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INSTITUTIONS AND BEHAVIOR: EXPERIMENTAL EVIDENCE ON THE EFFECTS OF DEMOCRACY

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ABSTRACT

A novel experiment is used to show that the effect of a policy on the level of cooperation is greater when it is chosen democratically by the subjects than when it is exogenously imposed. In contrast to the previous literature, our experimental design allows us to control for selection effects (e.g. those who choose the policy may be affected differently by it). Our finding implies that democratic institutions may affect behavior directly in addition to having effects through the choice of policies. Our findings have implications for the generalizability of the results of randomized policy interventions.

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1. Introduction

The study of institutions is key to our understanding of the determinants of economic performance (see North 1981, La Porta et al. 1998, Acemoglu, Johnson and Robinson 2001, and Easterly and Levine 2003 among others). In this paper we study how democratic institutions affect behavior. The central idea is that in addition to affecting the choice of policies, democratic institutions may affect behavior directly. We argue and provide experimental evidence that the same policy may have different effects depending on whether it was democratically selected or not, even after controlling for differences in the types of individuals who choose such a policy.

While the idea that democracy may influence the effect of policies can be traced to Tocqueville (1838),[1] our contribution consists of identifying this effect of democracy. We present results from a series of experiments designed to determine whether a policy that was exogenously imposed has the same effect as the same policy when it is democratically (that is, endogenously) chosen. In these experiments, subjects participate in several prisoners' dilemma games and may choose, by simple majority, to establish a policy that could encourage cooperation. This policy consists of a fine on unilateral defection, which transforms the game into a coordination game in which both mutual defection and mutual cooperation are Nash equilibria. In some cases the experimental software randomly overrides the votes of the subjects and randomly imposes, or not, the policy. Before proceeding to play again with either the original or the modified payoffs, the subjects are informed of whether payoffs are modified and whether it was decided by

[1] "It is not always feasible to consult the whole people, either directly or indirectly, in the formation of the law; but it cannot be denied that, when such a measure is possible, the authority of the law is much augmented. This popular origin, which impairs the excellence and wisdom of legislation, contributes prodigiously to increase its power." Tocqueville (1838), pag. 228. On other theories stating that political participation is intrinsically beneficial see Pateman (1970), Thompson (1970), and Finkel (1985).

their vote or by the computer. This setup allows us to compare the behavior of individuals and groups that voted in the same way and were presented with the same game (coordination versus prisoner's dilemma) but differed by whether the game was chosen endogenously (democratically chosen by the subjects) or exogenously (randomly chosen by the computer). By conditioning on the subjects' vote, we control for the fact that those that voted for the policy may differ in important ways from those who did not (for example, subjects that choose the policy may be more likely to value cooperative behavior and cooperate after the policy is implemented). As we condition on the subjects' vote, any remaining effect associated with endogenous choice of the policy cannot be due to differences between those that voted for the policy and those that did not. That is, the difference cannot be attributed to selection.

Even after controlling for selection, the results show that the effect of the policy (i.e., the fine) on the percentage of cooperative actions is significantly greater when it is democratically chosen by the subjects (endogenous) than when it is imposed by the computer (exogenous). We find that the effect of the fine on cooperation is 40% larger if it is imposed democratically. Our results suggest that the treatment effect of a policy (that is, its causal impact on behavior) depends on whether it is democratically chosen or not. This implies that the same policy may have different effects depending on whether it was democratically selected or autocratically imposed, even controlling for selection.

The observed difference in experimental outcomes between exogenous and endogenous policies is consistent with evidence from field settings. Bardhan (2000) finds that farmers are less likely to violate irrigation rules when they themselves have crafted those rules. Frey (1998) finds that Swiss cantons with greater democratic participation

face lower tax evasion. A literature on worker participation in workplace decisions finds that such participation positively affects productivity provided that some of the material gains also accrue to the workers (see Levine and Tyson 1990, and Bonin, Jones and Putterman 1993). While these findings from the field suggest that democratic institutions may affect cooperative behavior, they can also be explained by unobservable characteristics of the actors that affect both the degree of democratic decision making and individual behavior. In contrast, our experimental design allows us to control for potential unobservable characteristics that could be related to democratic decision making by randomizing the existence of democratic institutions. An emergent literature in development economics on the effects of local democracy (e.g., Foster and Rosenzweig 2005, and Besley, Pande and Rao 2005) has also paid attention to plausibly exogenous sources of variation in democracy but has largely ignored the possible direct effects of democratic institutions.[2]

There are extensive literatures considering the role of rewards and punishments in games[3] and exploring the effect of voting on the availability of rewards and punishments in voluntary contribution games.[4] This second literature studies the *total* effect of democratically allowing for rewards and punishments. For example, Sutter, Haigner and Kocher (2005) find that rewards and punishments are more effective when they are allowed democratically, and call this a "democratic participation rights premium."

[2] Our results are also related to the social psychology literature on procedural justice (see for example Thibaut and Walker 1975 and Lind and Tyler 1988). This literature has shown that subjects' evaluation of a given outcome may depend on the fairness of the procedures that have led to that outcome. An important element studied in this literature is whether subjects have an opportunity to express their opinions during the procedure (on "voice" see Folger 1977 and van den Bos 1999). For the related idea in economics of procedural utility see Frey, Benz and Stutzer (2004). For a discussion of the effects of institutions on behavior that combines economics and psychology see Bohnet (2006).

[3] See e.g. Fehr and Gächter (2000), Falkinger et al. (2000), and Andreoni, Harbaugh and Vesterlund (2003).

[4] See e.g., Botelho, et al. (2005), Ertan, Page and Putterman (2005), and Sutter, Haigner and Kocher (2005).

However, their results could be due to unobservable characteristics affecting both how groups vote and their response to rewards and punishments.

In contrast, our experimental design allows us to control for potential unobservable characteristics by comparing groups and individuals that were both exogenously formed and voted in the same way. This allows us to separate the total effect of an endogenous policy into a selection effect (due to differences across groups that vote differently) and a treatment effect (the real causal effect) and to study how the treatment effect varies depending on whether the policy was democratically chosen or exogenously imposed. We find that the total effect of an endogenous change of payoffs can be decomposed into 8% selection effect and 92% endogenous treatment effect. In addition, we find that the endogenous treatment effect is 40% greater than the exogenous treatment effect.

More generally, there are a number of papers comparing behavior in a given game when it was exogenously given and when it was chosen by the subjects.[5] While differences in behavior are sometimes considered evidence of selection, in other cases they are considered evidence that endogeneity affects behavior. Our main methodological contribution is to separate the total effect of endogeneity into a selection effect and an endogeneity premium.

Finally, there is also an extensive experimental literature on the issue of cooperation and its determinants (see Kagel and Roth 1995 for a survey of the literature), and a growing experimental literature that studies the determinants of voting turnout and

[5] See for example Van Huyck, Battalio and Beil (1993), Bohnet and Kübler (2005), Potters, Sefton and Vesterlund (2005), Charness, Fréchette and Qin (2006) and Lazear, Malmendier and Weber (2006).

the effects of different voting rules on information aggregation and efficiency.[6] Palfrey (2005) provides a useful survey of the experimental literature on political economy in general.

Our findings have two main implications. The first is that democratic institutions may affect not only the types of policies adopted but also the impact of a given policy, so that a policy democratically selected will not have the same effect when imposed undemocratically. The second implication relates to the study of treatment effects more generally. Much applied work in economics seeks to identify the treatment effect of policies, institutions, or products. Since people usually choose their policies, institutions and products, it is necessary to account for selection into treatment to measure the "true" treatment effect (i.e. one that does not reflect selection). Based on such estimates, policy recommendations may be made to assign the treatment without choice (that is, exogenously). Our experimental results suggest that such policy recommendations may be unwarranted given that the treatment effect may differ based on whether it is exogenously or endogenously determined, even after controlling for selection.

2. Experimental Design

In each experimental session, subjects participate anonymously through computers.[7] The subjects are randomly divided into groups of four for the entire session. Groups consist of four subjects so as to maximize the probability of a tie in the voting stage that is described below. Each session consist of two parts. In part 1, subjects play

[6] See Schram and Sonnemans (1996), Morton and Williams (1999), Hung and Plott (2001), Goeree and Holt (2005), Großer and Schram (2006), Casella, Gelman and Palfrey (2006), Levine and Palfrey (2007), and Battaglini, Morton and Palfrey (2006) among others.
[7] We adapted the Multistage software by SSEL-Caltech/CASSEL-UCLA.

10 rounds of the prisoner's dilemma game in Table 1 (Initial Payoffs).[8] The exchange rate is 50 points for one dollar. After each round each subject is randomly matched with another subject in his or her group for the next round. In part 2 of the experiment the subjects play 10 rounds as in part 1 but the payoffs can be modified at the beginning of this part to the payoffs in Table 1 (Modified Payoffs). The modification of payoffs consists of imposing a tax or fine on unilateral defection. While under the initial payoffs the unique Nash equilibrium is mutual defection, under the modified payoffs both mutual defection and mutual cooperation are Nash equilibria.

Table 1: Stage Game Payoffs (in points)

Initial Payoffs

Own action	Other's action: C	Other's action: D
C	50	10
D	60	40

Modified Payoffs

Own action	Other's action: C	Other's action: D
C	50	10
D	48	40

We chose a prisoners' dilemma game as the initial game as the tension between personal incentives and efficiency is not only an important feature of human interaction but also a feature that groups attempt to solve by imposing different kinds of policies. We chose a prisoners' dilemma game over other kind of social dilemma games (i.e. public good games) as the former is simpler which allows a simple explanation of the policy. The modified game was chosen to be a coordination game as it is intuitive to think that

[8] For neutrality, the actions C and D are denoted as 1 and 2 in the experimental sessions.

the incentive to follow policies and regulations may depend on the behavior of others and may result in a multiplicity of equilibria.

Whether the payoffs are modified in the policy selection stage is determined as follows. First, subjects vote on whether to modify payoffs. Second, the computer randomly chooses whether to consider the votes in each group. If the computer considers the votes, then the majority wins and in case of a tie the computer breaks the tie. If the computer does not consider the votes in a group, it randomly chooses whether to modify payoffs or not in that group. The voting stage is summarized in Figure 1. The subjects' computer screens inform them whether the computer randomly chose to consider the votes and whether payoffs were modified. The subjects do not learn the exact distribution of votes, including whether the computer needed to break a tie.[9] We denote the four possible outcomes of the voting stage as **EndoMod**, **EndoNot**, **ExoMod** and **ExoNot**, where Endo denotes that the votes of the group were considered, Exo denotes that the computer overrode the group and Mod denotes that payoffs were modified versus Not. After the voting stage, the subjects play 10 more rounds with other subjects in their group, with the payoff matrix depending on the results from the policy selection stage.

After the ten rounds in part 2, the subjects answer a series of questions that allow us to assess the subjects' understanding of the experimental design and their reasoning in the voting stage and after. In addition we ask them for personal characteristics such as:

[9] Since subjects know whether the group voted for modification or not when the votes are considered while that is not the case when votes are not considered, some of the effect of democracy that we will be measuring may well stem from the institution's informational effect. In our view, this is one of the effects of voting institutions in many settings, not something extraneous to democracy that we "confound" with it. Nevertheless, as will be discussed in the conclusion, it is also of interest to distinguish informational from other effects of democracy, as we plan to do in future research.

academic major, class, math and verbal SAT scores,[10] political philosophy. These questions allow us to study how personal characteristics affect the voting decisions and the impact of the policy. Finally, the subjects participate in a "beauty contest" game in order to gauge their strategic sophistication.[11]

We present next a short theoretical analysis of the game subjects play in this experiment. First, note that under the initial payoffs (prisoner's dilemma game) there is a unique Nash equilibrium in the stage game which is inefficient: both players play D. Second, under the modified payoffs (coordination game) there are two Nash equilibria in pure strategies, an efficient and an inefficient one: CC and DD, respectively. Since in the experiment there are a finite number of repetitions and in addition subjects are randomly re-matched after each round we expect that predictions from the one-shot games are valid also for the finite repetition (see Duffy and Ochs 2003).

How should subjects vote? While modified payoffs allow subjects to cooperate in equilibrium, mutual defection remains an equilibrium outcome. As such, if subjects expect to coordinate in mutual defection under modified payoffs, they have no incentive to vote for modification. Sub-game perfection does not provide a prediction regarding vote behavior. The optimal vote depends on subjects' expectation of others' behavior under the modified payoffs game. Subjects that expect to achieve mutual cooperation under modified payoffs should vote for modification. In contrast, subjects that expect no

[10] We believe that the self reported SAT scores can be trusted since Palacios Huerta (2003) found no misreporting of SAT scores among Brown undergraduates in a previous experiment.

[11] Each subject chose a number between zero and one hundred and the subject with the closest number to two thirds of the average of all numbers in the group earns 100 points. The unique Nash equilibrium of this game is to choose zero. See Bosch-Domènech, et al. (2002) and references therein for a detailed description of beauty contest games and the role of levels of strategic reasoning to explain behavior in these games.

change in behavior under modified payoffs have little incentive to vote for modification.[12]

Will subjects coordinate on the efficient outcome (CC) under modified payoffs? Under the modified payoffs the efficient outcome is an equilibrium outcome. However, previous experimental literature has shown the difficulty of coordinating on the efficient equilibrium in coordination games.[13] But if prior behavior affects behavior in the current game, having the subjects choose to modify payoffs may affect the equilibrium selection process in the resulting coordination game. [14] Knowing that the coordination game was chosen by the group may increase the probability that the efficient equilibrium becomes focal.

3. Strategies to identify the effect of democracy

To estimate the impact of democracy we cannot simply compare cooperation rates across the four vote stage results (EndoMod, ExoMod, etc.). This is the case even when both the formation of groups and consideration of the votes were random. The reason is that while groups were randomly formed they are not necessarily identical. Groups with

[12] Off equilibrium reasoning can justify voting for modification even for a defector. The reason is that if modification results in an increase in cooperation, a defector may obtain a higher profit. As such, voting for modification may be part of a "bait" strategy.

[13] For example Cooper et al. (1990) and Van Huyck et al. (1990), among others, have shown that in experimental coordination games subject may coordinate on the "safer" equilibrium over the efficient one. In our experiment, cooperation is optimal for a subject only if the partner cooperates with a probability higher than 30/32. Mutual cooperation is not very robust to uncertainty over others' behavior. For this reason, we may observe that subjects coordinate on mutual defection under modified payoffs.

[14] See the literature on forward induction (Kohlberg and Mertens 1986, and van Damme 1989) and related experimental literature (Cooper et al. 1992, Van Huyck, Battalio and Beil 1993, and Cachon and Camerer 1996). Note however that forward induction, as defined by van Damme (1989), has no bite in the game we analyze. Intuitively, the modification of payoffs does not affect the payoff from mutual defection (the unique equilibrium outcome under the initial payoffs) and, hence, voting for modification is not inconsistent with planning to defect. Moreover, it can be shown that the elimination of weakly dominated strategies does not eliminate the equilibrium in which subjects vote for modified payoffs and then defect even if payoffs are modified.

endogenous modification may be different from groups with exogenous modification: subjects in the former may have preferences for cooperative behavior that affect both cooperation and the decision to modify payoffs. In the presence of this type of selection, comparisons of cooperation levels between subjects in groups with endogenous and exogenous modifications can be misleading.

To make this point explicit, and develop an appropriate identification strategy, we develop a simple formal framework. In particular, we consider a simplified game in which individuals are matched in groups, they vote, they learn the mechanism used to select payoffs (votes or randomly by the computer), they learn the payoffs (initial or modified), and then they play the stage game.[15] An individual *i*'s action in the stage game depends on the information available to him at that time. This information includes the mechanism that selected payoffs $M \in \{Endo, Exo\}$ (votes or randomly by the computer), the payoffs chosen $P \in \{Mod, Not\}$ (modified and non-modified), his vote $v_i \in \{Y, N\}$, and his type μ_i. Thus we may write the probability that subject *i* cooperates as

(1) $C_i(M, P, v_i, \mu_i)$.

The type μ_i includes any personal characteristic that is unobserved to the researcher but that may be correlated with both the subject's probability of cooperation and his or her voting decisions. For example, the subject may have preferences for cooperative behavior that affect both cooperation and the decision to modify payoffs.[16] In addition, subjects may differ in their expectations of how often a modification of payoffs would result in

[15] In particular we abstract from the fact that players may have learned something about people in their group from the pre-vote rounds. This creates a potential inference problem, which we discuss below.
[16] On social preferences see Charness and Rabin (2002), Fehr and Fischbacher (2002), and Camerer and Fehr (2004) among others.

mutual cooperation and hence may have different propensities to vote for modification and to cooperate after a modification.

In this framework, an individual's vote can only depend on his type, as he is randomly matched with the others and does not know either their type or how they will vote

(2) $v_i = v(\mu_i)$.

Further, (2) may be substituted into (1) to give, abusing notation,

(3) $C_i(M, P, \mu_i)$.

To test for differences in outcomes between endogenous and exogenous modifications, we test whether, given the payoff structure P (*Mod* or *Not*), actions differ by mechanism M (Endo versus Exo). Consider, then the expected difference in behavior by selection mechanism given a payoff structure P:

(4) $$E(C_i|Endo,P) - E(C_i|Exo,P) = \int [C_i(Endo,P,\mu_i) f(\mu_i|Endo,P) - C_i(Exo,P,\mu_i) f(\mu_i|Exo,P)] d\mu_i$$

where $f(\mu_i|M,P)$ is the conditional density of the type given the selection mechanism and the payoff matrix. Note further that P is informative about μ when payoffs are determined by voting but not when payoffs are determined by the computer and thus

(5) $f(\mu_i) = f(\mu_i|Exo,P) \neq f(\mu_i|Endo,P)$.

Thus the difference (4) may be non-zero even if there are no differences in behavior by mechanism: $C_i(Exo,P,\mu_i) = C_i(Endo,P,\mu_i)$.

Similarly, to estimate differences that arise between exogenous and endogenous modification (i.e. whether there exists an endogeneity premium) we cannot simply compare cooperation averages:

$$\left[E\left(C_i \middle| Endo, Mod\right) - E\left(C_i \middle| Endo, Not\right)\right] - \left[E\left(C_i \middle| Exo, Mod\right) - E\left(C_i \middle| Exo, Not\right)\right].$$

We employ two strategies to solve this identification problem.

First, we use individual-level data and condition on both the payoff structure P and the individual vote v_i. This approach works because $f\left(\mu_i \middle| Endo, P, v_i\right) = f\left(\mu_i \middle| Exo, P, v_i\right) = f\left(\mu_i \middle| P, v_i\right)$: once one knows how somebody votes, the payoffs are no longer informative about type under either computer or voter regimes. Thus,

$$\begin{aligned} &E\left(C_i \middle| Endo, P, v_i\right) - E\left(C_i \middle| Exo, P, v_i\right) = \\ &\int \left[C_i\left(Endo, P, v_i, \mu_i\right) - C_i\left(Exo, P, v_i, \mu_i\right)\right] f\left(\mu_i \middle| P, v_i\right) d\mu_i \end{aligned} \tag{6}$$

can only be non-zero if, for some positive measure set of types, behavior differs by mechanism (*Endo* versus *Exo*).[17] Our experimental design yields the data necessary to make this comparison.

Second, we use group-level data and groups for which the vote is tied. Note that for these groups all four voting stage outcomes are possible. Moreover, as these groups voted in the same fashion, they should be similar in their personal characteristics. Their outcomes in the voting stage differed only due to random luck. Thus, the densities in (5)

[17] The key condition here is that the votes of the other players are not correlated with a player's type or with his vote. This is true given random assignment as long as individuals have no information about each other at the time of voting—something ruled out in our simplified framework but possible in the actual experiment because of the pre-vote rounds played by participants. We have shown using the same analytic methods that this problem can be addressed by conditioning on individual histories of play in the pre-vote rounds. Our analysis shows that, first, votes are statistically independent across members of each group and, second, our estimates are not affected by controlling for individual histories.

are equal: $f(\mu_i|Exo,P)=f(\mu_i|Endo,P)$. As a result we can compare $E(C_i|Endo,P)-E(C_i|Exo,P)$ for these groups to uncover the effect of democracy. However, identifying the effects of democracy by focusing on these groups is done at a considerable loss of data as we can only use the small subset of the observations with a tied vote for this analysis.

4. Experimental Results

We conducted 18 experimental sessions from May to November 2006 in a computer lab at Brown University. A total of 276 subjects participated in the experiment, with an average of 15 subjects per session. The subjects were Brown University undergraduates recruited through advertisement in university web pages and signs posted on campus. Table 2 displays the characteristics of subjects. A high number of subjects correctly answered the questions regarding the experiment. For example, more than 90% of the subjects remembered correctly the result from the voting stage. The subjects earned an average of $24.57, with a maximum of $29.40 and a minimum of $17.60. Given that sessions lasted on average little more than half an hour, the earnings represent a significant hourly rate.

The average level of cooperation was 18% in the first part of the experiment. The level of cooperation was decreasing with experience, with a maximum of 31.9% in round 1 and a minimum of 6.9% in round 10 (the last round of part 1). Both the level and evolution of cooperation in this experiment are similar to those on other experiments on prisoner's dilemma games (see for example Cooper et al. 1996, Bereby-Meyer and Roth

2006, Dal Bó 2005, and Aoyagi and Fréchette 2003); they also resemble those in the voluntary contributions mechanism literature (Ledyard 1995).

4.1. Results from the voting stage

Of the 276 subjects, 147 (53.26%) voted to modify payoffs and 129 (46.74%) voted not to modify payoffs in the second part of the experiment. Voting for modification (**votemod**) is positively and significantly correlated with the math SAT scores and negatively and significantly correlated with the number provided in the "beauty contest" game – see Table 3. This suggests that both cognitive ability and strategic sophistication are related to voting for modification of payoffs. Voting also seems to depend on the subjects' experience in the first part of the experiment. Subjects that cooperated more and those that faced little cooperation are more likely to vote for modification. Surprisingly, neither the class, the political philosophy nor the major are correlated with the voting decisions.

The fact that a large proportion of subjects (46%) voted to remain in a prisoner's dilemma game is of interest and has implications for the large political economy literature on inefficient polices and delayed reforms.[18] This experiment shows that subjects will not necessarily vote for reforms that may make efficient behavior incentive compatible.

We define the variable **voteshare** as the number of votes in favor of modification of payoffs in a group. This variable ranges from 0 to 4. The mode of the distribution of

[18] See Coate and Morris (1995), and Dixit and Londregan (1995) on inefficient redistribution, and Fernandez and Rodrik (1991) and Alesina and Drazen (1991) on reform delays.

this variable is 2. There is evidence that voting decisions are independent within groups. Figure 2 shows the observed cumulative distribution function of voteshare (solid line) and the distribution that would arise if subjects decide their votes independently of each other (binomial, depicted as a dashed line). As Figure 2 shows there is little difference between the two distributions. In fact the difference is not statistically significant (p-value=0.32).[19] A random-effects analysis of voting does not reject that there are no random-effects at the group level suggesting that voting decisions are independent within groups (p-value=0.368).

4.2. Exogenous versus endogenous treatment effect: individual level analysis

As discussed earlier, the difficulty identifying the effect of democracy is that the subjects in groups with endogenous modification may be different from those in groups with exogenous modification. In this section we solve this problem by conditioning on the voting behavior of the subject. Once we control for a subject's vote, whether he or she is under endogenous or exogenous modification is uncorrelated with any unobserved personal characteristic. Thus, greater cooperation under endogenous versus exogenous modification is evidence that democracy affects behavior.

In the analysis of the experimental data we initially focus on the behavior in round 11 (the first round of part 2), because after round 11 the impact of the payoff modification on cooperation is not independent across subjects given that the actions of one player will affect the actions of the other players. Panel A in Table 4 shows the

[19] Since the theoretical distribution is not continuous we do not use the usual Kolmogorov-Smirnov test but a modification proposed by Pettitt and Stephens (1977). The p-value is calculated by Monte Carlo simulation under the null that voteshare follows a binomial distribution with probability of success equal to the observed one (0.5326).

number of observations (subjects) by vote stage result and vote. The minimum number of observations in a cell is 17 and the maximum is 55.

There is little difference in the cooperation rates in round 10 (the last round of part 1) by vote stage results (see panel B of Table 4). In fact, there are no statistical differences in cooperation (p-value 0.87).[20] Therefore, before the voting stage subjects are statistically identical in terms of their levels of cooperation.

Panel C in Table 4 shows the percentage of cooperation at the beginning of part 2 (round 11) by voting stage result and individual vote. Aggregating over the votes of the individuals, we observe that subjects under endogenous modification cooperated more than subjects under exogenous modification: 72% against 50%. This difference is statistically significant at the 1% level (p-value 0.003 – see Table 5, column 1). However, as discussed before, this difference is not an unbiased estimate of the effect of democracy. First, groups with endogenous modification have a larger share of subjects that voted for modification than groups with exogenous modification (see Table 4, panel A). Second, subjects who voted for modification are more likely to cooperate under modification than those who did not vote for modification (see Table 4, panel C). This may imply that another factor affects both the vote of the individual (which affects the voting stage result of his group) and his behavior in part 2, thereby biasing our estimates. However, as discussed previously, we can obtain an unbiased estimate by controlling for how the individuals voted.

Among individuals who voted for modification, those who experienced an endogenous modification of payoffs (EndoMod) had levels of cooperation of 82% while

[20] The p-values in this section correspond to Wald tests. The results are robust to performing Wilcoxon-Mann-Whitney tests when applicable.

those who experienced an exogenous modification of payoffs (ExoMod) only had 58%. This difference is statistically significant at the 1% level (p-value 0.009 – Table 5, column 2). In addition, for players that voted for modification, there is no significant difference in cooperation under the original payoffs depending on whether votes were considered or not (24% versus 23.53%). These results are robust to controlling for own and observed behavior before the vote stage and eliminating subjects who did not remember the result of the voting stage.

In conclusion, for subjects that voted for modification, we find that democracy does not affect behavior under initial payoffs but it does have a significant effect under modified payoffs. As a result, the effect of modifying payoffs is greater when the modification is endogenous than when it is exogenous: 57.82% versus 34.05% respectively.

Among individuals who did not vote for modification, cooperation levels do not depend on the way that payoffs were chosen. In round 11, cooperation is 41.18% under endogenous modification and 41.94% under exogenous modification (p-value 0.95).

The effect of democracy can also be seen in Figure 3. Figure 3 shows the percentage of cooperation by vote stage result, round and individual vote. It is interesting to note that cooperation generally increases in round 11 for most vote stage results. Part of this increase is presumably reflective of the well-known re-start effect in prisoner's dilemma games (see Andreoni and Miller 1993). This jump tends to be larger for subjects that voted for modification, when payoffs are modified, and even larger when they are modified endogenously.

Interestingly, as Figure 3 shows, the difference in cooperation rates between individuals under endogenous modification (EndoMod) and exogenous modification (ExoMod) is not limited to round 11. However, after round 11 differences in cooperation between EndoMod and ExoMod cannot be fully attributed to the effect of democracy. This is because subjects under endogenous modification are more likely to meet a partner that voted for modification (and more likely to cooperate) than a subject under exogenous modification, and this can influence behavior in later rounds. To estimate the effect of democracy in later rounds it is necessary to control for the votes of partners that subjects meet in the second part of the experiment. In addition, we need to consider the fact that the behavior of a subject is not independent across rounds. A method for doing so is developed and described in detail in the appendix. As there is little difference in behavior between exogenous and endogenous initial payoffs, we focus on the effect of democracy under modification for the rest of the section.

Table 6 presents the estimates of the effect of democracy under modified payoffs for all rounds after the voting stage. For subjects who voted for modification, the effect is the largest in round 14 when the effect reaches 32% and it is the lowest in round 13 when it is 20%. The effect is significant at least at the 10% level in all ten rounds after the voting stage, and significant at the 5% level in seven of the rounds. It cannot be rejected that all effects are the same and that it is the same in rounds 11 and 20, both at the 10% significance level. Therefore, for subjects that voted for modification, democracy has a stable, large and statistically significant effect on cooperative behavior.

For subjects who did not vote to modify payoffs, Table 6 shows an interesting pattern in the evolution of the effect of democracy across rounds. While the effect is

negligible in round 11 it reaches a statistically significant level (31%) in round 13. The effect of democracy remains significant until round 16. This effect for subjects who did not vote to modify payoffs is due in part to their meeting subjects who voted to modify payoffs and being affected by their higher rate of cooperation under democracy. However, after round 16, the effect disappears for subjects who did not vote to modify payoffs.

Finally, the responses of subject to the question at the end of the experiment on whether the voting stage had affected their behavior are consistent with their observed behavior. Subjects who voted for modification are significantly more likely to say that the voting stage modified their behavior under endogenous modification than under exogenous modification (p-value less than 0.01). In addition, a significant share of subjects that voted for modification mention whether votes were considered or not in explaining their behavior after the voting stage.

In conclusion, the experimental results show that there is an effect of democratic institutions in addition to the instrumental effect through policy choice.

4.3. Decomposing the total effect of an endogenous modification

The individual level analysis allows us to separate the total effect of an endogenous modification of payoffs into a selection effect and an endogenous treatment effect. We can further separate this endogenous treatment effect into an exogenous treatment effect and an endogeneity premium (the part of the endogenous treatment effect that cannot be explained by the exogenous treatment effect). For simplicity we will focus on round 11 behavior to provide this decomposition of effects.

Total effect:

From the totals in the first two columns in panel C of Table 4 we calculate the effect of the policy under democracy (EndoMod versus EndoNot) and find that the total effect of an endogenous modification on cooperation is 55%. Note that the totals of these columns can be calculated as weighted averages of the cooperation rates by type of vote if we use as weights the proportion of subjects that voted for and against modification. If we denote as $f(v|P,M)$ the proportion of subjects that voted for $v \in \{Y,N\}$ given the payoff structure $P \in \{Mod, Not\}$ and the mechanism $M \in \{Endo, Exo\}$ and we denote as $C(v|P,M)$ the proportion of cooperation for subjects that voted for *v* given the payoff structure and mechanism, the total effect is:

$$TE = \sum_{v \in \{Y,N\}} f(v|Endo,Mod)C(v|Endo,Mod) - f(v|Endo,Not)C(v|Endo,Not).$$ [21]

Selection effect:

The selection effect captures the changes in cooperation that arise not from the change in treatment but from the change in the proportion of types of subjects. Thus, the selection effect can be measured as:

$$SE = \sum_{v \in \{Y,N\}} \left(f(v|Endo,Mod) - f(v|Endo,Not)\right)C(v|Endo,Not).$$

From Table 4 we calculate the selection effect as a 4% increase in the cooperation rate.[22]

[21] The total effect can be calculated from Table 4 as follows: TE=((17/72)41.18+(55/72)81.82)-((55/80)14.55+(25/80)24)=54.72.

[22] SE=(17/72-55/80)14.55+(55/72-25/80)24=4.27.

Endogenous treatment effect:

The endogenous treatment effect corresponds to changes in cooperation due to an endogenous change in the payoff matrix and not due to changes in the proportion of the different types of voters. In addition the endogenous treatment effect must be equal to the difference between the total effect and the selection effect. Thus, the endogenous treatment effect is:

$$EndoTrE = \sum_{v\in\{Y,N\}} f\left(v|Endo,Mod\right)\left(C\left(v|Endo,Mod\right)-C\left(v|Endo,Not\right)\right).$$

From Table 4 we calculate the endogenous treatment effect as 50%.[23]

Exogenous treatment effect:

The exogenous treatment effect corresponds to the change in cooperation due to an exogenous modification of payoffs. As such we must leave the proportion of the different types of voters constant but change the behavior due to exogenous modification. Moreover, the proportion of the different types of voters must be consistent with the ones used to calculate the endogenous treatment effect. Thus, we can calculate the exogenous treatment effect as:

$$ExoTrE = \sum_{v\in\{Y,N\}} f\left(v|Endo,Mod\right)\left(C\left(v|Exo,Mod\right)-C\left(v|Exo,Not\right)\right).$$

From Table 4 we calculate the exogenous treatment effect as 36%.[24]

[23] EndoTrE=(17/72)(41.18-14.55)+(55/72)(81.82-24)=50.45.
[24] ExoTrE=(17/72)(41.94-3.85)+(55/72)(57.58-23.53)=36.

Endogeneity premium:

Having calculated the endogenous and exogenous treatment effects, we can calculate the endogeneity premium. The difference between the endogenous treatment effect (50%) and exogenous treatment effect (36%) constitutes the endogeneity premium: 14%.

Decomposition:

The total effect from endogenous modification of payoffs can be separated in three components: the selection effect, the exogenous treatment effect, and the endogeneity premium. Our estimates show that in this case the selection effect explains 8% of the change in behavior, the exogenous treatment explains 66% and the endogeneity premium explains 26%. The difference between exogenous and endogenous treatment effects is large: the endogeneity premium is more than three times the size of the selection effect and more than 40% of the exogenous treatment effect. These results suggest that, even after controlling for selection, when studying the impact of institutions or policies on behavior it is important to distinguish whether they are endogenous or exogenous.

4.4. Exogenous versus endogenous treatment effect: group level analysis

In this section we consider the group as the unit of analysis and we focus on groups with even split votes since they allow us to estimate the difference between exogenous and endogenous modification controlling for underlying characteristics of the

groups since they are essentially the same. The evidence we present is consistent with the idea that the effect of the payoff modifications depends on whether the modification was endogenous or exogenous to the group. However, the result is not conclusive due to the statistical power of the analysis (by looking at evenly split groups we loose 46 of the 69 groups – see Table 7).

Table 8 shows the level of cooperation by the result of the voting stage and the vote share of the groups. There is little difference in the cooperation rates of groups with vote share 2 in part 1 (see panel A of Table 8). In fact, there are no statistical differences in cooperation (p-value 0.47). [25] If anything, the groups with exogenous modification (ExoMod) cooperated more in the first part of the experiment than those with endogenous modification (EndoMod) but this difference is not statistically significant (p-value 0.24). Therefore, before the voting stage all groups were basically identical in terms of cooperation levels.

Focusing on groups with evenly split votes (voteshare=2), we observe that the cooperation levels after the voting stage under the initial payoffs are very similar between groups whose votes were considered (EndoNot) and those that were not (ExoNot): 8.44% and 9.38% respectively (panel B of Table 8). As democracy has no effect under initial payoffs, we can focus on the difference between endogenous and exogenous modification (EndoMod versus ExoMod) to calculate the difference in treatment effects. We find that groups with endogenous modification (EndoMod) had 51.67% cooperation after voting against 43.50% for the groups with exogenous modification (ExoMod). The statistical

[25] For all the statistical tests in this section we only consider one observation per group. In this case the observation is the average cooperation rate in the group in the first ten rounds of the experiment. The p-values correspond to Wald tests. The results are robust to performing Wilcoxon-Mann-Whitney tests when applicable.

significance of these differences is provided in Table 9. The difference of 8% in favor of endogenous modification (EndoMod) versus exogenous modification (ExoMod) is not always statistically significant. It is significant at the 10% level if we eliminate from the analysis groups with subjects that did not remember the vote stage result. Finally, the payoff modification has a large effect on cooperation rates: a 43% and 34% increase for endogenous and exogenous modification. While this increase is always significant for endogenous modification (p-values less than 0.002, see Table 9) it is not significant for exogenous modification under all specifications.

To study the effect of democracy under modified payoffs (EndoMod versus ExoMod) we can also focus on the small number of groups with voteshare 3.[26] As shown in Table 8, of groups with voteshare 3, those under endogenous modification reach higher cooperation rates than those with exogenous modification (48% versus 32.5%). However, this difference is not statistically significant. Similarly, to study the effect of democracy under initial payoffs (EndoNot versus ExoNot) we can also focus on the small number of groups with voteshare 1. Consistent with previous results, Table 8 shows that there are no differences in cooperation between endogenous and exogenous initial payoffs for groups with voteshare 1 (11.67% versus 12.5%).

In sum, the results based on group-level analysis are consistent with the results from the individual-level analysis, but, due to small samples sizes, are not always statistically significant.

[26] However these groups do not allow us to study the differences in treatment effects as it is not possible to have observations for endogenous initial payoffs (EndoNot).

5. Conclusions

Previous literature has suggested that democratic institutions might have an effect on individual behavior in addition to their instrumental effect through policy choice. However, it has been empirically difficult to provide strong evidence for such an effect due to the possible endogeneity of democratic institutions and policies. Using data from a novel experiment design that overcomes these identification hurdles, we show that the effect of a given policy on behavior depends on whether it was democratically chosen or not. This experimental result supports the idea that democracy may have an effect on behavior in addition to its effect through the choice of policies. More generally, our results show that a treatment effect may depend on whether the treatment is endogenous or exogenous. The greater increase in cooperation that we observe for endogenous modification of payoffs relative to exogenous modification, once we control for selection, is what we refer to as the "endogeneity premium."

Understanding the forces that generate this "endogeneity premium" in our experiments remains for future work. One hypothesis is that an endogenous modification affects behavior because it reveals to the subjects that their partner is more likely to have voted for modification, affecting the subjects' beliefs about the partner's future behavior, and thus affecting their own behavior. A second hypothesis is that it is the endogeneity itself which affects behavior. Knowing that the policy was imposed by the decision of the group may directly affect subjects' behavior. For example, endogenous modification may strengthen the establishment of a cooperative social norm. Future experimental work will help us distinguish between these hypotheses and provide an explanation for the

difference between endogenous and exogenous treatment effects in our social dilemma experiments.

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Appendix: Estimation of democracy effects using individual data after round 11.

In this appendix we describe in detail the methodology used to estimate the effect of democracy in all rounds after the voting stage discussed in section 4.2. We focus on the effect of democracy under modified payoffs. The methodology we present here allows us to estimate the effect of democracy on behavior after "controlling" for the fact that subjects under endogenous modification are more likely to meet subjects that voted for modification than subjects under exogenous modification are. In addition, this methodology considers the fact that a subject's behavior may be correlated with her previous behavior and be affected by the behavior of previous partners.

Consider the following model of behavior after the voting stage:

$$
\begin{aligned}
& y_{1i} = x_i\beta_1 + u_{1i} \\
& y_{2i} = x_i\beta_2 + \rho_{21}u_{1i} + \varphi_{21}y_{1,-i} + u_{2i} \\
& y_{3i} = x_i\beta_3 + \rho_{31}u_{1i} + \rho_{32}u_{2i} + \varphi_{31}y_{1,-i} + \varphi_{32}y_{2,-i} + u_{3i} \\
& \ldots \\
& y_{ri} = x_i\beta_r + \sum_{s=1}^{r-1}\rho_{rs}u_{si} + \sum_{s=1}^{r-1}\varphi_{rs}y_{s,-i} + u_{ri}
\end{aligned}
\qquad \text{(A1)}
$$

where r denotes the round number in part 2 (for simplicity we start counting from 1), i denotes the subject and $-i$ denotes previous partner of i. The variable y_{ri} denotes cooperation in round r by subject i, $y_{r,-i}$ denotes cooperation in round r by subject i's partner in that round, and x_i is a vector of indicator variables for the four combinations of individual vote (yes or no) and whether votes where considered (Endo or Exo). The errors u_{ri} are assumed to follow these properties: $E(u_{ri}) = 0$, $E(u_{ri}u_{sj}) = 0$, and $E(u_{ri}x_j) = 0$ for any rounds r or s and subjects i or j. Note that (A1) is a linear

approximations to decision rules and that our inference will be valid to the extent that this linear approximation is reasonable.

To estimate the parameters in (A1) we start by estimating the system in (A2) which differs from (A1) in that we include the previous behavior of the subject as a control instead of previous errors:

$$
\begin{aligned}
& y_{1i} = x_i b_1 + \varepsilon_{1i} \\
& y_{2i} = x_i b_2 + r_{21} y_{1i} + f_{21} y_{1,-i} + \varepsilon_{2i} \\
& y_{3i} = x_i b_3 + r_{31} y_{1i} + r_{32} y_{2i} + f_{31} y_{1,-i} + f_{32} y_{2,-i} + \varepsilon_{3i} \\
& \ldots \\
& y_{ri} = x_i b_r + \sum_{s=1}^{r-1} r_{rs} y_{si} + \sum_{s=1}^{r-1} f_{rs} y_{s,-i} + \varepsilon_{ri}
\end{aligned}
\qquad \text{(A2)}
$$

It can be easily shown that the errors in (A2) coincide with the errors in (A1): $u_{ri} = \varepsilon_{rj}$. Given our previous assumptions about the errors in (A1) it follows that the errors in (A2) satisfy all the requirements for an OLS regression:

$E(u_{ri}) = 0$, $E(u_{rt} u_{sj}) = 0$, $E(u_{ri} x_j) = 0$ for any subjects *i* and *j* and rounds *r* and *s*, and finally $E(u_{ri} y_{sj}) = 0$ for any subjects *i* and *j* and rounds *r* and *s* such that *s*<*r*.

From the vector of estimated coefficients $(\hat{b}_r, \hat{r}_{rs}, \hat{f}_{rs})$ for (A2) we can construct the estimates of the coefficients in (A1) as follows:

$$
\begin{aligned}
& \hat{\beta}_r = \hat{b}_r + \sum_{s=1}^{r-1} \hat{\rho}_{rs} \hat{b}_s \\
& \hat{\rho}_{rs} = \hat{r}_{rs} + \sum_{t=s+1}^{r-1} \hat{\rho}_{rt} \hat{r}_{ts} \\
& \hat{\varphi}_{rs} = \hat{f}_{rs} + \sum_{t=s+1}^{r-1} \hat{\rho}_{rt} \hat{f}_{ts}
\end{aligned}
\qquad \text{(A3)}
$$

This is straightforward for *r=1*, as the first equation in (A1) coincides with the first equation in (A2) and $\hat{\beta}_1 = \hat{b}_1$. For *r=2*, we can use the first equation in (A2) to substitute for u_{1i} in the second equation in (A1) and then:

$$y_{2i} = x_i(\beta_2 - \rho_{21}b_1) + \rho_{21}y_{1i} + \varphi_{21}y_{1,-i} + u_{2i}.$$

Which implies that $\hat{b}_2 = \hat{\beta}_2 - \hat{\rho}_{21}\hat{b}_1$, $\hat{r}_{21} = \hat{\rho}_{21}$ and $\hat{f}_{21} = \hat{\varphi}_{21}$. Rearranging, we find the equalities in (A3) for *r=2*. For *r=3*, we can use the first two equation in (A2) to substitute for u_{1i} in the third equation in (A1) and then

$$y_{3i} = x_i(\beta_3 - \rho_{31}b_1 - \rho_{32}b_2) + (\rho_{31} - \rho_{32}r_{21})y_{1i} + \rho_{32}y_{2i} + (\varphi_{31} - \rho_{32}f_{21})y_{1,-i} + \varphi_{32}y_{2,-i} + u_{2i}$$

Which implies that $\hat{b}_3 = \hat{\beta}_2 - \hat{\rho}_{31}\hat{b}_1 - \hat{\rho}_{32}\hat{b}_2$, $\hat{r}_{31} = \hat{\rho}_{31} - \hat{\rho}_{32}\hat{r}_{21}$, $\hat{r}_{32} = \hat{\rho}_{32}$,

$\hat{f}_{31} = \hat{\varphi}_{31} - \rho_{32}\hat{f}_{21}$ and $\hat{f}_{32} = \hat{\varphi}_{32}$. Rearranging, we find the equalities in (A3) for *r=3*. In similar way we can verify (A3) for *r>3*.

With the vector of estimates $(\hat{\beta}_r, \hat{\rho}_{rs}, \hat{\varphi}_{rs})$ we can calculate the effect of democracy by round. As said before, we focus on groups with payoff modification. First, we calculate the direct effect of democracy by individual vote and round: DED_{rv}, where *r* denotes the round and *v* the individual vote (yes or no). The direct effect of democracy can be thought as the difference in cooperation under endogenous and exogenous modification once we control for the behavior of previous partners. This difference can be calculated as $DED_{rv} = \hat{\beta}_{rv,Endo} - \hat{\beta}_{rv,Exo}$, where $\hat{\beta}_{rv,Endo}$ is the estimated coefficient for those in round *r*, with individual vote *v* and whose vote was counted (endogenous modification) and $\hat{\beta}_{rv,Exo}$ is the coefficient for those whose vote was not counted (exogenous modification).

The effect of democracy is not only the direct effect as a subject's behavior is modified by the behavior of other subjects which in turn depend on whether payoffs are modified endogenously or exogenously. We calculate the effect of democracy ED_{rv} on round *r* for subjects with vote *v*, as follows:

$$ED_{1v} = DED_{1v}$$
$$ED_{rv} = DED_{rv} + \sum_{s=1}^{r-1} \hat{\varphi}_{rs} \left(p_{vy} ED_{ry} + p_{vn} ED_{rn} \right)'$$

where $\hat{\varphi}_{rs}$ is the estimated coefficient measuring how subjects' cooperation in round *r* responds to cooperation by their partners in round *s*, and p_{vy} and p_{vn} denotes the probabilities that a subject with vote *v* meets a *yes* and *no* subject respectively under endogenous modification. The estimates of the effect of democracy under modification are presented in Table 6.

Table 2: Summary statistics of sessions

Session	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Date	3/5/06	10/5/06	12/5/06	15/5/06	17/5/06	13/7/06	18/9/06	22/9/06	13/10/06
Subjects	20	16	16	20	12	12	12	16	24
Economics	10.00%	6.25%	12.50%	15.00%	16.67%	16.67%	33.33%	25.00%	8.33%
Class	1.90	1.63	2.19	2.45	2.42	3.25	2.08	2.13	2.08
Political Philosophy	2.26	2.00	2.36	2.11	1.91	2.09	1.91	2.43	2.21
SAT Math	730.79	697.33	736.88	734.00	662.73	706.36	743.33	711.88	720.87
SAT Verbal	723.16	728.67	720.00	736.00	689.00	720.91	717.50	681.25	723.48
Beauty Contest Num.	39.20	37.94	39.50	38.75	42.25	44.00	38.08	49.63	31.92
Subject Comprehension									
Vote stage	80.00%	81.25%	93.75%	100.00%	100.00%	91.67%	100.00%	81.25%	91.67%
Initial Payoffs	90.00%	93.75%	81.25%	85.00%	100.00%	91.67%	83.33%	81.25%	95.83%
Modified Payoffs	65.00%	75.00%	62.50%	70.00%	91.67%	58.33%	91.67%	93.75%	100.00%
Earnings									
Maximum	29.00	28.20	29.40	28.20	28.20	28.60	26.40	28.20	28.68
Average	24.44	24.23	24.86	24.42	24.78	24.35	24.16	23.62	25.51
Minimum	20.60	20.40	20.60	20.80	21.80	20.40	19.20	17.60	20.80

Session	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**All Sessions**	
Date	20/10/06	23/10/06	27/10/06	30/10/06	06/11/06	10/11/06	17/11/06	20/11/06	27/11/06	**Total/Means**	**Std. Dev.**
Subjects	12	20	8	16	16	12	12	12	20	276	
Economics	33.33%	10.00%	12.50%	18.75%	0.00%	8.33%	0.00%	16.67%	10.00%	13.41%	
Class	2.00	1.85	1.88	1.50	1.81	2.00	1.83	1.75	1.80	2.02	1.11
Political Philosophy	2.25	2.00	1.86	2.00	2.00	1.91	2.08	1.92	1.95	2.09	0.77
SAT Math	732.50	746.67	733.75	734.00	722.00	758.33	662.73	764.17	728.00	724.91	68.17
SAT Verbal	721.67	718.89	736.25	737.33	724.67	728.33	750.00	730.83	729.50	723.21	66.72
Beauty Contest Num.	35.92	37.10	28.63	37.56	30.44	28.67	47.25	37.00	35.30	37.68	19.63
Subject Comprehension											
Vote stage	91.67%	95.00%	100.00%	87.50%	87.50%	100.00%	91.67%	100.00%	95.00%	92.03%	
Initial Payoffs	100.00%	100.00%	100.00%	81.25%	81.25%	100.00%	66.67%	75.00%	95.00%	89.13%	
Modified Payoffs	75.00%	85.00%	100.00%	75.00%	68.75%	100.00%	41.67%	100.00%	95.00%	80.43%	
Earnings											
Maximum	26.40	28.40	26.80	27.60	27.60	26.60	27.64	28.20	29.36	29.40	
Average	24.50	24.41	25.49	24.36	24.15	24.45	24.17	25.83	24.75	24.57	2.19
Minimum	21.80	19.80	23.40	20.20	20.76	21.48	20.56	22.00	19.60	17.60	

Note: Economics is the percentage of Economics majors in the session; Class is equal to 1 for freshment, 2 for sophomore, etc.; Political Philosophy is equal to 1 for very liberal to 5 for very conservative; Beauty contest num. is the number chosen in the beauty contest game.

Table 3: Determinants of Voting

Dependent Variable: Voting for modification (Votemod)

	(1)	(2)	(3)	(8)	(7)	(6)	(5)	(4)	(9)
Own Part 1 Coop.	0.47								0.673
	[0.161]***								[0.170]***
Partners' Part 1 Coop.		-0.419							-0.762
		[0.211]**							[0.222]***
Class			-0.029						-0.019
			[0.027]						[0.028]
Guess Number				-0.003					-0.004
				[0.002]**					[0.002]**
SAT Verbal					0.001				0
					[0.000]				[0.000]
SAT Math						0.001			0.002
						[0.000]***			[0.000]***
Econ							0.072		-0.001
							[0.088]		[0.089]
Political								0.003	0.029
								[0.041]	[0.040]
Constant	0.448	0.608	0.59	0.657	0.01	-0.312	0.523	0.517	-0.733
	[0.042]***	[0.048]***	[0.063]***	[0.065]***	[0.334]	[0.324]	[0.032]***	[0.091]***	[0.454]
Observations	276	276	276	276	265	266	276	254	246
R-squared	0.03	0.01	0	0.02	0.01	0.03	0	0	0.15

Note: All results are from OLS regressions. The dependent variable is *Votemod* which is an indicator variable for whether the subject voted to modify payoffs. Standard errors in brackets: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: The effect of the democracy - Individual Level Data

Panel A: Number of observations

	Consider Votes		Not Consider Votes		
Vote for Modify	**Modify (EndoMod)**	**Not Modify (EndoNot)**	**Modify (ExoMod)**	**Not Modify (ExoNot)**	**Total**
No	17	55	31	26	129
Yes	55	25	33	34	147
Total	72	80	64	60	

Panel B: Cooperation Percentage in Round 10

	Consider Votes		Not Consider Votes	
Vote for Modify	**Modify (EndoMod)**	**Not Modify (EndoNot)**	**Modify (ExoMod)**	**Not Modify (ExoNot)**
No	5.88%	3.64%	9.68%	11.54%
Yes	5.45%	4.00%	9.09%	8.82%
Total	5.56%	3.75%	9.38%	10.00%

Panel C: Cooperation Percentage in Round 11

	Consider Votes		Not Consider Votes	
Vote for Modify	**Modify (EndoMod)**	**Not Modify (EndoNot)**	**Modify (ExoMod)**	**Not Modify (ExoNot)**
No	41.18%	14.55%	41.94%	3.85%
Yes	81.82%	24.00%	57.58%	23.53%
Total	72.22%	17.50%	50.00%	15.00%

Table 5: The effect of the democracy - Individual Level Data

Dependent Variable: Individual cooperation in round 11

	(1)	(2)	(3)	(4)	(5)
EndoMod	0.722				
	[0.050]***				
EndoNot	0.175				
	[0.048]***				
ExoMod	0.5				
	[0.053]***				
ExoNot	0.15				
	[0.055]***				
EndoModn		0.412	0.362	0.4	0.353
		[0.101]***	[0.102]***	[0.106]***	[0.106]***
EndoNotn		0.145	0.05	0.137	0.058
		[0.056]**	[0.067]	[0.057]**	[0.069]
ExoModn		0.419	0.314	0.4	0.316
		[0.075]***	[0.086]***	[0.075]***	[0.086]***
ExoNotn		0.038	-0.016	0.045	-0.001
		[0.082]	[0.084]	[0.087]	[0.090]
EndoMody		0.818	0.719	0.849	0.763
		[0.056]***	[0.063]***	[0.056]***	[0.064]***
EndoNoty		0.24	0.09	0.273	0.134
		[0.083]***	[0.090]	[0.087]***	[0.095]
ExoMody		0.576	0.431	0.633	0.502
		[0.072]***	[0.082]***	[0.075]***	[0.085]***
ExoNoty		0.235	0.112	0.226	0.121
		[0.071]***	[0.079]	[0.074]***	[0.080]
Own Part 1 Coop.			0.618		0.569
			[0.139]***		[0.141]***
Partners' Part 1 Coop.			-0.034		-0.066
			[0.179]		[0.181]
Exclude did not remember vote result	No	No	No	Yes	Yes
Observations	276	276	276	254	254
R-squared	0.54	0.57	0.6	0.6	0.62

Tests of differences of cooperation rates by mechanism (Endo versus Exo), payoffs (Mod versus Not) and vote (y versus n)

	p-values				
EndoNot=ExoNot	0.732				
EndoMod=ExoMod	0.003				
EndoMod=EndoNot	0.000				
ExoMod=ExoNot	0.000				
EndoNotn=ExoNotn		0.281	0.494	0.381	0.566
EndoModn=ExoModn		0.952	0.694	1.000	0.772
EndoModn=EndoNotn		0.022	0.006	0.030	0.013
ExoModn=ExoNotn		0.001	0.003	0.002	0.006
EndoNoty=ExoNoty		0.966	0.834	0.682	0.908
EndoMody=ExoMody		0.009	0.001	0.022	0.005
EndoMody=EndoNoty		0.000	0.000	0.000	0.000
ExoMody=ExoNoty		0.001	0.001	0.000	0.000

Note: All results are from OLS regressions. The dependent variable is an indicator variable for whether the subject cooperated in round 11. The explanatory variables in column (1) are indicator variables for the vote stage result. In the rest of the columns the explanatory variable are the interaction of indicator variables for vote stage results with indicator variables for the vote of the subject. EndoMod: endogenous modification, EndoNot: endogenous non-modification, ExoMod: exogenous modification, ExoNot: exogenous non-modification, n and y denote the individual vote of the subject (agains or for modification). Regressions in columns (3) and (5) control for the individuals' and their partner's cooperation rate in the rounds before the voting stage (Part 1). Standard errors in brackets: * significant at 10%; ** significant at 5%; *** significant at 1%. The p-values correspond to Wald tests based on the regression results.

Table 6: The effect of the democracy - Individual Level Data - All Rounds

	Vote for Modify	
Round	**Yes**	**No**
11	0.242	-0.008
	[0.124]**	[0.103]
12	0.216	0.143
	[0.116]**	[0.154]
13	0.204	0.309
	[0.144]*	[0.120]***
14	0.322	0.274
	[0.147]**	[0.132]**
15	0.217	0.300
	[0.138]*	[0.145]**
16	0.219	0.346
	[0.154]*	[0.136]***
17	0.296	0.086
	[0.154]**	[0.197]
18	0.270	0.091
	[0.153]**	[0.194]
19	0.299	0.216
	[0.157]**	[0.171]
20	0.264	0.069
	[0.160]**	[0.175]

Note: table reports estimated impact of democracy on likelyhood of choosing C by round for groups with modified payoffs following the model in the Appendix. Jackknife standard errors by group: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Number of Groups by Vote Stage Results and Vote Share

	Consider Votes		Not Consider Votes		
Vote Share	Modify (EndoMod)	Not Modify (EndoNot)	Modify (ExoMod)	Not Modify (ExoNot)	Total
0	X	3	0	0	3
1	X	9	5	4	18
2	6	8	5	4	23
3	5	X	6	6	17
4	7	X	0	1	8
Total	18	20	16	15	69

Table 8: The effect of democracy - Group Level Data

Panel A: Cooperation Percentage in Part 1

	Consider Votes		Not Consider Votes	
Vote Share	Modify (EndoMod)	Not Modify (EndoNot)	Modify (ExoMod)	Not Modify (ExoNot)
0	X	19.17%		
1	X	21.39%	31.00%	11.25%
2	11.25%	16.88%	16.50%	16.88%
3	12.00%	X	17.92%	19.58%
4	20.36%	X		10.00%

Panel B: Cooperation Percentage in Part 2

	Consider Votes		Not Consider Votes	
Vote Share	Modify (EndoMod)	Not Modify (EndoNot)	Modify (ExoMod)	Not Modify (ExoNot)
0	X	21.67%		
1	X	11.67%	24.50%	12.50%
2	51.67%	8.44%	43.50%	9.38%
3	48.00%	X	32.50%	12.50%
4	88.93%	X		7.50%

Table 9: The effect of democracy - Group level data - Voteshare=2

Dependent Variable: Group cooperation rate in part 2

	(1)	(2)	(3)	(4)
EndoMod	0.517	0.404	0.538	0.45
	[0.090]***	[0.117]***	[0.094]***	[0.123]***
EndoNot	0.084	-0.085	0.079	-0.047
	[0.078]	[0.139]	[0.071]	[0.134]
ExoMod	0.435	0.27	0.3	0.19
	[0.099]***	[0.149]*	[0.094]***	[0.136]
ExoNot	0.094	-0.075	0.108	-0.015
	[0.111]	[0.158]	[0.109]	[0.155]
Part 1 Cooperation		1.002		0.704
		[0.687]		[0.636]
Exclude did not remember vote result	No	No	Yes	Yes
Observations	23	23	18	18
R-squared	0.74	0.77	0.76	0.78

Tests of differences of cooperation rates by mechanism (Endo versus Exo) and payoffs (Mod versus Not)

	p-values			
EndoNot=ExoNot	0.946	0.944	0.822	0.806
EndoMod=ExoMod	0.550	0.333	0.096	0.074
EndoMod=EndoNot	0.002	0.001	0.002	0.001
ExoMod=ExoNot	0.033	0.028	0.204	0.176

Note: All results are from OLS regressions. The dependent variable is the cooperation rate by group in the 10 rounds after the voting stage (part 2). The explanatory variables are indicator variables for the vote stage result. EndoMod: endogenous modification, EndoNot: endogenous non-modification, ExoMod: exogenous modification, ExoNot: exogenous non-modification. Regressions in columns (2) and (4) control for the cooperation rate of the group before the voting stage (Part 1). Standard errors in brackets: * significant at 10%; ** significant at 5%; *** significant at 1%. The p-values correspond to Wald tests based on the regression results.

Figure 1: Voting Stage

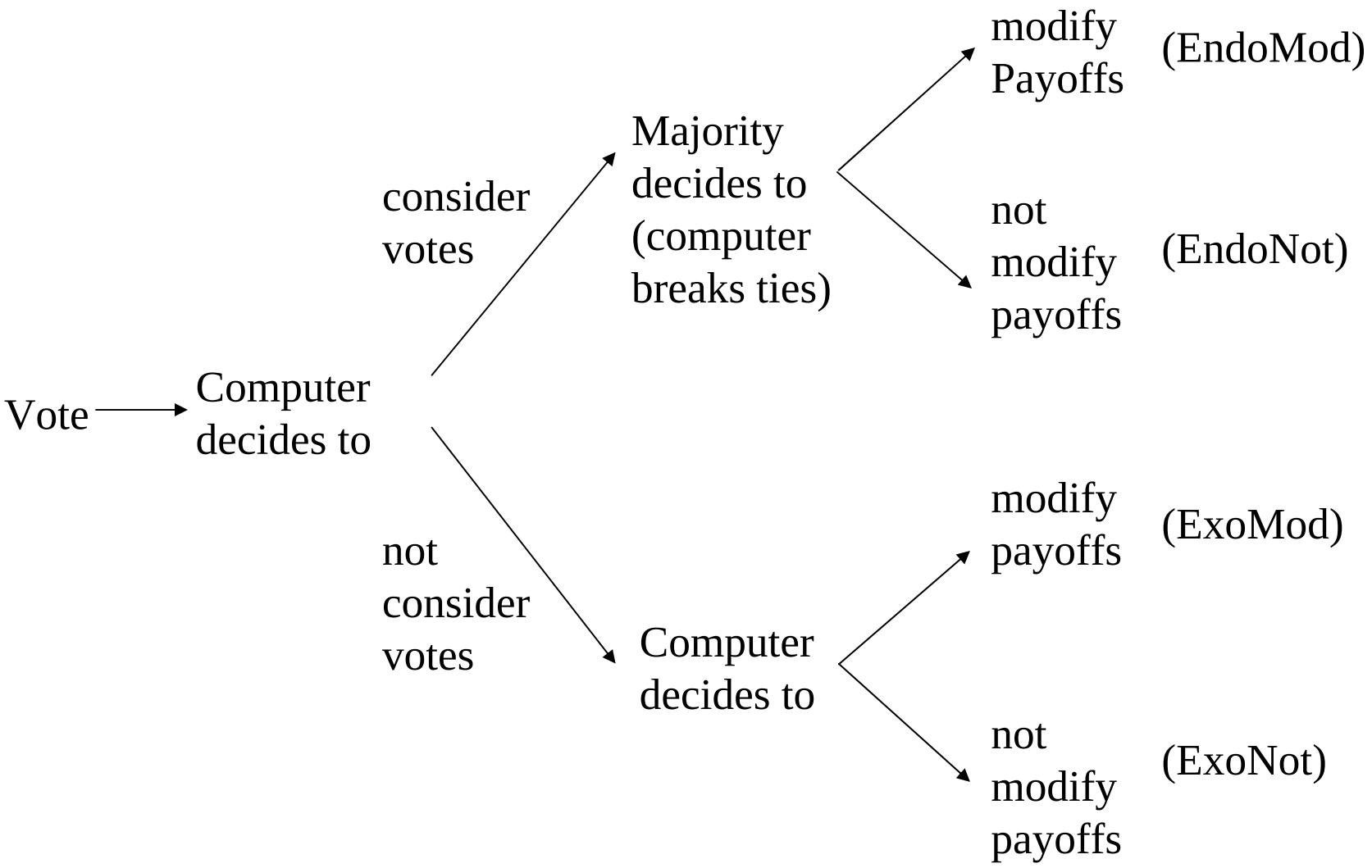

Figure 2: Cumulative Distribution of Vote Share

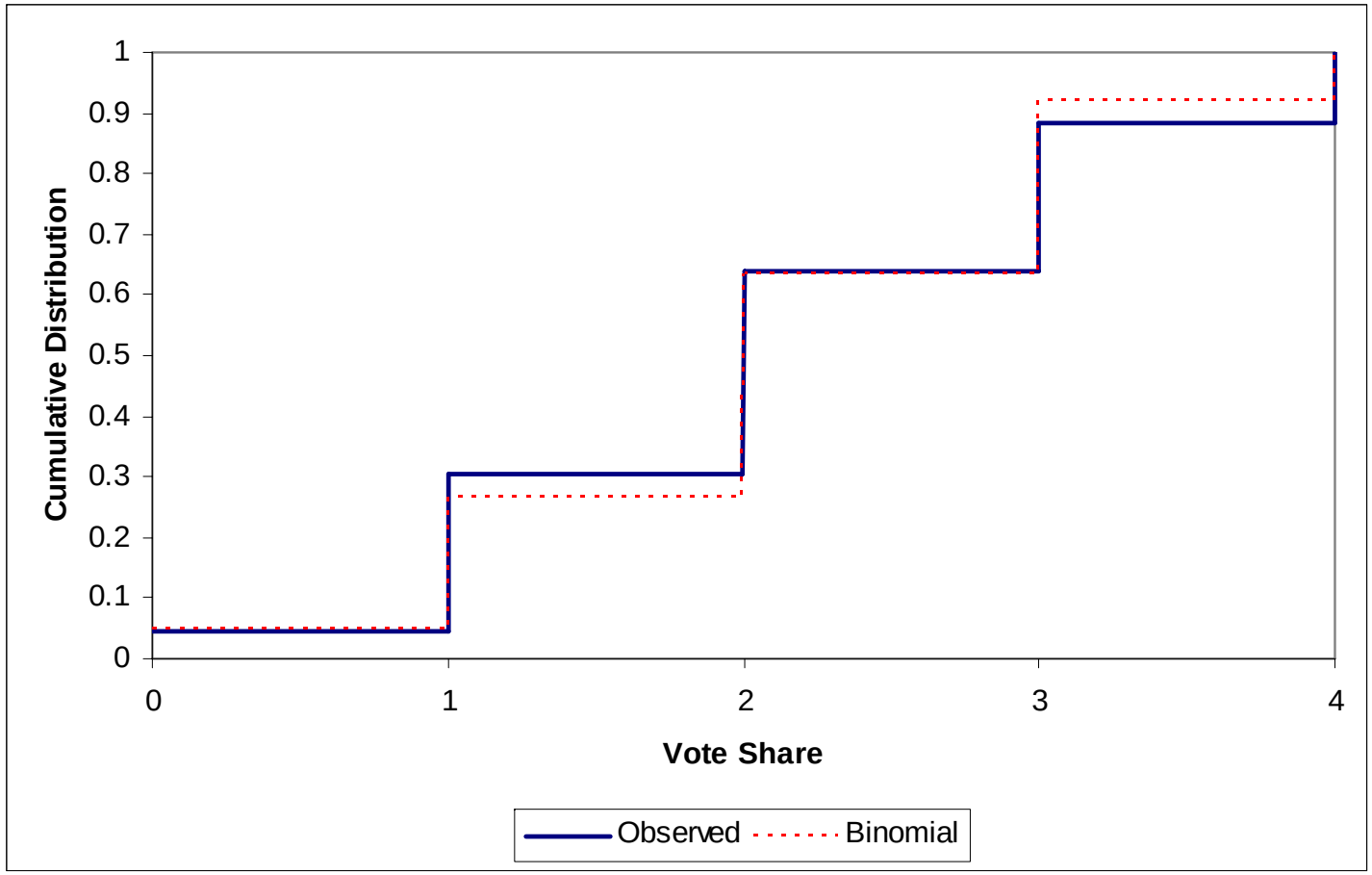

Figure 3: Cooperation by Round, Vote Stage Results and Individual Vote