Counting on My Vote Not Counting: Expressive Voting in Committees

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Abstract

How do voting institutions affect incentives of committees to vote expressively? We model the problem of a committee, whose members have different depths of reasoning, that decides whether to approve an ethical proposal. Members who vote for the proposal receive expressive utility, but all members pay a cost if the proposal is passed. The model suggests that institutional features that reduce the probability of a member being pivotal – such as larger committee size, or a more restrictive majority rule – increase the expected share of votes in favour of the ethical alternative. A laboratory experiment with a charitable donation framing demonstrates comparative statics that are in line with these results. Furthermore, we structurally estimate the distribution of expressive preferences across individuals. We also find that a high proportion of subjects are strategically naïve.

Keywords: expressive voting, committees, pivotality, laboratory experiment.

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1 Introduction

This paper analyses the effect of voting institutions on expressive voting in committees. In particular, it explores how a committee votes on decisions that involve costly ethical actions. Decisions that involve a conflict between self-regarding preferences and preferences for taking ethical actions (such as decisions on donating to charities, helping strangers, or contributing to a public good) have been the focus of a substantial amount of research. Yet less attention has been paid to situations when such decisions are made collectively – by committees, parliaments, or other bodies. At the same time, in many situations this is the case: corporate boards deciding whether to adopt costly labour or environmental standards; parliaments voting on whether to reduce greenhouse gas emissions or admit refugees into the country; or electorates choosing whether to enhance protections for minorities are all examples of collective decisions that involve an ethical dimension.

Two factors can underlie costly ethical choices. First, individuals may have consequentialist motivations: they may be altruistic, internalising some of the utility that others receive from their actions (for example, a person may donate to a stranger if she receives utility when the other person is better off). Second, individuals may be driven by non-consequentialist motives: they may derive utility from the action itself regardless of its actual outcome. For example, donors may get private warm-glow from the act of giving; voters may derive expressive utility from the act of voting for a particular alternative, irrespective of whether her vote influences the outcome.

The distinction between consequentialist and non-consequentialist motives for costly ethical actions is particularly important in a voting setup, because the voting mechanism separates actions from their consequences. An individual voting for the non-consequentialist ethical alternative will receive expressive utility from the act of voting. However, she will face the costs of the ethical choice, and receive the consequentialist altruistic payoff, only if the ethical choice becomes the winner of the vote. The probability of the latter outcome depends on voting institutions, such as the voting rule and the size of the voting body. Hence, these institutions affect the choices of individual voters.

In this paper, we analyse the effect of voting rule and committee size.

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1 See Andreoni (1989; 1990; 1995); Harbaugh (1998); Crumpler and Grossman (2008) for a discussion of the difference between pure altruism and warm glow motivations.

on voting behaviour of committee members when voting for an ethical but costly alternative. We model a committee that chooses whether to adopt a proposal that is considered ethical but costly. Each committee member who votes for the proposal receives an individual-specific expressive payoff, irrespective of the outcome of the vote. In the case the committee approves the proposal, all members, regardless of their individual votes, must pay a cost. In addition, each member may derive altruistic utility if the proposal is approved.

We analyse the model using the level-k solution concept (Stahl and Wilson, 1994). The key theoretical predictions of the model come from a tradeoff that committee members face. On the one hand, a member who votes for the proposal receives expressive utility. On the other hand, by doing so she runs a risk of moving the collective decision towards the ethical choice, which entails a cost. The latter risk, however, only becomes important in the event in which the voter is pivotal. Hence, features of the voting process that reduce the probability of an individual being pivotal – such as larger committee size, and a more restrictive voting rule – increase the incentive to vote for the ethical alternative.

We test the model in a laboratory experiment. In each round, subjects are randomly divided into committees. They are then asked to vote for or against donating to a well-known charity (the Red Cross). If the committee votes to donate, the experimenters transfer a fixed amount of money to the charity, at a certain cost to all committee members.

In every round, each subject faces the same voting rule (either unanimity rule, or simple majority rule, depending on the session). However, throughout the session a subject is assigned to committees of different sizes. The cost of donating also varies within subjects. This enables us to structurally estimate individual-specific expressive payoffs, as well as individual depths of reasoning.

Our experiment yields three main findings. First, in line with the theory, we find that voting institutions that reduce the probability of being pivotal encourage voting for the costly ethical alternative. In particular, individual subjects are more likely to vote in favour of donating when the committee size is larger, and when the voting under unanimity rule rather than simple majority rule. Nevertheless, the overall decision to donate is less likely to occur under the unanimity rule, especially in large committees.

Second, we estimate the distribution of individual expressive payoffs. The estimated expressive payoffs correlate positively with self-evaluated social
preferences. We also find that poorer subjects have, on average, lower expressive payoffs than their wealthier peer. More generally, we find evidence for the existence of expressive voting when voters face a conflict between instrumental and expressive motivations\(^3\).

Third, we estimate the distribution of depth of reasoning among voters. The empirical result from our maximum likelihood estimation suggests that in the voting setting with imperfect information, the share of strategically naive subjects is fairly sizeable. Approximately 40 percent of our subject pool randomise their vote between the two alternatives uniformly.

The rest of this section discusses the related literature. Section 2 introduces the theoretical model, and derives the main theoretical results. Section 3 describes the experimental design. Section 4 presents the results of the experiment. Section 5 extends the results of our level-k equilibrium model to greater depths of reasoning, as well as to the Nash equilibrium. The Appendix contains proofs, as well as experimental instructions.

**Related literature.** A number of laboratory experiments have analysed expressive voting over costly ethical choices, such as saving the lives of laboratory animals, redistributing an endowment equally across group members or (as in our paper) donating to a charity. To identify expressive voting, researchers have largely followed two approaches. The first approach elicits the subject’s expectations about the likelihood of being pivotal. Tyran (2004) asks a large group of subjects to vote on donating funds to a charity. He varies the voting rule (but not the group’s size) across-subject, as well as the effect of the vote on individual outcome\(^4\). The paper finds that greater perceived probability of being pivotal does not reduce the likelihood of voting in favour of donating – hence, the study finds no evidence of expressive voting. Bischoff and Egbert (2013) run a similar experiment with a fixed voting rule, but find evidence of expressive behaviour as well as bandwagon voting (a desire to vote for the winning alternative). In Tyran and Sausgруber (2006), a group of five subjects decides via majority rule on a proposal to redistribute income. The authors find that subjects who are adversely

\(^3\)At the moment, experimental evidence of this kind is mixed. Feddersen et al. (2009) and Bischoff and Egbert (2013) provide strong evidence for the low-cost theory of expressive voting while many find the evidence to be inconclusive or null (for instance Tyran (2004) and Kamenica and Brad (2014)). See Tyran and Wagner (2016) for a survey.

\(^4\)In one treatment, all subjects lose their endowments if the collective decision is to donate, while in the other treatment only those who voted in favour of donating
affected by redistribution are not less likely to vote for it when they believe to be pivotal; thus, they find no evidence of expressive voting.

The second approach, rather than eliciting perceived probabilities of being pivotal, directly induces them. In these random dictator (RD) experiments, subjects are told that, with a certain exogenous probability, their decision will have an effect. Researchers can then check whether a decrease in that probability makes subjects more likely to choose the ethical alternative, as the expressive voting hypothesis suggests. In Carter and Guerette (1992), subjects choose whether to donate to charity, while in Feddersen et al. (2009) and Shayo and Harel (2012) they decide on whether to redistribute money within a group of subjects.

Our paper takes a different approach: we induce a variation in the probability of being pivotal (rather than eliciting subjective expectations), but we do it by varying the voting institutions (rather than directly as in RD experiments). In this way, we can analyse how voting institutions (the size of the voting body, and the voting rule) affect expressive voting though its effect on the pivotality.

Falk and Szech (2017) focus on diffusion of responsibility in collective decisions. They compare two treatments: in one, a subject individually decides whether to select a costly ethical option (saving the life of a laboratory mouse, or donating to a charity); while in the other, the decision is made in a group of eight, and the ethical option is chosen if and only if at least one member votes for it. In the language of our model, they compare committees of size 1 and 8 under a voting rule in which the share of votes necessary for the ethical option to be chosen is 1 and $\frac{1}{8}$, respectively. In contrast, we vary the size of the committee separately from the voting rule, and use simple majority and unanimity rules. This enables us to distinguish the effects of the voting rule under various committee sizes, and of committee size under simple majority and unanimity rules.

Kamenica and Brad (2014) analyse whether ideology affects voting decisions through expressive voting. They present subjects with a redistribution choice, which is costly for some subjects but beneficial for others. Subjects were divided into groups. In some groups, a single subject was a dictator and made the decision (thus, his or her decision was certain to be implemented,

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5Fischer (1996) uses a combination of the two approaches. Across-subject, he compares voting behaviour of some subjects who are randomly selected to be a dictator, to one in which subjects vote collectively as a group.
while that of the other group members was certain to be ignored), while in other groups the decision was reached by majority voting. They then test whether subjects’ ideological preferences have different effects depending on the subject’s group and role within the group. The authors found little evidence of expressive voting. Our paper, in contrast, focuses on the role of voting institutions. Hence, rather than comparing the decisions of individual dictators to those of members of a voting group, we analyse the effect of committee size and voting rule on votes for a proposal that is costly for all members.

More broadly, a number of papers have compared the choices of individuals to the choices of small groups in interactions that involve some form of pro-social concerns. In Cason and Mui (1997) and Luhan et al. (2009), subjects play a dictator game either individually or in teams. Gillet et al. (2009), Cox and Stodard (2018), and Auerswald et al. (2018) compare individual and group actions in a public good game. Cason and Mui (2019) analyse a repeated prisoner’s dilemma. The focus on that literature is on analysing whether teams are more self-regarding than individuals, rather than on individual choices driven by a tradeoff between expressive and instrumental motivations. Thus, in these experiments group decisions are reached after some form of deliberation, which eliminates the uncertainty about being pivotal that drives the tradeoff in our model. Furthermore, that literature focuses on comparing individual decisions to group decisions, rather than on comparing committees of different sizes.

Several papers have also developed theoretical models of collective decisions in which for a certain alternative carries a moral cost. Huck and Konrad (2005) analyse a committee that chooses whether to expropriate profits from a foreign investor. Doing so gives a benefit to each member, but voting in favour carries a moral cost. Since the resulting voting game has multiple equilibria, the authors focus on the payoff-dominant one, unlike our level-k approach. In Rothenhäuser et al. (2018), moral costs enter the utility function through a consequentialist channel: each voter suffers several kinds of moral costs if and only if the unethical option is chosen by the committee.

Typically consisting of two or three subjects, that is, not larger than the smallest committee modelled in our paper.

Either free-form discussion or, as in Gillet et al. (2009) and Auerswald et al. (2018), repeated proposals.

Including an individual-specific fixed cost similar to the altruistic utility in our paper; a cost that directly depends on the size of the committee; and a cost that occurs only if
In contrast, in our paper, voting for the unethical alternative directly reduces the committee member’s utility in a non-consequentialist manner. In addition, a number of papers have modelled a Condorcet framework, in which each of the imperfectly informed voters cares about the outcome of the vote (that is, about selecting the correct alternative, given the state of the world), but also receives direct utility from voting in a particular way (see Visser and Swank 2007; Callander, 2008; Morgan and Várdy, 2012; Midjord et al., 2017).

2 Theory

2.1 Model setup

A committee consisting of $n$ members needs to decide whether to adopt a certain proposal which is considered to be ethical. The decision is made by simultaneous voting: each member votes for one of the alternatives, and the proposal is accepted if and only if the number of voters who vote in favor of it is at least $qn$, where $q \in \left[\frac{1}{2}, 1\right]$ denotes the voting rule.

If the proposal is accepted, each member pays a cost $c > 1$. In addition, each member is characterised by a pair of individual-specific preference parameters. First, if the proposal is selected, each member $i$ receives a (consequentialist) altruistic payoff $a_i \in \mathbb{R}$. Second, each member who votes for the proposal receives, regardless of the outcome of the vote, a (non-consequentialist) expressive payoff $x_i \geq 0$. Thus, $a_i$ and $x_i$ reflect member $i$’s, consequentialist and non-consequentialist other-regarding preferences, respectively. Both $a_i$ and $x_i$ are member $i$’s private information. For each member, $a_i$ and $x_i$ are drawn, respectively, from distributions $F_{a}$ and $F_{x}$, independently from each other and across members.

Our solution concept is level-k equilibrium. We will assume that each member has a type $k \in \{0, 1\}$. Individuals of type 0 randomise uniformly

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9 The authors also consider a variation of the model with non-consequentialist utility, although they do not analyse the effect of voting rule and committee size in that framework.

10 Thus, in principle, we allow for the altruistic payoff to be negative - for example, donating to a charity may carry a negative payoffs for members who oppose the charity’s cause.

11 The results also hold if altruistic payoffs are homogeneous across committee members.
between the two actions (voting for or against the ethical alternative). Individuals of type 1 play the best response to members of type 0 – that is, they act as if all the other committee members were of type 0. Nature draws the type of each player at the beginning of the game; each player has type 0 with probability $1 - \alpha$ and type 1 with probability $\alpha$. Each member is privately informed about her type.

The timing of the game is as follows. First, nature draws the type $k$, as well as preference parameters $a_i$ and $x_i$, of every committee member. Every member learns her type and preferences. Next, members simultaneously vote for or against the ethical alternative. Finally, payoffs are realised. We will focus on symmetric equilibria, in which a member’s vote only depends on her preferences.

### 2.2 Equilibrium

Type 0 members vote for either alternative with equal probabilities. For a given type 1 member $i$, let $p_i(m)$ be the probability that at least $m$ of the other members voted for the proposal. Then if $i$ votes for the proposal, her expected payoff will be $-p_i(qn - 1)(c - a_i) + x_i$. If she votes against it, her expected payoff will be $-p_i(qn)(c - a_i)$. She thus votes for the ethical proposal if and only if $x_i > [p_i(qn - 1) - p_i(qn)](c - a_i)$, where $p_i(qn - 1) - p_i(qn) \equiv \gamma_{q,n}$ denotes the usual probability that a type 1 member $i$ is pivotal. Hence, member $i$ of type 1 votes for the proposal with probability 1 if $a_i > c$. Otherwise, conditional on $a_i$, she votes for the proposal with probability $1 - F_\gamma(q \mid x, [c - a_i])$. Hence, ex ante, her probability of voting for the proposal equals

$$
\int_{-\infty}^c [1 - F_\gamma(q \mid x, [c - a_i])] dF_a(a_i) + 1 - F_a(c) = 1 - \int_{-\infty}^c F_\gamma(q \mid x, [c - a_i]) dF_a(a_i)
$$

Overall, at the equilibrium, given $q$ and $n$, the probability that a randomly selected member votes for the ethical proposal equals

$$(1 - \alpha) \frac{1}{2} + \alpha - \alpha \int_{-\infty}^c F_\gamma(q \mid x, [c - a_i]) dF_a(a_i) \equiv \pi_{q,n} \quad (1)
$$

In the above, $\gamma_{q,n}$ is the perceived probability of being pivotal from the perspective of a type 1 member. From her perspective, each of the other
members votes for the proposal with probability $\frac{1}{2}$. Hence, $\gamma_{q,n}$ is given by

$$\gamma_{q,n} = \left( \frac{n-1}{m_{qn}} \right) \frac{1}{2^{n-1}}$$

where $m_{qn}$ denotes the largest integer that is strictly smaller than $qn$.

### 2.3 Comparative statics

How do voting institutions – specifically, the voting rule $q$ and the committee size $n$ – affect the votes? From (1), it is easy to see that $\pi_{q,n}$ is decreasing in $\gamma_{q,n}$. Thus, to determine the effect of a change $q$ or $n$ on individual actions, it is sufficient to determine its effect on the probability that an individual is pivotal. This underlies the following two results, the proof of which are in the Appendix.

**Proposition 1.** Consider two voting rules $q$ and $\hat{q}$ such that $\hat{q} > q$. Then $\pi_{\hat{q},n} \geq \pi_{q,n}$, and the inequality is strict if $\hat{q} - q$ is sufficiently large.

Thus, for a given $n$, the probability that an individual votes for the ethical alternative is maximised when the voting rule is simple majority. Making the voting rule more restrictive either does not change the voting outcome or (if the shift in $q$ is sufficiently large), increases the probability that a member votes for the ethical alternative.

The next result demonstrates the effects of an incremental increase in the committee size for two of the simplest voting rules, simple majority and unanimity.

**Proposition 2.** Consider two committee sizes $n$ and $\hat{n}$. If $\hat{n} > n$, then $\pi_{q,\hat{n}} > \pi_{q,n}$.

This implies that under a simple majority rule as well as under unanimity rule, any increase in the committee size increases the probability that an individual member votes for the ethical option.

### 3 Experimental Design

The laboratory experiment was conducted at Universidad de los Andes, Bogota, Colombia. The subjects were recruited from an undergraduate subject
pool. We focus on whether individuals’ decisions under collective decision are sensitive to: (i) the size of committee; (ii) different voting rules – i.e. changing the threshold needed to reach a decision; and (iii) different costs of being ethical. Tables 1 and 2 report the summary statistics of basic characteristics of our subjects across each voting rule treatments. To show that our subjects are balanced along the observable measures of education, financial situations and socioeconomic strata, column (7) presents the p-values from the pairwise null hypothesis that there is no significant differences across voting rule treatments.

In general, subjects were randomly assigned to be a member of a committee of size \( n \in \{3, 9, 15\} \) (a within-subjects Committee Size Treatment). Each subject was endowed with \( s = 10 \) Experimental Tokens (ET). Each individual had to vote Yes or No on whether they wanted a third-party recipient, which in the experiment was played by the Red Cross Organization, to receive a donation of \( B \). All committee members had to pay an out-of-pocket cost \( c \in \{4, 6\} \) (exogenously determined at the beginning of the round) if the committee collectively passed the ethical alternative.

The cost of donation came out of their own endowment – regardless of their individual vote. Committees then made collective decisions, without deliberation, via simultaneous voting. These were made according to two

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12 A sample of instructions is found in Appendix 6.2. Individuals were recruited using ORSEE. They were informed that they were guaranteed a show-up fee of 10,000 Colombian Peso (COP), and could earn in additional up to 10,000 COP for an hour-long experiment. The total amount is equivalent to approximately $7 USD. In actuality, a session lasted for 1 hour and 10 minutes including reading instructions (15 minutes), taking decisions (25 minutes), filling an exit questionnaire (15 minutes) and payment stage (15 minutes).

13 We set the committee size as listed so as to allow for possible non-linear extrapolation of the predicted effect of larger size of voting body on voting behaviour.

14 Our theoretical model sets an individual-specific altruistic payoff to be \( a_i \) from donating amount \( B \) as a group to the charity. To satisfy the incentive compatibility according to the theoretical prediction, it must be that \( c - a_i > x_i \), where \( x_i \) is the expressive payoff from having voted for the ethical alternative. Therefore, we set \( B = 91,000 \) COP (or 31.4 USD) so that it is always socially efficient to donate. In no cost variation an individual may feel that committee is burning money if they decide to vote to donate. Notice also that the amount to donate does not change with committee size nor individual cost of donating, and it is greater than the overall amount paid by the largest committee at the highest individual cost. Instead of keeping \( B \) constant we could have made it an increasing function of \( n \), however this would have made larger committees more willing to donate, thus creating a confounding effect on the empirical content of our model. This said, our design is conservative in the sense that the efficiency of donating declines with size, which allows us to study a lower bound of the effect from expressive payoff.
voting rules \( q \) (Voting Rule Treatment, between subjects): (i) Simple majority \( q = 1/2 \), and (ii) Unanimity \( q = 1 \). Each subject faced only one Voting Rule Treatment throughout the entire session. By combining these variations we have in total a \( 3 \times 2 \times 2 \) design: Committee size \( \times \) Cost \( \times \) Voting Rule treatments. The first two variations are a within-subjects design while the last one follows a between-subjects one.

The experiment runs as the following: For each \((n,c)\) pair we let subjects take decisions for 10 rounds.\(^{15}\) For each committee grouping, a computer randomly assigned each subject into a committee, which was strictly different from her prior round in a given pair.\(^{16}\) All individuals started the experiment session while belonging to a committee of size \( n = 3 \). After taking decision over each cost \( c \in \{4,6\} \) they were allocated to a different group size \( n \) either \( n = 9 \) and then \( n = 15 \), or \( n = 15 \) first and then \( n = 9 \). This is done to guarantee that our results are not driven by potential order effects due to the order of committee size.\(^{17}\)

The multiple-round design permits us to investigate whether some subjects made their voting choices based on a mixed strategy or otherwise.\(^{18}\) Each session consists of 33 subjects who received 10 ET as their initial endowment. Cost of donation is out-of-pocket and it is exogenously determined at the start of each round at \( c \in \{4,6\} \). We do not provide feedback so as to mitigate the issue of learning, or from individuals following richer strategic actions taking into account the history of past plays.\(^{19}\) In total, each subject took 60 voting decisions per session. Final payoffs are determined by

\(^{15}\)In the laboratory, in practice some subjects took voting decisions for a given \((n,c)\) pair between 10, 11 or 13 rounds. We take only the first 10 rounds for each \((n,c)\).

\(^{16}\)The subjects would see indexes associated to other members, but they would not be able to link those indexes to specific individuals in the room. Each session was composed by \( N = 33 \) students, each indexed \((n,c)\) pair by an element of \( I = \{1,2,\ldots,33\} \). The computer screen showed the composition of indexed members in order to make it salient to each subject that they never faced this committee in any previous rounds. This intends to mitigate learning effects from repeated rounds of the same setup.

\(^{17}\)The Ordering treatment was set-up as a between-subject design.

\(^{18}\)Ochs (1995) investigates mixed strategy equilibrium and repeats the game for something between 16 to 64 rounds. McCabe et al. (2000) run their experiments for \( r \sim U(70,...,79) \) periods while also varying the feedback, going from very rich information set to no feedback apart from individuals’ own payoff.

\(^{19}\)Another possibility we considered was the Roth-Malouf (1979) binary lottery mechanisms: gains in each of the rounds give individuals points and these are translated into lottery tickets to see whether or not the subject would earn a low or high payoff (see Ochs (1995)). The downside is that it could be hard to explain or implement.
randomly choosing one round.

The experiment was programmed in z-Tree (Fischbacher, 2007). We conducted a total of 6 sessions (3 sessions for the unanimity voting rule \((q = 1)\); 3 sessions for the simple majority rule \((q = 1/2)\)).\(^{20}\) Sessions lasted 75 minutes. At the end of the incentivised experimental session, subjects were also required to give responses to a questionnaire. The questions include their family background, and an additional module on their social and risk preferences (non-incentivised). We pay subjects a show-up fee of 10 ET, on average individuals earned 21 ET and $157 USD were donated to the Red Cross.

4 Experimental Results

4.1 Stylised statistics

We begin by describing individual voting behaviour.\(^{21}\) Figure 1 shows the percentage of instances, for each \((n, c)\) treatment variation, in which individuals voted to donate.\(^{22}\) Panels 1(a) and 1(b) show decisions under simple majority, unanimity, respectively. In each panel we report the statistics by committee size \((n \in \{3,9,15\})\) and by cost of donation \((c \in \{4,6\})\).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1}
\caption{Figure 1 here}
\end{figure}

Regardless of voting rules, our subjects’ voting behaviours are cost sensitive. For a given voting institution, they were substantially less likely to vote for the ethical alternative when the potential cost of doing so was high. In line with Proposition (1), which predicts in favour of stricter voting rules, the subjects were more likely to vote to donate under the unanimity rule treatment than under simple majority. When \(c\) was 4 they did so between 62\% to 69\% of the cases, and from 44\% to 48\% when \(c\) is 6 compared to simple majority rules (ranging from 49\% to 57\% of the instances when \(c\) was 4, and around 31\% when \(c\) was 6).

At the low cost treatment, we find that an increase in committee size made subjects more likely to vote for costly donation. This is suggestive evidence

\(^{20}\) We run 2 additional sessions for the super majority rule design as a robustness check \((q = 2/3)\), results are similar to \(q = 1/2\) and are available upon request.

\(^{21}\) See Tables 1-2 for some descriptive statistics of the laboratory sample.

\(^{22}\) Figure 5 shows a histogram of the percentage of instances, among the 10 rounds they faced the same \((n,c)\) treatment variation.
that supports Proposition (2). Under simple majority, subjects belonging to committees of size 3 voted in favour half of the time, while those belonging to committees of size 15 did so in 57% of the time. The same pattern is replicated in the unanimity voting rule (going from 62% when $n = 3$ to 69% when $n = 15$).

The previous histogram suggests subjects followed a rich set of strategies rather than sticking to either always donating or never donating. In Figure 2 we plot the percentage of instances in which individuals voted to donate while facing a given committee size. The figure shows the instances when $c$ is 6 against the case when $c$ is 4 whereby each circle represents a percentage of individuals following a particular strategy profile.

---Figure 2 here---

No matter the voting rule or committee size, circles are concentrated above the diagonal line which implies that individuals voted to donate more frequently when cost was 4 than when was 6. Secondly, when committee size increased, individuals were more likely to follow a pure strategy of always donating across the 10 rounds in which they faced a given cost. The same happens when we contrast unanimity rule and simple majority. In the former we find more cases of individuals following a pure strategy of voting to donate.

In Figure 3 we investigate how individual votes translate into committee decisions to donate. Here we show the percentage of instances in which committees voted to donate by committee size, cost of donation and voting rule. The figure demonstrates that committee’s vote outcomes were highly sensitive to cost incurred by individual members. Specifically to the simple majority rule treatment, committees were more likely to donate whenever the committee size was large and the donation cost incurred by each member was small. On the other hand, we do not find such collective voting patterns in other voting rule treatments.

---Figure 3 here---

In Figure 4 we take a different approach and plot the average number of votes in favour of donation at committee level. Each panel represents the share of members who voted to donate, in a given committee size, cost of donation and voting rule. Most noticeably, across all treatment variations, the share of members under the unanimity rule who opted for the ethical but costly alternative is always higher than in other voting rule treatments.
Next, we investigate voting strategy of each individual subject in a given fixed voting institution and donation cost. Recall that each subject was presented with the same \( \{q, n, c\} \) for 10 rounds when she decided on her voting choice in each different composition of the committee. Figure 5 plots the histograms of the likelihood that each individual subject cast her vote in favour of the ethical but costly alternative - average across all 10 rounds. Subjects on each end of the histograms are those who stuck to one vote option all through the 10 rounds in a given voting institution treatment. They consist of those who always voted to donate and those who never voted to donate.

These so-called purist voters accounts for %56 of the subjects in the treatment with the highest individual pivot probability \((q = \frac{1}{2}, n = 3)\), up to %77 of the subjects in the treatment with the lowest individual pivot probability \((q = 1, n = 15)\). Whereas the proportion of purist voters who never voted to donate stays somewhat constant across all committee size treatment variations (%30 when \(q = \frac{1}{2}\); %20 when \(q = 1\)), we observe a rise in the share of purists who always voted to donate as committee size increases.

In essence, as \(n\) gets larger, fewer members alternated their votes between rounds. We also note that there are more subjects who never voted to donate in the high cost than in the low cost treatment. And this pattern is consistent across all voting institutions in our experiment.

### 4.2 Individual behaviour

We now investigate the robustness of our summary statistics findings with a linear probability model.

Table 3 shows a linear estimation of individual votes to donate. The dependent variable equals to 1 when an individual voted in favour of the committee donating to the charity, and zero otherwise. In the first five columns we sequentially add treatment variables. We notice individuals became more willing to vote to donate whenever they belonged to larger committees, and were sensitive to changes in cost.

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Once we include the full set of controls (column 7) subjects facing larger committees voted in line with Proposition (2). Those belonging to committees of size \( n = 15 \) (\( n = 9 \)) are approximately 6.9pp (5.1pp) more likely to vote to donate than those belonging to 3-members committees. Columns (8) and (9) confirm that the results are robust across different voting rule treatments. The estimation specifications account for issues of learning by controlling for the round subjects faced in each pair of \((n, c)\) treatment variation.

The regressions also confirm the hypothesis from Proposition(2) that under unanimity subjected are more likely to donate. Specifically, committee members are 13.8pp more likely to vote for donating. We can rule out framing effects resulted from the order in which subjects face different committee sizes.\(^24\)

### 4.3 Committee behaviour

In Table 4 we extend the previous individual-level analysis of members’ vote casting to the committee-level decisions. The dependent variable in focus here equals to 1 if the committee collectively decided to donate, and zero otherwise.

\[ \text{Table 4 here} \]

Contrary to what had been found at the individual level, committees were less likely to donate whenever the committee size increased. Overall, committees of sizes \( n = 9 \) and \( n = 15 \) were approximately 6pp less likely to donate than committees of size 3. When we restrict the sample to only the majority voting rule treatment (column 7), the average number of votes in favour of donating increased with \( n \). Going from a committee size of 3 to one with 9 members in fact increases the probability of donating in 13.4pp. In addition, expanding committees from 9 to 15 members increases the probability to donate in almost 10pp. Yet the rate at which they did is not sufficient to eventually move the collective decision towards donating (see Figure 4).

\(^{23}\)We do not include individual characteristics in all regression because, due to a server error, we lost subjects’ responses to the demographic questionnaire in one of the experimental sessions.

\(^{24}\)In columns (4) till (8) we include an indicator variable equal to 1 for sessions where individuals faced the (3,15,9) order of committee sizes, and zero when the order was (3,9,15).
While subjects were more likely to individually vote in favour of donating in the unanimity rule than in the majority voting rule treatment, committee decision under the unanimity threshold failed to donate more frequently (see column 8). In fact, committees under unanimity rule were almost 27% less likely to donate than those under the majority rule. At the core of this results uncovers a coordination failure between committee members.

4.4 Structural estimation

We now structurally estimate the parameters of our model. Recall that members of type 0, whose share is \( \alpha \), randomise uniformly between the two actions (voting for or against the ethical alternative). Members of type 1 play the best response to members of type 0 — that is, they act as if all the other committee members were of type 0. A set of parametric assumptions are imposed in order for our model to be identified.

First, we assume that a level-1 member \((t = 1)\) has an unobserved preference component \( \epsilon_{d,i} \) for vote outcome \( d \in \{0, 1\} \), where \( d = 1 \) represents voting for the ethical alternative. We assume this component is independent and identically distributed across individuals with known Gumbel distribution function \( G_\epsilon(\epsilon_{d,i} < \epsilon) = \exp(-\exp(-\epsilon)) \).

Therefore, a level-1 member votes for the ethical alternative if and only if \( \epsilon_{1,i} - \epsilon_{0,i} > (c - a)\gamma_{q,n} - x_i \), which gives us that a level-1 member votes for the ethical alternative with probability

\[
P(d = 1 \mid t = 1, x_i, \gamma_{q,n}, c, a) = \frac{\exp((c - a)\gamma_{q,n} - x_i)}{1 + \exp(c\gamma_{q,n} - x_i)}.
\]

For a strategically naïve member \((t = 0)\), we assume that they uniformly randomise their votes for the ethical alternative. That is,

\[
P(d = 1 \mid t = 0, x_i, \gamma_{q,n}, c, a) = \frac{1}{2}.
\]

If the share of level-1 individuals is given by \( \alpha \), the probability that a randomly chosen individual votes for the ethical alternative is given by

\[
P(d = 1 \mid \alpha, x_i, \gamma_{q,n}, c, a) = \alpha P(d = 1 \mid t = 1, x_i, \gamma_{q,n}, c, a) + (1 - \alpha)P(d = 1 \mid t = 0, x_i, \gamma_{q,n}, c, a)
\]

To simplify the estimation we assume that \( x_i \) is a linear function of individual characteristics \( z_i \), including a constant. That is, \( x_i = \theta^t z_i \). Given
the Red Cross received the equivalent of 91 ET, we know \( a = \beta \times 91 \), so we estimate and obtain the marginal altruistic payoff \( \beta \).

In our experimental data, each individual \( i \) faced voting rules \( q \in \{ \frac{1}{2}, 1 \} \) and took decisions for 10 rounds per each \((n, c)\) pair. Denote \( \mathbf{d} \) as all votes with element \( d_{i,r}^{nc} \); \( Z \) as the matrix of characteristics, our log-likelihood function is given by

\[
L_N(d \mid Z; \alpha, \theta, \beta) = \frac{1}{N} \sum_{q \in \mathcal{Q}} \sum_c \sum_{r=1}^{10} \left[ d_{i,r}^{nc} \log \mathbb{P}(d = 1 \mid \alpha, \theta, \gamma_{q,n}, c, \beta) + (1 - d_{i,r}^{nc}) \log (1 - \mathbb{P}(d = 1 \mid \alpha, \theta, \gamma_{q,n}, c, \beta)) \right]
\]

(2)

where \( N \) is the total number of observations. In \( z_i \), we include gender, socioeconomic strata, log of weekly expenditures, whether studying an economics related major, and the stated willing to donate from an hypothetical endowment of 100 USD.

Table 5 reports the estimated share of level-1 members and shows that 57.6% of our sample are level-1 individuals. Hence, just two-fifths of our subjects are strategically naive.

- Table 5 here -

Figure 6 presents the distribution of estimated expressive payoffs. It shows that males have higher expressive payoff from voting for the right cause.

- Figure 6 here -

Our estimation also reveals a relationship between wealth (measured by socioeconomic stratum) and expressive preferences. The distribution of expressive payoffs for subjects who come from poor households is dominated by an equivalent distribution for subjects of wealthier background. This indicates richer subjects have generally higher expressive payoffs which may be due to a lower marginal cost of money. We also observe that our estimated expressive payoffs are positively correlated with the self-reported amount that individuals are willing to donate if they receive an endowment of USD 100.

- Figure 7 here -

\(^{25}\) Structural parameters associated to the altruistic marginal payoff and coefficients explaining the expressive payoffs are reported also in Table 5.
5 Discussion

5.1 Discussion of modelling choices and generalisations of the model

Comparison to the Nash equilibrium. The use of level-k equilibrium as a solution concept, rather than the more usual Nash equilibrium, is due to the fact that level-k provides a more tractable solution. As Huck and Konrad (2005) show, a voting model with expressive payoffs under simple majority voting rule admits multiple Nash equilibria. This presents problems for structural estimation of behavioural parameters, particularly since comparative statics move in different directions in different equilibria. Hence, we chose level-k equilibrium as our solution concept to ensure sufficient tractability for the empirical analysis.

Nevertheless, under unanimity rule the Nash equilibrium is sufficiently tractable. Suppose that, given \( n \), a randomly selected member votes for the ethical alternative with probability \( \hat{\pi} \). Then under the Nash equilibrium, a member receives a payoff of \( x_i - \hat{\pi}^{n-1}(c - a_i) \) if she votes for the ethical alternative, and a payoff of 0 if she votes against it. Hence, member \( i \) votes for the ethical alternative if and only if \( x_i \geq \hat{\pi}^{n-1}(c - a_i) \). Given \( a_i \), this always holds if \( a_i > c \); and if \( a_i \leq c \) this holds with probability \( 1 - F_x(\hat{\pi}^{n-1}[c - a_i]) \). Hence, at a symmetric equilibrium, member \( i \) votes for the ethical alternative with probability

\[
\hat{\pi} = \int_{-\infty}^{c} \left[ 1 - F_x (\hat{\pi}^{n-1}[c - a_i]) \right] dF_a(a_i) + 1 - F_a(c) \quad (3)
\]

Thus, we obtain the following result

**Proposition 3.** Under a unanimity rule, there exists a symmetric equilibrium characterised by a unique \( \hat{\pi} \in (0, 1) \) such that

\[
\hat{\pi} = 1 - \int_{-\infty}^{c} F_x(\hat{\pi}^{n-1}[c - a_i]) dF_a(a_i) \quad (4)
\]

Furthermore, \( \hat{\pi} \) is increasing in \( n \).

Hence, under the unanimity rule, the equilibrium displays comparative statics similar to the result of Proposition 2.
Greater depth of reasoning. Our level-k model assumes that there are only two types of players, level 0 and level 1. This section will extend the analysis to account for greater depth of reasoning.

Let $\pi_{k,n,q}$ denote the probability that a member with level-$k$ rationality votes for the proposal when the group size is $n$ and the voting rule is $q$. Level-0 members vote for the proposal with probability 0.5. Consider a member $i$ who is of type $k \geq 1$.

She assumes that all other members are level-$(k - 1)$. Assuming all $n - 1$ other members are level-$(k - 1)$, let $p^{k-1}(m)$ be the probability that at least $m$ of these level-$(k - 1)$ members vote for the proposal. Then if member $i$ who has depth of reasoning $k$ votes for the proposal, her perceived payoff will equal $-p^{k-1}(qn - 1)(c - a_i) + x_i$. If she votes against it, her perceived payoff will equal $-p^{k-1}(qn)(c - a_i)$. She thus votes for the ethical proposal if and only if

$$x_i > [p^{k-1}(qn - 1) - p^{k-1}(qn)](c - a_i) = \gamma_{k,n}^q (c - a_i)$$

where $\gamma_{k,q,n} \equiv p^{k-1}(qn - 1) - p^{k-1}(qn)$ denotes the probability of being pivotal as perceived by level-$k$ member.

Hence, member $i$ votes for the proposal with probability 1 if $a_i > c$; otherwise, conditional on $a_i$, she votes for the proposal with probability $1 - F_x(\gamma_{k,q,n} [c - a_i])$. Hence, ex ante, her probability of voting for the proposal equal

$$\int_{-\infty}^{c} [1 - F_x(\gamma_{k,q,n} [c - a_i])] dF_a (a_i) + 1 - F_a (c) = 1 - \int_{-\infty}^{c} F_x(\gamma_{k,q,n} [c - a_i]) dF_a (a_i)$$

We will focus on the simple majority rule. Suppose that $n$ is odd. Then $\gamma_{k,\frac{1}{2},n}$, the perceived probability of being pivotal, is given by

$$\gamma_{k,q,n} = \left(\frac{n - 1}{n-1} 2\right) \pi_{k-1,\frac{1}{2},n}^{n-1} (1 - \pi_{k-1,\frac{1}{2},n})^{n-1}$$

Consider a simple majority rule. Let the group size be $2n + 1$. Let $\lambda_{k,n}$ denote the probability that a member with level-$k$ rationality votes for the ethical alternative when the group size is $2n + 1$.

When the committee is of size $2n + 1$, member $i$ with rationality level $k$ will vote for the ethical alternative if and only if

$$x_i > c \binom{2n}{n} \lambda_{k-1,n}^{n} (1 - \lambda_{k-1,n})^{n}$$
where the right-hand side represents the cost of adopting the ethical alternative multiplied by the probability that member $i$ is pivotal, under the assumption that every other member has rationality level $k-1$. Then we have

$$\lambda_{k,n} = 1 - F \left[ c \binom{2n}{n} \frac{n^n}{k-1,n} (1 - \lambda_{k-1,n})^n \right]$$  \hspace{1cm} (5)$$

Then the following holds.

**Proposition 4.** Take any $F$ and $c$. Then for every $k$, the following holds:

1. $\lim_{n \to \infty} \lambda_{k,n} = 1$;
2. There exists $\hat{n}(k)$ such that $\lambda_{k,n}$ increases in $n$ for all $n > \hat{n}(k)$;
3. If $F \left( \frac{c}{2} \right) \leq \frac{1}{2}$, then $\lambda_{k,n}$ increases in $n$ for all $n$.

In words, Proposition (4) says the following. First, when the size of the committee becomes very large, the probability that any given member (of any depth of reasoning) votes for the proposal converges to 1. Second, as long as the committee is sufficiently large, any member is more likely to vote for the proposal when the size of the committee increases, as long as the committee is sufficiently large.

Hence, the basic intuition of Proposition (2) holds under arbitrary depths of reasoning.

**References**


Figures

(a) Simple Majority

(b) Unanimity

Figure 1: Percentage of instances in which subjects voted to donate by voting rule, cost to donate and committee size
Figure 2: Number of individuals by their percentage of instances in which they vote to donate when $c = 4$ vs when $c = 6$ by voting rule and committee size.
Figure 3: Percentage of instances in which committees voted to donate (by committee size, individual cost to donate and voting rule)
Figure 4: Average number of members who votes in favour to donate per committee (by committee size, individual cost to donate and voting rule)
Figure 5: Histograms of the percentage of instances that each subject voted to donate by voting rule, cost to donate and committee size.

(Note: On the x-axis, 0 indicates that the individual never voted to donate while 1 indicates that the individuals always voted to donate in a given voting institution.)
Figure 6: Histogram of predicted expressive payoffs $\hat{x}_i$, Total population (Top), by Gender (Bottom)
(a) Kernel density of $\hat{x}_i$ by Socioeconomic Strata

(b) Scatter between $\hat{x}_i$ and: Willingness to donate from hypothetical 100USD (b), Log weekly expenses (c)

Figure 7: External validity of predicted expressive payoff, $\hat{x}_i$
## Table 1: Descriptive Statistics

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### Edu Financing:

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### Note:
Socioeconomic stratum is 1 for poorest and 6 for richest households. Academic semester ranges from 1 to 10. Weekly expenses are reported in thousand col. Econ/Business refers to Economics and Business Administration undergrad students. *Edu Financing* refers financial means students fund their studies. ICETEX is a State entity that promotes Higher Education through the granting of educational loans. *Ser Pilo Paga* is a scholarship program of the National Government targeting nation-wide high-achievement students with financial difficulties to access accredited Higher Education Institutions of high quality.
### Table 2: Descriptive Statistics (continued)

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Note: Red Cross Donation in Money, Red Cross Donation in Kind and Red Cross Volunteer report whether the individual donated in money, in kind or volunteered to the Red Cross, respectively. Donation of 100USD reports the amount of dollars that the individuals would like to donate if they had 100 USD. Fairness Situation 1 reports the percentage of individuals that would consider fair if a friend finds 100 USD and keeps them all. Fairness Situation 2 reports the percentage of individuals that would consider fair if a friend finds 100 USD and decides to keep 51 USD and give them 49 USD. Voting experience indicates whether the individual has voted in school, college, local, parliamentary or presidential elections. Property Owner and Car Owner report whether the individual lives in a family owner of at least one property, and at least one car, respectively.
Table 3: Linear estimation of individual donation decision

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<tbody>
<tr>
<td></td>
<td>Dependent: Individual vote to donate</td>
<td>Majority</td>
<td>Unanimity</td>
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<td>0.030***</td>
<td>0.030***</td>
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<td></td>
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<td>(0.011)</td>
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<tr>
<td>Group Size = 15</td>
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<td>0.042***</td>
<td>0.042***</td>
<td>0.042***</td>
<td>0.042***</td>
<td>0.042***</td>
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<tr>
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<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
</tr>
<tr>
<td>Cost = 6</td>
<td>-0.210***</td>
<td>-0.210***</td>
<td>-0.210***</td>
<td>-0.179***</td>
<td>-0.166***</td>
<td>-0.177***</td>
<td>-0.180***</td>
<td>-0.041**</td>
<td>-0.039**</td>
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<td>-0.039**</td>
<td>-0.062**</td>
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<td>-0.075**</td>
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<td>-0.075**</td>
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<td></td>
<td>(0.021)</td>
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<td>(0.032)</td>
<td>(0.023)</td>
<td>(0.027)</td>
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<tr>
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<td>0.138***</td>
<td>0.138***</td>
<td>0.138***</td>
<td>0.138***</td>
<td>0.138***</td>
<td>0.138***</td>
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<td>(0.051)</td>
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<td>0.508***</td>
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<td>(0.041)</td>
<td>(0.471)</td>
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<td>Controls†</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
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<td>11,760</td>
<td>11,760</td>
<td>9,840</td>
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<td>5,820</td>
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<td>0.065</td>
<td>0.066</td>
<td>0.074</td>
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</table>

*** p<0.01, ** p<0.05, * p<0.1. Robust Standard errors clustered at individual level in parentheses. Dependent variable is 1 if a subject voted to donate. †Controls include whether subject is female, socioeconomic strata (from 1 to 6), log of weekly expenditures, whether studying an economics related major, and standardized willingness to donate from an hypothetical transfer of 100 USD. Observations when adding controls drop because we lost questionnaire’s answers for a session.
Table 4: Linear estimation of committee-level donation decision

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<th>(5)</th>
<th>(6)</th>
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<tr>
<td>Dependent: Committee vote to donate</td>
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<td>Unanimity</td>
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<tr>
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<td>-0.079***</td>
<td>-0.079***</td>
<td>-0.079***</td>
<td>-0.076***</td>
<td>-0.040</td>
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<td>(0.021)</td>
<td>(0.021)</td>
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<td>(0.031)</td>
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<td>-0.067**</td>
<td>-0.066**</td>
<td>-0.066**</td>
<td>-0.065**</td>
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<td>(0.026)</td>
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<td>(0.026)</td>
<td>(0.037)</td>
<td>(0.059)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Cost = 6</td>
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<td>-0.246***</td>
<td>-0.246***</td>
<td>-0.246***</td>
<td>-0.211***</td>
<td>-0.245***</td>
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<td>(0.017)</td>
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<tr>
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<td>0.157***</td>
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<td>(0.069)</td>
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<tr>
<td>15.n#6.cost</td>
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<td>-0.452***</td>
<td>0.160***</td>
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<td>(0.055)</td>
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<td>-0.274***</td>
<td>-0.274***</td>
<td>-0.274***</td>
<td>-0.274***</td>
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<td>(0.017)</td>
<td>(0.017)</td>
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<td>-0.006</td>
<td>-0.006</td>
<td>-0.006</td>
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<td>Period per (n,c)</td>
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<td>-0.003</td>
<td>-0.005</td>
<td>-0.001</td>
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<tr>
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<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.003)</td>
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<tr>
<td>Constant</td>
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<td>0.399***</td>
<td>0.521***</td>
<td>0.523***</td>
<td>0.538***</td>
<td>0.521***</td>
<td>0.333***</td>
<td>0.237***</td>
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<tr>
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<td>(0.014)</td>
<td>(0.016)</td>
<td>(0.017)</td>
<td>(0.023)</td>
<td>(0.024)</td>
<td>(0.036)</td>
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<td>2,017</td>
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<td>2,017</td>
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<tr>
<td>R-squared</td>
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<td>0.111</td>
<td>0.195</td>
<td>0.196</td>
<td>0.200</td>
<td>0.180</td>
<td>0.105</td>
<td></td>
</tr>
</tbody>
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*** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses. Dependent variable is 1 if the committee decides to donate.
Table 5: Estimation of share of level-1 members ($\alpha$) and altruistic marginal payoff ($\beta$), via MLE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>T-stat.</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$: share of level-1</td>
<td>0.576***</td>
<td>(0.009)</td>
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<tr>
<td>$\beta$: marginal altruistic payoff</td>
<td>0.265</td>
<td>(38.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$x_i$: expressive payoff</td>
<td></td>
<td></td>
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<tr>
<td>Female</td>
<td>-0.823***</td>
<td>(0.153)</td>
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</tr>
<tr>
<td>Socioeconomic strata</td>
<td>0.229***</td>
<td>(0.059)</td>
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</tr>
<tr>
<td>Log weekly expenses</td>
<td>0.123</td>
<td>(0.111)</td>
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<td>Econ/Business</td>
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<td>(0.294)</td>
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<td>Donation 100USD</td>
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<td>(0.077)</td>
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<td>Constant</td>
<td>1.731</td>
<td>(1.299)</td>
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</tbody>
</table>

Notes: Robust Standard errors clustered at individual level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Individual characteristics $x_i$ include whether subject is female, socioeconomic strata (from 1 to 6), log of weekly expenditures, whether studying an economics related major, and standardized willingness to donate from an hypothetical transfer of 100 USD.
6 Appendix

6.1 Proofs

Proof of Proposition (1) If \( m_{\hat{q},n} = m_{qn} \), then \( \gamma_{\hat{q},n} = \gamma_{q,n} \), so \( \pi_{\hat{q},n} = \pi_{q,n} \).

Suppose instead that \( m_{\hat{q},n} = m_{qn} + r \) for some \( r \in \{1, 2, \ldots \} \). Then

\[
\frac{\gamma_{\hat{q},n}}{\gamma_{q,n}} = \frac{(n-1)!}{(m_{qn}+r)![(n-m_{qn}+1-r)!]} = \frac{(m_{qn})!(n-m_{qn}+1)!}{(m_{qn}+r)![(n-m_{qn}+1-r)!]} = \frac{\prod_{j=1}^{r} (n-m_{qn} - j)}{\prod_{j=1}^{r} (m_{qn} + j)}
\]

Note that \( m_{qn} \geq \frac{n}{2} - 1 \), and the inequality is strict unless \( q = \frac{1}{2} \) and \( n \) is even. Hence,

\[
\frac{\gamma_{\hat{q},n}}{\gamma_{q,n}} \leq \frac{\prod_{j=1}^{r} (\frac{n}{2} + 1 - j)}{\prod_{j=1}^{r} (\frac{n}{2} - 1 + j)}
\]

which equals 1 if \( r = 1 \), and is strictly smaller than 1 if \( r > 1 \).

Thus, \( \pi_{\hat{q},n} = \pi_{q,n} \) if \( \hat{q} - q \) is small enough that \( m_{\hat{q},n} = m_{qn} \). If \( \hat{q} - q \) is such that \( m_{\hat{q},n} = m_{qn} + 1 \), then \( \pi_{\hat{q},n} = \pi_{q,n} \) if \( q = \frac{1}{2} \) and \( n \) is even; otherwise, \( \pi_{\hat{q},n} > \pi_{q,n} \). Finally, if \( \hat{q} - q \) is sufficiently large that \( m_{\hat{q},n} \geq m_{qn} + 2 \), then \( \pi_{\hat{q},n} > \pi_{q,n} \).

\[\Box\]

Proof of Proposition (2). We only need to show that the relationship holds for \( \hat{n} = n + 1 \); the rest follows by induction. Note that \( m_{qn} \) can have two values: either \( m_{q,n} = m_{qn}, \) or \( m_{q,n} = m_{qn} + 1 \).

In the former case, we have

\[
\frac{\gamma_{q,n}}{\gamma_{q,n}} = \frac{n!}{(m_{qn}+1)![(n-m_{qn})]} = \frac{n!}{m_{qn}!(n-m_{qn}-1)!} \quad \frac{1}{2} = \frac{n + 1}{2}
\]

Since \( m_{qn} < qn \), we have \( \frac{n}{n-m_{qn}} < \frac{n}{n-qn} = \frac{1}{1-q} \leq 2 \). Thus, \( \frac{\gamma_{q,n}}{\gamma_{q,n}} < 1 \), and \( \pi_{q,n} > \pi_{q,n} \).

If \( m_{q,n} = m_{qn} + 1 \), we have

\[
\frac{\gamma_{q,n}}{\gamma_{q,n}} = \frac{n!}{(m_{qn}+1)![(n-m_{qn}+1)]]} = \frac{n!}{m_{qn}!(n-m_{qn}-1)!} \quad \frac{1}{2} = \frac{n + 1}{2}
\]

Since \( m_{qn} + 1 \leq n \), we have \( \frac{\gamma_{q,n}}{\gamma_{q,n}} < 1 \), and \( \pi_{q,n} > \pi_{q,n} \).

\[\Box\]
Proof of Proposition (3). Equation (4) is a straightforward simplification of (3). When \( \hat{\pi} = 0 \), the left-hand side of (4) is strictly smaller than the right-hand side, and the opposite is true when \( \hat{\pi} = 1 \). Because (4) is continuous in \( \hat{\pi} \), there exists at least one \( \hat{\pi} \in (0,1) \) at which (4) holds with equality. Furthermore, note that the left-hand side of (4) is increasing in \( \hat{\pi} \) while the right-hand side is decreasing in \( \hat{\pi} \), which implies that the \( \hat{\pi} \) which solves equation (4) is unique.

To show the effect of increasing \( n \), suppose \( n \) is replaced by \( \tilde{n} > n \). Let \( \tilde{\pi} \) be the new solution to (4). If \( \tilde{\pi} \leq \hat{\pi} \), then \( \tilde{\pi}^{\tilde{n}-1} < \pi^{n-1} \leq \pi^{n-1} \), and thus \( 1 - \int_{-\infty}^{c} F(x (\tilde{\pi}^{\tilde{n}-1} [c-a_i])) dF_{a_i}(a_i) > 1 - \int_{-\infty}^{c} F(x (\pi^{n-1} [c-a_i]) dF_{a_i}(a_i) \). Hence, the right-hand side of (4) becomes larger than the left-hand side, so (4) does not hold. Hence, we must have \( \tilde{\pi} > \hat{\pi} \). Thus, \( \hat{\pi} \) increases with \( n \).

Proof of Proposition (4).

Proof. Result (i) follows from the fact that \( \lambda_{k,n} = 1 - F \left[ c \left( \frac{2n}{n} \right) \lambda_{k-1,n}^{n} (1 - \lambda_{k-1,n}^{n}) \right] \geq 1 - F \left[ c \left( \frac{2n}{n} \right) \frac{1}{2n} \right] \), which converges to 1 as \( n \to \infty \).

We will now prove (ii) and (iii) by induction. For \( k = 1 \), the result holds because \( \lambda_{k,n} = 1 - F \left[ c \left( \frac{2n}{n} \right) \frac{1}{2n} \right] \), which is increasing in \( n \). We will now prove that if either (ii) or (iii) holds for levels of rationality \( 1, \ldots, k-1 \), then it holds for \( k \).

Note that \( \lambda_{k,n} \) increases in \( n \) if and only if \( \frac{\binom{2n}{n} \lambda_{k-1,n}^{n} (1 - \lambda_{k-1,n}^{n})}{\binom{2n+2}{n+1} \lambda_{k-1,n+1}^{n} (1 - \lambda_{k-1,n+1}^{n})} \geq 1 \) which can be written as

\[
\frac{\binom{2n}{n} \lambda_{k-1,n}^{n} (1 - \lambda_{k-1,n}^{n})}{\binom{2n+2}{n+1} \lambda_{k-1,n+1}^{n} (1 - \lambda_{k-1,n+1}^{n})} \geq 1 \quad (6)
\]

Note that

\[
\frac{\binom{2n}{n}}{\binom{2n+2}{n+1}} = \frac{(2n)!}{n! (2n+2)!} \quad \frac{(n+1)^2}{(2n+1) (2n+2)} = \frac{1}{2} \frac{n+1}{2n+1} > \frac{1}{4} \quad (7)
\]

Furthermore,
\[
\frac{1}{\lambda_{k-1,n+1} (1 - \lambda_{k-1,n+1})} \geq 4
\]  
\hspace{1cm} (8)

which comes from the fact that for any \( x \in [0, 1] \), we have \( x (1 - x) \leq \frac{1}{4} \).

Substituting (7) and (8) into (6), we can conclude that for the second and the third parts of the proposition to hold, it is sufficient to have

\[
\frac{\lambda_{k-1,n} (1 - \lambda_{k-1,n})}{\lambda_{k-1,n+1} (1 - \lambda_{k-1,n+1})} > 1
\]  
\hspace{1cm} (9)

To complete the proof of (ii), note that when \( n \) is sufficiently large, we have \( \lambda_{k-1,n+1} > \lambda_{k-1,n} > \frac{1}{2} \), where the first inequality comes from the fact that \( \lambda_{k-1,n} \) is increasing in \( n \) by our induction statement, and the second – from the fact that it converges to 1 as \( n \to \infty \). Hence, when \( n \) is sufficiently large, \( \lambda_{k-1,n} (1 - \lambda_{k-1,n}) > \lambda_{k-1,n+1} (1 - \lambda_{k-1,n+1}) \), and thus (9) holds.

To complete the proof of (iii), note that for any \( n \), we have \( \lambda_{k-1,n+1} > \lambda_{k-1,n} > \lambda_{k-1,1} = 1 - F [2c \lambda_{k-1,1} (1 - \lambda_{k-1,1})] \geq 1 - F \left( \frac{c}{2} \right) \), where the first two inequalities come from the fact that \( \lambda_{k-1,n} \) is increasing in \( n \) by our induction statement, while the third comes from the fact that \( \lambda_{k-1,1} (1 - \lambda_{k-1,1}) \leq \frac{1}{4} \).

If \( F \left( \frac{c}{2} \right) \leq \frac{1}{2} \), this implies that \( \lambda_{k-1,n+1} > \lambda_{k-1,n} \geq \frac{1}{2} \). Hence for any \( n \), \( \lambda_{k-1,n} (1 - \lambda_{k-1,n}) > \lambda_{k-1,n+1} (1 - \lambda_{k-1,n+1}) \), and thus (9) holds. \( \square \)
Bienvenidos. Muchas gracias por participar en este experimento de decisión individual.

A partir de este momento está prohibido comunicarse con los demás participantes que están en esta sala. Por favor hagan silencio y apaguen sus celulares. El uso de celulares y calculadoras está terminantemente prohibido.

Si tiene alguna pregunta sobre el experimento, levante la mano y uno de nosotros acudirá a su escritorio para contestarla. No haga preguntas en voz alta.

Toda la información que usted nos proporcione en este experimento será utilizada con fines estrictamente académicos y no será revelada a nadie. Tanto sus decisiones como sus ganancias serán confidenciales. Nadie conocerá las acciones que usted tomó, ni cuánto dinero recibirá al final de la sesión.

Sólo por su participación hasta el final de este experimento usted recibirá 10.000 pesos. Además dependiendo de sus acciones y de las acciones de otros participantes, usted puede ganar más dinero. Durante la actividad hablaremos en términos de Unidades Monetarias Experimentales (UME) en lugar de Pesos Colombianos. Sus pagos serán calculados en términos de UMEs y luego se cambiarán a Pesos Colombianos al final del experimento siguiendo esta tasa de intercambio

1 UME = 1000 Pesos

Si usted no desea participar en el experimento, puede retirarse ahora. Si desea participar, por favor lea y firme la hoja que dice Consentimiento Informado.
INSTRUCCIONES

A cada individuo se le asignará un número al principio de la actividad que será su Identificación Experimental durante el experimento. La asociación de este número con su identidad sólo la conocerá usted y nadie más en la sala. Esta Identificación Experimental puede tomar un número de 1 a 33.

Esta es una actividad sobre decisiones grupales en la que deberá participar a lo largo de varias rondas. En cada ronda usted será asignado aleatoriamente a un nuevo grupo. La única información que recibirá de los otros integrantes del grupo es su Identificación Experimental.

En cada ronda, usted tendrá una dotación de 10 UME y deberá tomar una decisión que se detalla más adelante. Sus pagos al final de esta actividad se definirán con base en sus ganancias de una de las rondas escogida al azar. Sus pagos dependerán únicamente de las decisiones hechas por usted, los otros miembros de su grupo y del azar. Antes de comenzar, tendremos dos rondas de práctica que no afectarán su pago final.

Situación General

En cada ronda, usted será asignado a un grupo que puede estar compuesto por 3, 9, o 15 integrantes. Usted deberá votar si está A Favor o En Contra de que la Cruz Roja Colombia reciba una donación de $91.000 pesos. Este dinero saldrá de recursos destinados a Donaciones asociados al proyecto de investigación del cual esta actividad hace parte. La Cruz Roja Colombiana es una entidad privada sin ánimo de lucro que busca prestar atención humanitaria, sin discriminación, a personas desprotegidas en tiempos de conflicto armado y en otras situaciones de emergencia. Su misión es preservar la vida y la salud, y prevenir y aliviar el sufrimiento humano en todas las circunstancias promoviendo la inclusión social, la educación y el respeto de los derechos humanos.

La decisión final de su grupo en cuanto a si la Cruz Roja recibe dicha donación se definirá con base en la regla de unanimidad (mayoría simple) [mayoría de dos tercios]: Para un grupo conformado por 3 integrantes se necesita que los 3 hayan
votado \{ al menos 2 \ de ellos hayan votado \} A Favor de la
donación para que la Cruz Roja Colombiana la reciba. Para un grupo
conformado por 9 integrantes se necesita que los 9 \{ al menos 5 \ de ellos \} [al menos 7] hayan votado
A Favor de la donación para que la Cruz Roja Colombiana la reciba. Para un grupo
conformado por 15 integrantes se necesita que los 15 \{ al menos 8 de ellos \} [al menos
11] hayan votado A Favor de la donación para que la Cruz Roja Colombiana la reciba.
La siguiente tabla resume estas reglas de votación

<table>
<thead>
<tr>
<th>Tamaño del grupo</th>
<th>Número mínimo de votos A Favor de donar $91.000 a la Cruz Roja Colombiana</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regla de unanimidad { mayoría simple } [mayoría de dos tercios]</td>
</tr>
<tr>
<td>3</td>
<td>3 {2} [3]</td>
</tr>
<tr>
<td>9</td>
<td>9 {5} [7]</td>
</tr>
<tr>
<td>15</td>
<td>15 {8} [11]</td>
</tr>
</tbody>
</table>

Si su Grupo vota A Favor de donar, según la regla de votación, entonces La Cruz Roja
Colombiana en efecto recibirá la donación justo después de terminar el experimento.
Si este es el caso, cada integrante de su Grupo, sin importar su decisión, deberá pagar
un costo que puede ser de 4 o de 6UME. Por tanto, usted recibirá su dotación inicial
de 10 UME menos el costo. Este costo le será indicado en cada ronda y es común para
todos los integrantes del grupo.

En cambio, si el Grupo vota En Contra de donar, según la regla de votación, entonces
La Cruz Roja Colombiana no recibirá la donación. Si este es el caso, ningún integrante
de su grupo, sin importar su decisión, tendrá que incurrir en el costo y por tanto
mantendrá su dotación inicial de 10 UME.
**Detalles adicionales**

Recuerde que usted deberá votar, en varias rondas, si está A Favor o En Contra de que la Cruz Roja Colombiana reciba una Donación de $ 91.000. En la pantalla (ver Pantalla 1), usted verá el número de la ronda de decisión en la esquina superior izquierda. Para votar, tendrá que hacer click sobre uno de los botones A Favor o En Contra, que aparecen debajo de la pregunta ¿Usted vota a Favor o en Contra de que la Cruz Roja Colombiana reciba una Donación de $ 91.000?

Las siguientes variables cambiarán entre rondas:

- El tamaño de su grupo: Este puede ser de 3, 9 o 15 integrantes. La información del tamaño del grupo aparecerá en la esquina superior izquierda. Una vez se le asigna un tamaño de grupo, usted tomará decisiones por algunas rondas consecutivas enfrentándose a grupos de ese mismo tamaño hasta que el computador le asigne un tamaño de grupo diferente.

- Las identidades de los miembros de su grupo: En cada ronda se le mostrará en la esquina superior derecha las identidades experimentales de dichos integrantes, excluyendo la suya.

- El costo individual si el Grupo vota A Favor de donar: Este puede ser de 4 o 6 UME. Será el mismo para todos los integrantes del grupo para la ronda considerada. Usted será informado sobre el costo relevante en cada ronda en la pantalla de su computador. Una vez se le asigna un costo individual de donar, usted tomará decisiones por algunas rondas consecutivas enfrentándose a ese mismo costo hasta que el computador le asigne un nuevo costo.

Para cada combinación de Tamaño de Grupo y Costo Individual de votar A Favor, usted decidirá por un número total de rondas que esta entre 10 y 13.

**Pagos de la Actividad**

Además de los 10.000 pesos por participar en la actividad, al final de las rondas el computador elegirá UNA de ellas al azar para determinar sus pagos, estos se
 calcularán según la votación grupal sobre la donación a la Cruz Roja Colombiana, su dotación inicial y el costo individual asociado. Por tanto sus pagos por sus decisiones en la actividad serán

Si su Grupo vota A Favor de que la Cruz Roja reciba la donación:

\[
\text{Dotación Inicial} - \text{Costo individual en la ronda elegida}
\]

En dicho caso, la Cruz Roja Colombiana recibirá una donación de $91.000 que saldrán de recursos destinados a Donaciones asociados al proyecto de investigación del cual esta actividad hace parte.

Si su Grupo vota En Contra de que la Cruz Roja reciba una donación anónima:

\[
\text{Dotación Inicial}
\]

En dicho caso, la Cruz Roja Colombiana no recibirá la donación.
Preguntas *(Cambian según Regla de Votación)*

**Pregunta 1:** ¿Mi pago será definido por la ronda en la que tenga el mejor resultado?

*Respuesta:* No. El computador elegirá una de las rondas aleatoriamente, excluyendo las dos rondas iniciales de práctica. El resultado en esa ronda elegida será el que determine cuál será su pago en pesos colombianos al finalizar el experimento.

**Pregunta 2:** ¿Que mi grupo vote A Favor o En Contra de la donación a la Cruz Roja Colombiana depende únicamente de mi voto?

*Respuesta:* Aunque las decisiones en este juego son individuales, la decisión grupal depende de lo que el grupo elija por **unanimidad**. Por ejemplo, aunque usted haya votado A Favor, si la decisión de los otros integrantes de su grupo hace que el grupo, según la regla de votación, este En Contra, ninguno de sus integrantes pagará el costo individual y la Cruz Roja no recibirá la donación estipulada. En cambio, si la decisión de los otros integrantes de su grupo hace que el grupo, según la regla de votación, este A Favor, todos los integrantes deberán pagar el costo individual y la Cruz Roja recibirá la donación estipulada. Otro caso sería si usted decide votar En Contra, no importa la decisión de los otros integrantes de su grupo, según la regla de votación, el grupo estará también En Contra y por lo tanto ninguno de sus integrantes pagará el costo individual y la Cruz Roja no recibirá la donación.

**Pregunta 3:** ¿El costo individual en el que incurro, si mi grupo vota A Favor de la donación, es el mismo a lo largo de las rondas?

*Respuesta:* No. El costo individual en el que se incurre, si el grupo vota A Favor de la donación, puede ser de 4UME o 6UME en distintas rondas. Sin embargo, este será el mismo para todos los integrantes de su grupo para una ronda dada.

**Pregunta 4:** ¿Mi grupo será siempre el mismo a lo largo de las rondas?

*Respuesta:* No. Los grupos serán reasignados a lo largo de sus decisiones. En algunas rondas usted hará parte de un grupo de 3 integrantes, en otras de 5, en otras de 9 y en otras de 11 integrantes y sus integrantes son decididos por el azar. Una vez se le asigna un tamaño de grupo, usted tomará decisiones por algunas rondas consecutivas.
enfrentándose a grupos de ese mismo tamaño hasta que el computador le asigne un tamaño de grupo diferente.
<table>
<thead>
<tr>
<th>Ronda Práctica 1</th>
<th>Su identificación: 54</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamaño de su grupo: 3 integrantes</td>
<td>Identificación de los otros integrantes de su grupo: 16, 5</td>
</tr>
<tr>
<td>Costo individual, si su Grupo vota A Favor de donar: 4 URE</td>
<td></td>
</tr>
</tbody>
</table>

Si su grupo vota A favor de la donación (para lo cual se necesitan de por lo menos 2 votos), el costo individual para cualquier integrante es 4 URE.

Si su grupo vota En Contra de la donación (para lo cual se necesitan de por lo menos 2 votos), el costo individual para cualquier integrante es 3 URE.

¿Usted está A favor o En Contra de que la Cruz Roja Colombiana recibe una Donación de $ 91000?

- A Favor
- En Contra

[Continuar]