is known to be of type t is an increasing function of t. Here, without loss of generality, I normalize one's perception to equal his type, i.e., $p = t$. Given the concavity assumptions, the private optimum is unique. Let $\widetilde{x(t)}$ denote the optimal choice. Moreover, assume that consumption and image are weak substitutes (this requires the assumption that $u_{12} \leq 0$ for a self-interested agent, and $u_{13} \leq 0$ for an agent who is motivated by altruism or warm-glow), and that contribution and image are compliments for an agent motivated by altruism or warm-glow ($u_{23} > 0$). Under these assumptions, in the full information case, a type t agent will contribute at least as much as in the limited information case. This result is a consequence of the fact that image and consumption are now substitutes: The individual is now willing to forgo some consumption to build a more favorable perception. This is stated formally in the following claim:

Claim 4 *The cumulative distribution of contributions in the full information case first-order stochastically dominates the cumulative distribution function of contributions in the limited information case.*

Proof. See Appendix D. ■

Finally, the model predicts that there exist agents who contribute nothing or their entire endowment. The following claim tells us that there is always mass at zero and at 1 in the limited information case.

Claim 5 $\exists\ t^* > 0$, *such that* $x^{**}(t) = 0$ *for* $t \leq t^*$. *Also* $\exists\ \widehat{t} > 0$, *such that* $x^{**}(t) = 1$ *for* $t \geq \widehat{t}$.

Proof. See Appendix D. ■

The result will also hold in the full information case.

The claims that have been made so far assume that the type of an agent is observable. However, this is generally not the case. In the case where types are unobservable, each agent forms beliefs

about the type of other agents, and infers their type on seeing their choice, x. Therefore, it becomes a signalling game. In principle, one can show the existence of both a separating equilibrium, and a pooling equilibrium under certain conditions.[10] However, the goal of this section was to come up with testable hypotheses for the empirical setting. Having done that, I move to an empirical setting which will allow me to test the various claims outlined in this section.

4 Experiment

In real-world instances, measuring social interaction effects raises difficult identification problems because interdependent behavior can take different forms that are difficult to isolate. In Manski's terminology (1993), an individual's behavior may vary according to the endogenous behavior of the group, but it may also vary with the exogenous characteristics of the group members. Moreover, outcomes need not arise from interdependent behavior: Members of a given group may behave similarly because they have similar unobserved characteristics or face similar institutional environments (correlated effects). In a simple linear-in-means model, Manski (1993) shows that equilibrium outcomes cannot distinguish endogenous effects from exogenous effects or correlated effects, and that it is impossible to identify the true nature of social interactions. Even if one were to overcome these identification issues, estimation raises serious econometric problems. The mean group behavior (which appears as a regressor) can be endogenous if individuals self-select within groups. In that case, they are likely to face common shocks and their unobserved characteristics are likely to be highly correlated (sorting bias). Moreover, in small groups, individual and group behavior feed on one another, and thus they are potentially simultaneously determined (simultaneity bias).

Therefore, I consider a laboratory experiment setting, as laboratory experiments have many advantages over alternative sources of information for the purpose of estimating social interactions. Randomization of participants across groups limits correlated effects and sorting biases. Experiments allow one to control the reference group with whom individuals interact in the laboratory. Moreover, group size can be determined exogenously and membership assigned randomly. This clearly helps identify the endogenous and exogenous interactions effects. However, these groups are artificial. Therefore, given the nature of social image and reputational concerns, I believe that any results found in this artificial setting offer a lower bound for the importance of these effects in real-world instances.

[10] The full information case where types are unknown is similar to the framework in Andreoni and Bernheim (2007). They explain the norm of equal splits in a dictator game as a desire to be perceived as fair, and model this as a signalling game.

4.1 Experimental Design

The theoretical model in section 3 provided a guideline of how to design the experiment to test the various model predictions. The experiment is basically a charitable contribution game. The experiment consists of six rounds, and each stage game is played only once. Each subject is assigned to a reference group, members of whom are initially unknown to the subject. The six rounds of the experiment correspond to the different information cases (no, limited, and full information).

The stage game in round 1 is as follows: Each subject is endowed with \$10 dollars, and has the option to make a contribution to the American Red Cross. At the start of the experiment, to ensure that students were aware of the scope of operations conducted by the Red Cross, a brief description was provided to the subjects (section A.3 in Appendix A). The subject has to pick a contribution, x, where x can be any number between 0 and 10 in multiples of \$0.5. If the subject decides to contribute to the Red Cross, there is a 40% chance that the contribution does not go through, in which case the Red Cross gets nothing and the subject keeps his \$10. Thus, there are two ways in which Red Cross does not receive anything: Either the subject donates nothing, or he donates but the donation does not go through. The instructions given to the subjects at the beginning of the experiment are in Appendix A.

The stage game is the same in each of the rounds. However, each round differs from the previous one is some way. More specifically:

- Round 2 is the same as Round 1 except that each subject is informed of the average amount Red Cross received from his group in Round 1 before he makes a decision.

- In Round 3, the subject is informed of the average amount Red Cross received from his group in Round 2, and is then asked to make contribution decision with the knowledge that the amount Red Cross receives from him in this round will be made public to other group members in Round 4. However, the subject is informed that identities will not be revealed.

- In Round 4, the subject observes the entire contribution distribution of his group (i.e., the amount Red Cross receives from each group member) before making the contribution decision. He is informed that the amount which Red Cross will receive from him in this round and his identity will be made public to other group members in Round 5.

- In Round 5, subjects observe the amount Red Cross received from each group member in Round 4 along with their identities. They are then asked to make their contribution decision. In addition, they are told that other group members will observe their identity, the amount Red Cross receives

from them, and their exact action (donate; not donate) in the next round. This round removes all uncertainties.

- Round 6 is analogous to Round 5.

The experimental design is summarized in Table 1.

In Round 1, after the subject has made his choice, his subjective belief about the average donation of other group members is also elicited.[11] In order to incentivize the subjects to report their actual beliefs, a monetary reward (of one dollar) is awarded if their guess is within a certain range of the actual group average. At the end of the session, data on some demographic characteristics was collected from the subjects. In addition, subjects were also administered the Marlowe-Crowne test M-C 2 (10). The test consists of ten questions concerning personal attitudes to which the subject has to respond either yes or no. The responses are then matched with a scoring algorithm, and the final score ranges from zero to ten, with a higher score corresponding to higher social desirability.[12]

The experiment does not use a double-blind procedure, i.e., the experimenter can observe subjects' actions throughout the experiment. Therefore, behavior throughout the experiment, in particular the first round, could be influenced by subjects' expectations about experimenter's judgement (Hoffman at al., 1994). However, since the analysis focuses on changes from one round to another, concerns about the experimenter's judgement are differenced out, and as long as these concerns stay the same over the course of the experiment, the results will be unbiased.

4.2 Experimental Design and Theoretical Model

The American Red Cross is one of the largest and most well-known charity organizations.[13] There are two main reasons for choosing the American Red Cross as the recipient charity. One, to rule out the possibility that the contributions of others serve as a signal of the quality of the charity (Vesterlund, 2003). A large charity is also chosen so that contributions made during the experiment account for a negligible part of the charity's total revenues. This is so that receipt of information about others' contributions during the experiment has minimal effect on $\sum x_j$, the total amount that the charity receives from the population.[14] Recall that an agent motivated by altruism cares about the total

[11] Since asking subjects to think about what others are doing (or should do) may draw attention to the norm and change one's own behavior (Bicchieri and Xiao, 2008; Krupka and Weber, forthcoming), subjects were asked to report their beliefs after they had made their own contribution decision.

[12] See Mandell for a discussion of the shorter version of the M-C Social Desirability Scale, and Appendix B for the questions on the test.

[13] For example, in 2007, it received more than seven hundred million dollars in contributions alone (source: 2007 American Red Cross Consolidated Financial Statements).

[14] Others' contributions refers to the contributions made by one's *group members*, while $\sum x_j$ denotes the contributions the charity receives from the *population* of contributors. In the case where group size is small relative to the population of contributors, any change in group behavior should have a negligible effect on $\sum x_j$.

amount contributed to the charity, and hence the contribution of others shows up in his utility function, $u(1-x_i, \sum x_j)$. In the case of the Red Cross (and the concavity of the utility function in its arguments), it is reasonable to assume that, in the absence of social comparison, the contribution of an altruistic agent stays unaffected upon receipt of information about others' contributions. Therefore, the empirical counterpart of Claim 1 is:

(Empirical) Claim 1 *In the absence of social comparison, upon receipt of some information about others' contributions, the contribution of an agent will be unaffected.*

Round 1 of the experiment corresponds to the no information case in the model. Round 2 corresponds to the limited information case: The subject makes the choice after observing the group choice: the average of other group members' *implemented* choices. Recall that, in the experiment, an agent's contribution may not go through with a probability of 0.4. Each subject only observes the average of what the Red Cross receives (which may be different from what the Red Cross was sent by other group members). Therefore, the group choice, s_{-i}, is the observed average contribution that the Red Cross receives. The penalty for not conforming to the group choice, $G(x_i, s_{-i})$, uses the distance between the agent's actual choice (which is always observed to oneself) and the observed group behavior (which may be different from actual group behavior).

Round 3 is similar to Round 2 in the sense that only information about group choice is given (and identities are not revealed). If a subject changes his contribution in Round 2 (relative to Round 1) or in Round 3 (relative to Round 2) after learning about the average donation from the previous round, it is primarily attributed to social comparison.

Round 4 is the first round in which the subject has to make a choice knowing that his identity will also be revealed along with his contribution. The change in contributions in this round relative to the third round is attributable to concerns for image and reputation. A subject's contribution still only goes through with probability 0.6. Therefore, even with image-related concerns, an agent may continue to not donate in this round since other group members will not know whether his donation did not go through, or whether he did not donate in the first place. Each subject infers the type of other group members from their observed contribution, and the perception of an agent is an increasing function of his type. This means that the inferred type as well as perception of an agent whose observed contribution is zero may still be higher than if there were no uncertainty with regards to the contribution going through. It is important to note that the experimental feature that contributions go through with probability 0.6 does not affect any of the claims that are derived from the model. The agent always observes his own actual action. Conformity in the model is defined as conforming to the *observed* group choice. Similarly,

prestige comes from conforming to the observed descriptive norm.

Round 5 differs from the fourth round in that all information is made public, i.e., the subject makes a choice knowing that all information (his identity, the decision to donate or not, and the contribution amount) will be revealed to everyone in the next round. In particular, now an agent's contribution goes through with probability 1. Therefore, relative to Round 4, fewer agents may be observed choosing to send zero if image-related concerns are indeed important (this is because prestige and type are inferred from one's observed choice). Moreover, under the assumption that contribution and image are compliments (and controlling for social comparison concerns), an agent who sends a non-zero amount in Round 4 should continue to do so in Round 5. This leads to the following claim:[15]

Claim 6 *The mass at zero in Round 5 should not be larger than that in Round 4.*

Finally, in Round 6, respondents observe all information and are aware that this is the final round.

As described in Section 2, an agent may also care about his self-image, i.e., one's behavior may also be affected by a desire to manage an impression of oneself (Bodner and Prelec, 2003; Benabou and Tirole, 2006). Distinguishing between self-signaling and social-signaling requires an experimental setup that manipulates the observability of one's choice environment and of one's own actions. While the setup described above does manipulate the observability of one's actions, the extent to which the choice environment is observable to others does not vary sufficiently enough (the probability of the donation going through is fixed at 0.6 in the first four rounds and is 1 in the last two). Therefore, the experiment design is not rich enough to isolate the importance of self-signaling, which could be an important determinant of prosocial behavior.

4.3 Experimental Procedure

Subjects were recruited by posting flyers around campus and on Facebook, and by E-mailing the Northwestern economics undergraduate listserv. The study was advertised as an online economics experiment of decision-making. Subjects were informed that the study would last at most half an hour, and that they could earn as much as $15. A total of 101 subjects were recruited: 55 of them were females. Nearly half of the subjects were freshmen or sophomores.

The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007) in the Northwestern Main Library Computer Lab. Nine sessions were held in total. Subjects were assigned randomly to a group. Across all sessions, there were 11 groups of 4 subjects each, 3 groups of 5 subjects each, and 7 groups of 6 subjects each. Each session had at least two groups playing the experiment

[15] This claim is not derived in section 3, because that would require me to incorporate beliefs in the theoretical model, which is beyond the scope of this paper.

simultaneously. This was done so that individuals could not tell with certainty who the other members in their group were.

The following method was used to reveal the identities of the group members: Each subject got to see the names of his group members on his screen at the start of round 5. In addition, the location of each group member in the room was shown on the whiteboard in the front of the class at the start of the fifth round.

Students were paid $4 as a show-up fee. In each round, they were endowed with $10 and had to decide how much to donate to the Red Cross under different settings. At the end of the experiment, one round was chosen at random to determine the payoff to the subject and the Red Cross. This was done so that subjects had an incentive to treat each round as if it were a real round. Subjects were made aware of this feature of the experiment. Subjects earned an average of $12.67 (standard deviation of $2.83).

Subjects were provided with a hardcopy of the instructions which were also read aloud at the beginning of the experiment. In addition, a handout explaining the different projects undertaken by the Red Cross was provided to the subjects (see Appendix A). They were informed that, if they decided to donate, they could direct their donation to any cause of their choice from the list.[16] Donations were submitted to the Red Cross after the end of each session; receipts of the donations to the Red Cross were sent by E-mail to all donors. The experiment concluded with debriefing the subjects.

5 Empirical Analysis

5.1 Experimental Results

Table 2 presents some statistics for each round. The first two columns of the table show that Claim 5 (presence of subjects who donate none or all of their endowment) holds in the data: in every round, there are at least 7 subjects who contribute their entire endowment, and at least 40 subjects who don't contribute anything.

Before I start the round-specific analysis, I test if the contribution pattern between any two consecutive rounds is different or not. This is done to assess the effect of the change in the stage setup on contribution behavior. Since there might be dependence between the contribution behavior of an individual across rounds, I use the (non-parametric) Wilcoxon signed rank sum test to check if there is a treatment effect between any two consecutive rounds. According to the results of the test presented in Table 3, a significant (at the 5% level) and positive effect is found on the contributions of Round 4,

[16] The options were: National Disaster Relief Fund; International Response Fund; Your Local Red Cross Chapter; Military Services; Measles Initiative; Blood Services Campaign.

the first round in which subjects make a decision knowing that their identities will be revealed.

Analysis of the data reveals that 54 subjects make the same contribution in each of the first three rounds. According to (Empirical) Claim 1, one's contribution should only change in rounds 2 and 3 (relative to the previous round) if the subject cares about social comparison. Therefore, this implies that these concerns are absent for 54 subjects. There are 45 subjects who make the same contribution throughout the course of the experiment– the choices of these subjects are not affected by concerns of either social comparison or image.

5.1.1 Baseline Case (No Information Case)

In order to understand the contribution behavior of the subjects, I analyze one round at a time. In round 1, the subject makes a decision without any group information. As mentioned in section 3, one cannot pin down the type of an agent based on his contribution. For example, the 45 subjects who don't contribute anything to the charity in the first round could either be self-interested or motivated by pure altruism. I check if there is a positive correlation between the individual's contribution in Round 1 and his expectation of the group average (elicited after the contribution is made). The theoretical model does not have any prediction with regards to this because it does explicitly include beliefs. However, if an individual believes that the average action of others is the *appropriate* behavior in this context (social proof; Cialdini, 1993), then one would expect to find a positive correlation between one's own contribution and his beliefs about what others will be doing. Moreover, a positive correlation would provide suggestive evidence of social concerns being an important determinant when making the choice. I, therefore, test the hypothesis:

H_1 : *Round 1 contribution (x_1) is correlated with the agent's expectation of contributions of other group members (guess*1*).*

Before measuring the *degree* of correlation between x_1 and *guess1*, I test for the *existence* of correlation between x_1 and *guess1* by using the Spearman rank correlation coefficient (r_s). I find that $r_s = 0.50$, and that H_1 cannot be rejected at the 1% level. I interpret this as support for hypothesis H_1, and then measure the degree of correlation. There is a positive correlation of 0.45 between x_1 and *guess1*, suggesting that subjects expect others to choose what they are themselves choosing.

5.1.2 Limited Information Case

Round 2 corresponds to the limited information case. The subject is informed of the average (received) contribution of the group from the previous round (*avg1*). Proposition 1 states that all self-interested subjects would donate an amount $\in [0, s_{-i})$. Analysis of data shows that only 28 subjects donate an amount equal to or greater than the first period observed average. Therefore, there are at least 28

subjects across the sessions who can be classified as being motivated by altruism or warm-glow. I next check if Claim 2, i.e., the contributions of subjects move in the direction of the revealed group choice if social comparison concerns are present, holds in my data. This leads to the following hypothesis:

H_2 : Relative to the Round 1 contributions (x_1), Round 2 contributions (x_2) are closer to the group choice ($s_{-i,2}$).

I define $Diff_{i,t} \equiv x_{i,t+1} - x_{i,t}$, i.e., $Diff_{i,t}$ is the change in subject i's contribution from round t to round $t+1$, and $M_{it} \equiv s_{-i,t+1} - x_{i,t}$, where $s_{-i,t+1}$ is the group choice that is presented to subject i in period $t+1$ before he chooses his $x_{i,t+1}$. In the second period, the group choice ($s_{-i,2}$) is the period 1 average *received* contribution of other group members. To test H_2, I consider the following regression:

$$Diff_{i,t} = \alpha + \beta M_{it} + \varepsilon_{i,t}, \tag{1}$$

for $t = 1$. Here $M_{i1} = s_{-i,2} - x_{i,1}$, i.e., it is the distance between the average round 1 contribution of the group and the agent's contribution in round 1. Support for H_2 would require $\beta > 0$. Column (1) of Table 4 shows that this is indeed the case (standard errors are corrected for clustering at the group level in all the regressions). The estimate of β is positive and significant, and implies that for a one dollar difference between the group choice and the subject's contribution, the subject's contribution moves, on average, by 31 cents in the direction of the group choice. Since some observations might be censored ($-10 \leq Diff_{i,1} \leq 10$), I estimate a tobit regression in column (2), and find that the estimate of β is still quantitatively similar.

Column (3) estimates the model:

$$Diff_{i,t} = \alpha + \beta_1 |M_{it}| * \mathbf{1}(M_{it} > 0) + \beta_2 |M_{it}| * \mathbf{1}(M_{it} \leq 0) + \varepsilon_{i,t}, \tag{2}$$

for $t = 1$. Here $\mathbf{1}(M_{i1} > 0)$ is an indicator function that equals 1 when $M_{i1} > 0$, i.e., when $s_{-i,2} > x_{i,1}$. Recall that $s_{-i,2}$ is the period 1 group average (excluding one's own contribution), so $M_{i1} > 0$ if the subject contributed less than the group average in period 1. Therefore, β_1 captures the effect of the group choice on subjects who contributed less than the group average in round 1, and β_2 captures the effect of the group choice on subjects who contributed more than the group average in round 1. One would expect $\beta_1 > 0$ and $\beta_2 < 0$ if H_2 were true for all subjects. Columns (3)-(4) in Table 4 show the results for this specification. β_2 is significantly negative and β_1 is not significantly different from zero, implying that subjects who contributed less than the group average in round 1 do not engage in social comparison, and continue to contribute the same low amount. Conversely, subjects who contributed more than the group average in round 1 lower their contribution by about 55 cents for every dollar that they contributed more than the social norm in the previous period. This explains the lower average for

round 2 reported in Table 2.

Round 3 also corresponds to the limited information case. It is similar to round 2 with the only difference being that subjects make a decision after being told that the entire group (received) contribution distribution would be made public in the fourth round (and that identities will not be revealed). In the third round, 28 subjects donate at least as much as the group choice (the second period group average); 22 of them also contributed an amount equal to or more than the group choice in the second round. To check whether individual behavior changes between rounds 2 and 3, I test for the equality of the distributions of the contributions in the two rounds using the Kolmogorov-Smirnov test. The null that the two distributions are same is rejected.[17] I undertake the regression outlined in equation (1) for $t = 2$. The group choice in this case is the round 2 group average contribution. Columns (1)-(2) of Table 5 show that β is still significantly positive: A one dollar difference between the individual's round 2 contribution and the group choice leads to a change of 15 cents in the individual's round 3 contribution in the direction of the group choice. Columns (3)-(4) present the estimates for the model in equation (2) for $t = 2$. The results are rather intriguing: $\beta_1 \approx 0.30$, while β_2 is not significantly different from zero; subjects who are above the group choice in round 2 don't change their contribution behavior, but subjects below the group choice increase their contribution, on average, by about 30 cents for every dollar that they are below the social norm. This is the converse of what is observed in round 2, and also explains why the average contribution in round 3 is higher than in round 2 (Table 2).

Since round 3 is similar to round 2, it is not clear whether an agent who already changed his contribution in round 2 (relative to round 1) after observing the group choice (round 1 average) will respond to the group choice in round 3 or not. I, therefore, define the dummy variable 1[unchanged in round 2] to equal 1 if the subject did not change his round 2 contribution (relative to his round 1 contribution), and zero otherwise. The model in equation (2) is now estimated by allowing the social comparison coefficients to be different depending on whether the subject changed his contribution in round 2 (relative to round 1). Column (5) of Table 5 shows that all subjects who were below the group choice in round 2 increase their round 3 contribution, though the increase is larger for subjects who had also changed their contributions in round 2. Conversely, subjects who contributed more than the group choice in round 2 do not seem to change their contributions in round 3 irrespective of whether they had changed their contributions in round 2 or not. These results suggest that, in round 3, subjects who were below the group choice (in round 2) increase their contribution independent of whether they had changed their contribution in round 2 or not.

I interpret the results of round 2 and round 3 as follows: Individuals who are below the group choice

[17] However, as shown in Table 3, I cannot reject the null hypothesis that the median difference between the two distributions is zero (the p-value of the test is 0.2184). Moreover, the K-S test is for independent samples while in my case the round 2 and round 3 contributions are clearly related.

don't seem to indulge in social comparison in round 2 since their contributions don't change relative to round 1. Some of the same individuals change their contributions in the direction of the group choice in round 3. It seems that the prospect of the contribution distribution being made public in the next round causes them to increase their contributions, even though they know that identities will not be revealed. It could be that revelation of the contribution distribution makes their relative contribution more salient such that, for example, they might not want to be the lowest contributor in the group; this would be consistent with the theory of avoiding shame.[18] Conversely, individuals who contributed more than the group choice in round 1 engage in social comparison and decrease their contributions in round 2, while in round 3 no effect is found for such individuals since they had already adjusted their contribution in the previous round. On the whole, the analysis of rounds 2 and 3 supports claim 2, i.e., contributions should move closer to the group choice because of learning about the social norm.[19]

I next check if there is evidence for claim 3 (i.e., contributions increase in the group choice) in the data. This leads to the hypothesis:

H_3 : *Contributions are increasing in the group choice.*

The contribution is regressed on the group choice (which is presented to the individual before he makes his contribution decision). As can be seen in Table 6, this hypothesis finds strong support in the data.

5.1.3 Full Information Case

I now move to the analysis of the fourth round, the first round in which subjects make a decision under the knowledge that their identities will be revealed. Table 2 shows that the highest number of subjects donate in this round, and that the contribution average is the highest in this round. Moreover, there is a positive treatment effect on round 4 contributions (Table 3). I first check if claim 4 holds. As discussed in section 3.3, this requires testing the hypothesis:

H_4 : *The round 4 contribution distribution first-order stochastically dominates the round 3 contribution distribution.*

H_4 is tested graphically. Figure 1 presents the cumulative distributions of the contributions of rounds 3 and 4. As can be seen, it is indeed the case that $\Pr(\text{contribution} \leq x)$ for $x \in [0, 10]$ is weakly lower in round 4 than in round 3. Thus, claim 4 holds in the data. In other words, the prospect of identification causes subjects to contribute at least as much as they had in the previous rounds. Figure 2, which

[18] See Bowles and Gintis (2003) for a theoretical model where shame increases the level of cooperation in a group.

[19] Contributions could change in rounds 3 and 2 (relative to the previous round) for a purely altruistic subject if the revealed group choice causes him to update his belief about the total amount the charity receives. However, since the Red Cross is one of the largest charity organizations, any information about group choice should have minimal effect on one's belief about the total contributions to the charity. Therefore, I attribute the relative contribution changes in rounds 2 and 3 to social comparison concerns.

presents the histogram of contributions in rounds 3 and 4, shows that the least generous subjects in round 3 start donating more in round 4.

Since the subjects observe the entire round 3 group contribution distribution, it is not clear what information they use to decide their contribution in round 4. To explain subjects' behavior in round 4, I undertake the following regression:

$$\begin{aligned} Diff_{i,t} &\equiv x_{i,t+1} - x_{i,t} \\ &= \alpha + \beta MC_i + \gamma_1[\text{Statistic}(X_{i,t}) - x_{i,t}] + \gamma_{12}[\text{Statistic}(X_{-i,t}) - x_{i,t}] * MC_i + \varepsilon_{i,t} \end{aligned} \tag{3}$$

for $t = 3$; Statistic$(X_{i,t})$ is some summary statistic of the contributions in round t in i's group; I use the Mode, Median, and Mean of the contributions of other group members in period t. In this specification, for example, γ_1 captures the average change in the individual's contribution from round t to round $t+1$ in response to the distance between his contribution in round t and the statistic about behavior of others in round t. A positive γ_1 would imply change in the contribution in the direction of the statistic. MC_i is i's score on the Marlow-Crowne (MC) test. This score is also interacted with the distance between own contribution and the statistic about others' behavior. Since the score is increasing in one's social desirability, one would expect subjects with high MC scores to conform more, i.e., $\gamma_{12} > 0$. In order to interpret the empirical results better, instead of using a continuous measure of the MC score, the score is coded as a binary variable with scores above 4 on the 10-point scale being coded as 1, and zero otherwise.[20]

The tobit regression results of equation (3) for round 4 are presented in the top panel of Table 7 (to fit the table to one page, estimates of α and β are not reported since they're not of interest). The first three columns report the estimates using the mode, median, and mean of others' contributions, respectively. In each of the three cases, the subject changes his contribution in the direction of the mode ($\gamma_1 > 0$), the median ($\gamma_2 > 0$), and the mean ($\gamma_3 > 0$). The estimates are quantitatively similar: Individuals change their round 4 contribution by 13 cents for both a \$1 gap between their round 3 contribution and the group median as well as mean, and by 17 cents for a \$1 gap between the round 3 contribution and the group mode. This indicates that subjects do in fact indulge in social comparison, and conform to what others are doing even when there is no information value in other subjects' actions. The interaction terms with the M-C score for each of these statistics is negative, suggesting that conformitory behavior is negatively correlated with one's performance on the M-C test. However, none of these are statistically different from zero. Columns (4) and (5) of Table 7 report the estimates of equation (3) where all three summary statistics of the distribution are included simultaneously. While the estimates of the mode

[20] The mean MC score is 3.79 (with a standard deviation of 2.10). The results are robust to other cutoffs.

and the mean are positive ($\gamma_1 > 0$; $\gamma_3 > 0$), the estimate for the median, γ_2, is negative, suggesting that individuals move away from the median contribution of the group. This result is most likely driven by the fact that the three statistics are highly correlated with each other.[21] Therefore, it's better to focus on the model estimates where the statistics are entered one at a time.

Round 5 is similar to round 4, except that subjects are informed that their precise action (whether they donate or not) will also be revealed. According to Claim 6, one would expect the number of people who donate a positive amount to weakly increase in this round. However, Table 2 shows that this is not the case. In fact, relative to round 4, the number of subjects who donate decreases by 7. The data reveal that, while 2 subjects who did not donate in Round 4 now donate, 9 subjects who donated in round 4 do not donate. This is inconsistent with the model. One possible explanation for this is that since a high contribution norm never evolves in round 4, subjects who only donate in round 4 may think that a contribution of zero is socially acceptable, and hence revert back to not contributing (descriptive evidence of this is documented in section C of the Appendix). In fact, 5 of the 9 respondents who donate in round 4 but not in round 5 also do not donate in any of the earlier rounds. The second panel of Table 7 show the results of equation (3) for round 5. Subjects continue to change their contribution in the direction of the statistics but the magnitudes are smaller, and most estimates are not statistically significant now.

Recall that round 6 is analogous to round 5: Subjects observe everyone's actual donation decision from the previous round before making their contribution decision, with the knowledge that their exact action would be revealed at the end of the round. The average amount contributed in round 6 is even lower than in round 5. One possible explanation for this is that the low round 5 contributions (relative to round 4) indicate the emergence of a low contribution norm for the group, which may make it easier for oneself to justify a low contribution in round 6 as well.[22] Estimates of equation (3) for round 6 are shown in the third panel of Table 7. Estimates on the statistics reported in the first three columns are still positive but smaller in magnitude than the top two panels, and none are statistically different from zero.

The last panel of Table 7 presents the tobit regression for the pooled sample, i.e., for rounds 4, 5,

[21] In fact the mode contribution in most groups is zero, while the mean contribution is less than the median contribution for the majority of groups. In the case where individuals are inclined to conform to the modal and mean choice of the group, γ_2 would be negative.

In specifications not reported here, I also experiment with versions of equation (3) which include the distance between one's contribution from the lowest and highest contributions, i.e., $\text{Min}(X_{-i,t}) - x_{i,t}$ and $\text{Max}(X_{-i,t}) - x_{i,t}$. These statistics are highly correlated with other statistics of the distribution, in particular the mode. Thus, in a specification that also includes the max and the min, some of the variables get dropped because of multicollinearity. Though the results change slightly in quantitative terms, the interpretation stays the same.

[22] Though this finding seems to be similar to the stylized fact of repeated public goods games that contributions decline over the period of repetition (Ledyard, 1995), the design in this study is very different from a public goods game and it's not clear that the end game effect should be observed in this setting.

and 6 combined. I allow the error term, $\varepsilon_{i,t}$, to be correlated across the rounds for the same individual. The results are qualitatively similar to those obtained for the fourth round.

5.2 Who Affects Whom?

Since, in the real world, the desire to be well-regarded by others may be affected by the nature of the social ties between the individual and the others, it may be useful to look further into the behavior of subjects in rounds where a contribution decision is made after the identities and actions of group members have been revealed. Each subject was asked to report members of their group they knew from outside the laboratory.[23] It would be interesting to see whether, in a setting where strategic complementarities are absent, subjects respond differently to the behavior of people they know in the group. As Ouchi (1981) says about behavior in groups:

> *"What we care about most is what our peers think about us... More than hierarchical control, pay, or promotion, it is our group memberships that influences our behavior. There are daily examples of the tremendous power group memberships can exert upon people to the extent of changing their religious beliefs, their attitudes towards work, and even their self-image... It is not external evaluation or rewards that matter in such a setting (the workplace), it is the intimate, subtle and complex evaluation by one's peers – people who cannot be fooled – which is paramount." (Ouchi 1981:pg. 25)*

Surprisingly, few experimental studies have attempted to study the economic significance of social ties (defined as subjects knowing each other from outside the lab). For example, Haan et al. (2006) find that friends are likely to contribute more to the public good than other classmates.[24] However, the setup used in this paper differs from these existing studies in that there are no externalities arising from the monetary incentive scheme across individuals. To my knowledge, the role of social ties in settings with no strategic complementarities has not been studied in an experimental setup.[25] In order to see how friends affect one's choice, I estimate the following equation for $t = 4$ and $t = 5$:

$$x_{i,t+1} - x_{i,t} = \alpha + \eta_F[\overline{X_{i,t}^{Friends}} - x_{i,t}] + \eta_S[\overline{X_{i,t}^{Strangers}} - x_{i,t}] + \varepsilon_i \tag{4}$$

[23] This was asked in round 5 once the subject observed the names and location of each group member. 37 of the 101 subjects reported that they knew at least one other person in their group from outside the lab.

[24] Other exceptions are Abbink et. al (2006), and Reuben and van Winden (2007). The former studies the role of social ties in an experimental group project meant to mimic the setup of microfinance institution. They find that self-selected groups exhibit a higher willingness to contribute in the beginning of the experiment. The latter explores the effect of the presence of social ties on emotional reactions in a three-player power-to-take game.

[25] In a field experiment, Bandiera et al. (2007) find that presence of friends affects worker's performance in a setting where there are no externalities across workers due to the compensation scheme.

where $\overline{X_{i,t}^{Friends}}$ is the average contribution in round t of members in i's group with whom the subject has some sort of acquaintance from outside the lab, while $\overline{X_{i,t}^{Strangers}}$ is the average contribution of group members whom i does not know from outside the laboratory. I use the average contribution of group members as the relevant statistic to conform to since the median and mode for the two groups (friends and strangers) are highly correlated and one of them gets dropped in the regression because of multicollinearity. η_F and η_S are the parameters of interest. One would expect $\eta_F > 0$ ($\eta_S > 0$) if the subject is concerned about being close to the choice of the friends (strangers) in the group. The results of a tobit regression of equation (4) are presented for decisions taken in rounds 5 and rounds 6. The results for round 5 ($t = 4$ in equation 4) are shown in column (1) of Table 8. η_F is significant at the 10% level and positive: A one dollar gap between the average of one's friends and one's own contribution causes the subject to change his next period contribution by 10 cents in the direction of the average of the friends. No corresponding effect is found for strangers. In round 6, there is only weak evidence of contributions being correlated with those of one's friends. One reason for the weak effects is that these parameters are estimated off very few observations. On the whole, it seems that the change in one's behavior is indeed correlated with the choices of people they know in their group.

To dig deeper into the question of how friends affect each other, I define $Gap_{i,t}^F \equiv \overline{X_{i,t}^{Friends}} - x_{i,t}$. The indicator $\mathbf{1}[Gap_{i,t}^F > 0] = 1$ if the subject donated less than the average contribution of his friends in round t. The following equation is estimated:

$$\begin{aligned} & x_{i,t+1} - x_{i,t} \qquad (5) \\ = \; & \alpha + \eta_{F1} * |Gap_{i,t}^F| * \mathbf{1}[Gap_{i,t}^F > 0] + \eta_{F2} * |Gap_{i,t}^F| * \mathbf{1}[Gap_{i,t}^F \leq 0] + \eta_S[\overline{X_{i,t}^{Strangers}} - x_{i,t}] + \varepsilon_i \end{aligned}$$

where η_{F1} (η_{F2}) captures the effect on i's contribution in period $t+1$ if his period t contribution was less (greater) than the period t average of the group members whom he knows from outside the lab. $\eta_{F1} > 0$ ($\eta_{F2} < 0$) would imply that an individual increases (decreases) his period $t+1$ contribution if he was below (above) the average contribution of his friends in round t. The tobit estimates of equation (5) for $t = 4$ and $t = 5$ are shown in the columns (3) and (4) of Table 8 respectively. In both rounds, subjects don't respond to the behavior of strangers. In round 5, subjects who contributed more than their friends (in round 4) decrease their contribution ($\eta_{F2} \approx -0.15$; for every dollar that they contribute more than the average of their friends in round 4, they decrease their round 5 contribution by about 15 cents). Contributions of subjects who contribute less than their friends stay unchanged (η_{F1} is not significantly different from 0). This suggests that subjects evaluate themselves relative to their friends.[26] However, it is not clear why the high contributors change their contributions but not the

[26] For example, one subject wrote: "Even though group members knew my identity, I wasn't especially influenced because I did not know them." See section C of the Appendix for other comments.

low contributors. In round 6, $\eta_{F2} < 0$; individuals who contribute one dollar more than the average of their friends decrease their contributions by about 12 cents. To summarize: In round 5, subjects above the friends' average decrease their contribution, while those below the average keep their contributions the same. In round 6, when this pattern is made public, subjects realize that their friends are not increasing their donations, so friends decrease their contributions even more. On the whole, it seems that individuals feed off the behavior of their friends: The presence of friends in one's group generates a contagion that cause subjects to donate less in the presence of friends.

5.3 Discussion of Results

The purpose of this experimental setup was to disentangle some of the mechanisms through which conformity may arise. Section 2 outlined four possible channels of conformity: (1) social learning, (2) social comparison, (3) strategic complementarities, and (4) image-related concerns. By making the payoff of the individual dependent only on his own action, the third explanation is eliminated in the setting considered in this paper. Focussing on a charity whose quality and scale of operations is well-known (the American Red Cross), social learning is also ruled out as one of the mechanisms that leads to conformity in the empirical framework. The experimental setup allows me to disentangle the way in which contribution behavior is affected by social comparison and concerns of image and prestige.

The empirical analysis confirms most of the predictions of the theoretical model outlined in section 3. In round 1, in the absence of any group information, the behavior of individuals is found to be correlated with their beliefs of other group members' actions. This could be the case if an individual believes that the actions of others is the *appropriate* behavior in this context. Round 2 in the experimental setup presents the cleanest evidence for the limited information case (subjects observe the mean of other group members' contributions). The results indicate that conformity does in fact arise because of concerns for social comparison. However, only the subjects who contribute more than the group average in round 1 conform to the norm of low contributions by lowering their own contributions. One possible reason for why the converse (i.e., people below the norm increasing their contributions) doesn't happen is that while subjects above the norm can conform by lowering their contribution and increasing their own payoff, subjects below the norm have to increase their contribution to conform, which is relatively more costly. Round 3 is similar to the limited information case. However, the converse of round 2 is now observed: Subjects below the norm increase their contributions and conform to a norm of a higher donation now. It could be that individuals now respond to the fact that their contributions (though not identities) would be made public in the next round– an individual wanting to avoid the guilt and shame of being the lowest contributor in the group may change his offer in the third round since their

contribution is more salient now.[27] Another possible explanation for the change in contributions in rounds 2 and 3 (relative to the previous round), which cannot be totally ruled out, is that it is partially being driven by altruistic agents who update their beliefs about the total amount the Red Cross receives. This would change the interpretation of the results for rounds 2 and 3– conformity in that case would be a consequence of social learning (in addition to social comparison). Since the type of an agent cannot be inferred from his action, I cannot empirically test this explanation.

Round 4 presents the cleanest evidence of the full information case (subjects make a decision knowing that both their contribution and identity will be made public in the next round). Changes in contributions in this round (relative to round 3) are *primarily* attributable to image-related concerns.[28] As predicted by the model, the round 4 contribution distribution first order stochastically dominates the contribution distribution from the third round. Since the decision in round 4 is made prior to the revelation of the group members, and all members face the same institutions, the conformity in contributions in this round can be interpreted as an endogenous interaction in the terminology of Manski (1993). Rounds 5 and 6 are slight modifications of round 4: All uncertainty in actions is removed in these rounds. One would expect more subjects to contribute once their exact action is observable, but I don't find evidence of this. This is primarily because of the emergence of a low contribution norm in the experiment which keeps contributions low in later rounds as well. Prestige comes from conforming to the descriptive norm (i.e., what others are doing). Therefore, social approval or prestige depends on the norms prevalent in one's social context; in a group where no one donates, low donations would bring prestige, while in a group with a high-contribution norm, high contributions would earn prestige. Therefore, once subjects observe that the norm is one of low contribution, they don't change (increase) their contributions even when all actions are publicly observable. In rounds 4-6, the analysis reveals that subjects conform to the various statistics of others' contribution distribution (I consider the mode, median, and mean). For every dollar that the subject's contribution is away from the statistic, he changes his contribution by \$0.05-\$0.17 in the direction of the statistic.

Since an individual is aware of the exact composition of his group in rounds 5 and 6, subjects were asked to report which group members they knew from outside the laboratory. In section 5.2, I use this information to further understand the group behavior. It emerges that individuals only respond to the contributions of group members whom they know from outside the laboratory. More specifically, they move their contribution in the direction of that of their friends. However, the decrease in the contributions of individuals who contributed more than their friends in the previous round is

[27] See Charness and Dufwenberg (2006) for an experimental investigation of how guilt aversion may be relevant for understanding interactions.

[28] Subjects also observe the entire contribution distribution of others for the first time in this round, i.e., they also get more information. However, the model prediction only relies on image concerns.

significantly larger than the corresponding increase in the contributions of individuals who donated less than their friends in the previous round. The consequence of this is that a low contribution norm emerges that causes friends to contribute less in the presence of friends. To my knowledge, the role of social ties in experimental settings without any externalities in the payoff structure has not been explored. In a field experiment, Bandiera et al. (2007) analyze social interactions in a setting where there are no externalities arising from monetary incentives. They find that friends conform to a common productivity norm that lies between the productivities of the most and least able friends. In the current context, one possible explanation for why the presence of friends does not provide positive role models or generate incentives to contribute to be the most generous in the group could be that subjects treat the experiment as an artificial setting, and rationalize their actions as not being reflective of their everyday behavior; in that case, a low contribution norm rather than a high contribution norm would be more likely to emerge. However, this suggests that social information may not always lead to more prosocial behavior, as is usually assumed in the literature.

6 Conclusion

The attempt of this study was to go beyond what most economic studies of social interactions do, and instead of just measuring the extent of social interactions, pin down potential channels through which conformity may arise. This distinction is relevant from both a theoretical point of view to understand the processes through which individual choices are affected, and from a policy point of view. This paper introduces a simple model in which conformity arises from social comparison concerns and from image-related concerns. In order to disentangle the two, I use the fact that concerns for image are only present if actions are observable to others.

The model predictions are tested in an experimental setting which unmasks individuals' actions and identities in a controlled and systematic way. The experimental design eliminates learning and strategic complementarities as possible mechanisms that could affect subjects' behavior, and is able to disentangle conformity arising from social comparison and image. The empirical setting considered in this paper is an experimental charity contribution game in which each individual is randomly assigned to a group. A key feature of the setup is that one's payoff only depends on his own actions, and therefore, competing hypotheses like reciprocity can be ruled out in explaining the motivations of the agents. I find that individuals indulge in social comparison and change their actions in the direction of the social norm even when their identities stay hidden. Once identities and contribution distributions of group members are revealed, individuals conform to the (mean, median, as well as mode) choice of the group. The second set of findings sheds some light on how social ties affect choices of individuals.

Using information provided by the individuals on which group members they know from outside the laboratory, I find that individuals only respond to the contributions of their friends. Moreover, the analysis reveals that a low contribution norm evolves that causes individuals to contribute less in the presence of friends.

It has been argued in the literature that social comparison and social-image concerns are important determinants for prosocial behavior (see references in the introduction and literature review). I find that both are important in explaining behavior in the experiment. However, these motivations are usually seen as a way to increase contributions to public goods. For example, Croson, Handy, and Shang (2008) state: "These results suggest strategies for fundraising practice. Informing donors of contributions made by another person influences their perceptions about the descriptive social norm, which in turn influences their giving behavior." This paper finds that image concerns and the desire to conform to the norm can lead to lower contributions if a low-contribution norm is in place. This has practical implications: Unless the planner has tight control over the environment and control over the information that donors get to see, revealing social information may not always lead to higher contributions.

The experimental setting in this study allows me get around the difficult identification problems in measuring social interaction effects in real-world instances (Manski, 1993; 2000), and presents clean evidence on some of the mechanisms through which conformity arises. However, a limitation of this study is that the evidence is based on a stylized experimental setting. Since the laboratory is an artificial setting where stakes are much lower, one should be careful in extrapolating the findings in this study to other settings. Given the nature of image-related concerns, I believe the effects found in this study offer a lower bound for effects found in real-world instances. However, we care about social interactions because they affect everyday behavior. The ultimate goal is to disentangle the various mechanisms that lead to conformity in behavior in real-world settings. That is a much more challenging task since empirically different mechanisms lead to the same outcomes. For example, peer effects in schooling may arise either because students learn from others or have a preference of similarity. One could pin down the precise mechanism by considering two separate interventions: One where knowledge is disseminated to all students, and second where the focus is on improving outcomes for a few popular students which could then lead to spillovers. Therefore, I believe the next step in the area of social interactions is to conduct field experiments with specific interventions that may shed light on the underlying mechanisms.

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7 Appendix

A Experimental Instructions

Welcome to the Experiment. Thanks you for your participation.

A.1 Instructions

You are about to participate in an experimental study of decision making. The experiment will last about half an hour. In the experiment, you will be assigned randomly to a group consisting of 4-6 persons (you will get to know the actual number when the experiment starts). Your group will remain the same for the entire experiment. As you notice, there are more people in the room than the size of the group, so you cannot know who are the other members of your group. A person sitting next to you may or may not be in the same group as you. Please try not to look at other people's screens during the experiment. You will be paid $4 as a show-up fee. In addition, you may earn money during the experiment.

The experiment will consist of 6 rounds. At the end of the experiment, one round will be picked at random to determine your earnings from the experiment. Therefore, you should treat each round as a real round. All the money will be paid in cash at the end of the experiment.

You will not be allowed to talk or communicate with other participants. If you have a question, please raise your hand and I will come to you. Are there any questions about what has been said up till now?

The next section describes the basic idea of the experiment.

A.2 The Basic Procedure

Recently the world, and in particular the US, has been struck by several natural disasters. Currently, there are hundreds of thousands of hurricane survivors (US), famine survivors (Africa), and flood-displaced individuals (Asia) out there who are in dire need of your help. Over 1 billion people—1 in 6 people around the world—live in extreme poverty, defined as living on less than $1 a day. More than 800 million go hungry each day. This experiment provides you with the opportunity to help a cause that might be dear to your heart.

You will get $10 every round, and will have the opportunity to donate part of this amount to the Red Cross (you will get to choose the specific effort to which your donation will go). The decision procedure will be as follows: you will have two options:

1 Take the \$10, and do not donate any amount to the Red Cross. In this case, your earnings for that period will be \$10.

2 Donate part of your \$10 to the Red Cross. If you decide to donate x (x can be any number between 0.5 and 10 in multiples of \$0.5), then one of two things can happen:

- With probability 60%, the donation goes through: Red Cross will get x, and you get $\$10 - x$.
- With probability 40%, the donation does not go through, i.e. Red Cross does not get anything, and you keep your \$10.

If you decide to donate, you will be given the option to choose the specific Red Cross effort to which you want to contribute.

Note there are two ways in which Red Cross does not get anything: either you decide not to donate anything; or you decide to donate, but the donation does not go through.

The instructions for each student in your group will be the same for each round.

This procedure will be repeated for 6 rounds. Each round might have some modification about which you will be informed before you make the decision.

At the end of the experiment, one round will be picked at random. You will be paid in cash for your earnings of that round (as well as the show-up fee), and Red Cross will receive the donation for that round (you will be given a receipt of the donation made to Red Cross).

The next section describes some of the efforts undertaken by the Red Cross to which you may direct your donation.

A.3 About the Red Cross

The American Red Cross is comprised of hundreds of local Red Cross chapters and blood services regions that provide a variety of programs and services in cities, towns and neighborhoods across the country and around the world. You could direct your gift to any of the Red Cross efforts listed below:

1. NATIONAL DISASTER RELIEF FUND: The American Red Cross responds to approximately 75,000 disasters a year, including Tropical Storms Dean and Erin, floods, house fires, storms, tornadoes, hurricanes and other disasters, providing aid to more disaster victims nationwide. This means that every eight minutes a disaster strikes and a family turns to the Red Cross for help. The Red Cross stands ready to turn the compassion of our donors into action. With your support of the Disaster Relief Fund, a fund that requires constant replenishment, the Red Cross can be there for the victims of the recent storms.

2. WHERE OUR NEED IS GREATEST: The American Red Cross is where people mobilize to help their neighbors—down the street, across the country and around the world—in emergencies. The American

Red Cross, a humanitarian organization led by volunteers, guided by its Congressional Charter and the Fundamental Principles of the International Red Cross Movement, provides relief to victims of disasters and helps people prevent, prepare for, and respond to emergencies. You can help ensure that the Red Cross can continue to provide these lifesaving services and has the resources, talent and ability to continue to deliver them by making a donation to support all of its core services today.

3. INTERNATIONAL RESPONSE FUND: You can help those affected by countless crises around the world each year by making a financial gift to the American Red Cross International Response Fund, which will provide immediate relief and long-term support through supplies, technical assistance and other support to help those in need. If you wish to designate your donation to a specific disaster please do so at the time of your donation.

4. YOUR LOCAL RED CROSS CHAPTER: Your local Red Cross chapter is committed to meeting the humanitarian needs of the people in your area, be it in disaster preparedness, disaster response, first aid and CPR training, or disease prevention. You can help support your local chapter programs and services by a gift to Your Local Red Cross Chapter. The gift will be sent to your local area chapter based on zip code.

5. MILITARY SERVICES: The American Red Cross is a lifeline for deployed military members, allowing them to communicate to loved ones back home during emergencies. You can help the Red Cross keep military families connected with a gift to Red Cross Armed Forces Emergency Services.

6. MEASLES INITIATIVE: The Measles Initiative is a partnership committed to reducing measles deaths globally. Launched in 2001, the Measles Initiative—led by the American Red Cross, the United Nations Foundation, the U.S. Centers for Disease Control and Prevention, UNICEF and the World Health Organization—provides technical and financial support to governments and communities on vaccination campaigns in all regions of the world. To date, the Initiative has supported the vaccination of more than 372 million children helping to reduce measles deaths by more than 60% globally (compared to 1999). To learn more, visit http://www.measlesinitiative.org/.

7. BLOOD SERVICES CAMPAIGN: Your gift to the Blood Services Campaign of the American Red Cross supports our commitment to the nation's blood supply. Through this 10-year undertaking we will update and reconfigure our blood manufacturing facilities across the nation, to better serve the health needs of patients nationwide.

The instructions for each round are available upon request.

B Marlowe-Crowne 2(10) Social Desirability Scale

This is taken from Mandell.

Respondents were required to answer True or False to the following set of 10 questions:

Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to you personally.

1. I never hesitate to go out of my way to help someone in trouble. (T)
2. I have never intensely disliked anyone. (T)
3. There have been times when I was quite jealous of the good fortune of others. (F)
4. I would never think of letting someone else be punished for my wrong doings. (T)
5. I sometimes feel resentful when I don't get my way. (F)
6. There have been times when I felt like rebelling against people in authority even

though I knew they were right. (F)

7. I am always courteous, even to people who are disagreeable. (T)
8. When I don't know something I don't at all mind admitting it. (T)
9. I can remember "playing sick" to get out of something. (F)
10. I am sometimes irritated by people who ask favors of me. (F)

The scoring algorithm is as follows:

For each answer the respondent provides that matches the response given above (i.e.,T=T or F=F) assign a value of 1. For each discordant response (i.e., the respondent

provides a T in place of an F or an F in place of a T) assign a value of 0. Total score can range from 10 (when all responses "match") to 0 (when no responses "match"). A higher score implies higher social desirability.

C Debriefing

Below I report selective responses of subjects to the question: "What was your strategy during the course of the experiment? Especially explain the pattern of your donations during the experiment."

- I had originally decided on a set amount to donate, and I saw no reason to change it.
- I did not want to donate \$0.0 to the Red Cross because it is a great organization. I wanted to donate something and \$1 was 6.6% of my maximum payoff, which I thought was fair. I want to give more than 5% and at the same
- Initially, I reckoned that everyone would donate \$10 since it didn't cost them anything. However, after seeing that the average for that round was a measly \$3, I lowered my donation to \$5.

- I guessed that the more information that each person received about the other participants the more they would choose to donate.
- Earn the most money possible.
- I figured that the $15 would be of more use to me right now as a broke college student than it would be to the Red Cross, so I did not donate at all.
- Try to maximize my earnings.
- The strategy was to maximize payoff.
- It was essentially random. I felt the need to donate more if I knew people could find out whether or not I TRIED to donate
- I donated the same amount each time because I knew how much I wanted to donate and none of the conditions changed that.
- I originally was donating out of generosity but as I saw that others were not doing so, I no longer felt that it was a group effort to donate so I did not in round 4. However, seeing at least some donation after that, I decided to donate
- At first, I thought that 2 dollars was an efficient amount, but after seeing that most people donated around 5 dollars, I felt selfish and increased it a little, especially after seeing someone donate 10 dollars.
- When people began to know who I was, I donated some money to the red cross. Then it turned out that it didn't matter anyway so I donated nothing.
- I wanted to keep the entire 15, and don't like to gamble, so I consistently did not donate, even with the pressure of people knowing. Since I only know one other person in this room, I'm not too worried about being judged for it.
- I wasn't planning on donating until my identity and location became known to other members of my team
- My strategy was donate every time an amount I was willing to lose. On estimating the average given to the Red Cross, I figured that $2 was safe bet because it was good average based on my assumption of what people would donate.
- I think donating half the money is fair, so I did that. However, at the beginning of round 2 I saw the average was $6, so I decided I should be more generous like my peers. Then, when they started donating less, I went back to my original mind.

- I kept my donations more or less consistent from round to round but I was a poor judge of the average amount donated by my group. Even though group members knew my identity, I wasn't especially influenced because I did not know them.
- To maintain a consistent donation pattern throughout the experiment.
- I donated a little at the beginning. However, when people could see my identity, I donated slightly more.
- I wanted to be generous but still keep some for myself, so I originally decided to walk away with 10. However, seeing the average donation made me reconsider my donation, and I lowered it to about the average.

D Mathematical Appendix

Proposition 1: Stated in the body of the paper.

Proof. Agent i's maximization problem is:

$$\max_{x\in[0,1]} \mathbf{1}_{SI} * u(1-x_i) + \mathbf{1}_A * u(1-x_i, \sum_{j=1}^{N_i} x_j) + \mathbf{1}_{WG} * u(1-x_i, x_i) + t_i G(\frac{|x_i - s_{-i}|}{\sigma_{-i}}) \tag{6}$$

Case 1: $1 > x^{**} > s$:The FOC is:

$$\underbrace{\mathbf{1}_A * u_2 + \mathbf{1}_{WG} * u_2}_{+ve} + \underbrace{\frac{t}{\sigma} G'(\frac{|x-s|}{\sigma}) - u_1}_{-ve} = 0 \tag{7}$$

Since this FOC is never satisfied for a self-interested agent, there is no $x^{**} > s$. For an agent motivated by altruism or warm glow, this FOC is satisfied.

Case 2: $0 < x^{**} < s$: The FOC is:

$$\underbrace{-u_1}_{-ve} + \underbrace{\mathbf{1}_A * u_2 + \mathbf{1}_{WG} * u_2 - \frac{t}{\sigma} G'(\frac{|x-s|}{\sigma})}_{+ve} = 0 \tag{8}$$

This FOC can be satisfied by an $0 < x^{**} < s$. This is the case of partial conformity

Case 3: $x^{**} = 0$. The FOC is:

$$\underbrace{-u_1}_{-ve} + \underbrace{\mathbf{1}_A * u_2 + \mathbf{1}_{WG} * u_2 - \frac{t}{\sigma} G'(\frac{|x-s|}{\sigma})}_{+ve} < 0 \tag{9}$$

which can be satisfied.

Case 4: $x^{**} = 1$. The FOC is:

$$\underbrace{\mathbf{1}_A * u_2 + \mathbf{1}_{WG} * u_2}_{+ve} + \underbrace{\frac{t}{\sigma} G'(\frac{|x-s|}{\sigma}) - u_1}_{-ve} > 0 \tag{10}$$

which is never satisfied for a self-interested agent, but is satisfied for an altruistic or warm glow motivated agent.

Case 5: $x^{**} = s$. Recall that $G(0) = 0$. The FOC is simply:

$$\underbrace{-u_1}_{-ve} + \underbrace{\mathbf{1}_A * u_2 + \mathbf{1}_{WG} * u_2}_{+ve} = 0 \tag{11}$$

which is never satisfied for a self-interested agent, but is satisfied for an altruistic or warm glow motivated agent.

Thus, $x^{**}(t) \in [0, s)$ for a self-interested agent, while $x^{**}(t) \in [0, 1]$ for an agent motivated by altruism or warm glow. ■

Proposition 2: Stated in the body of the paper.

Proof. Proof of (a):

I show the proof for the case of a self-interested agent. For the other two types, one only needs to replace the term $u_{11}(1-x)$ with $u_{11}(1-x,\zeta) + u_{22}(1-x,\zeta)$ where ζ is the relevant argument. The proof still goes through because the utility is concave in both arguments.

(1) Differentiating equation 8 implicitly yields:

$$\frac{dx}{dt} = \frac{\frac{1}{\sigma} G'(\frac{|x-s|}{\sigma})}{u_{11}(1-x) + \frac{t}{\sigma^2} G''(\frac{|x-s|}{\sigma})} \tag{12}$$

under the concavity assumptions on $u(.)$, and $G(.)$, and the assumption that $u_{12} < 0$, both the numerator and the denominator are strictly negative, and thus $\frac{dx}{dt} > 0$. Moreover, note that if $x = 0$ is optimal for some t, then from equation 9 it is also optimal for smaller t.

(2) Implicitly differentiating equation 8 with respect to s:

$$\frac{dx}{ds} = \frac{\frac{t}{\sigma^2} G''(\frac{|x-s|}{\sigma})}{u_{11}(1-x) + \frac{t}{\sigma^2} G''(\frac{|x-s|}{\sigma})} \tag{13}$$

since both the numerator and denominator are strictly negative, $\frac{dx}{ds} > 0$

(3) Implicitly differentiating equation 8 with respect to σ:

$$\frac{dx}{d\sigma} = -\frac{\frac{t}{\sigma^2}G'(\frac{|x-s|}{\sigma}) + \frac{t|x-s|}{\sigma^3}G''(\frac{|x-s|}{\sigma})}{u_{11}(1-x) + \frac{t}{\sigma^2}G''(\frac{|x-s|}{\sigma})} \tag{14}$$

the numerator and denominator are both negative. With the negative sign in front of them, $\frac{dx}{d\sigma} < 0$.

Proof of (b):

(1) Differentiating equation 7 implicitly yields:

$$\frac{dx}{dt} = \frac{-\frac{1}{\sigma}G'(\frac{|x-s|}{\sigma})}{u_{11}(1-x,\zeta) + u_{22}(1-x,\zeta) + \frac{t}{\sigma^2}G''(\frac{|x-s|}{\sigma})} \tag{15}$$

since the numerator is positive, and the denominator is strictly negative, $\frac{dx}{ds} < 0$. Moreover, if $x = 1$ is optimal for some t, then from equation 10 it is also optimal for larger t.

(2) Implicitly differentiating equation 7 with respect to s:

$$\frac{dx}{ds} = \frac{\frac{t}{\sigma^2}G''(\frac{|x-s|}{\sigma})}{u_{11}(1-x,\zeta) + u_{22}(1-x,\zeta) + \frac{t}{\sigma^2}G''(\frac{|x-s|}{\sigma})} \tag{16}$$

the numerator and denominator are both strictly negative, and so $\frac{dx}{ds} > 0$.

(3) Implicitly differentiating equation 7 with respect to σ:

$$\frac{dx}{d\sigma} = \frac{\frac{t}{\sigma^2}G'(\frac{|x-s|}{\sigma}) + \frac{t|x-s|}{\sigma^3}G'(\frac{|x-s|}{\sigma})}{u_{11}(1-x,\zeta) + u_{22}(1-x,\zeta) + \frac{t}{\sigma^2}G''(\frac{|x-s|}{\sigma})} \tag{17}$$

the numerator and denominator are both strictly negative, and so $\frac{dx}{d\sigma} > 0$. ■

Claim 4: Stated in the body of the paper

Proof. In order to prove this claim, I need to show that:

(1) For the case where $\widetilde{x(t)} < s$: the full information contributions weakly increase in t at a faster rate than they would in the limited information if perception and consumption are substitutes (i.e. $u_{12} < 0$ for a self-interested agent; $u_{13} < 0$ and $u_{23} > 0$ for the other two types). I show the proof for the case of a self-interested agent. In a full information case, equation 12 now becomes

$$\frac{dx}{dt} = \frac{u_{12}(1-x,t) + \frac{t}{\sigma}G'(\frac{|x-s|}{\sigma})}{u_{11}(1-x,t) + \frac{t}{\sigma^2}G''(\frac{|x-s|}{\sigma})}$$

under the assumption that $u_{12} < 0$, both the numerator and denominator are strictly negative. Thus $\frac{dx}{dt}$ is positive and strictly larger than the slope in equation 12.

(2) For the case where $\widetilde{x(t)} > s$, the contribution in the full information case decreases in t at a slower rate than it would in the limited information case if it is assumed that consumption and perception are substitutes ($u_{13} < 0$), and that contribution and perception are compliments ($u_{23} > 0$). In order to show this, note that in the full information case, equation 15 is:

$$\frac{dx}{dt} = \frac{u_{13}(1-x,\varsigma,t) - u_{23}(1-x,\varsigma,t) - \frac{1}{\sigma}G'(\frac{|x-s|}{\sigma})}{u_{11}(1-x,\zeta) + u_{22}(1-x,\zeta) + \frac{t}{\sigma^2}G''(\frac{|x-s|}{\sigma})}$$

The denominator is strictly negative. Under the assumption that $u_{13} < 0$ and $u_{23} > 0$, the numerator may be positive or negative. However, $\frac{dx}{dt}$ is strictly greater than the slope in equation 15.

These two claims collectively imply that the contribution distribution in the full information case will first-order stochastically dominate the cumulative distribution function of contributions in the limited information case. ■

Claim 5: Stated in the body of the paper

Proof. From equation 9,

$$t < \frac{-u_1(1,t)}{\frac{1}{\sigma}G'(\frac{s}{\sigma})}$$

So equation 9 is satisfied for $t^* = \min\{\frac{-u_1(1,t)}{\frac{1}{\sigma}G'(\frac{s}{\sigma})}, \bar{t}\}$. Similarly from equation 10;

$$t > \frac{-u_1(1,t) + \mathbf{1}_{WG} * u_2 + \mathbf{1}_A * u_2}{\frac{1}{\sigma}G'(\frac{s}{\sigma})}$$

So equation 10 is satisfied for $\widehat{t}$ =max$\{\frac{-u_1(1,t)+\mathbf{1}_{WG}*u_2+\mathbf{1}_A*u_2}{\frac{1}{\sigma}G'(\frac{s}{\sigma})}, 0\}$. ■

E Figures and Tables

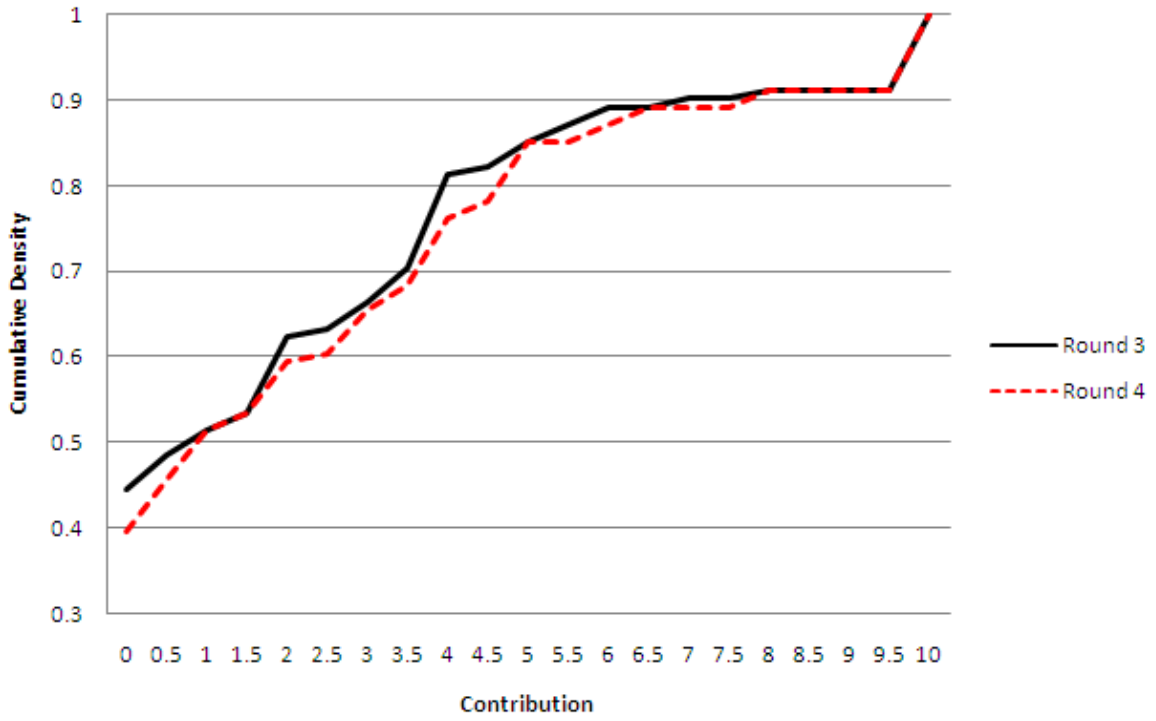

Figure 1: Cumulative Density of Contributions

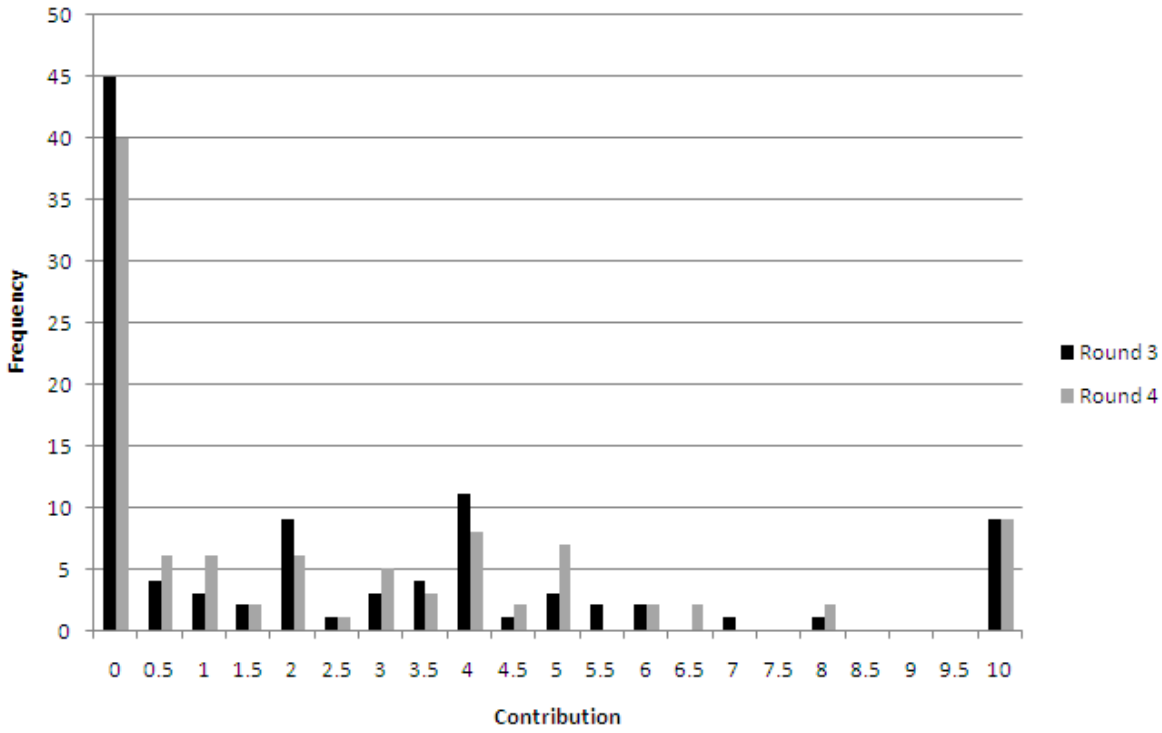

Figure 2: Frequency of Contributions

Table 1: Experimental Design

	What do respondents know when making a decision?		**Classification**	**Mechanisms**
	from previous round	about next round		
Round 1	-	will observe mean of others' contributions from Round 1 in Round 2	baseline case	
Round 2	observe mean of others' contributions from Round 1	will observe mean of others' contributions from Round 2 in Round 3	limited info	Social Comparison Concerns
Round 3	observe mean of others' contributions from Round 2	will observe the entire Round 3 contribution distribution in Round 4		
Round 4	observe the Round 3 contribution distribution	will observe Round 4 contribution distribution and corresponding identities in Rd 5	full info case	Social Comparison + Image-Related Concerns
Round 5	observe Round 4 contribution distribution and corresponding identities of group members.	will observe *exact* Round 5 contribution decision (donate or not donate) and identities in Round 6.		
Round 6	observe *exact* contribution distribution and identities of group members from Round 5.	-		

Table 2: Donation Statistics

	Number of subjects who donate	Number of subjects who donate all endowment	Avg. amount contributed	Avg. amount contributed by subjects who donate
Round 1	56	9	\$2.33	\$4.21
Round 2	57	7	\$2.15	\$3.81
Round 3	56	9	\$2.41	\$4.33
Round 4	61	9	\$2.56	\$4.25
Round 5	54	9	\$2.39	\$4.47
Round 6	55	8	\$2.31	\$4.24

NOTES: Total Number of subjects is 101.

Table 3: Wilcoxon Rank Sum Test

	Test Statistic	p-value
Round 2 - Round 1	0.365	0.715
Round 3 - Round 2	1.231	0.218
Round 4 - Round 3	1.970	0.048
Round 5 - Round 4	−1.351	0.177
Round 6 - Round 5	−0.863	0.388

Table 4: Contribution response to group choice in Round 2

	OLS	Tobit	OLS	Tobit
	(1)	(2)	(3)	(4)
α (constant)	-0.67^{**}	-0.70^{**}	0.15	0.16
	(0.32)	(0.34)	(0.24)	(0.25)
β (soc. comparison)	0.31^{**}	0.32^{***}	–	–
	(0.11)	(0.12)		
β_1(soc. comparison if donated LESS	–	–	0.024	0.021
than group avg. in round 1)			(0.07)	(0.07)
β_2 (soc. comparison if donated MORE	–	–	-0.56^{**}	-0.59^{**}
than group avg. in round 1)			(0.24)	(0.26)

robust standard errors in parentheses; * sig. at 1%, ** sig. at 5%; *** sig. at 10%

Table 5: Contribution response to group choice in Round 3

	OLS	Tobit	OLS	Tobit	Tobit
	(1)	(2)	(3)	(4)	(5)
α (constant)	0.016	0.0187	−0.385	−0.389	−0.513
	(0.191)	(0.192)	(0.329)	(0.313)	(0.318)
β (soc. comparison)	0.157*	0.159*	–	–	–
	(0.081)	(0.084)			
$\beta \times$ 1[unchanged in round 2][a]	–	–	–	–	–
$\beta \times$ (1-1[unchanged in round 2])	–	–	–	–	–
β_1 (soc. comparison effect if donated	–	–	0.297**	0.302**	–
LESS than group avg. in round 2)			(0.134)	(0.137)	
$\beta_1 \times$ 1[unchanged in round 2]	–	–	–	–	0.297**
					(0.143)
$\beta_1 \times$ (1-1[unchanged in round 2])	–	–	–	–	0.426***
					(0.159)
β_2 (soc. comparison effect if donated	–	–	0.025	0.0259	–
MORE than group avg. in round 2)			(0.058)	(0.057)	
$\beta_2 \times$ 1[unchanged in round 2]	–	–	–	–	0.005
					(0.062)
$\beta_2 \times$ (1-1[unchanged in round 2])	–	–	–	–	0.334
					(0.309)

robust standard errors in parentheses; * sig. at 1%, ** sig. at 5%; *** sig. at 10%

a : 1[unchanged in round 2]=1 if subject's round 2 contribution is same as in round 1

Table 6: Contributions and the Group Choice

Dependent Variable: Contribution (x)		
	Round 2	**Round 3**
Constant	−0.251	−0.671
	(0.813)	(0.832)
Group choice	0.656**	0.829***
	(0.197)	(0.199)

*** Sig. at 1%; ** Sig. at 5%; * Sig. at 10%

Table 7: Explaining the Change in contributions in Rounds 4-6

Dependent Variable: Contribution change $(x_{i,t+1} - x_{i,t})$					
	(1)	(2)	(3)	(4)	(5)
			ROUND 4		
γ_1 (dist. from mode)	0.172*	-	-	0.246*	0.420**
	(0.060)	-	-	(0.133)	(0.171)
(mode * M-C score)	-0.137	-	-	-	-0.449*
	(0.113)	-	-	-	(0.267)
γ_2 (dist. from median)	-	0.133**	-	-0.392**	-0.392*
	-	(0.066)	-	(0.165)	(0.210)
(median * M-C score)	-	-0.113	-	-	-0.033
	-	(0.116)	-	-	(0.328)
γ_3 (dist. from mean)	-	-	0.132**	0.232*	0.096
	-	-	(0.055)	(0.117)	(0.148)
(mean * M-C Score)	-	-	-0.041	-	0.338
	-	-	(0.096)	-	(0.235)
			ROUND 5		
γ_1 (dist. from mode)	0.142**	-	-	0.469***	0.558***
	(0.060)	-	-	(0.117)	(0.149)
(mode * M-C score)	-0.057	-	-	-	-0.235
	(0.125)	-	-	-	(0.246)
γ_2 (dist. from median)	-	0.062	-	-0.497**	-0.500**
	-	(0.066)	-	(0.170)	(0.210)
(median * M-C score)	-	-0.076	-	-	0.007
	-	(0.127)	-	-	(0.354)
γ_3 (dist. from mean)	-	-	0.071	0.092	0.016
	-	-	(0.057)	(0.129)	(0.170)
(mean * M-C Score)	-	-	-0.047	-	0.168
	-	-	(0.102)	-	(0.263)
			ROUND 6		
γ_1 (dist. from mode)	0.053	-	-	-0.204	-0.003
	(0.037)	-	-	(0.136)	(0.172)
(mode * M-C score)	-0.043	-	-	-	-0.470*
	(0.076)	-	-	-	(0.271)
γ_2 (dist. from median)	-	0.057	-	0.196	0.071
	-	(0.039)	-	(0.187)	(0.230)
(median * M-C score)	-	0.013	-	-	0.236
	-	(0.079)	-	-	(0.380)
γ_3 (dist. from mean)	-	-	0.045	0.064	-0.011
	-	-	(0.033)	0.085575	(0.102)
(mean * M-C Score)	-	-	0.050	-	0.213
	-	-	(0.064)	-	(0.176)
			POOLED SAMPLE[a]		
γ_1 (dist. from mode)	0.116***	-	-	0.256***	0.389***
	(0.031)	-	-	(0.070)	(0.090)
(mode * M-C score)	-0.082	-	-	-	-0.333**
	(0.061)	-	-	-	(0.143)
γ_2 (dist. from median)	-	0.079**	-	-0.382***	-0.384**
	-	(0.033)	-	(0.096)	(0.119)
(median * M-C score)	-	-0.061	-	-	-0.027
	-	(0.063)	-	-	(0.196)
γ_3 (dist. from mean)	-	-	0.080**	0.176**	0.069
	-	-	(0.029)	(0.064)	(0.081)
(mean * M-C Score)	-	-	-0.009	-	0.269**
	-	-	(0.052)	-	(0.131)

*** Sig. at 1%; ** Sig. at 5%; * Sig. at 10%;
[a]Observations pooled for rounds 4 to 6.

Table 8: Responding to friends and strangers

Dependent Variable: $(x_{i,t+1} - x_{i,t})$	**Round 5** $(t = 4)$	**Round 6** $(t = 5)$	**Round 5**	**Round 6**
	(1)	(2)	(3)	(4)
Constant (α)	0.0588	0.0746	0.1836	0.2261
	(0.236)	(0.163)	(0.2903)	(0.1975)
Distance from friends (η_F)	0.108*	0.0696	–	–
	(0.0541)	(0.0537)		
Distance from strangers (η_S)	−0.0258	0.0107	−0.0504	−0.0251
	(0.0707)	(0.0514)	(0.0789)	(0.0577)
η_{F1}	–	–	0.0287	−0.0526
			(0.128)	(0.1064)
η_{F2}	–	–	−0.1483*	−0.1216*
			(0.0882)	(0.0661)

*** Sig. at 1%; ** Sig. at 5%; * Sig. at 10%