

Playing with the Good Guys

A Public Good Game with Endogenous Group Formation*

Kjell Arne Brekke, Karen Evelyn Hauge, Jo Thori Lind, Karine Nyborg[†]

September 30, 2010

Abstract

Are some individuals generally more pro-social than others? If so, socially beneficial commitments could serve as a costly screening device helping the pro-social to match. We present a public good game experiment in which subjects choose between two group types: in *blue* groups, subjects receive a fixed extra payoff; in *red* groups, this extra payoff is donated, instead, to the Red Cross. A substantial share of our subjects chose red groups. Contributions in red groups were initially higher and stayed high, while contributions in blue groups displayed the well-known declining pattern.

JEL codes: D11, D12, D64, H41

Keywords: Altruism; conditional cooperation; self-selection

*We are grateful to the Research Council of Norway (RCS) for funding through the RAMBU/Miljø2015 programmes, to Geir Asheim, two reviewers and numerous conference and seminar participants for comments and suggestions, and to Kenneth Birkeli, Sunniva P. Eidsvoll, and Kristine Korneliusen for excellent research assistance. Part of this project was undertaken while Brekke and Nyborg were employed by the Ragnar Frisch Centre for Economic Research. The authors are part of the ESOP - Centre of Equality, Social Organization, and Performance, which is supported by the Research Council of Norway.

[†]Addresses: Brekke, Lind, Nyborg: Department of Economics, University of Oslo, P.O. Box 1095 Blindern, N-0317 Oslo, Norway. Hauge: Institute of Transport Economics, Gaustadellén 21, N-0349 Oslo, Norway. E-mails: k.a.brekke@econ.uio.no, kha@toi.no, j.t.lind@econ.uio.no, karine.nyborg@econ.uio.no.

1 Introduction

Groups' ability to sustain voluntary contributions is important in a wide range of real life situations. When individual effort in teamwork is unobservable, effort can be regarded as a voluntary contribution to a local public good (Holmström, 1982; Rob and Zemsky, 2002; Encinosa et al., 2007), and maintaining cooperation in such teams can, of course, be vital to firms' survival. Clubs, organizations, school classes, neighborhoods and friends likewise depend on individuals' willingness to keep local environments clean, host parties, chair community meetings, contribute to classroom discussions and create a pleasant social atmosphere (Cornes and Sandler, 1986; Scotchmer, 2002; Brekke et al., 2007). Understanding how voluntary contributions can – or cannot – be sustained is thus of general interest.

Our starting point is the idea that some people may be generally more pro-social than others; more specifically, that there could be a positive correlation between an individual's willingness to contribute to different public goods. If pro-social behavior originates from an underlying ethical principle, while the weight attached to this principle varies between individuals, a positive correlation between a given individual's cooperativeness in different contexts will arise endogenously, as demonstrated in Brekke and Nyborg (2008). Based on this idea, they show that socially responsible firms can attract workers who exert more non-observable effort and are thus more productive.¹

Due to the vast number of causes an individual could possibly contribute to, and the existence of small, but fixed costs of making contributions to any given cause, the hypothesis of correlated willingness to contribute would be hard to test using market data. Nevertheless, if such a correlation does exist, this could still have profound effects in the marketplace; in particular, groups would have the opportunity to use costly, but socially beneficial commitments as a screening device to prevent low contributors from entering the group.

Existing empirical evidence for correlated contribution behaviors is sparse and somewhat mixed. Several studies do find positive correlations, but often of a relatively low magnitude (Thøgersen and Ölander, 2006; Hartshorne and May, 1929; Piliavin and Charng, 1990; Aronson et al., 2005). Within experimental economics, a few recent studies focusing on other issues might be interpreted as supporting correlated contribution behaviors. For example, Johnson et al. (2009) find that individuals who pay to enforce equality are also more likely to punish free-riders in a public good game; in Blanco et al. (2007), subjects who cooperate as first movers in a sequential prisoners' dilemma game are also more likely to reciprocate first mover cooperation when placed in the role of second movers. However, we are not familiar with previous experimental studies explicitly designed to test the correlated contribution

¹See also Heyes (2004); Besley and Ghatak (2005); Brekke and Nyborg (2010).

hypothesis. This is our aim with the public good game experiment presented in the current paper.

The effect of exogenous variation in group composition has been studied in several previous papers (Gächter and Thöni, 2005; Gunnthorsdottir et al., 2007; Ones and Putterman, 2007).² These papers show that if high contributors in a public good game are exogenously matched with each other, average contribution levels stay high. Nevertheless, if group formation is endogenous, free-riders will have an incentive to invade groups of high contributors. We are aware of only a few experimental papers with endogenous group formation. Ehrhart and Keser (1999) find, indeed, that while high contributors tend to create new groups in order to escape free-riders, the free-riders keep following them around. In Gürer et al. (2006), subjects can choose between two groups, one with and one without a sanctioning instrument. The authors find that over time, all subjects are attracted to the group with sanctioning. Nevertheless, in both these studies, group size is endogenous; and since group size can substantially affect subjects' payoffs, these experimental designs are not ideally suited to study the effects we are interested in here.

Our experiment consists of three parts, all of them with exogenously fixed group size. Part I is a standard one-shot public good game with exogenous group formation. In Part II, a public good game is repeated 10 times with fixed group composition throughout. However, before groups are formed, subjects can choose between two group types. In what we label *blue* groups, each member receives an extra, fixed amount of money. For each member of the *red* groups, the same extra, fixed amount is instead donated to the Norwegian Red Cross. In Part III, subjects choose their preferred group type (blue or red) between each period, and new groups are formed in every period. The number of periods is increased to 20.

If willingness to contribute to the Red Cross and to one's group are positively correlated, high contributors in Part I will be more likely to choose red groups in Parts II and III. We would also expect average contributions in red groups to be higher than in blue groups.

We find that throughout Parts II and III, a substantial share of our subjects, about 35-40 percent, choose red groups. High contributors in Part I are indeed more likely to choose red groups in Parts II and III. Contributions in red groups are, on average, substantially higher than in blue groups. In every single period, average contributions are higher in red groups; and while the difference is relatively small initially, it increases over time. Finally, while blue groups display a marked deterioration of contributions over time, a result typical of repeated public game experiments (Ledyard, 1995; Fehr and Gächter, 2000, 2002; Zelmer, 2003), no clear downwards trend is observed for the red groups.

²See also Page et al. (2005) and Ahn et al. (2008).

2 Experimental design

The experiment consists of 31 periods, labeled $t = 0, 1, \dots, 30$, divided into three parts. Part I consists of period 0, Part II consists of periods 1 to 10, and Part III consists of periods 11 to 30. All subjects participated in all three parts in the same order.

Part I of our experiment is a standard one-shot public good game with exogenous group formation. Groups of three are formed randomly, and each subject is given an initial endowment of NOK 60.³ The subject's task is to decide how much to allocate to her group and how much to keep for herself. Every contribution to the group is doubled by the experimenters, and then divided equally between the three group members (note that this implies a relatively high marginal return of own contributions). Each subject is thus paid according to the following monetary payoff function:

$$x_i^0 = 60 - g_i^0 + \frac{2}{3} \sum_{j=1}^3 g_j^0 \quad (1)$$

where x_i^0 is subject i 's monetary payoff in period 0, g_i^0 is i 's contribution to her group in period 0, $0 \leq g_i^0 \leq 60$, and $j = 1, 2, 3$ are the members in i 's group.

Before Part I starts, subjects are informed that they will subsequently participate in two additional experiments, but that their choice in Part I will influence neither their payoffs nor their available choices in Parts II and III. No further information about subsequent experiments is provided; further, no feedback is given about behavior or payoffs before proceeding to Part II. Before the experiment starts, subjects are tested in their understanding of the instructions.

Part II is a repeated public good game with fixed group composition throughout (i.e. partner design) where the stage game is played 10 times, but preceded by a choice of group type. Subjects are informed that their *actual payment* to take home from Part II (and, as will become clear in a moment, *actual* donations to the Red Cross) will be determined as the *average* of calculated period payoffs (and period donations) in each of these 10 periods. Calculated period payoffs and donations are determined as follows.

Before period 1, each subject states whether she prefers to be in a red or blue group for the entire 10 period game.⁴ Each member of a blue group receives an extra payoff per period of NOK 50 (which cannot be used to contribute to one's group). For each member of a red group, an extra NOK 50 per period is donated, instead, to the Norwegian Red Cross.

³In February 2008, the time of the experiment, this was equivalent to about 11 USD.

⁴In the experiment, group types were called Z groups and X groups instead of red and blue, in order to avoid framing effects. To avoid confusion, there is a reminder of the difference on every screen where subjects make choices concerning X and Z .

The calculated period payoff function can thus be written as

$$x_i^t = \begin{cases} 60 & -g_i^t + \frac{2}{3} \sum_{j=1}^3 g_j^t & \text{in a red group} \\ 60 + 50 & -g_i^t + \frac{2}{3} \sum_{j=1}^3 g_j^t & \text{in a blue group} \end{cases} \quad (2)$$

where x_i^t is calculated period payoff for subject i in period $t = 1, \dots, 10$, $j = 1, 2, 3$ are the members in i 's group, and $0 \leq g_i^t \leq 60$. *Actual* payment to i in Part II is given by $\frac{1}{10} \sum_{t=1}^{10} x_i^t$, while actual donation from i to the Norwegian Red Cross in Part II is given by NOK 50 if she is in a red group, and 0 if she is in a blue group.

Subjects are allocated randomly to groups of their preferred type; if the number of subjects preferring a group type is not divisible by 3, there will be one mixed group, and this group's type is determined by the majority preference of its members.

Before Part II starts, subjects are tested in their understanding of the instructions. After each period, every subject is informed about her own contribution, the average contribution in her group, and her calculated period payoff from that period.

Part III is a repeated public good game where group composition changes between each period (stranger design), and where the stage game is played 20 times. Again, the contribution choice is preceded by a group type choice, but now subjects make a new choice of group type between each period. Groups of 3 are formed randomly among subjects with similar group type preferences. If the number of subjects preferring a given group type in a period is not divisible by 3, there will be a mixed group. Calculated period payoffs are determined exactly as before, that is, according to equation (2). *Actual* payment to subjects is given by the average calculated period payoff over all 20 periods (but note that now i may be a member of a red group in some periods and a blue group in others). Actual donation from i to the Red Cross in Part III is given by the average calculated donation, that is, NOK 2.5 times the number of periods i has been a member of a red group.

Between each period in Part III, each subject receives information about her own contribution and her own payoff in that period, and the average contribution and payoff in her group in that period. In addition, each subject is informed of the average contribution and payoff in one red group and one blue group.⁵

For given contribution levels, the monetary payoff to group members will obviously be

⁵To maximize variation in information received by subjects, each subject is either shown information from the red (blue) group with the highest average contribution or from the red (blue) group with the lowest average contribution, each with 50% probability. In the instructions, subjects are simply informed that they will be shown the average of one red and one blue group.

higher in blue groups. For a given own contribution, however, a subject will earn more in a red than in a blue group whenever the contribution of the two others is at least NOK 37,5 higher on average in the red than in the blue group.

3 Experimental results

The experiment was programmed in z-tree (Fischbacher, 2007) and conducted at the Oeconlab at the University of Oslo. All subjects were recruited among students from various departments at the University of Oslo. The experiment was conducted in February 2008, and comprised 5 sessions with a total of 87 subjects (29 groups).

3.1 Group choice

Group choices are illustrated in Figure 1. We see that nearly 45% of subjects chose red group membership in Part II. In Part III, the fraction of subjects preferring red group membership is on average 36%, remaining fairly stable throughout. The darker colors in the graph show individuals who chose the same group type throughout Parts II and III. About 22% of our subjects consistently chose blue, while 10% consistently chose red. The remaining 68% switched group type preference at least once during the experiment.

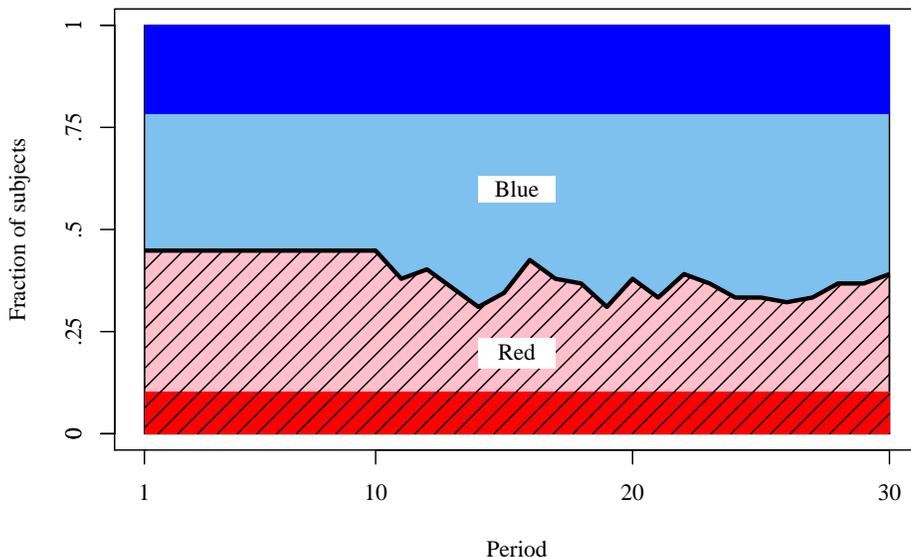
Result 1. *Throughout the main treatment, the red group type was chosen by a substantial share of the subjects.*

Recall that in mixed groups, there would be one (random) subject whose group type preference was not fulfilled. In Part II, 41% of the groups actually formed were homogeneously red and 52% homogeneously blue. 7% of the groups were mixed. In Part III the number of red groups was relatively stable – the percentage of subjects actually in red groups, averaged across periods, was 36%. Unless otherwise stated, mixed groups are not included in results reported below.

If the hypothesis of correlated contribution behaviors holds, subjects who are high contributors in Part I are more likely to choose red groups in Parts II and III. Equivalently, those who later choose red groups could be expected to contribute more to their groups in Part I. This implies that most of our hypotheses could be tested using one-sided tests. However, we choose the conservative strategy of keeping to two-sided tests throughout the paper. Table 1 reports the relationship between contributions in Part I and consecutive group choices.⁶

⁶A regression of choosing a red group regressed on contribution yields qualitatively similar results – a logit coefficient of 0.0181 with a standard error of 0.00815 clustered at the individual level. Repeating this analysis period by period yields similar results, but the estimates are not significant in all periods.

Figure 1: Subjects' choice of group type



Notes: The graph shows the fraction of subjects who chose red (hatched) and blue (solid) groups by period. The dark colored areas show the fraction of subjects who consistently choose either red or blue groups throughout Parts II and III.

Column (1) in Table 1 reports the relationship between contributions in Part I and group type choice in Part II (period 1). Subjects who chose red in period 1 contributed on average NOK 6.95 (or 12 % of their total endowment) more in period 0 than those who chose blue group membership. A t-test that allows for varying variances between group types indicates that this difference is significant at the 10% level.

Columns (2) and (3) of Table 1 are concerned with the relationship between contributions in Part I and group type preferences in Part III. First, Column (2) considers those subjects who never changed their preferred group type throughout Part III. Comparing the contributions in Part I of those who always (later) chose red against those who always (later) chose blue, using a standard t-test, reveals a huge difference of NOK 21.39, more than a third of the players' endowment.

However, most subjects changed their group type during Part III. To include these in the analysis, we regress contributions in Part I on the fraction of rounds in Part III spent in red groups (Column (3)). The estimated effect is NOK 11.94, which can be interpreted as the effect of going from spending the whole of Part III in blue groups to spending the whole

Table 1: Contribution difference in Part I between subjects who later chose red and those who later chose blue

	(1)	(2)	(3)
Contribution difference	6.947* (1.68)	21.39*** (3.16)	11.94** (2.02)
Part	II	III	III
R ²	0.0299	0.179	0.0459
Obs	87	29	87

*Notes: The table shows the contribution difference in Part I for subjects who later chose red and those that later chose blue. Columns (1) and (2) report results from t-tests allowing for different standard deviations in red and blue groups (assuming identical standard errors gives t-values of 1.62 and 2.43). Only subjects with consistent group choices in Part III are used in Column (2). Column (3) reports the contribution difference as a function of the fraction of subsequent periods spent in red groups based on OLS regression. t-values reported in parenthesis. *, **, and *** denote significance at the 10%, 5%, and 1% level.*

Part III in red groups. If a subject prefers red one additional period, the expected effect on her contribution in Part I is estimated to be NOK $11.94/20 \approx 0.60$.

If we combine the results from the group choices in both Part II and III, we get roughly the same results, with a difference of NOK 11.32. In fact, the relationship between contributions in Part I and subsequent group choices is stronger the further into the experiment we move: for example, contributions in Part I are NOK 8.49 higher for those who chose red instead of blue in every period from 11 to 20 ($t=1.45$), whereas the same number is NOK 13.60 for those who chose red in every period from 21 to 30 ($t=2.45$). Thus, although many subjects appear to experiment with their group type choices throughout the experiment, high contributors in Part I were more likely to choose red groups, and this tendency becomes stronger the later periods we look at.

Result 2. *High contributors in Part I were more likely to choose red groups in Parts II and III.*

3.2 Contributions

If contribution behaviors are correlated, we would also expect average contributions to be higher in red than in blue groups. Figure 2 shows average contribution levels by group type

for each period of the experiment⁷. Note that although no group type choice was made in Part I (period 0), subjects who chose red in period 1 (Part II) have in Figure 2 also been classified as red in period 0, while those who chose blue in period 1 are classified as blue in period 0.

The figure reveals a rather striking pattern. Firstly, the average contribution in red groups is higher than in blue groups in every period; secondly, this difference appears to be increasing over time.

If we average contributions over the ten periods of Part II, participants in (non-mixed) red groups contributed NOK 16 more than participants in blue groups. Treating the 27 groups as the unit of observation, this difference is statistically significant at strong levels both using a t-test ($p=0.0063$) and a Mann-Whitney test ($p=0.0091$).

The lower panel of Figure 2 shows the statistical significance of the differences period by period using two sided tests. To assure that our findings are robust, we report results from three different tests: t-tests with and without clustering at the group level, and a Mann-Whitney test.⁸

All three tests provide similar results: initially the difference is modest (but still significant at the 10% level according to two of the tests), but from period 4 the difference is significant at the 5% level according to all three tests. After period 1, subjects receive feedback on others' behavior; thus, observations after this point cannot be considered independent. The standard t-test does not take this dependency into account, which is why we also provide a clustered test. Note, however, that if the interdependency is caused by conditional cooperation, an initial difference is required for significantly different group dynamics to arise over time.

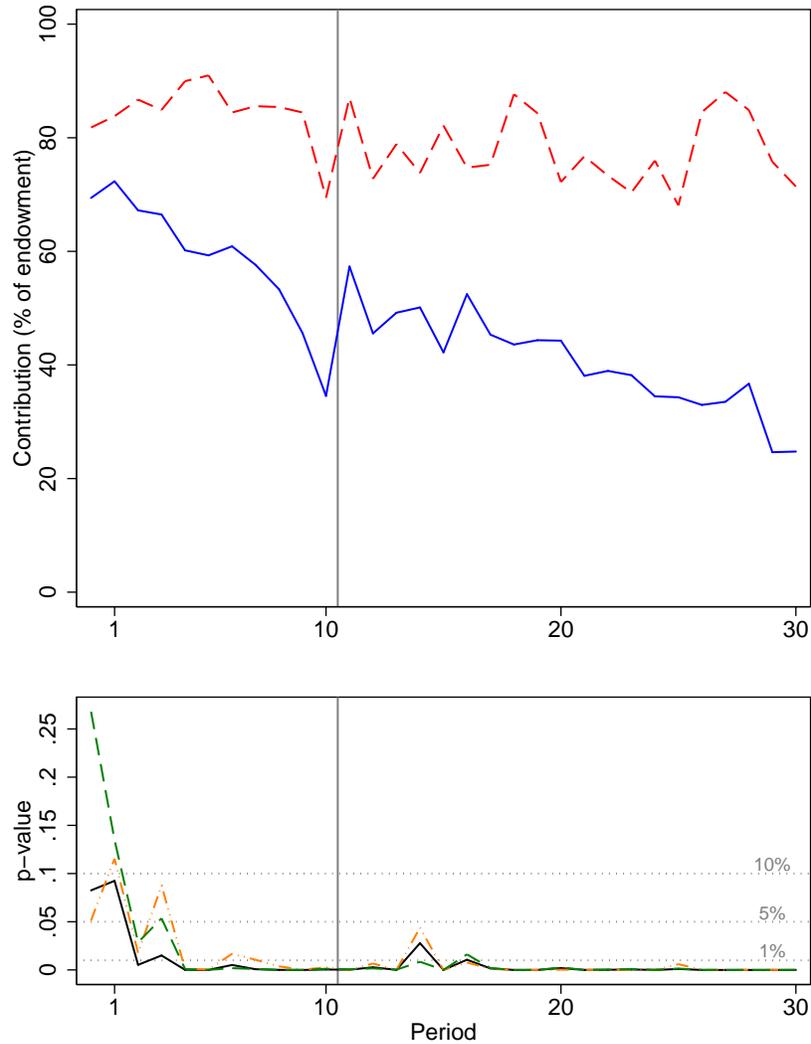
Combining the whole panel of observations further strengthens the findings. This is done in Table 2, where we regress individual per period contribution on group choice using different specifications. In Columns (1) to (3), we study Part II and Part III separately and jointly. All specifications include period dummies.⁹ Column (1) shows that in Part II, contributions are on average NOK 15 higher in red than blue groups. This difference is significant. Since group membership is constant from period 1 through 10, all regressions are clustered at the group level.

⁷Note that contributions are higher than typically observed in other public good game experiments, probably due to a relatively high return (2/3) to own contributions.

⁸The reason for including three tests is that each of them have their drawbacks. The standard t-test requires normally distributed and independent data. The clustered t-test is robust to possible correlations within the groups, but requires a reasonably large sample. The Mann-Whitney test is robust to the contributions not being drawn from normal populations, but requires independent data.

⁹Excluding the period dummies has only small effects on the estimates parameters and makes them more significant.

Figure 2: Contribution by group type



Notes: The upper panel shows the average contribution as percentage of individual endowments in red (dashed) and blue (solid) groups by period.

The lower panel shows p-values from tests of equal contribution levels in red and blue groups. The solid black line represents t-statistics from t-tests, the dashed-dotted orange line similar tests clustering at the group level, and the dashed green line z-statistics from Mann-Whitney tests.

All tests are two-sided. Data from mixed groups are excluded.

Table 2: Regression of individual per period contribution on group type

	(1)	(2)	(3)	(4)	(5)
Red group	15.35*** (3.08)	21.10*** (19.45)	19.09*** (20.01)	12.27*** (5.25)	9.881*** (4.38)
Cluster level	Group	Group×Period	Group×Period	Individual	Individual
Part	II	III	II and III	III	II and III
Individual FE	No	No	No	Yes	Yes
R ²	0.146	0.189	0.197	0.115	0.146
Obs	870	1740	2610	1740	2610

Notes: The dependent variable is per period contribution; Red group is a dummy for currently being in a red group. All specifications contain period dummies, Columns (4) and (5) also individual fixed effects.

*t-values clustered at indicated levels are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels.*

Column (2) analyzes Part III, where players can choose group type in each period. Here results are even stronger: Contributions in red groups were about NOK 21 higher than in the blue groups, and the difference is statistically significant.¹⁰ Finally, Column (3) uses data from both Part II and III; the difference between red and blue groups is now NOK 19.

Result 3. *Average contributions were higher in red groups than in blue groups.*

In Columns (4) and (5) of Table 2, we again regress contributions on group type, but now include individual fixed effects. This can reveal whether changes in group type choice are associated with changes in contribution levels. Column (4) uses data from Part III, where group choice is made every period, whereas Column (5) also include data from Part II. We see that an individual who changes group type contributes more when in a red group than when in a blue group. This difference is statistically significant. The estimated differences are smaller than when we do not condition on the individual, indicating that a major part of the difference is due to selection of individuals into red and blue groups.

Result 4. *A given individual contributed more when member of a red group than when member of a blue group.*

¹⁰For Part III and the joint analysis, group composition changes, so we cluster instead on the group-period.

3.3 Declining contributions?

The literature on public good games documents that average contribution levels, although starting off at high levels, usually decline rather dramatically as the game is repeated (Ledyard, 1995). Figure 2 illustrates that while this well-known pattern is replicated in our blue groups, no clear downwards trend seems to be present in the red groups.

Column (1) of the upper panel of Table 3 shows the results from regressing individual contributions in Part II on a linear trend.¹¹ There is a clear downward trend. Specification (2) demonstrates that this decline stems from the blue groups. The negative trend in contributions in blue groups is substantial and statistically significant. In red groups, there is no significant trend. However, there are some signs of an end game effect in both group types. From the last column, we also notice that there is an increasing difference in contributions between red and blue groups, which is also statistically significant.

The lower panel of Table 3 shows the results from regressing contributions in Part II on period dummies instead. These dummies give the change in contribution levels from period 1 to the given period. This specification would capture potential deviations from the linear pattern. The pattern is similar to the one found with a linear trend.

The last part of the experiment does not have fixed groups. However, there still appears to be a declining trend in contributions in blue groups. Studying this formally, we find that there is a significant falling trend in the blue groups and no significant trend in the red groups, as well as a significant increasing difference between the group types (detailed results not shown but available from the authors upon request).

Result 5. *Contributions in blue groups decreased over time. In red groups, there was no significant downwards trend.*

4 Alternative explanations

Our starting point was the hypothesis that some individuals are generally more pro-social than others. If this hypothesis holds, high contributors in Part I would be more likely than others to join red groups in Parts II and III; moreover, one should expect average contributions to be higher in red than in blue groups. This is, indeed, what we find. However, alternative explanations are possible. Below, we discuss two: First, whether subjects may have expected red group membership to be more profitable, second, whether group choice can be a costly signalling device, allowing cooperative individuals to match while having nothing

¹¹Period 10 is excluded to not capture end game effects.

Table 3: Trend in contributions, Part II

	(1)	(2)		
	All	Blue	Red	Diff
Trend	-1.032*** (-3.50)	-1.704*** (-4.11)	-0.205 (-0.77)	-1.499*** (-3.14)
R ²	0.0437	0.0922	0.00269	0.0666
N	783	432	351	783
Period				
2	-1.092 (-0.76)	-2.875 (-1.53)	1.103 (0.53)	3.978 (1.40)
3	-2.115 (-1.06)	-3.708 (-1.22)	-0.154 (-0.07)	3.554 (0.97)
4	-3.276 (-1.59)	-8.500*** (-3.02)	3.154 (1.22)	11.65*** (2.83)
5	-3.299 (-1.33)	-8.583*** (-2.84)	3.205 (1.30)	11.79*** (3.42)
6	-3.736* (-1.83)	-7.271** (-2.39)	0.615 (0.30)	7.886** (2.15)
7	-5.276** (-2.34)	-8.688*** (-2.97)	-1.077 (-0.36)	7.611* (1.82)
8	-6.184** (-2.66)	-10.69*** (-3.78)	-0.641 (-0.20)	10.05** (2.26)
9	-9.966*** (-3.46)	-17.52*** (-4.56)	-0.667 (-0.25)	16.85*** (3.69)
10	-17.24*** (-6.22)	-23.75*** (-7.77)	-9.231** (-2.28)	14.52*** (2.84)
R ²	0.115		0.146	
N	870		870	

Notes: The table shows regressions with per period contribution as the dependent variable. The upper panel shows regressions on a linear trend, excluding period 10. The lower panel shows regressions on a set of period dummies. Specification (1) combines all subjects whereas specification (2) has separate trends and dummies for red and blue groups. The last column indicates the difference between the estimated coefficients.

*Both specifications include individual fixed effects. *, **, and *** denote significance at the 10%, 5%, and 1% levels.*

to do with altruism toward the Red Cross. Finally, we discuss the dynamic development in light of conditional cooperation.

4.1 The profit motive

With our experimental design, it is possible that private earnings are higher in red than in blue groups – provided that contributions from others in red groups are sufficiently higher. In fact, this was never the case in our data. Figure 3 shows calculated period payoffs in each group type, as well as calculated period payoffs in red groups plus calculated period contributions to the Red Cross. One can see that it was never privately profitable to join a red group.

Still, subjects might have believed otherwise during the experiment. In a post-experimental survey, we asked subjects about the reasons for their choices in Part II. Many of the subjects who chose red reported that they did this to support the Red Cross. Some also reported that they expected higher contributions in red groups, but none stated that they expected higher payoffs. The following statement, from a subject who consistently chose red, is typical: “The Red Cross is good, and people are perhaps less egoistic in this group. Thus I will be partly compensated for the NOK 50.” Contrast this with a typical statement from a subject who consistently chose blue: “Because I was egoistic :)”.

During Part III, players were given differentiated information about payoffs in one red and one blue group after each period. In only 84 situations out of the total of 1740 (87 subjects×20 periods) did any subject receive information indicating that red groups were more profitable than blue.

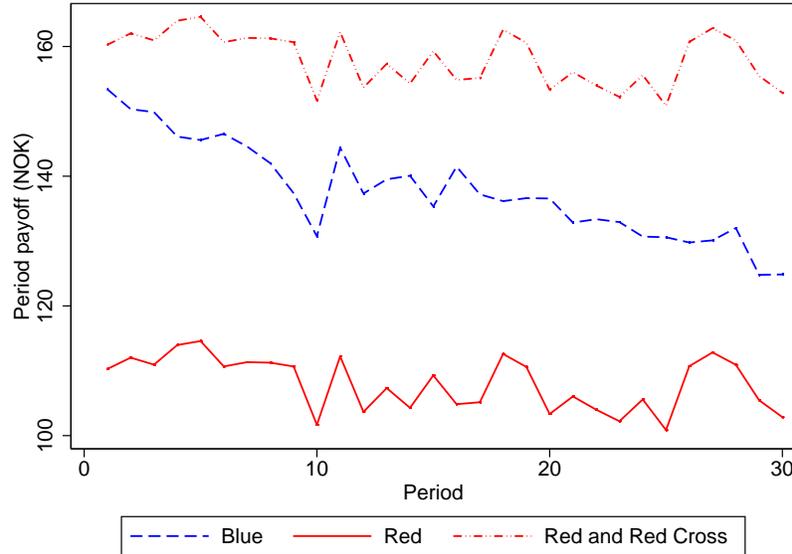
Given the pattern illustrated in Figure 3, answers from the post-experimental survey and the feedback given between group choices, the explanation based on private profit motives alone seems somewhat implausible.

4.2 Signaling

If conditionally cooperative high contributors prefer being matched with other high contributors, red group membership could simply serve as a costly signal that one is a conditionally cooperative high contributor. While earnings in red groups are lower than in blue groups, the utility loss from feeling that one is being taken advantage of by free-riders may outweigh this difference, even if there is no warm glow of giving to the Red Cross.

To explore this possibility, we ran a placebo treatment where red group members simply did not get the extra NOK 50 given to blue group members, and no mention was made of the Red Cross. Apart from the latter, all instructions and payoffs were exactly as

Figure 3: Average period payoff by group type



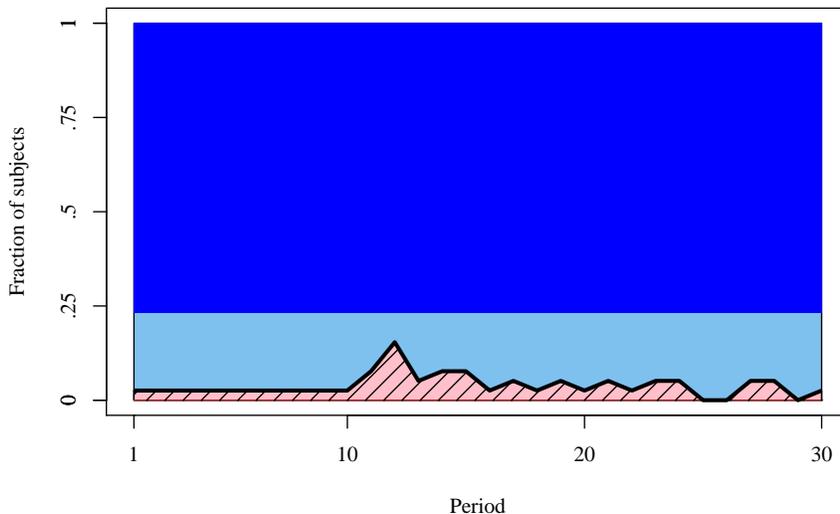
Notes: “Red and Red Cross” is the average period payoff in red groups plus NOK 50 given to the Red Cross. Data from mixed groups are excluded.

in the main treatment – except that no donation to the Red Cross took place. The placebo treatment was conducted in October 2009, comprising 2 sessions with a total of 39 subjects (13 groups). Individual group choices in the placebo treatment are illustrated in Figure 4. Very few subjects chose red groups. In Part II, only one single person chose red. In Part III, between zero and six subjects chose red, resulting in at most two red groups.

Result 6. *In the placebo treatment, few, if any, chose red groups. Contributions in red groups were not significantly higher than in blue groups.*

Contributions in the placebo treatment closely resemble the pattern found in blue groups in the main treatment, in particular the downward trend. In Part III members in red groups donated about NOK 3 more than members in blue groups (not statistically significant), which should be compared to a difference of NOK 21 in the main treatment. Note, however, that comparing red and blue groups in the placebo treatment is not very informative, as there were so few red groups. Still, since next to no-one chose red, we conclude that donating the payoff difference of NOK 50 to the Red Cross does matter.

Figure 4: Subjects' choice of group type, placebo treatment



Notes: The graph shows the fraction of subjects who chose red (hatched) and blue (solid) groups by period. The dark colored areas show the fraction of subjects who consistently chose either red or blue groups throughout Parts II and III.

4.3 Self-selection or conditional cooperation?

Our results are consistent with the hypothesis that generally pro-social individuals self-select into red groups. But if this was only a story about self-selection of generous types, there would be no reason for the difference in average contributions between group types to be increasing over time. One interpretation is that while self-selection does secure a slightly higher initial contribution level in red groups, this initial difference is amplified by conditional cooperation.

Previous experimental studies have established that conditional cooperation – i.e., the subject's contribution is increasing in the contributions of others – is very common (see Fischbacher et al., 2001; Fischbacher and Gächter, 2006, 2010; Croson et al., 2006; Croson, 2007; Hauge, 2010).

Within each group type, there is substantial variation in contribution levels in period 1. The mean contribution differences between red and blue groups in periods 8, 9 and 10 are 19.25, 23.29, and 20.93 respectively. This drops to 11.29, 15.93, and 13.94 when we control for the group's average contribution level in period 1. That is, initial contributions explain less than half the difference we observe toward the end of Part II. Thus, while the increasing

differences may be partly explained by conditional cooperation, there also seems to be a self-selection effect that affects groups' ability to sustain cooperation. A further exploration of this mechanism is beyond the scope of the present work, and will be left for future research.

5 Conclusion

The ability to sustain high contributions to local public goods is important for many types of groups. If some individuals are generally more pro-social than others, groups may use costly social responsibility measures, such as a commitment to charity donations, as a device to attract more cooperative members. This may secure higher provision of local public goods for such groups.

We explored this idea by means of a public good game experiment with endogenous group formation. Before making their contribution choice, subjects could choose which type of group they preferred to be a member of. In blue groups, a fixed extra monetary payoff was given to individual members; in red groups, the same amount was donated, instead, to the Red Cross.

The share of subjects who chose red groups was always between 30 and 45 percent, with no clear trend in either direction. High contributors in an initial one-shot public good game with exogenous groups were significantly more likely to choose red groups in subsequent parts of the experiment. Average contributions were significantly higher in red groups, although not sufficiently so to make red group membership profitable. While contributions in blue groups decreased substantially over time, contributions stayed high in red groups.

Our experimental findings are consistent with the hypothesis that some individuals are generally more pro-social than others. Such initial self-selection effects may be amplified by conditional cooperation. If correct, this idea has several interesting implications, one of them being that corporate social responsibility may pay off by attracting more responsible employees who work harder when not monitored.

References

- Ahn, T., Isaac, R. M., and Salmon, T. C. (2008). Endogenous group formation. *Journal of Public Economic Theory*, 10, 171–194.
- Aronson, E., Wilson, T., and Akert, R. (2005). *Social Psychology*. New Jersey: Pearson Education International, 5th ed.

- Besley, T., and Ghatak, M. (2005). Competition and incentives with motivated agents. *American Economic Review*, 95, 616–636.
- Blanco, M., Engelmann, D., and Normann, H. (2007). A within-subject analysis of other-regarding preferences. Mimeo, Royal Holloway, University of London.
- Brekke, K. A., and Nyborg, K. (2008). Attracting responsible employees: Green production as labor market screening. *Resource and Energy Economics*, 30, 509–526.
- Brekke, K. A., and Nyborg, K. (2010). Selfish bakers, caring nurses? A model of work motivation. *Journal of Economic Behavior and Organization*, 75, 377–394.
- Brekke, K. A., Nyborg, K., and Rege, M. (2007). The fear of exclusion: Individual effort when group formation is endogenous. *Scandinavian Journal of Economics*, 109(3), 531–550.
- Cornes, R., and Sandler, T. (1986). *The Theory of Externalities, Public Goods, and Club Goods*. New York: Cambridge University Press.
- Croson, R. (2007). Theories of commitment, altruism and reciprocity: Evidence from linear public goods games. *Economic Inquiry*, 45, 199–216.
- Croson, R., Fatas, E., and Neugebauer, T. (2006). Reciprocity, matching and conditional cooperation in two public goods games. *Economics Letters*, 87, 95–101.
- Ehrhart, K.-M., and Keser, C. (1999). Mobility and cooperation: On the run. Working Paper 99s-24, CIRANO, Montreal.
- Encinosa, W. E., III, Gaynor, M., and Rebitzer, J. B. (2007). The sociology of groups and the economics of incentives: Theory and evidence on compensation systems. *Journal of Economic Behavior & Organization*, 62, 187–214.
- Fehr, E., and Gächter, S. (2000). Cooperation and punishment in public goods experiments. *The American Economic Review*, 90(4), 980–994.
- Fehr, E., and Gächter, S. (2002). Altruistic punishment in humans. *Nature*, 415(6868), 137–140.
- Fischbacher, U. (2007). z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10(2), 171–178.
- Fischbacher, U., and Gächter, S. (2006). Heterogeneous social preferences and the dynamics of free riding in public goods. IZA Discussion Papers 2011.

- Fischbacher, U., and Gächter, S. (2010). Social preferences, beliefs, and the dynamics of free riding in public goods. *American Economic Review*, 100, 541–56.
- Fischbacher, U., Gächter, S., and Fehr, E. (2001). Are people conditionally cooperative? evidence from a public goods experiment. *Economics Letters*, 71, 397–404.
- Gächter, S., and Thöni, C. (2005). Social learning and voluntary cooperation among like-minded people. *Journal of the European Economic Association*, 3(2-3), 303–314.
- Gunthorsdottir, A., Houser, D., and McCabe, K. (2007). Disposition, history and contributions in public goods experiments. *Journal of Economic Behavior and Organization*, 62(2), 304–315.
- Güerker, Ö., Irlenbusch, B., and Rockenbach, B. (2006). The competitive advantage of sanctioning institutions. *Science*, 312, 108–111.
- Hartshorne, H., and May, M. (1929). *Studies in the Nature of Character*, vol. 2 of *Studies in Service and Self-Control*. New York: Macmillan.
- Hauge, K. E. (2010). Eliciting moral ideals in a public good game experiment. In *Morality and economic decisions: An experimental approach*. PhD dissertation, University of Oslo.
- Heyes, A. (2004). The economics of vocation or ‘why is a badly paid nurse a good nurse’? *Journal of Health Economics*, 24, 561–569.
- Holmström, B. (1982). Moral hazard in teams. *Bell Journal of Economics*, 13, 324–340.
- Johnson, T., Dawes, C. T., Fowler, J. H., McElreath, R., and Smirnov, O. (2009). The role of egalitarian motives in altruistic punishment. *Economics Letters*, 102, 192–94.
- Ledyard, J. O. (1995). Public goods: A survey of experimental research. In J. H. Kagel, and A. E. Roth (Eds.) *The Handbook of Experimental Economics*, (pp. 111–194). Princeton, New Jersey: Princeton University Press.
- Ones, U., and Putterman, L. (2007). The ecology of collective action: A public goods and sanctions experiment with controlled group formation. *Journal of Economic Behavior and Organization*, 62(4), 495–521.
- Page, T., Putterman, L., and Unel, B. (2005). Voluntary association in public goods experiments: Reciprocity, mimicry and efficiency. *The Economic Journal*, 115(October), 1032–1053.

- Piliavin, J. A., and Charng, H.-W. (1990). Altruism: A review of recent theory and research. *Annual Review of Sociology*, 16, 27–65.
- Rob, R., and Zemsky, P. B. (2002). Social capital, corporate culture, and incentive intensity,. *RAND Journal of Economics*, 33, 243–257.
- Scotchmer, S. (2002). Local public goods and clubs. In A. J. Auerbach, and M. Feldstein (Eds.) *Handbook of Public Economics*, vol. 4, (pp. 1997–2042). Amsterdam: Elsevier.
- Thøgersen, J., and Ölander, F. (2006). To what degree are environmentally beneficial choices reflective of a general conservation stance? *Environment and Behavior*, 38, 550–568.
- Zelmer, J. (2003). Linear public good games: A meta-analysis. *Experimental Economics*, 6, 299–310.

A Instructions

Instructions in square brackets were taken out in the placebo treatment.

Welcome to this experiment in economics. The results from this experiment will be used in a research project. Therefore, it is important that you follow certain rules. It is important that you do not talk or in other ways communicate with any of the other participants during the experiment. Please turn off mobile phones, and use only pre-opened software on the computer. In the experiment, there will be full anonymity, which means that no other participants in this room will know which decisions you in particular make during the experiment. In addition, it is not possible to track the decisions made during the experiments back to individuals. You will be notified when the experiment starts, and when you can start entering your answers on the computer in front of you. If you have any questions during the experiment, please raise your hand, and an experimenter will come to you and answer your question in private.

You will receive money in compensation for participating in this experiment. How much money you receive will depend on the decisions you make during the experiment. After the experiment is over, you will be informed about your total payment. The person who organizes the practical payments will not know the details of the experiment and can therefore not know which decisions you have made.

Instructions Part 1

This experiment consists of three parts. Your choices in part 1 will not influence what happens, or what payment you can receive from part 2 and 3.

In part 1 of the experiment, you will be part of a group consisting of 3 people (yourself and 2 others). All three members of the group will receive an endowment of 60 NOK each. Your task is to decide how you want to allocate the money. You shall choose how many NOK you want to keep, and how much you want to contribute to an account which belongs to your group.

Your compensation for participating in the experiment, depends on how much of the endowment you choose to keep, how much you contribute to the group account, and how much the others in your group contribute to the group account. When all members of your group have decided how they wish to contribute to the group account, the total amount contributed to your group's account will be doubled and then divided equally between the three of you. For each NOK you keep, you (and only you) will earn 1 NOK. For each NOK you contribute to the group account, you and all the others in your group will earn $2/3$ NOK. The same applies for the others in your group.

Examples: If for instance you contribute all your 60 NOK to the group account and the others in your group keep all for themselves, you will be paid 40 NOK ($2/3 \times$ the 60 NOK you contributed to the group account =40), while the two others will be paid 100 NOK each (the 60 NOK they kept + $2/3 \times$ the 60 NOK you contributed to the group account). If all three group members contribute the entire endowment to the group account, each group member will be paid 120 NOK each ($2/3 \times 3 \times 60 = 120$ NOK). If all three group members contribute 30 NOK, each group member will be paid 90 kroner each (the 30 NOK kept, plus $2/3 \times 3 \times 30$ NOK = 60 NOK to each from the group account). If all three contribute zero to the group account, all three are paid the initial endowment of 60 kroner.

Notice that what happens in your group does not influence participants in other groups. Likewise, the decisions of participants in other groups than your own does not influence you.

It is important for the results of the experiment that there are no misunderstandings of the instructions. To ensure that the instructions are clear, we ask you to fill in the question sheet on the desk in front of you. This is not a test of your knowledge, but insurance for us that we have given you clear instructions. You will now get a couple of minutes to read through the instructions and answer the questions on the sheet. Raise your hand when you are finished, or if you have any questions.

Instructions Part 2

The experiment will now continue. Your decisions in part 2 will not influence what happens or the payment you can receive in part 3.

Part 2 of the experiment is quite similar to part 1. In difference from part 1, there are two types of groups: X and Z. Before you decide how much to contribute to the group account, you first shall choose the type of group you prefer being a member of: X or Z.

When all participants have chosen their preferred group type, the computer will randomly create groups of 3 according to preferred group type. If the number of participants preferring one type is not divisible by three, there will be one mixed group. The type of the mixed group will be decided by the majority wish of the mixed group. All participants in all groups will be informed about what kind of group they are members of, and whether it is a homogenous or a mixed group.

Part 2 consists of 10 periods. Your actual payment from part 2 will consist of your average payoff across these 10 periods.

The group composition will be the same in all periods, and your group will NOT consist of the same individuals as in part 1 of the experiment. In each period each participant will receive an endowment of 60 NOK. Just as in part 1, your task is to decide how many NOK

to keep, and how many NOK to contribute to the group account. After each period, you will receive feedback concerning how many units you yourself contributed to the group account, how many units the other two in your group on average contributed to the group account, and your calculated payoff from that period. Just like before, the total amount in the group account will be doubled, and then divided equally between the three group members. Your actual payoff from part 2 will be the average of your calculated payoffs from the 10 periods of part 2.

What is the difference between the group types? Group type X: Those organizing the experiment have inserted an extra amount of money into the group account in advance, such that each participant in every X-group will receive an extra payoff of 50 NOK per period. Group type Z: Here there is no extra payoff to the participants. [Instead, those that organize the experiment in each period for each participant in each Z-group will reserve 50 NOK to the Norwegian Red Cross. Just as your payoff is the average of your calculated payoff over the 10 periods, the actual payment to the Red Cross will be equal to the average of the reserved for the Red Cross over the 10 periods.]

Again we ask you to fill in a sheet of questions. The sheet will be handed out, and you will get some minutes to read through the instructions on your own, and answer the questions. Raise your hand when you are finished, or if you have any questions.

Instructions Part 3

In this last part of the experiment there are 20 periods. In this part you will be able to choose group type between every period. In each period you will be part of a new group. Otherwise the rules are as they were in part 2.

After every period you will receive feedback about your calculated payoff from the previous period, and how many units were contributed to the group account on average in your group. You will also be told how many units on average was contributed to the group account in one X- and one Z-group, and the average calculated payoff for the members of these two groups. The rules for payoff are as before: Contributions from group members are doubled and then divided equally between the group members. In X-groups each member will in addition receive a calculated payoff of 50 kroner each in each period. In Z-groups [no such additional payoff is given/50 kroner for each member in each period is reserved for the Red Cross]. From part 3 your actual payoff is equal to the average of your calculated payoff in the 20 periods. [The Norwegian Red Cross will receive an amount equal to the average of what is reserved over the 20 periods.]