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Abstract:

With heterogeneous endowments, subjects collectively choose between a lottery contest, where only one individual in a group receives an award, and a public good which benefits the less-endowed more. Unlike standard theoretical predictions, the majority of the subjects vote for the public good regardless of the award size in the contest. Also, the subjects' average risk preferences don't differ by voter type. Furthermore, their payoffs, whether ex-ante expected payoffs based on beliefs or ex-post payoffs, are more equally distributed in the public good regime. These suggest that people's collective institutional choices may be driven by inequality-averse concerns in our context.

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1. Introduction

The prevalence of heterogeneous resources is one of the most fundamental features of our organizations and societies today (e.g., Stiglitz 2012, Piketty 2014). For example, there are wide income gaps within a society. The Gini coefficient of household disposable incomes is on average 0.31 even in OECD countries.[1] Likewise, in organizations, the competence of workers is diverse even if they have similar work experiences, which may create salary gaps among them. It is also often the case that the distributions of resources are skewed to the right. While the heterogeneity of resources has some positive aspects such as potential to increase material gains, it nonetheless has negative aspects. For instance, inequality in society often leads to serious intra-group conflicts.[2] We therefore face a difficult collective decision to make: as an organization or a society, should we promote competition by which ex-post inequality may be enhanced? Or should we lead to a more equal environment by offering some redistribution mechanism?

People's collective choices on policies have important consequences for resulting norms and situations at organizations or societies. Incentive schemes such as tournaments that are used in firms may contribute to increasing productivity of workers and thus perhaps seem to bring better material outcomes in a management's view. Such competition-oriented policies may, however, lead to more uncooperative behaviors among workers. Some companies take approaches to compress their heterogeneous competence, such as voluntary mentoring and education programs. While these programs may help workers maintain harmony, they may demotivate high-skilled workers if they want higher compensations. For another example, voluntary activities at charitable organizations are supported by the reduction of tax requirements in order to alleviate poverty in a society. This policy would help shrink the income gap and create a fairer society. However, it may displease those with wealth who would lead the economic growth of the society as they cannot enjoy the benefits. In addition, the presence of such redistribution mechanisms may reduce people's work motivation.

In modern democratic societies, people have rights to either directly or indirectly choose their preferred policies through their votes. Given the fact that highly-endowed persons account

[1] See OECD Factbook 2013 (DOI : 10.1787/18147364).
[2] In a firm, wage inequality may be helpful in securing or attracting highly skilled workers, but it may also decrease work motivation among low-skilled workers and may cause disharmony among workers in interdependent work (e.g., Akerlof and Yellen 1998, Trevor *et al.* 2012). For another example, inequality increases anti-social behavior such as violent crime in societies (e.g., Kelly 2000).

for a very small percentage of the population, one may expect to see most countries or organizations employing strong redistributive or cooperative policies. In reality, however, we do not observe a large degree of redistribution. This field observation may not reflect the population's collective distributional preferences. For example, the literature on political economy explains that the moderate redistributive policies could be the outcome of the political process, such as low voter turnout of low-income people, party royalty and electoral competition in representative democracy (see Harms and Zink (2003) for a survey). It is also possible that the less-endowed may in fact prefer light redistributive policies for various reasons. For instance, they may tolerate inequality if have the prospect of upward mobility (pages 657-665 of Harms and Zink 2003). In recent decades, economists have actively studied people's collective institutional choices using laboratory experiments. However, little attention has been paid to how people collectively prefer to implement institutions, either competitive or cooperative, within a group with heterogeneous endowments and this remains as an empirical question to be answered.

Exploring behavioral principles for people's collective choices on this topic is not straightforward, however. First, past extensive experiments have found that some individuals have other-regarding preferences such as inequality aversion (see Fehr and Schmidt (2006) for a survey). For example, some people may enjoy higher non-material gains if their payoffs are similar to each other. Therefore, we cannot infer their institutional choices only from their material incentives. Second, recent experiments show that egalitarian subjects − those who prefer fair distribution of payoffs − are more likely to stay away from competitive environments when self-selecting their environments in real-effort experiments (e.g., Bartling *et al.* 2007, Balafoutas *et al.* 2012).[3] The more egalitarian preferences they have, the less likely they may be to support competitive institutions in our context. The voting decisions of the egalitarian individuals nonetheless may depend on the degree of material incentives under the competitive regime. A person might, even if she is strongly inequality-averse, support a competitive institution if her potential benefits from competition are sufficiently high. In addition, their voting decisions may also depend on their assigned endowments as their material incentives or non-material incentives differ by the endowment. Third, other-regarding preferences in a risky situation are still a new research area to be explored. Having a competitive institution involves a risk in which people obtain lower returns if they lose competition. People's decisions might be based on ex-ante

[3] The subjects made choices between a tournament and a piece rate scheme in these two papers.

comparison (i.e., opportunities), the distribution of ex-post payoffs, or a mix of the two (e.g., Brock *et al.* 2013). Fourth, a rich experimental literature has found that in situations where their resources are unbalanced, those vested with larger (smaller) resources behave more (less) selfishly (e.g., Buckley and Croson 2006, Chan *et al.* 1996, Cherry *et al.* 2005, Maurice *et al.* 2013). This tension between higher and lesser endowed members may be severe enough for them to collectively choose a more competitive environment if there is such an opportunity.

We conduct an experiment in order to study people's collective institutional choices between a competitive scheme versus a public good scheme that helps the less-endowed more when their resources are unequally distributed. A novel feature of our experimental design is to let subjects collectively select one from two fundamentally different institutions under each of which the same endowments can be used. The group size is five. Endowments are unbalanced across subjects; endowments are randomly assigned to the subjects at the onset of the experiment. Specifically, one member receives an endowment of 50 points, two members each receive 20 points, and the remaining two members each receive 10 points. Each group then collectively chooses one out of two regimes by voting: a public good regime and a competitive lottery contest regime. This is the only collective vote decision. A group has a social dilemma when it collectively implements the public good. Under this regime, each member makes allocation decisions between their private account and public account using their own endowments. They get one point for each point they allocate to their private account. The total contributions to their public account are doubled and are then redistributed among the members. The distribution rule is that the smaller endowments they have, the more they receive from the public account. By contrast, members compete for an award of 50 points or 110 points if a group collectively selects the lottery contest regime. Under this regime, each member decides how many points they allocate to their lottery account. The more points a subject assigns to the account the more likely she is to win the competition and receive the award. Only one member wins the competition in the contest regime. Because each subject has an opportunity to win the competition, ex-ante expected payoffs within a group are more equally distributed in the contest regime than in the public good regime, according to the standard theoretical assumption of all being selfish. Subjects would, however, have a greater ex-post inequality in the end if they choose the contest as only one individual in a group receives an award. The policy implementation decision and

their interaction under a collectively selected regime are one-shot.[4] Their beliefs on the allocation decisions of the other four group members under collectively selected regimes and their risk attitudes are elicited in order to explore driving forces behind their institutional choices.

Our data shows that a majority of the subjects, around 70% to 80% of the entire subjects, prefer having the public good, contrary to the standard theoretical prediction. It also indicates that the likelihood of the subjects selecting the public good and their endowment amounts are negatively correlated. A closer look at the data suggests a possible cause of the negative correlation. We find that while less-endowed subjects believe that they are materially better off in expectation under the public goods regime, the subjects with high endowments believe that they can earn more money under the lottery contest when the award is high.

The award size in the lottery contest determines which regime the subjects believe has bigger material incentives. However, the percentages of the supporters for the public good are not affected by the size of the award in the lottery contest regime. Moreover, under the public good regime, not everyone behaves for the sake of others. Once the public good is collectively chosen, the subjects with the high endowment contribute much smaller percentages of their endowment to the public accounts, compared with the subjects with lower endowment. This behavior of the highly-endowed subjects is anticipated by the less-endowed subjects.

A comparison of the distributions of payoffs suggest that the subjects' collective institutional choices may be driven by their (either ex-ante or ex-post) inequality-averse motives in our context. The average Gini coefficients of realized payoffs within groups are significantly smaller in the public good regime than in the lottery contest regime. In addition, subjects also on average believe that their payoffs are more equally distributed in their groups if the public good regime is implemented. The subjects' risk attitudes, by contrast, are statistically similar between those who vote for the public good and those who vote for the lottery contest. These results imply that people have a collective preference for a policy with a public good aspect rather than a competitive policy if the competitive one enlarges inequality among the members when their resources are unequally distributed.

[4] This experimental setup is used to obtain data without reputation effects.

The rest of the paper proceeds as follows: Section 2 describes our experimental design. Section 3 provides the theoretical predictions and hypotheses. Section 4 reports results, and Section 5 discusses our results and concludes.

2. Experimental Design

The experiment consists of two phases. The first phase is a stage in which endowments are randomly given to subjects. The second phase is a voting decision stage, followed by an allocation stage. Subjects collectively make one-time policy implementation decisions and individual allocation decisions in Phase 2. Our study consists of two main treatments in which either a public good or a lottery contest is endogenously selected by subjects' votes. We also conduct one control treatment in which a public good is exogenously imposed in Phase 2 in order to examine whether the democracy premium affects their votes for the case that they collectively choose a public good (Table 1).[5]

At the onset of Phase 1, subjects in all treatments are randomly assigned to a group of five individuals. We use a partner-matching protocol: the group composition does not change between Phase 1 and Phase 2. Phase 1 plays a role in generating an unequal distribution of endowments among members. In each group, one subject receives 50 points, two subjects each receive 20 points, and the remaining two each are given 10 points. The assignment of endowments is random: the probabilities with which they receive 50, 20 and 10 points are 1/5, 2/5 and 2/5, respectively. We refer to the set of subjects who are given 50, 20 and 10 points as their endowments as Sets *H*, *M* and *L*, respectively. Note that the endowments of the Set *M* and Set *L* subjects are less than the average in their groups, 22 (= (50+20·2+10·2)/5).

In the two main treatments, the Low and High treatments - dubbed L and H, Phase 2 begins with subjects' voting decisions concerning whether to create a public good or to implement a lottery contest, contingent on two voting rules: an equal and a weighted voting rule (see Section 2.2). Subjects subsequently submit their beliefs on the other members' voting decisions. In order to avoid a hedging problem, the belief elicitation task is not incentivized. Also,

[5] We also conducted one additional treatment as a robustness check of our results to a very large award under the contest regime. It turns out that our results are robust. See Section 4 for the details.

we do not tell subjects about the presence of the elicitation task at the onset of the experiment.[6] After that, the computer randomly assigns one of the two voting rules for each group. The public good or the lottery contest is then collectively implemented in accordance with the result of their votes; and each subject makes an allocation decision under a selected regime as explained in Section 2.1. (In the control treatment, which is called the Exogenous Public Good treatment, subjects do not vote on the two regimes; they make contribution decisions based on their endowments to their groups' public goods.) Once all subjects complete their allocation decisions, they submit their beliefs on the other four members' allocation decisions before being informed of the outcomes of the allocation stage. As in the first belief elicitation task, this elicitation task is also not incentivized. However, at the end of the experiment, just before they are informed of the outcome of the allocation decisions, all subjects are asked to answer incentivized questions concerning their risk attitudes (see Section 2.3).[7] Fig. 1 is a schematic diagram of the experiment. We will explain each piece of the design in details below.

2.1. Two Possible Regimes: The Target of Collective Choices

The public good, one of the options of the vote, corresponds to goods and services, such as voluntary mentoring or education programs for employees in corporations, poverty alleviation programs in international organizations, or some redistribution mechanisms in societies. If the public good is created in a group, then each subject in the group simultaneously makes an allocation decision between their private account and the public account. Their contributions must be integers between 0 and their own endowments (50, 20 or 10). As usual in voluntary contribution game experiments, a subject gets one point for each point that she allocates to her private account. The allocation to the public account, by contrast, is doubled and redistributed among members: 25% of the amounts are given to each of the two Set *L* subjects, 20% of them are given to each of the two Set *M* subjects and 10% of them are given to the Set *H* subject (note that $25\% \times 2 + 20\% \times 2 + 10\% = 100\%$). In other words, the distribution rule is that the less resources a member has, the more the member receives from the public account. This redistribution rule is often prevalent in the real world. For example, such funds in international

[6] They are instead told that some additional questions related to the experiment may be asked while the experiment is in progress and that their responses to these questions will not affect their payoffs.
[7] They are not told about the presence of this task at the onset of the experiment. They are instead told that some additional questions unrelated to the main part of the experiment may be asked.

organizations are often used to help less-developed countries. In a society, various policies such as public welfare assistance are generally used to help the poor. In a firm, voluntary "buddies" programs tend to help less-skilled workers more than highly skilled workers.

Suppose that the public good is put in place in a group and a member having an endowment E_i contributes C_i to the public good. Then, her payoff, π_i, is expressed as follows:

$$\pi_i = (E_i - c_i) + \alpha_i \cdot 2 \sum_{j=1}^{5} c_j, \quad (1)$$

where $\alpha_i = .1$ if subject *i* is a Set *H* subject; $\alpha_i = .2$ if subject *i* is a Set *M* subject; and $\alpha_i = .25$ if subject *i* is a Set *L* subject. The first term, $E_i - c_i$, refers to the payoff of subject *i* from her private account.

By contrast, when the lottery contest is collectively implemented in a group, subjects compete with the other four members for an award. Specifically, each member in the group simultaneously decides an allocation amount to their lottery account. The award is 50 points (110 points) and the competition is low (high) in the L treatment (the H treatment). Only one member in the group receives the award. Each subject in this regime can increase the probability of winning the competitive battle by raising their allocation amounts to their lottery account. Suppose that subject *i* makes an investment of x_i out of his endowment E_i and also that the other four members allocate X_{-i} in total to their lottery accounts. Then, subject *i*'s probability of obtaining the award is $\frac{x_i}{x_i + X_{-i}}$. x_i must be non-negative and less than or equal to her endowment (E_i). When all five members allocate nothing (i.e., $x_i = 0$ for all *i*), then the award is randomly given to one of the members (i.e., each receives it with a probability of 20%).[8] They receive their remaining points after investment, $E_i - x_i$, as a part of their payoff. The competition in the lottery contest is also prevalent in our real world. For example, in organizations, workers' capacities or resources vary by employee as in our paper. It is often the case that the more efforts they exert, the more likely they are to get promoted to a higher position. The chances of promotion, however, would negatively depend on the contributions of other workers in the firm as higher-ranked

[8] This experimental setup is employed to make the experiment simple, although we notice that this may be a little unrealistic. An alternative, a more realistic setup could be to set the size of prize positively proportional to the total allocations in a group. In our setup, the size of prize is a sufficiently high constant, regardless of the total allocation amounts. In other words, our lottery contest regime would be more attractive to the subjects than the alternative mentioned above with regards to material incentives. We find that our subjects, nevertheless, choose a public good regime, rather than the lottery contest regime in the experiment (see Section 4).

positions are limited. In competitions across countries for research and development, the chances that a national company succeeds in developing a new technology ahead of other companies depends on its relative investment amount of resources.

Once all subjects make their allocation decisions under one of the two regimes, they are asked about their beliefs on how other members made allocation decisions. Specifically, a Set *H* subject is asked about his or her beliefs on the average allocation of the two Set *M* subjects and that of the two Set *L* subjects in her group. A Set *M* (Set *L*) subject is asked about his or her beliefs on (a) the allocation of the Set *H* subject, (b) the allocation of the other Set *M* (Set *L*) subject and (c) the average allocation of the two Set *L* (Set *M*) subjects in her group. These elicited beliefs are used in analysis to calculate (expected) payoff that each subject believes they would obtain under their collectively implemented regime. This information would be helpful in understanding causes of their voting decisions as discussed in Sections 3 and 4.

2.2. Voting Rules

Our study lets subjects vote under the two voting rules: a weighted voting rule and an equal voting rule and assesses the effects of voting power on their collective institutional choices as an additional analysis.[9] This analysis is conducted as it is shown that collective institutional choices may differ by voting rule. For instance, Markussen, Reuben and Tyran (2014) have experimentally found that an inter-group competitive scheme is more likely to be selected in a set of three groups when an equal voting rule (i.e., a voting rule that imposes a policy if the majority of the three group members support it) is used, relative to when a group veto rule (i.e., a rule that imposes a policy if the majority of each group supports it) is used. Collective outcomes may differ by voting rule in our study as well because subjects' voting decisions may be affected by the heterogeneity of their endowments, considering that their incentives (material or non-material) under each regime may differ by the amount of endowments they are given.

Specifically, in the L and H treatments, at the onset of Phase 2, subjects vote on whether to have the public good or the lottery contest for each of the two scenarios: (1) the equal voting rule is used and (2) the weighted voting rule is used. After all subjects complete their decisions, they are subsequently asked about their beliefs concerning how the others in their groups voted

[9] Weighted voting rules are often used in organizations or societies (e.g., Leech 2002, Rapkin and Strand 2006). Examples include collective decision-making in IMF and IBRD or in shareholder meetings of a corporation.

before they are informed of its collective outcomes.[10] The two voting decisions are incentive compatible. Once all subjects submit their voting decisions and the subsequent questions on their beliefs, the computer assigns either the equal or weighted voting rule for each group with a probability of 50% each. Then, one of the two voting decisions made by each subject is cast as their vote.[11] When the weighted voting rule is assigned to a group, the voting power of subject i is $E_i/110$. Here, 110 yields from 50 + 20 + 20 + 10 + 10 (the sum of endowments in a group). Consequently, the distribution of voting power among the members is unequal: the more resources a subject has, the more his or her vote influences the outcome. The voting power of the Set *H* subjects is the largest. However, it is not possible for them alone to decide the adoption of the policy by their votes, as their voting power equals 50/110, which is not greater than 0.5, in their groups. Therefore, the votes cast by the subjects belonging to the Sets *M* and *L* also influence each group's collective decision, although they influence the result of their collective decisions less than those of the Set *H* subjects do. When the equal voting rule is assigned to a group, then, the voting power is one-fifth for each subject. In other words, the standard majority rule determines each group's regime, either the public good or the lottery contest.

2.3. Elicitation of Risk Preferences

Once all subjects submit their beliefs on the other four members' allocations to either a public account or a lottery account, they are subsequently asked to answer questions concerning risk attitudes. The questionnaire on risk attitudes consists of the ten questions used in Holt and Laury (2002). We include this task in order to study whether their voting preferences between the two regimes are affected by their risk attitudes as discussed in Section 3.

3. Theoretical Predictions

[10] For example, each Set *M* subject is asked about their belief on the voting decision made by their Set *H* subject, the decision made by the other Set *M* subject, and the decisions made by the two Set *L* subjects for each of the two voting rules.

[11] This kind of strategy method is commonly used when there is a need to obtain a sufficient number of incentive-compatible decisions under each of many possible conditions. For example, in Fehr, Herz and Wilkening (2013), who study the value of individual decision rights in a principal-agent framework, a principal first decides whether or not to delegate a decision right to an agent; and then, before the principal and the agent are informed of the delegation decision, both players choose their effort levels as well as their beliefs about their matched partners' effort levels, contingent on whether they have a right to decide, using a strategy method. In Dal Bó, Foster and Putterman (2011) and Kamei (2014), who study the impact of endogenous decision-making on people's pro-social behavior, all subjects make voting decisions on implementation of a policy before implementation conditions (either endogenous or exogenous) are assigned to their groups. After their voting decisions, the computer randomly assigns either an endogenous or exogenous condition to each group.

A group has a collective action dilemma if the public good is collectively selected in that group. This is because the MPCR (marginal per capita return) is $2 \cdot \alpha_i$, which is less than 1 for each subject, as shown in Eq. (1). Therefore, according to the standard theory, contributing nothing to their public account is a strictly dominant strategy for each group member. The Set *H*, Set *M* and Set *L* subjects obtain 50 points, 20 points and 10 points, respectively, as their payoffs under Nash Equilibrium (NE).

By contrast, if the lottery contest is collectively implemented in a group, the group members can enjoy some expected gains, regardless of whether they are risk averse. Suppose that each member in a group is risk neutral. Then, the utility function of a subject is proportional to his or her expected payoff. The expected payoff of subject i, $E[\pi_i]$, is calculated by:

$$E[\pi_i] = (E_i - x_i) + \frac{x_i}{x_i + X_{-i}} z. \quad (2)$$

Here, z = 50 (110) in the L (H) treatment. Under this assumption, we find that all members, regardless of their endowments, choose to allocate eight points to their lottery account in order to maximize their expected payoffs in the L treatment (see Appendix A.1). They can each raise their expected payoffs by two points in equilibrium in the L treatment. Optimal allocation amounts differ by their endowment in the H treatment: the Set *H*, Set *M* and Set *L* subjects allocate 21, 20 and 10 points, respectively, to their lottery accounts in equilibrium. This means that the probability of winning the competitive battle is the highest (the lowest) for the Set *H* subjects (Set *L* subjects) in the H treatment. As shown in Table 1, nevertheless, the expected payoff of each category of subjects is higher in equilibrium in the H treatment than in the L treatment (see Table 1). Standard theory therefore predicts that subjects prefer to have the lottery contest in both the L and H treatments under the assumption of the risk-neutral preference.

The advantage of the lottery contest over the public good does not change even if we instead assume that subjects are risk-averse. This is because they can allocate amounts as small as possible to the lottery accounts if they wish to while securing a chance of receiving an award in case all of the other four members allocate smaller points to the lottery accounts.

Prediction 1: Standard Theoretical Predictions.

Subjects allocate nothing to their public accounts when the public good regime is imposed in their groups. By contrast, they enjoy positive expected gains when the lottery contest regime is imposed. They therefore vote in favor of having the lottery contest in their groups.

However, experiments in recent decades have found that people have other-regarding preferences, such as inequality aversion (e.g., Fehr and Schmidt 1999, Bolton and Ockenfels 2000) and reciprocity (e.g., Rabin 1993, Dufwenberg and Kirchsteiger 2004, Falk and Fischbacher 2006). These preference models predict that some subjects contribute positive amounts to their public accounts and thus some of them enjoy payoffs higher than their own endowment amounts under the public good regime. As a result, their preferences between the two regimes may be different from Prediction 1. Suppose that subjects have inequality-averse preferences. For simplicity, we assume that subject *i* has the following utility function:

$$u_i(\pi_i|\pi_{-i}) = \pi_i - \mu_i \cdot \frac{1}{N-1}\sum_{j=1}^{N}(\pi_j - \pi_i)^2. \quad (3)$$

Here, μ_i is utility weight of subject *i* on inequality and *N* is group size ($N = 5$).[12] Subjects are assumed to be heterogeneous: μ_i differs by subject. As illustrated in Appendix A.2, the mutual full free-riding equilibrium (i.e., $c_i = 0$ for all *i*) no longer occurs for a broad range of μ. Moreover, the inequality-aversion model predicts that a higher percentage of the Set *H* subjects, compared with the Set *L* subjects, allocate positive amounts to their public accounts regardless of the decisions of the Set *L* or Set *M* subjects as the endowments of the Set *H* subjects are much higher than those of Set *L* subjects. The inequality-averse model also predicts conditional cooperative behavior of the Set *L* and Set *M* subjects. This is because the Set *L* subjects (the Set *M* subjects) do not like inequality between themselves and the other Set *L* subjects (the other Set *M* subjects) or the two Set *M* subjects (the two Set *L* subjects). It is also because the Set *L* subjects (the Set *M* subjects) want to avoid having inequality with the Set *H* subjects when Set *L* subjects (Set *M* subjects) obtain very high payoffs thanks to the others' decisions.

Prediction 2: Contribution to the Public Good Based on Inequality Aversion.

(a) Some subjects contribute positive amounts to their public accounts. (b) A higher percentage of the Set H subjects, relative to the Set L subjects, contribute positive amounts to their public

[12] A similar utility function is used in Chen and Kamei (2014). The use of a quadratic form, instead of the prominent functional form proposed by Fehr and Schmidt (1999), is due to its tractability.

accounts, regardless of the decisions of the Set M and Set L subjects. (c) The contribution decision of a Set L subject (a Set M subject) is conditional, dependent on the contributions of the others: it is positively propositional to his or her beliefs on the contribution decision of the Set H subject, the contribution decision of the other Set L subject (the other Set M subject), and the average contribution decision of the two Set M subjects (the two Set L subjects).

We note that regarding prediction (b), a Set *H* subject's optimal contribution amount may depend on her beliefs in the experiment. She may decide how much inequality to reduce in her group, according to her utility weight on inequality (μ). For instance, suppose that a Set *H* subject believes that each of the two Set *M* subjects contributes 7 points and each of the two Set *L* subjects contributes 0 points to the public account. In that case, if the Set *H* subject contributes 33 points to her public account, the five subjects obtain almost the same payoffs and hence the Gini Coefficient in her group would be minimized (which is .0075) according to her beliefs.[13] However, most likely she would choose to contribute less than 33 points as her material payoff would have some weight on her utility.

In the lottery contest regime, only one individual in a group wins a large award (50 or 110 points). The subjects do not know who will win the competition beforehand. Predictions based on social preferences in such a risky environment need an additional assumption regarding the subjects' decision-making principles. There are two ways to model social preferences in this environment, as studied in Brock *et al.* (2013). One way is to assume that a subject *i* cares about the ex-post distribution of income in her group. Under this assumption, as shown in Eq. (3), the inequality-averse agent incurs a large utility loss due to a high inequality in the lottery contest regime, regardless of whether the agent wins or loses the competition.[14] Therefore, those who are concerned more about ex-post inequality would be more likely to vote for the public good regime. Combined with Prediction 2(a), we have the following prediction for voting behavior:

Prediction 3: Voting Decisions Based on Ex-post Inequality Aversion.

[13] In this example, the set *H* subject obtains a payoff of 21.7 points, each of the two Set *M* subjects obtains a payoff of 22.4 points, and each of the two Set *L* subjects obtains a payoff of 21.75 points.

[14] $E[u_i(\pi_i|\pi_{-i})|G_i] = E[\pi_i|G_i] - \mu_i \cdot \frac{1}{N-1}\sum_{j=1}^{N} E\left[(\pi_j - \pi_i)^2|G_i\right]$, where G_i is the probability distribution of each member's winning in the group of subject *i* based on (a) subject *i*'s own allocation decision and (b) subject *i*'s belief about the allocation decisions made by the other four members to their lottery accounts under the contest regime. $\sum_{j=1}^{N} E\left[(\pi_j - \pi_i)^2|G_i\right]$ is much larger in the contest regime than the one in the public good regime.

If subjects care about ex-post inequality within their groups and Prediction 2(a) holds, then some of them vote in favor of the public good regime, rather than the lottery contest regime.

Another way to model social preferences in a risky environment is based on the subjects' likelihood to win the contest (see Brock *et al.* for this modeling also). If a subject *i* cares about ex-ante opportunities to receive high payoffs, then we can assume that subject *i* has a utility function which depends on the expected utility of him and his four peers: $\{E[\pi_i]\}_{i\in\{1,2,3,4,5\}}$. The degree of inequality is measured by using the Gini coefficient. The Gini coefficient of the equilibrium expected payoffs with the standard theoretical assumption is .327 under the public good regime (five members' payoffs are 50, 20, 20, 10, 10), .300 under the contest regime with prize of 50 (five members' payoffs are 52, 22, 22, 12, 12), and .292 under the contest regime with prize of 110 (five members' payoffs are 57.5, 27.2, 27.2, 13.6, 13.6). Therefore, in a world where all subjects behave selfishly, the public good regime has more unequal ex-ante expected payoff distribution. This implies that if the subjects care about ex-ante inequality, rather than ex-post inequality, they do not vote in favor of the public good regime unless Prediction 2(a) holds.

A comparison of the above three Gini coefficients also reveals that ex-ante inequality in the contest regime is somewhat lower in the H treatment than in the L treatment. Recall that the expected payoff for each category of the subjects (Set *H*, *M* and *L*) under the standard theory is higher in the H treatment than in the L treatment. We therefore have the following prediction about the subjects' voting decisions:

Prediction 4: Voting Decisions Solely Based on the Ex-ante Inequality Aversion.

If risk attitudes do not drive the subjects' institutional choices between the public good and the contest regime, then a significantly higher proportion of the subjects in the H treatment, compared with the L treatment, vote in favor of having the lottery contest regime.

There is also a possibility that subjects' risk preferences do drive their institutional choices even when subjects have social preferences. The distribution of a subject's ex-post payoffs substantially differs between the two regimes. The range of his or her possible payoffs is larger in the lottery contest regime. This means that a higher payoff is possible, but they obtain nothing from their lottery accounts if they lose the competition. Especially, the contest regime in the H treatment generates a higher expected return, but the subjects may perceive it is more risky

as they believe that larger amounts must be allocated to their lottery accounts in order to win the competition as in Table 1. Hence, more risk-averse subjects may vote in favor of the public good.

Prediction 5: Risk Preferences and Voting Decisions.

More risk-averse (risk-loving) subjects vote for the public good (the lottery contest).

We can test Prediction 5 using the risk elicitation task by Holt and Laury (2002). This task consists of ten questions, each of which asks subjects to choose an option between a risky lottery and a safe lottery. We use the number of risky options chosen by a subject (which we denote as $\eta \in \{0, 1, 2, \ldots, 10\}$) as a proxy of his or her risk preference. If Prediction 5 holds, then the average η of those who vote for the public good should be significantly smaller than that of those who vote for the lottery contest.

Nevertheless, Prediction 5 may not hold, as subjects under the public good regime may exhibit what recent studies found as betrayal aversion. That is, there may be some additional psychological cost to the subjects when other members in their groups do not contribute to their public accounts. They may therefore want to avoid having the public good because of the potential psychological damage. This cost would not be present under the contest regime. Some recent studies find that people are less likely to take a risk in sending money to their matched trustees in trust games, compared with their risk-taking behavior in structurally identical decision tasks without partners (e.g., Bohnet *et al.* 2008, Bohnet and Zeckhauser 2004). Even if a subject is shown to be strongly risk-averse by the risk elicitation task, he may vote in favor of the lottery contest regime if his premium due to betrayal aversion is sufficiently high.

4. Results

Ten sessions, with four per each of the two main treatments and two for the control treatment, were conducted at the University of Michigan in Ann Arbor in April and May, 2014. The experiment was programmed using ztree (Fischbacher 2007). Almost all subjects were undergraduate students there. They were recruited via solicitation emails using a recruiting website, ORSEE (Online Recruitment System for Economic Experiments). No subjects participated in more than one session. No communication was allowed during the sessions. Experimental sessions lasted on average one to one and a half hours, and subjects earned on average $22.39 (part of it was a participation fee of $5). Neutral framing was used in all

instructions and experiments.[15] In this section, we will overview the subjects' institutional choices and their subsequent allocation decisions. At the same time we explore the driving forces behind these decisions using data from additional tasks, such as their beliefs on the other members' allocation decisions.

Table 2 reports subjects' voting decisions and their collective vote outcomes. We find that a strikingly large portion of subjects, more than 70% of them in total, voted for the public good under each of the two voting rules, contrary to Prediction 1, which was based on standard theory (see the "Total" row in Table 2). Also, Prediction 4 (based on ex-ante inequality aversion) does not hold: the high percentages of support for the public good are statistically similar between the L and H treatments. This implies that the size of ex-ante expected payoff each subject believes or the distributions of the expected payoffs within a group may not be the only factors for the subjects to decide which regime to choose. In addition, the subjects' voting decisions are affected little by voting rule.[16] The last observation is not so surprising as even with the weighted voting rule the voting power of the Set *H* subjects is less than 50% and a vote cast by any category of subjects affects their collective decisions to some degree.

A closer look at the voting data by endowment category reveals that around half of the Set *H* subjects prefer having the public good whereas a larger fraction of the Set *L* or Set *M* subjects vote for the public good in both the L and H treatments. A regression analysis, shown in Appendix Table B.1, confirms that the smaller endowment the subjects are assigned, the more likely they are to vote for the public good.[17] The significantly different distribution of individual votes by endowment leads to a significant difference in their collective vote outcomes between

[15] For instance, the terms "group fund" and "allocation" were used instead of "public good" and "contribution," respectively, in the public good regime.

[16] The number of votes for a public good under the equal voting rule (102 out of 140 votes) is not significantly different from that under the weighted voting rule (98 out of 140 votes) according to a two-sample z-test of proportion (p-value = .597, two-sided).

[17] The regression analysis also indicates that female subjects are significantly more likely than male subjects to vote for the public good in the H treatment, but not in the L treatment. The lottery contest in the H treatment is more competitive due to a high award (z = 110). The result that women tend to stay away from competition is consistent with the findings of past studies (e.g., Niederle and Vesterlund 2007).

the equal and weighted voting rules. We find that the public good regime is significantly more likely to be collectively chosen with the equal voting rule than with the weighted voting rule.[18]

Result 1: Subjects' Voting Decisions and their Collective Vote Outcomes

(a) Prediction 1 does not hold: around 70% to 80% of the subjects vote for the public good. (b) The smaller endowments they are assigned, the more likely they are to vote for the public good. (c) The public good option is more likely to be collectively selected under the equal voting rule. (d) Prediction 4 does not hold: the subjects' votes for the public good are not affected by the size of the award under the contest (50 points or 110 points).

Part of the subjects' behavior under the collectively selected public good regime can be explained by inequality-averse motives. We observe strong conditional cooperative behavior under the public good regime for the Set *M* and Set *L* subjects. This is consistent with Prediction 2(c). The contribution decisions of these two sets of subjects are positively proportional to their beliefs on the (average) allocation decisions of the Set *M* and Set *L* subjects (see Appendix Table B.4). This resonates with the idea that the subjects are inequality-averse agents and prefer a situation with a smaller inequality in payoffs through their mutual cooperation.

Result 2: Conditional Cooperation of the Set M and L Subjects in the Public Good Regime

The contribution decisions of the Set M and Set L subjects in the public good regime are positively dependent on their beliefs about the (average) contribution decisions of the Set M and Set L subjects.

However, some aspect of the subjects' behavior under the public good regime cannot be explained by the inequality-averse model. We find that a significantly smaller proportion of the Set *H* subjects, compared with the Set *M* or Set *L* subjects, contribute positive amounts in the public good regime (see Appendix Table B.2).[19] This contradicts Prediction 2(b). In addition, this also cannot be explained by the differences between the Set *H* subjects and the Set *M* or *L*

[18] The number of vote outcomes having the public good under the equal voting rule (24 out of 28 cases) is significantly different from that under the weighted voting rule (17 out of 28 cases) according to a two-sample z-test of proportion (p-value = .0347, two-sided). See the hyp. columns in Table 2.

[19] The levels of contributions are very similar between the three categories of the subjects in the L treatment due to the fact that one Set *H* subject contributed his or her full endowment. The average contribution of the Set *H* subjects (3.36) is insignificantly smaller than that of the Set *M* subjects (6.36) or that of the Set *L* subjects (5.32) in the H treatment.

subjects in their beliefs on the contribution decisions of the other members − the differences are not statistically significant for most of the comparisons (Appendix Table B.3).[20] Moreover, the Set *M* and *L* subjects also believe that their peers in the Set *H* contribute significantly smaller percentages of the endowments than other categories of subjects do (Appendix Table B.3). Their anticipation turns out to be correct (Fig. 2). Although these results cannot be explained by inequality-aversion, they are consistent with the well-known experimental evidence that subjects' allocation amounts are positively dependent on their MPCRs (e.g., Fisher *et al.* 1995, Zelmer 2003). The MPCR of the Set *H* subjects (Set *L* subjects) is the lowest (highest) as shown in Eq. (1). In addition, it is also consistent with the findings of past studies showing that those vested with higher (lower) endowments cooperate less (more) in public goods games when their endowments are heterogeneous (e.g., Buckley and Croson 2006, Chan *et al.* 1996, Cherry *et al.* 2005, Maurice *et al.* 2013).

Result 3: Contribution Decisions of the Set H subjects in the Public Good Regime

A significantly smaller proportion of the Set H subjects, relative to that of the Set M and Set L subjects, contribute positive amounts to their public accounts.

Despite that the Set *M* and Set *L* subjects correctly believe that Set *H* subjects would contribute a lower percentage of their endowment to the public good than they do, Set *M* and Set *L* subjects still believe that they would obtain significantly higher payoffs than what standard theory predicts under the public good regime. The average payoff that the Set *H* subjects believe they would receive, however, is not significantly higher than their own endowment amount (Appendix Table B.7). A subject's believed ex-ante expected payoff is calculated by using her own allocation decision and her beliefs on the other four members' allocation decisions.[21]

In the lottery contest regime, the average allocated amounts to the lottery accounts by each category of the subjects are smaller than the standard theoretical predictions under the risk neutral preference (see Table 1 and Appendix Table B.5). This implies that they are on average risk-averse and that they attempt to avoid receiving smaller payoffs in case of losing competition.

[20] It implies that the less frequent positive contributions by the Set *H* subjects cannot be explained by reciprocity models either.

[21] Eq. (1) or (2) is used for this calculation. For instance, a Set *M* subject's believed payoff in the public good regime is calculated by: $20 - C_M + .2 \cdot 2 \cdot (C_H^b + C_M + C_M^b + 2C_L^b)$. Here, C_M is the contribution of the Set *M* subject, and C_H^b, C_M^b, and C_L^b are the Set *M* subject's beliefs on the contribution of the Set *H* member, the contribution of the other Set *M* member, and the average contribution of the two Set *L* members, respectively.

However, the overall characteristics of allocation amounts across subjects within groups stays close to the equilibria. We find that allocation amounts to the lottery accounts are similar among all subsets of the subjects (Set *H*, *M* or *L*) in the L treatment.[22] We also find that the average allocation amounts by the Set *H* subjects (Set *L* subjects) are the highest (lowest) in the H treatment.

An exploration of the subjects' beliefs reveals that the subjects with lower endowments under the contest regime overestimate the allocation amounts by their peers in the Set *H* (Appendix Table B.6). Both of the Set *M* and *L* subjects believe that the Set *H* subjects in their group allocate significantly more than 8 points (the optimal allocation amount predicted by standard theory with risk neutrality) to their lottery accounts in the L treatment. The Sets *M* and *L* subjects accordingly believe that their winning probability would be less than the standard theoretical predictions. In the H treatment, the Set *L* subjects on average believe that the Set *H* subjects in their groups allocate around 36 points to their lottery accounts, although it is not significantly different from the 22 points predicted by the standard theory due to small sample size: only two groups selected the lottery contest regime. Pessimism due to their incorrect estimates on the decisions of the Set *H* subjects may prevent the subjects with lower endowments from voting for the competitive regime to some degree.

Result 4: Allocation Decisions under the Lottery Contest Regime

The subjects in all categories allocate smaller amounts to their lottery accounts than the standard theoretical predictions with risk neutrality. Sets M and L subjects believe that their Set H subjects allocate significantly larger amounts to their lottery accounts and therefore have higher winning probabilities than the standard theoretical predictions in the L treatment.

An inter-regime comparison of the subjects' ex-ante expected payoffs finds that material incentives between the public good and contest regimes differ by assigned endowment (Fig. 3 and Appendix Table B.8). The Set *L* subjects on average believe that they would receive significantly higher expected payoffs under the public good regime in both of the L and H

[22] This result in the L treatment is different from a recent study by Corazzini *et al.* (2010). They find that allocation amounts are positively proportional to their assigned endowments in a lottery contest, where standard theory predicts each subject allocates the same amount. Note that in their study purchasing lottery tickets not only increases a chance of winning a prize but also contributes to a public good, unlike our study. Also, endowment amounts are private information for subjects in their study.

treatments. By contrast, the Set *M* subjects on average believe that they would obtain higher expected payoffs under the lottery contest regime in the H treatment, while they believe their payoffs would be higher under the public good regime in the L treatment. The Set *H* subjects on average believe that their expected payoffs would be higher under the lottery contest regime in the H treatment; but their believed payoffs are almost identical between the two regimes in the L treatment. These results partially explain Result 1: the smaller endowments subjects are assigned, the more likely they are to vote for the public good. For those with smaller endowments, unlike the Set *H* subjects, the public good regime is a materially more beneficial institution. However, despite the higher material incentive under the contest that the Set *H* and *M* subjects believe they would have, their actual voting decisions are surprisingly similar between the L and H treatments. This observation suggests that individuals' voting decisions, especially the Set *H* subjects', are driven not only by the level of their believed *own* ex-ante expected payoffs.

The ex-post payoffs of the subjects are similar to their believed ex-ante expected payoffs (Appendix Fig. B.1 and Table B.9). While the Set *L* subjects enjoy higher ex-post payoffs in both of the L and H treatments if the public good regime is collectively selected, the Set *H* subjects are materially better off in the H treatment if the lottery contest regime is collectively selected.

Result 5: Believed Ex-ante Expected Payoffs between the Two Regimes

The Set L subjects believe that they would obtain significantly higher expected payoffs under the public good regime, regardless of the award size in the lottery contest. The Set H and Set M subjects believe that they would obtain significantly higher expected payoffs under the lottery contest regime in the H treatment.

Despite Result 5, around half of the Set *H* subjects prefer having the public good regime in both of the main treatments (see Table 2). What drives this voting decision of theirs? Inter-regime comparisons on the distributions of the subjects' ex-ante expected payoffs and ex-post payoffs appear to suggest that their votes are affected by their (ex-ante or ex-post) inequality-averse concerns.

First, we find the Set *H* subjects believe that the Gini coefficients of expected payoffs are significantly smaller under the public good in the L treatments (see Fig. 4(a) and Appendix Table

B.10).[23] Each subject's believed Gini coefficient in her group can be calculated using Eq. (1) or (2). For this calculation, ex-ante expected payoffs of the five group members are computed based on the subject's own allocation decision and her beliefs on the decisions of the other four members'. The smaller believed Gini coefficient in the public goods regime suggests that the voting decisions of the Set *H* subjects may be affected by the difference in the ex-ante inequality between the two regimes.

Second, a similar observation can be made with ex-post inequality between the two regimes. Fig. 4(b) reports the average Gini coefficients of the subjects' realized payoffs within a group by regime. The Gini coefficients in the lottery contest regime are on average 65% and 135% higher than those in the public good regime in the L and H treatments, respectively.[24] The significant difference in the degree of ex-post inequality between the two regimes suggests that the subjects' inequality-averse motives may drive their voting decisions for the public good. Fig 4(b) also indicates that the average ex-post Gini coefficient under the contest regime is higher in the H treatment than in the L treatment. Despite the higher material incentives, the subjects in the H treatment may be discouraged from voting for the lottery contest due to the higher ex-post inequality.[25] This higher ex-post inequality in the H treatment may be the reason that Prediction 4 does not hold. These observations resonate with the result of Brock *et al.* in that ex-ante expected payoff comparison alone cannot explain people's decisions in a risky environment.

Result 6: Gini Coefficients by Regime

The Set H subjects believe that ex-ante expected payoffs are significantly more equally distributed under the public good regime than under the lottery contest regime in the L treatment. Gini coefficients of ex-post payoffs are significantly smaller under the public good regime than under the lottery contest regime in both the L and H treatments.

Another cause that could be responsible for the subjects' collective institutional choices, besides the inequality aversion, is their risk attitudes (see Section 3). However, our data does not

[23] Also the Set *H* subjects believe that the Gini coefficients are smaller under the public good in the H treatment although the difference is not statistically significant due to the small number of observations under the endogenously selected lottery contest regime (only two groups collective selected the contests).
[24] A Mann-Whitney test finds that the difference in the average Gini coefficient between the two regimes is significant in each treatment (see Appendix Table B.10).
[25] Also notice that the Gini coefficients of ex-ante expected payoffs under the contest regime are similar between the L and H treatments (Fig. 4(a)).

support Prediction 5. The average risk attitudes (η) are not significantly different between the supporters of the public good regime and those of the lottery contest regime for each of the Sets *H*, *M* and *L* subjects, regardless of the size of awards in the contest regime (see Appendix Table B.11).[26] This suggests that the risk attitudes are not the most important factor of the subjects' voting decisions.

Result 7: Risk Attitudes by Treatment

Prediction 5 does not hold. Risk Attitudes (η) are not significantly different between those who vote for the public good regime and those who vote for the lottery contest regime in each category of the subjects.

We note that as mentioned earlier there is a possibility that the subjects' institutional choices may be affected by the effects of the endogenous process. Recent research has found that democratic decision processes may raise people's pro-social behavior through a number of ways including the effects of signals sent through voting and the democracy premium (e.g., Tyran and Feld 2006, Dal Bó *et al.* 2010, Kamei 2014). We could therefore expect that the presence of the endogenous process may drive their votes for the public good, assuming that some subjects have non-standard preferences and may enjoy a higher level of mutual cooperation when the public good regime is endogenously imposed. As shown in Appendix Table B.12, we find that the more the Set *M* and *L* subjects (the Set *L* subjects) expect the other members to vote for the public good, the more likely they are to vote for it in the L (H) treatment. In addition, for most categories of subsets, the supporters of the public good regime contribute larger amounts, compared with the supporters of the lottery contest regime; although the differences in the average contribution are significant only for some comparisons. This suggests that some subjects may prefer to collectively implement the public good and to achieve mutual cooperation with the help of the endogenous process. These endogenous effects alone do not explain the subjects' collective institutional choices, however. The average contribution under the endogenous public good regime is actually slightly lower in the two endogenous treatments than in the Exogenous Public Good treatment (see Fig. 2). This suggests that the effects of signals and the democracy premium are not the most important factors that drive their institutional choices in our

[26] Also see Appendix Table B.1. A regression analysis finds that η and their votes for the public good regime are negatively correlated, but the correlation is not significant in each of the L and H treatments.

environment. This result, along with Results 6 and 7, suggest that it is more reasonable for us to interpret some of the Set *H* subjects' voting decisions as their dislike for an unequal distribution of payoffs (either ex-ante believed, or ex-post) among the members.

One may suspect that our results on the subjects' preferences for the public good are because of an insufficient size of the awards under the lottery contest regime. Accordingly, one may wonder how people would behave if the incentives of competition were even higher. Do the subjects with higher endowments still prefer having the public good rather than the lottery contest? How about the less-endowed subjects if their material incentive under the contest substantially increases? As the subjects with higher endowments have advantages over the others in competition, they may be inclined toward the contest regime more if the awards are sufficiently high. But, if their inequality-averse preferences are strong, their voting preferences may not be affected even if an award in the contest is sufficiently high. To gauge robustness of our preliminary conclusion to a very high award under the lottery contest regime, we additionally conducted two sessions by raising the size of the award in the contest from 110 points to 220 points while keeping all of the other experimental setups in the main treatments as they are.[27]

Our additional data indicates that the average ex-ante expected payoff the Set *H* subjects believe they would receive is higher under the contest regime as in the original treatments. Even though their material incentives under the contest regime increases, around 43% of the Set *H* subjects still vote for the public good in the additional experiment (Appendix Table B.13). This is similar to Bartling *et al.* that find people have strong aheadness-averse preferences when self-selecting their environment. The Gini coefficients for the subjects' ex-post payoffs are significantly different between the two regimes, but not for ex-ante expected payoffs that the Set *H* subjects believed their group members would obtain in their groups. It might be the case that in our context, ex-post comparison matters more than ex-ante comparison, or as suggested by Brock *et al.*, an inequality-averse preference based on the mixture of the ex-ante and ex-post

[27] With an award of 220 points, the equilibrium strategies based on the risk-neutral preference are: $x_H = 50$, $x_M = 20$ and $x_L = 10$; and their expected payoffs are: $\pi_H = 100$, $\pi_M = 40$ and $\pi_L = 20$. These expected payoffs are much higher than those in the L and H treatments (see Table 1). Notice that the subjects' strategic uncertainty in the public good regime stays the same in this additional treatment as that in the original treatments. Therefore, if people's material incentive or risk aversion is the most important driving force of our results, particularly risk-loving subjects would be more likely to vote for a competitive contest in the additional treatment, compared with the L and H treatments. Note that this should hold even if some kind of betrayal aversion is prevalent under the public good regime. This is because the degree of the betrayal-averse motives in the additional treatment is the same as that in the L and H treatments.

fairness may better explain their behavior. A further investigation concerning their relative importance between ex-ante or ex-post comparison and how it differs by endowment remains for future research. The data shows that their risk attitudes in this treatment are not significantly different between the supporters of the public good and of the lottery contest. Moreover, a calculation of relative risk aversion that rationalizes the decisions of the Set *H* subjects in the additional treatment suggests that factors other than risk aversion and material incentives must have driven their voting decisions.[28] These results support our preliminary conclusion in that the highly-endowed subjects' collective institutional choices in our environment are driven more by social preferences such as inequality aversion.

The additional analysis also indicates that the average ex-ante expected payoff the Set *L* subjects believe they would obtain is higher (although insignificantly) under the contest regime unlike the original treatments. However, the Set *L* subjects' voting preferences in this additional treatment are similar to those in the original treatments. Around 60% of them prefer having the public good regime. These results suggest that the less-endowed subjects' choices might also have been substantially affected by inequality aversion in the original treatments.

5. Conclusions

This paper provides the first experimental evidence concerning people's collective choices between a policy that helps the less-endowed to a greater degree − a public good regime − and a policy that promotes competition − a competitive lottery contest regime, in a situation where the resources of individuals are unequally distributed. In the experiment, around 70% to 80% of the subjects in total prefer having the public good in their groups, contrary to the standard theoretical predictions. The subjects with higher endowments believe that their expected payoffs would be higher if they choose the lottery contest when there is a possibility of winning a large prize. Nevertheless, the subjects' preferences for the public good, including those with

[28] The average expected payoff of the Set *H* subjects based on their beliefs is 56.1 points in the public good regime. The Set *H* subjects on average allocated 5.5 points to their lottery accounts and they believed that in total 18 points were allocated by the other four members in the additional treatment. This suggests that they on average believe that their winning probability in the competition is 5.5/(5.5+18)·100 ≈ 23.4%. Suppose that an individual *j* has a CRRA (Constant Relative Risk Aversion) utility function, $u_j(x) = \frac{x^{1-r}}{1-r}$. Here *r* indicates the degree of relative risk aversion. Suppose that individual *j* chooses option (a) 56.1 points with a probability of 100%, instead of option (b) 264.5 = 50−5.5+220 points (44.5 = 50−5.5+0 points) with a probability of 23.4% (76.6%), only considering her own payoff. Then, $u(56.1) \geq .234 \cdot u(264.5) + .766 \cdot u(44.5)$, or, $r \approx 1.888$. This means that she is ridiculously risk averse (see Table 3 of Holt and Laury 2002).

higher endowments, are not affected by the size of award in the other option: lottery contest regime.

A closer look at our data reveals that the highly-endowed subjects' institutional choices can be explained by inequality-averse preferences, although there is one aspect, their contribution decisions to the public good, that cannot be explained by it. The distributions of payoffs within groups − not only for ex-post payoffs but also for ex-ante expected payoffs the subjects believe their peers would receive in their groups − are more equal under the public good regime than the lottery contest regime. Our data does not support hypotheses that suggest other driving forces behind the subjects' collective institutional choices. That is, the subjects' decisions cannot be explained only by their risk attitudes or the effects of the endogenous decision process.

Our paper has two important implications regarding people's collective institutional choices. First, our study suggests that people's inequality-averse motives may be strong enough to drive their collective institutional choices away from competitive rules. This implies that a competitive scheme may not be collectively implemented in a society or an organization even though it may generate a materially better outcome, relative to an alternative with a public good aspect. Second, recent papers including Ertan *et al.* (2009), Putterman *et al.* (2011) and Kamei *et al.* (forthcoming) show that institutions that may materially benefit all members equally are more likely to be collectively selected when an equal voting rule is used because the majority of assenting votes outperform the fractions of perverse dissenting votes. Our results suggest that competitive policies, even if it may raise material benefits among people, may be *less* likely to be imposed with an equal voting rule (compared with a weighted voting rule) when there is an alternative with a public good aspect if the population's inequality-averse preferences are sufficiently strong and the alternative competitive rule generates a greater inequality among people.

We acknowledge that our experimental result on people's collective preferences for cooperative policies appears to contradict the light or moderate redistributive policies currently observed in our societies or organizations. It could be that the moderate redistributive policies seen in reality are consequences of the political process as briefly discussed in Section 1. We could also conjecture that as people collectively prefer having a cooperative policy over a competitive policy, policies may be pulled towards more redistributive direction in the long run.

Nevertheless, our study is definitely at the initial step on this topic. A further experimental or empirical investigation not only on people's collective preferences but also on the effects of the political process in relation to policy choices is desirable.

As a final remark, we note that societies or organizations combine policies that promote competition and ones mitigate inequality unlike our simpler setup. Researchers have proposed the importance of blending different policies. For example, Lazear (1989) has proposed that when relative performance evaluations of workers are used in a firm, pay inequality among them should not be too large. The competitive aspect of the policy prevents the demoralization of high-skilled workers while the less unequal wage structure prevents workers from engaging in uncooperative behavior. An experimental investigation concerning how people construct institutions when both kinds of policies are combined remains as an area for future research.

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Fig. 1: Schematic Diagram of the Experimental Design

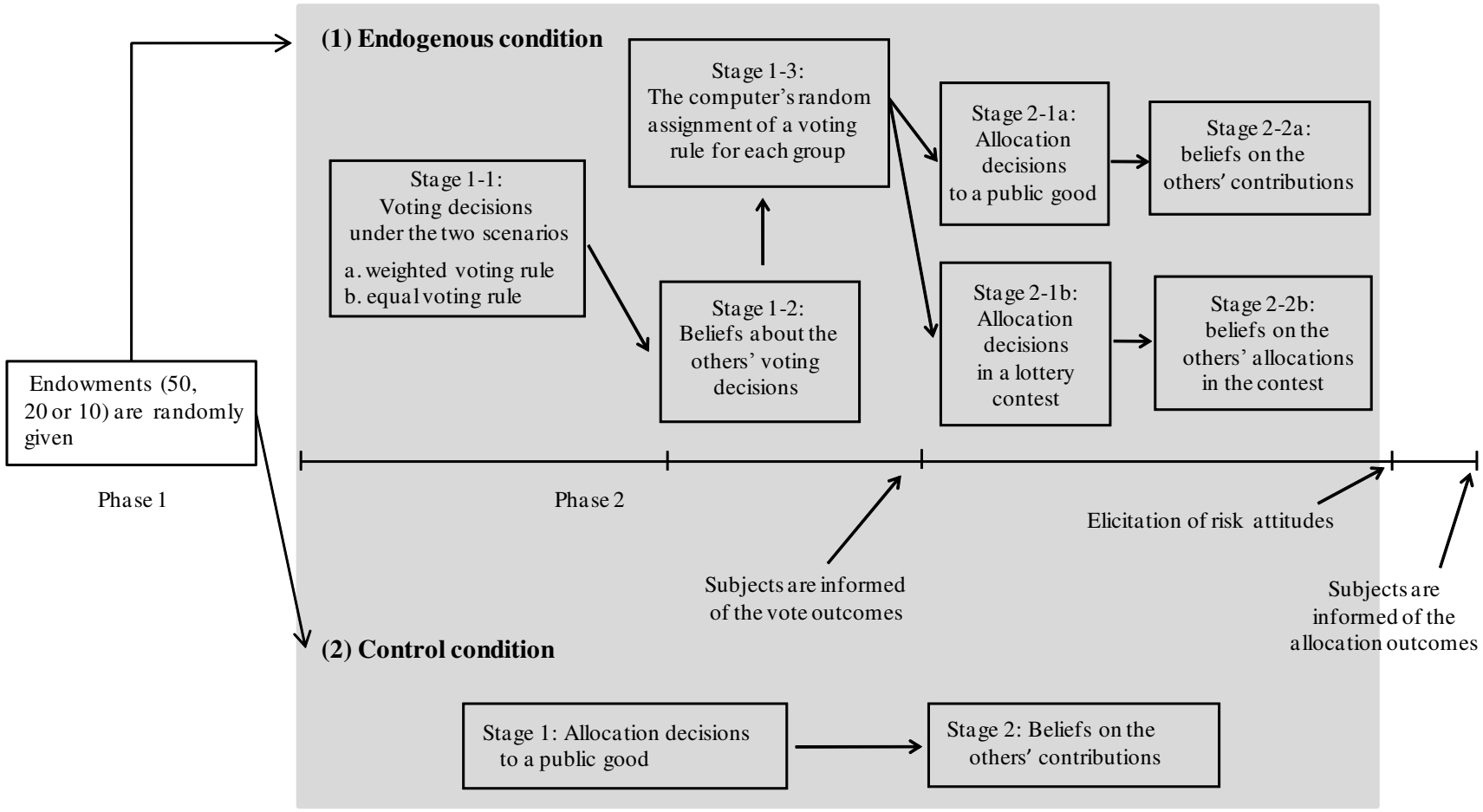


Table 1: Summary of Main Treatments

Treatment name	Award in a lottery contest	Number of sessions	Number of groups (subjects)	Standard theoretical predictions under the risk neutral preference				
				(a) Allocation decisions		(b) Payoff		(c) Voting decisions
				Public good	Lottery contest	Public good	Lottery contest	
[Main Treatments]								
L (Low)	50 points	4	15 (75)	$c_i = 0$ for all i	$x_i = 8$ for all i	$\pi_H = 50$ $\pi_M = 20$ $\pi_L = 10$	$\pi_H = 52$ $\pi_M = 22$ $\pi_L = 12$	All members vote for contest
H (High)	110 points	4	13 (65)	$c_i = 0$ for all i	$x_H \approx 21$ $x_M = 20$, and $x_L = 10$.	$\pi_H = 50$ $\pi_M = 20$ $\pi_L = 10$	$\pi_H = 57.5$ $\pi_M = 27.2$ $\pi_L = 13.6$	All members vote for contest
[Control Treatment]								
Exogenous Public Good	----	2	6 (30)	$c_i = 0$ for all i	----	$\pi_H = 50$ $\pi_M = 20$ $\pi_L = 10$	----	----

Notes: [1] Allocations to the public account are doubled and redistributed to group members. c_i is the contribution of subject i to her public account. x_i is the allocation of subject i to her lottery account. π_H, π_M, and π_L are the payoffs of Set H, Set M and Set L subjects, respectively. Besides these three treatments, one additional treatment was also conducted to check the robustness of our results by changing the award size in the contest regime to 220 points. See Section 4 for the details.

Table 2: Voting Decisions and Outcomes

(1) Individual conditional voting decisions

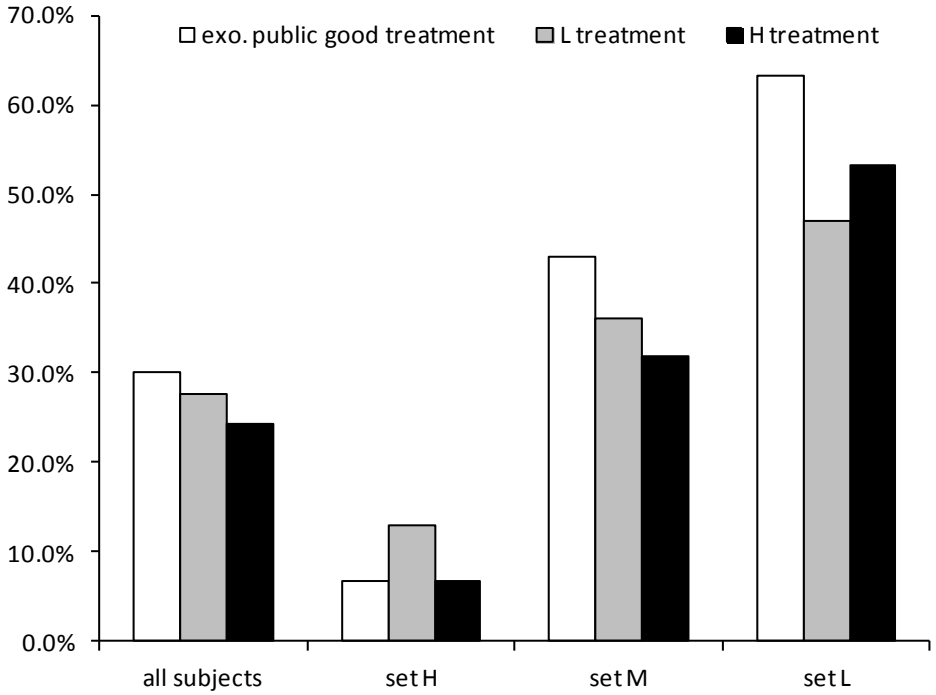
Treatment	category		Number of votes under EV[1]	Number of votes under WV[1]	Percentage under EV	Percentage under WV
L treatment	Set *H* subjects	Public good	8	8	53%	53%
		Lottery contest	7	7	47%	47%
	Set M subjects	Public good	23	21	77%	70%
		Lottery contest	7	9	23%	30%
	Set *L* subjects	Public good	21	23	70%	77%
		Lottery contest	9	7	30%	23%
	Subtotal	Public good	52	52	69%	69%
		Lottery contest	23	23	31%	31%
H treatment	Set *H* subjects	Public good	8	6	62%	46%
		Lottery contest	5	7	38%	54%
	Set *M* subjects	Public good	21	20	81%	77%
		Lottery contest	5	6	19%	23%
	Set *L* subjects	Public good	21	20	81%	77%
		Lottery contest	5	6	19%	23%
	Subtotal	Public good	50	46	77%	71%
		Lottery contest	15	19	23%	29%
Total		Public good	102	98	73%	70%
		Lottery contest	38	42	27%	30%

(2) Collective vote outcomes

		Number of groups				Percentage			
		EV[1]		WV[1]		EV		WV	
		actual[2]	hyp.[3]	actual	hyp.	actual	hyp.	actual	hyp.
L treatment	Public good	4	12	6	10	80%	80%	60%	66.7%
	Lottery contest	1	3	4	5	20%	20%	40%	33.3%
H treatment	Public good	4	12	7	7	100%	92.3%	78%	53.8%
	Lottery contest	0	1	2	6	0%	7.7%	22%	46.2%
Total	Public good	8	24	13	17	89%	85.7%	68%	60.7%
	Lottery contest	1	4	6	11	11%	14.3%	32%	39.3%

Notes: [1] The numbers in the EV (WV) columns in Panel (1) indicate the ones of individual voting decisions under the equal (weighted) voting rule. The numbers in the EV (WV) columns in Panel (2) indicate the ones of collective outcomes under the equal (weighted) voting rule. [2] The columns labeled actual indicate realized vote outcomes in groups where the equal or weighted voting rule was randomly assigned in the experiment. [3] The numbers in the hyp. columns under EV (WV) are the sums of (a) the numbers of realized collective outcomes under EV (WV) and (b) the numbers of unrealized collective outcomes based on subjects' unused votes under the EV (WV) in groups where the WV (EV) was assigned.

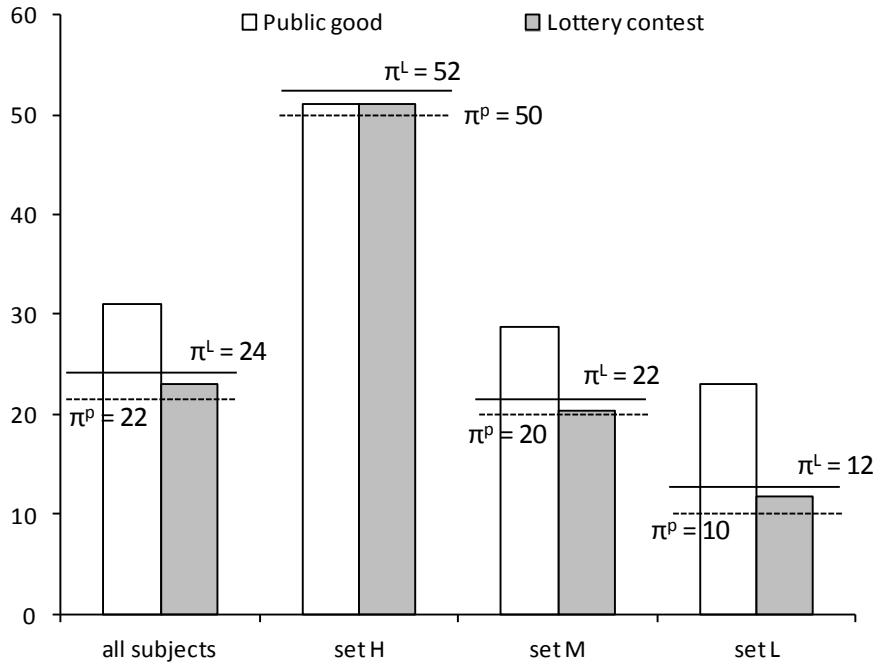
Fig. 2: Average Contribution Decisions in the Public Good Regime



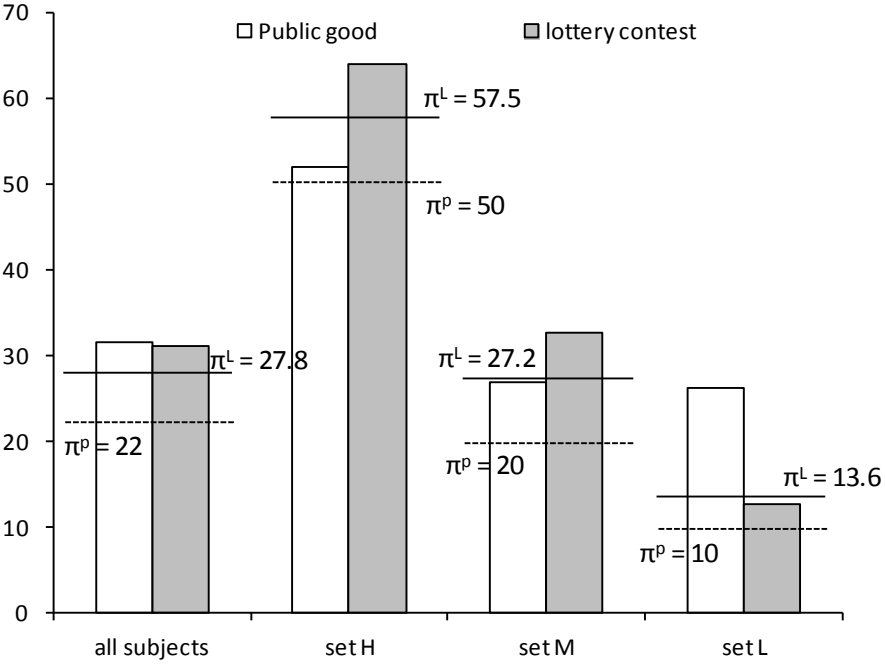
Notes: Each number in this figure is calculated by: 100·(the average contribution in the category)/(their endowments). Each of the "all subjects" bars is calculated by: 100· (the average contribution of all subjects in the corresponding treatment)/22. Here, 22 is the average endowment amount (= 110/5).

Fig. 3: Average Believed Ex-ante Expected Payoffs by Endowment and Regime

(a) The L treatment



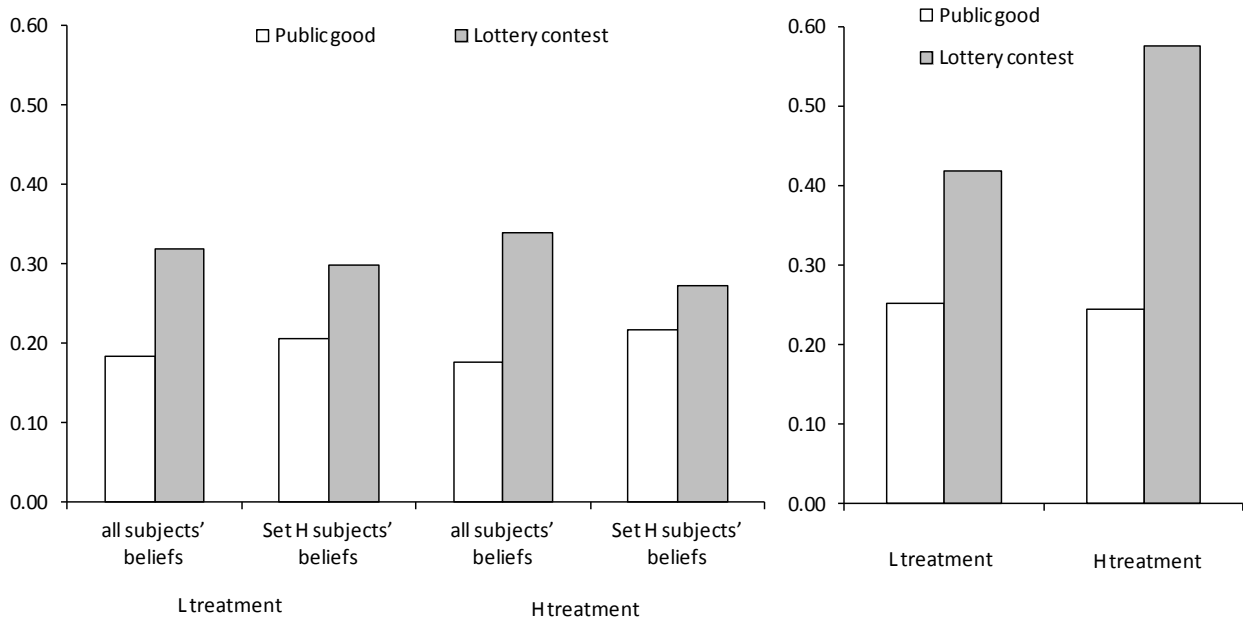
(b) The H treatment



Notes: π^p (π^L) are the payoffs under the public good (the lottery contest) based on the standard theoretical predictions with the risk-neutral preference. A subject's believed ex-ante expected payoff is calculated based on his or her own allocation decision and beliefs on the decisions of the other four members. The figures of average realized payoffs by endowment and regime are found in Appendix Fig. B.1.

Fig. 4: Average Gini Coefficients of the Subjects' Payoffs by Regime

(a) For believed distributions of ex-ante expected payoffs (b) For distributions of ex-post payoffs



Notes: Each bar in figure (a) indicates the average believed Gini coefficient across all the subjects or across the Set *H* subjects. Specifically, we first calculated each subject's (i) own ex-ante expected payoff and (i) believed other four members' ex-ante expected payoffs based on her allocation decision and beliefs. Eq. (1) or (2) were used in calculating the expected payoffs. We then calculate each subject's Gini coefficient. Each bar in figure (b) indicates the average realized Gini coefficient in groups by regime.