# Institutional Preferences, Social Preferences and Cooperation

*Evidence from a Lab-in-the Field Experiment in Rural China*

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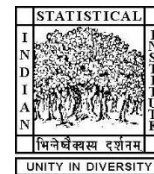
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**Contents**

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## Abstract

In this study, we examine institutional preferences, social preferences, and contribution in public goods games by conducting a lab-in-the-field experiment in rural China. Specifically, we examine whether people contribute differently depending on whether they are facing their preferred enforcement institution – punishment versus reward – and what factors are behind their institutional preferences. We find that subjects are more likely to choose reward than punishment. However, whether subjects' preferred institution matches the exogenously assigned institution does not have significant impacts on their contributions in the public goods game. Moreover, we find that subjects who prefer punishment tend to be free-riders, which cannot be fully explained by strategic concern or game history. We further find that there is a robust relationship between the preference for the punishment institution and certain efficiency-reducing social preference profiles, such as anti-social preferences, which may help explain the institutional preferences.

**Key Words:** institutional preferences; reward; punishment; social preferences; cooperation; public goods game.

**JEL Codes**: C92; C93; D02

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## 1. Introduction

Institutions are a crucial element in social organization and economic development. Institutions have played a significant role in promoting economic growth (Acemoglu and Robinson, 2010), community governance (Ostrom, 1990), human cultural evolution (Tabellini, 2008), etc. In the public goods provision environment, appropriate institutions can help maintain cooperation, thus reducing free-riding. The existing literature mainly focuses on studying how institutions are formed and identifying the effect of institutions on promoting cooperation. In general, it is found that endogenously formed institutions incorporating people's institutional preferences are more effective than exogenously imposed institutions in improving cooperation (Dal Bo, Foster, and Putterman 2010; Ertan, Page, and Putterman 2009; Kamei, Putterman, and Tyran 2015; Sutter, Haigner, and Kocher 2010). This to a large extent motivates experimental studies of why people prefer specific institutions.

Although many experimental studies have discussed people's preferences for public goods institutions, they mainly concentrate on preferences for informal sanction mechanisms, and relatively scant attention has been paid to how people choose formal institutions. Formal institutions such as laws, rules, and regulations are often imposed by a higher authority without people's participation or fair procedures in the decision-making process. However, formal institutional rules can be ineffective if enforcement capability is weak, as is often the case in rural China. In addition, there may be a mis-match between exogenously imposed institutions and individuals' institutional preferences. Individuals might be more likely to cooperate depending on whether their preferred institutions are implemented. It's thus intriguing to investigate people's preferences related to formal institutions and how the institutional preferences could affect the success of formal institutions in encouraging cooperation in public goods provision. One type of formal institution is the mechanism for enforcing rules. This paper investigates preferences for enforcement through punishment versus rewards.

A further question is what factors are behind people's institutional preferences. Studies examining this question have been limited, and the results are far from conclusive. For example, Drouvelis and Jamison (2015) examine the link between institutional choices and individual preferences such as risk aversion, loss aversion, and ambiguity aversion, but find no significant relationship. Similarly, Sutter, Haigner, and Kocher (2010) and Kocher and Matzat (2016) do not find significant correlations between institutional preferences and social-value orientations. We ask how social preferences could help explain subjects' preferences for specific institutions, especially preferences related to formal institutions. Similarly to Drouvelis and Jamison (2015), this paper

attempts to establish the link between social preference measures, elicited by an incentive-compatible experiment, and institutional preferences. One important reason to study the correlation between social preferences and institutional preferences is the realization that both reflect individuals' concerns for efficiency, but we have quite limited knowledge of how these concerns and preferences relate to each other.

We conducted a lab-in-the-field experiment in rural China. The core of the experiment was a three-stage public goods game (PGG). First, subjects played a standard linear public goods game. Then, we introduced two institutions exogenously implemented by the experimenters – one centralized automatic punishment institution and one centralized automatic reward institution – and we asked subjects to report which institution they preferred. To examine whether institutional preferences affect the effect of formal institutions on contributions in public goods games, after reporting institutional preferences, subjects were randomly assigned to either the punishment or the reward institution, regardless of their institutional preferences. We chose an exogenous punishment and reward design to mimic the institutional environment in rural China, where local lives are often affected by policies imposed by higher authorities without democratic participation of locals. In addition, we elicited subjects' social preferences in an incentive-compatible manner. In the experiment, subjects played three binary-choice dictator games where they chose between an equal allocation and an unequal allocation of payoffs.[1] We can thus comprehensively depict subjects' social preference profiles by combining these three choices.

This paper provides a first attempt to investigate individuals' preferences for formal institutions in a field setting, and to further examine the effect of formal institutions on cooperation by taking into account institutional preferences. In addition, this study provides complementary evidence about individuals' behavior in public goods provision by using Chinese farmers as experimental subjects. Compared with students and the urban population, rural residents in China tend to be more directly involved in public goods provision, as traditionally they have to provide many important local public goods for themselves, such as village schools, road maintenance, and irrigation facilities. Moreover, we believe our experimental design is appropriate to test how subjects with different institutional preferences respond to exogenously imposed formal institutions. In reality, it is difficult to identify the effect of institutional (mis)match on cooperation by collecting survey data. Our study thus can help improve the evaluation of the effect of formal

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[1] Binary-choice dictator games have been widely used to depict people's social preference profiles in economic literature (e.g., Fehr, Hoff, and Kshetramade 2008; Bauer, Chytilová, and Pertold-Gebická 2014; d'Adda and Levely 2016).

institutions on cooperation through increasing knowledge of individuals' preferences for formal institutions.

Furthermore, to our best knowledge, there are no previous studies investigating the relationship between social preferences and preferences for formal institutions. Our study thus contributes to the literature on the determinants of institutional preferences. In the public goods literature, it is often found that punishment is more effective than reward in improving cooperation (Choi and Ahn 2013; Dickinson, Masclet, and Villeval 2015; Sefton, Shupp, and Walker 2007; Sutter, Haigner, and Kocher 2010). Such findings are based on the condition that the low contributors or free-riders are punished, and this phenomenon is thus called pro-social punishment. But peer-punishment literature also finds an "anti-social punishment" phenomenon (Cinyabuguma, Page, and Putterman 2006; Herrmann, Thöni, and Gächter 2008; Nikiforakis 2008) where free-riders punish more pro-social players. Thus, whether individuals would prefer punishment may depend on their social preferences. Therefore, individuals' choices of different institutions could be related to their social preferences. In this study, our experimental design of three binary-choice dictator games allows us to classify subjects' social preferences into five different profiles (i.e., inequality averse, selfish, altruistic, envious, and equality averse), which have different implications in terms of social efficiency. We thus can examine which specific social preferences could help explain subjects' institutional preferences.

We find that about a quarter of all subjects prefer the punishment institution over the reward institution. Yet, whether or not subjects' preferred institution matches the exogenously assigned institution does not have significant impact on subjects' contributions in the public goods game. However, subjects who prefer punishment[2] tend to contribute less than those who prefer reward. This relationship cannot be fully explained by either strategic concern or the interactions that subjects faced previously. We further find that the preference for punishment is related to efficiency-reducing social preference profiles and that this relationship is robust to game history and to individual, household, and village characteristics.

The rest of the paper is structured as follows. In Section 2, we describe the experimental design and procedure. Experimental results are presented and discussed in Section 3. We conclude the paper in Section 4.

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[2] In the rest of the paper, we use the terms "prefer punishment/reward" and "prefer the punishment/reward institution" interchangeably, for the sake of brevity, although their meanings are slightly different.

## 2. Experimental Design and Procedure

### *2.1 Experimental Design*

The core of our experiment is a three-stage public goods game: first, subjects play a standard public goods game for five rounds; then they are asked to choose between the punishment and reward institution; finally, they play a public goods game with an exogenously imposed punishment/reward institution for another five rounds. The order of the three stages is fixed, and subjects do not have prior information about the next stage(s). We provide more details for each stage below.

**Stage 1: Standard PGG**

The first stage is a standard repeated linear public goods game. The game has five rounds. At the beginning of each round, subjects were randomly divided into three-person groups and each subject received an initial endowment of 10 yuan (CNY).[3] They were then asked to allocate an integer amount of money to a group account. The payoff function is as follows:

$$\pi_i = 10 - g_i + 0.5 \sum_{j=1}^{3} g_j, \; i\text{=1,2,3}$$

where $\pi_i$ is subject $i$'s payoff and $g_i$ is his contribution to the group account. The net marginal payoff of contribution is 0.5, offering monetary incentives to free ride. After all subjects made their contribution decisions, they were informed of the total group contribution and their individual payoffs before entering the next round.

**Stage 2: Preferences for Punishment and Reward Institutions**

After five rounds of the standard public goods game, we introduced the formal punishment and reward institutions to the subjects. Then, subjects were asked to choose which institution they would prefer if they were to play the public goods game again.

In the punishment (reward) institution, the payoff of the subject who contributed the least (the most) in his group in a round was automatically reduced (increased) by 1 yuan. If there was more than one subject contributing the least (the most), then the 1-yuan punishment (reward) was equally split among them. The size of punishment or reward is set to a low level such that free riding is still a Bayesian Nash equilibrium.[4] We use a

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[3] At the time of the experiment, 1 USD=6.55 CNY.

[4] To see this, consider first the punishment institution. Suppose everyone contributes $0 \leq k < 10$ and thus receives a punishment of 0.33 yuan. If a subject increases his contribution by 1 yuan, this decision avoids a punishment of 0.33 yuan, but reduces his payoff by 0.5 yuan. Because $0.33 - 0.50 < 0$, the subject will be better off without increasing the contribution. This argument indicates that subjects do not have an incentive to increase their contributions. When $k \geq 2$, one is strictly better off by deviating to a contribution of zero. In sum, there are two free-riding equilibria: no one contributes and everyone contributes 1 yuan.

weak punishment and reward design because we are particularly interested in behavior in the presence of free-riding incentives. It is also a more realistic reflection of the institutional environment in rural China, where many formal institutions suffer from weak enforcement capability and high detection costs, so that they are often non-deterrent de facto.

The punishment institution and reward institution we use in our experiment are different from the commonly used formal punishment design (see e.g., Tyran and Feld 2006; Putterman, Tyran, and Kamei 2011; Vollan et al. 2017) where there is a specific punishment-free contribution threshold. We don't specify a threshold, because the existence of the threshold may invoke an experimenter demanding effect or make some of the subjects anchor their contributions to the threshold. We believe our punishment/reward design also mimics many real-life situations where the appropriate or acceptable level of contribution to public goods is not salient or the same for everyone. Our punishment/reward design is similar to the "hired gun" punishment design in Andreoni and Gee (2012), in the sense that punishment (reward) targets the lowest (highest) contributors. A difference is that we allow subjects to be punished or rewarded even if they all contribute the same amount, so that punishment is strictly efficiency-reducing and reward is strictly efficiency-enhancing at the group level. This automatic non-deterrent punishment and reward design also helps avoid the strategic use of punishment/reward (Choi and Ahn 2013) .

**Stage 3: PGG in Exogenously Imposed Institutions**

After all subjects chose their preferred institutions, half of the groups were randomly assigned to the punishment institution and the other half to the reward institution, regardless of their stated institutional choices. Subjects were not informed of the institutional choices of others.[5] The public goods game with punishment or reward also has five rounds. The payoff function is the same as in the standard repeated linear public goods game in the first stage except for the imposed punishment and reward as described above. Subjects were randomly divided into three-person groups at the beginning of this stage and then the group composition was kept constant. The choice of partner design is mainly based on two considerations. The first is that we do not want subjects to switch

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Similar arguments apply to the reward institution, and there are two free-riding equilibria: one or two subjects contribute 1 yuan and the rest contribute zero.

[5] We do not choose an incentivized method to ask subjects for their institutional choices, for two reasons. First, most incentivized methods are complicated. Given that our subjects have low levels of education, we believe any complication might decrease data quality. Second, because subjects do not know what tasks they will face in the later stages, there is no reason for subjects not to state their true institutional preferences.
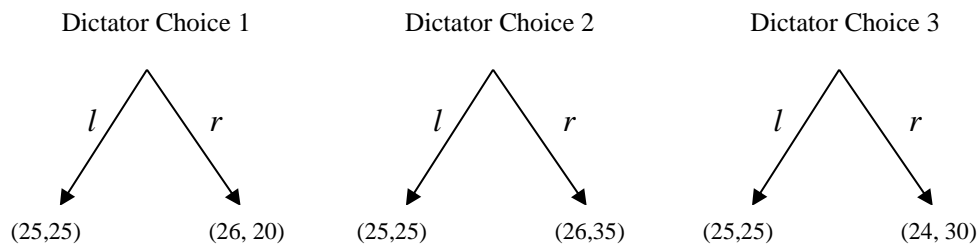
between institutions, which may cause confusion among subjects. The second consideration is a practical one. We have only six subjects in each institution. Even if we had used a stranger design to randomly divide six people into two groups for five rounds, the group members would hardly be strangers anyway.

After making their contribution decisions in each round, besides the total contribution of the group and the individual payoffs from the public goods game, subjects were informed of whether they have been punished or rewarded in the previous round and the size of the punishment or reward.

**Elicitation of Social Preferences**

We elicit subjects' social preferences via three binary-choice dictator games. In each dictator game choice, each subject played as one dictator, and chose between an equal distribution and an unequal distribution between himself and another randomly paired anonymous partner in the same session. Each subject made the decision independently. Figure 1 shows the different options of the three choices.

**Figure 1. Binary-Choice Dictator Games for the Elicitation of Social Preferences**

| Dictator Choice 1 | Dictator Choice 2 | Dictator Choice 3 |
|---|---|---|
| $l$        $r$ | $l$        $r$ | $l$        $r$ |
| (25,25)   (26, 20) | (25,25)   (26,35) | (25,25)   (24, 30) |

Subjects' choices boil down to the relationship among the four payoff allocations: (25, 25), (26, 20), (26, 35) and (24, 30). Different combinations of the three choices reflect different social preference profiles. We classify subjects into five mutually exclusive social preference profiles based on their choice combinations and name them according to possible interpretations: subjects who always choose allocations that maximize their own payoffs are classified as "selfish"; subjects who always choose the equal allocation are defined as "inequality averse"; subjects who prefer (26, 20) over (26, 35) or prefer (24, 30) over (26, 35) are classified as "envious" as they avoid inequality disadvantageous to themselves by reducing other people's payoffs;[6] subjects who maximize the payoffs of

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[6] Preferring (26, 20) over (26, 35) means choosing (26, 20) in choice 1 and choosing (25, 25) in choice 2. Preferring (24, 30) over (26, 35) means choosing (25, 25) in choice 2 and choosing (24, 30) in choice 3. This profile contains three different choice combinations. As we show later, these profiles show similarity in terms of institutional preferences. Thus, we combine them into one social preference profile. Further detailed classification does not change the main results.

others in the first two choices are classified as "altruistic";[7] and subjects who always choose the unequal allocations are defined as "equality averse."

The experiment was computerized and programed with z-Tree (Fischbacher 2007). For payment, the subjects were randomly paired for each choice and one of the three dictator choices was randomly selected to be paid. Because all subjects made decisions as dictators, one from each pair in the selected dictator choice was randomly picked as the dictator and the other as the passive receiver. The dictator's choice in the selected dictator game determined the payoffs of both players.

## 2.2 Experimental Procedure

We created a lab environment with tablets and cartons in the village conference rooms. We turned cartons into small cubicles with tablets inside so that subjects could make their decisions independently and anonymously. Communication among subjects was not permitted. Subjects received oral instructions from the experimenters at the beginning of each task and were asked to answer practice questions on paper before they started to make decisions in the experiments. The practice questions aimed to test whether the subjects understood how to calculate the payoff from the contributions in the public goods game. The experiment proceeded only when all subjects were able to correctly answer the practice questions. The whole experiment lasted around one and a half hours. Besides the experiments, subjects also needed to finish a household survey regarding their individual characteristics, household characteristics, and some individual attitudes.[8] Subjects were paid only after they finished both the experiment and household survey. The average payment to subjects was 166 yuan, which was equivalent to one and a half days' salary of an off-farm worker.

## 2.3 Subject Pool

We conducted our experiments and household survey in January 2016 in Minle County, Gansu Province, located in northwestern China.[9] We randomly selected 26 villages and conducted one experiment session in each village. For each experiment session, we randomly selected 12 men as our experimental subjects. In total, we had 312 male subjects. We deliberately chose all male subjects because men are usually household

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[7] This profile can be further divided into two sub-profiles based on the third choice between (25, 25) and (24, 30). Subjects who were willing to give up their own payoff to increase the payoff of others can be seen as "strongly altruistic" and those who were not can be regarded as "weakly altruistic." But this further classification does not affect the main results.

[8] Village information was collected by interviewing village leaders with a village questionnaire.

[9] The choice of the study site is partly driven by our research interest in understanding the relationship between water scarcity and cooperation.

decision-makers and represent their families in most of the community events. [10] Moreover, most middle-aged women in rural Gansu have little education and our pilot suggested that they might have found it difficult to understand the setup of our experiment.[11]

Table 1 summarizes individual characteristics, household characteristics, village characteristics, and social preferences indictors in the survey. Ninety-seven percent of our subjects are household heads.[12] The average age is 51 years, and the average education level is less than 7 years. About 10 percent of our subjects hold positions in village administration. The subjects on average spend more than 8 months at home, mainly for farming activities, and 40% of them had off-farm jobs in 2015. The average net household income per capita is 14,102 yuan. In addition, considering the survey measure of social preferences indicators, subjects on average think most people are trustworthy, whether or not they are their peer villagers.

*[Table 1 here]*

## 3. Results

### *3.1 Contributions in PGGs*

We first briefly look at subjects' average contributions in the standard public goods game and in the public goods game under exogenously imposed institutions without considering their institutional preferences. On average, subjects contribute about 60 percent of their endowment to the public account at the beginning and their contributions only slightly decrease over time. The mean contribution in the standard PGG is 5.95 yuan, close to Vollan et al. (2017), who conducted a similar PGG using Chinese migrant workers as subjects. Figure 2 shows the average group contributions in each round of the PGG. Rounds 6-10 in Figure 2 show average contributions of subjects in PGGs with punishment and reward separately. For the convenience of within-subject comparison and balance check, we also show the contributions of these two groups in the standard PGG in Rounds 1-5 in Figure 2. We can see that contributions are similar regardless of the stage of PGG and the institution implemented. We do not find any significant differences between the contributions in the PGG with punishment and the PGG with reward

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[10] It has been found that women on average have less decision power than their husbands in the context of rural western China (Bulte, Tu, and List 2015; Yang and Carlsson 2016).

[11] Thirty-nine percent of the wives of our male subjects never received any formal education and only seven percent received education higher than elementary school, while the corresponding figures for our male subjects are three percent and 57 percent respectively.

[12] One subject is the son of the household head and seven are the fathers of the household heads.

(clustered t-test, t=0.18, p=0.855; Somers' D, z=0.17, p=0.861). The two groups of subjects behave similarly in the standard PGG as well (clustered t-test, t= -1.42, p=0.167; Somers' D, z= -1.39, p=0.165), especially in the first round (M-W test, z=0.473, p=0.636, t-test=0.412, p=0.681). Furthermore, comparing the subjects' contributions in the PGGs with punishment/reward with their own contributions in the standard PGG, we find that neither the reward nor the punishment institution changes contributions significantly.[13] These insignificant effects could be due to the weak institutions or the exogenously implemented institutions mismatching subjects' institutional preferences.

*[Figure 2 here]*

### 3.2 Institutional Preferences, Institution (Mis)match and Contributions in PGG

In this section, we investigate how subjects' institutional preferences affect the effect of exogenous institutions on contributions in a public goods game. In particular, we aim to examine whether subjects' contributions depend on whether their preferred institutions match the exogenously assigned institutions.

The majority of subjects (232 out of 312) prefer the reward institution over the punishment institution. This result is consistent with the literature on institutional preference, where people tend to avoid punishment (Drouvelis and Jamison 2015; Gürerk 2013; Gürerk, Irlenbusch, and Rockenbach 2006; Kocher and Matzat 2016; Sutter, Haigner, and Kocher 2010). Yet, this also means that about a quarter of all subjects (80/312) prefer the punishment institutions. Because subjects are randomly assigned to groups with either the punishment or the reward institution regardless of their institutional preferences, subjects can be divided into four mutually exclusive groups based on which institution they prefer and which institution they are assigned to: subjects who prefer the punishment institution and are assigned to it (45 subjects, denoted as P in P); subjects who prefer the punishment institution but are assigned to the reward institution (35 subjects, denoted as P in R); subjects who prefer the reward institution but are assigned to the punishment institution (111 subjects, denoted as R in P); and subjects who prefer the reward institution and are assigned to it (121 subjects, denoted as R in R).

Figure 3 also shows the contribution trend of the four groups of subjects in both the standard PGG and the PGGs with exogenous institutions, where Rounds 1-5 are the contributions of the four groups in the standard PGG and Rounds 6-10 are the

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[13] See Table A1 in the Appendix for the detailed comparisons. Because we use stranger design in the standard PGG and rematch at the beginning of the PGGs with the punishment/reward institution, contributions in each session are likely related to each other. Therefore, all statistics and p-values shown in this sub-section are clustered at session level.

contributions of the four groups in the PGG with exogenous institutions. First, for each exogenously imposed institution, we compare the contributions of subjects who are assigned to their preferred institution with those who are not (see Table A2 in the Appendix for the detailed comparison). For subjects who prefer the reward institution, those who are assigned to the punishment institution (R in P) contribute in a manner similar to those who are assigned to the reward institution (R in R). For subjects who prefer the punishment institution, those who are assigned to the reward institution (P in R) contribute slightly less than those who are assigned to their preferred punishment institution (P in P), although the difference is not statistically significant (clustered t-test, t= -1.38, p=0.182, Somers' D, z= -1.46, p=0.146). Second, when we further take into account the contributions of the four groups in the standard PGG by combining both within-subject and between-subject comparisons, we still do not find any statistically significant institution mismatch effects on the contributions. If subjects choose the punishment institution to improve cooperation, they would increase their own contributions when assigned to the PGG with the punishment institution. But, as our results suggest, subjects do not respond to the punishment institution significantly, even for those who prefer punishment. Therefore, these results suggest that, although subjects favor one institution over the other, they do not respond much when the institutions are exogenously imposed on them.

*[Figure 3 here]*

The question is why subjects have preferences for a certain institution, especially preference for the punishment institution. Figure 3 reveals some interesting results when we compare the contributions of subjects who prefer the reward institution with the contributions of those who prefer the punishment institution. Subjects who prefer the punishment institution contribute consistently less than those who prefer the reward institution in both the standard PGG (5.05 yuan vs. 6.26 yuan, clustered t-test, t= -3.95, p=0.001; Somers' D, z= -3.80, p=0.000) and the PGGs with an exogenously imposed institution (4.69 yuan vs. 6.34 yuan, clustered t-test, t=-4.37, p=0.000; Somers' D, z= -4.53, p=0.000; see Table A3 in the Appendix for the detailed comparison). As the punishment institution is designed to automatically punish the lowest contributors, it is surprising to see that a preference for the punishment institution is actually associated with lower levels of contributions. This result is different from the findings in the literature on PGGs with peer punishment/reward where subjects strategically choose the punishment institution to improve contributions. Nonetheless, our formal automatic weak punishment/reward institutions have little space for such strategic considerations. The

contribution behaviors of subjects with different institutional preferences thus inspire us to explore what factors could drive their preferences over the specific institution.

### *3.3 The Determinants of Institutional Preferences*

### 3.3.1 Game History and Institutional Preference

Before we investigate how the institutional preferences are related to social preferences, we first simply test whether the specific institutional preferences result from the interaction history in the first five-round standard PGG. Subjects who are matched with uncooperative group members and fall victims of free-riding may want to punish free-riders and reduce their own contributions at the same time. Thus, both the lower average contributions from subjects who prefer punishment and their preference for punishment could be the results of misfortune in the initial interactions. However, this explanation is not supported by our data. Figures 4A and 4B display subjects' own contributions and payoffs as well as the average contributions and payoffs of other group members in each round of the standard PGG by subjects' institutional preferences.[14] As we can see, the lower contributions of subjects who prefer the punishment institution are not driven by the misfortune of encountering free-riders. On the contrary, the average contributions of subjects who prefer punishment are lower not only in absolute terms, but also in relative terms. Correspondingly, subjects who prefer punishment consistently contribute less and have higher payoffs than other members in their groups. It should be noted that, in the first round, the average contributions of other group members are actually similar both for subjects who prefer punishment and those who prefer reward, and the main difference comes from subjects' own contributions. This means that subjects who prefer punishment weren't matched with other group members who were free-riders, but subjects who prefer punishment themselves were more likely to be the free-riders who pulled down the group contributions.

*[Figure 4a here]*

*[Figure 4b here]*

### 3.3.2 Social Preferences and Institutional Preferences

We then examine how subjects' social preferences correlate with their institutional preferences. We first simply test whether subjects who prefer punishment are inherently less cooperative by looking at the distribution of first-round contributions conditional on

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[14] Detailed information about the contributions of subjects with different institutional preferences in the PGGs is shown in Table A3 in the Appendix.

their institutional preferences. In fact, contributions in the first round of the standard PGG are not affected by the game history and can be considered as a measure of subjects' willingness to cooperate. As shown in Figure 5, one result stands out clearly: there is a much higher proportion of free-riders (those who contribute nothing) among subjects who prefer the punishment institution. Based on the contribution distribution in Figure 5, we follow Gunnthorsdottir, Houser, and McCabe (2007) to classify the whole sample into three categories according to contribution level in the first round of standard PGG: "High" contributors are subjects who contribute at least 7 yuan; "Middle" contributors are those who contribute 4-6 yuan; and "Low" contributors are those who contribute no more than 3 yuan. Table 2 summarizes the proportions of people who prefer the punishment institution in each of the three categories. We find that more than 44% of "Low" contributors prefer the punishment institution, much higher than the proportion among the "High" and "Middle" contributors. Proportion tests show that subjects with low contributions are statistically more likely to prefer the punishment institution than those with Medium and High contributions (Low vs. Medium, z=3.0021; Low vs. High, z=3.0400) and there is no difference between subjects with Medium contributions and those with High contributions (z=0.2338). The above findings imply that people who prefer punishment are less cooperative to begin with.

*[Figure 5 here]*

*[Table 2 here]*

We further investigate whether subjects' institutional preferences are driven by their social preferences measured by the dictator games that are independent of the public goods game. As described in Section 2, we elicit subjects' social preferences with three binary-choice dictator games. Then, we classify subjects into five mutually exclusive social preference profiles based on subjects' choices in those three games. The distribution of these five social preference profiles in our sample is reported in Table 3. The "altruistic" profile and the "inequality averse" profile are the two most common social preference profiles, accounting for about 65% of the sample, while the "selfish" profile has the smallest number of subjects in any of the five profiles.

Different preference profiles have different implications in terms of social efficiency. The "selfish" and "inequality averse" profiles don't care about social efficiency. The "envious" profile seems to be efficiency-reducing or anti-social, as people are willing to reduce others' payoffs without personal gain or even are willing to sacrifice their own payoffs. Meanwhile, the "altruistic" profile is more pro-social or other-regarding, as people refrain from taking advantage of others and are willing to accept a large

disadvantageous inequity for a mutually beneficial allocation. The "equality averse" profile is a bit tricky to interpret. This relationship implies a "perverse" utility function, where people have an increasing rate of substitution between their own payoff and others' payoffs, as they are more willing to trade their own payoff for the benefit of others when they have less, but less willing to do so when they are better-off. Conversely, they are more willing to hurt others for their own benefit when they are richer than when they are poorer. In a way, this can also be perceived as an "anti-social" type. Because our punishment institution is efficiency-reducing and the reward institution is efficiency-enhancing given contributions in the PGG, we would like to examine whether the preferences for the punishment institution are related to the social preference profiles with "efficiency-reducing" or "anti-social" traits.

Table 3 displays the proportion of subjects who prefer the punishment institution in each social preference profile. We observe substantial heterogeneities in institutional preferences across different social preference profiles, ranging from 8% to 41%. Subjects with "envious" and "equality averse" profiles have a much stronger preference than others for the punishment institution. About 40% of subjects of both profiles prefer the punishment institution,[15] whereas people of all other profiles prefer the punishment institution in less than 21% of cases. It seems that the preferences for punishment are related to "efficiency-reducing" or "anti-social" social preferences.

*[Table 3 here]*

To examine whether these relationships are robust when taking other factors into account, we further run Probit regressions using the dummy of preference for punishment institution as the dependent variable. The results are shown in Table 4, and the figures reported are the marginal effects. In column (1), we only include dummy variables for different preference profiles with the "altruistic" profile as a reference group. We then add individual, household, and village characteristics in column (2).[16] In column (3), we further include survey-based social preference indicators (general trust, trust toward villagers, perception about whether people are willing to take advantage of others, and perception about whether people are ready to help others). To further control for the

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[15] As shown in Table 3, the "envious" profile contains three different choice combinations. However, the proportions of subjects who prefer punishment are very similar (41% in [l, l, r], 42% in [r, l, l] and 41% in [r, l, r]). The "altruistic" profile also has two choice combinations, and they are also similar in terms of their institutional preferences (20% in [l, r, r] and 24% in [l, r, l]). Therefore, we do not further discuss them separately.

[16] The individual and household characteristics variables include age, years of schooling, risk attitude measured on a 1-10 scale, number of siblings, household land size, household size, and whether the household owns an apartment in town (as a proxy for wealth). The village characteristics variables include village land size, whether the village has an enterprise, share of population engaged in off-farm labor, distance to nearest town seat, and distance to the county seat.

possible influence of interactions in the standard PGG, in column (4) and column (5), we add subjects' contributions and the gap between their own contribution and the average contribution of other group members in the first round and fifth round of the standard PGG respectively as additional explanatory variables. To distinguish possible different effects of being free-ridden by others and free-riding others, we include the size of the positive gap and the absolute value of the negative gap respectively.

The main findings are robust to the inclusion of various additional explanatory variables and consistent with the descriptive results in Table 3. With the "altruistic" preference profile as the reference group, the two "anti-social" preference profiles, namely "envious" and "equality averse," still stand out. Subjects of the "envious" profiles are about 15 percentage points (specific size depends on which regression specification we look at) more likely to prefer the punishment institution than those of the "altruistic" preference profile. This result implies that the preference for the punishment institution is indeed related to certain efficiency-reducing or anti-social preferences. The result is further supported by the survey-measured social preference indicator. Subjects who think more people in society will take advantage of others are more likely to choose punishment.

Moreover, we also find some evidence that the interactions in the first round and fifth round of the standard PGG have explanatory power for the preference for the punishment institution. As shown in columns (4) and (5), given their own contributions, the experience of being free-ridden by others (measured by the positive gap between their own contribution and the average contribution of others) in the first round increases the likelihood of subjects choosing the punishment institution, while this experience in the fifth round is not significant. This again strengthens the previous findings that the contribution behaviors in the first round to a large extent reflect subjects' cooperative dispositions (Gunnthorsdottir, Houser and McCabe 2007; Kurzban and Houser 2005; Ones and Putterman 2007). In addition, the experience of being free-riders in both the first and fifth round does not have an additional effect on the likelihood of choosing the punishment institution. Finally, we don't find other socioeconomic characteristics that significantly correlate with subjects' choices for punishment versus reward, except for years of schooling: subjects who have a low level of education are more likely to choose the punishment institution. Although the experimental design and context are different, we find similar results to Drouvelis and Jamison (2015): that subjects' risk attitudes do not have significant links with their preferences for punishment or reward as an enforcement institution.[17]

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[17] We also conducted one simple risk experiment to measure subjects' risk attitudes. Subjects were asked to choose between a sure income of 10 yuan and a lottery with a 50% chance of getting 20 yuan and 50%

*[Table 4 here]*

## 4. Conclusions

Formal institutions are widely observed in the real world, but we have limited knowledge of how the outcomes of formal institutions are affected by people's institutional preferences. Therefore, increasing the understanding of how people choose formal institutions and the driving factors that form their choices is important to improving institutional design. This paper uses experimental methods to investigate individuals' preferences for punishment or reward as enforcement institutions in the context of public goods provision and how such preferences are related to their social preferences.

We conducted a lab-in-the-field experiment with 312 male subjects in rural northwestern China. We introduced exogenously imposed centralized punishment and reward institutions in public goods game settings and asked for subjects' preference between the two institutions before randomly assigning them to either of the institutions. In this way, some subjects' institutional preferences matched the institutions they were assigned to, but others did not. Thus, we can examine whether people's contribution behavior in the PGG depends on whether their preferred institution matched the exogenously assigned institution. We adopted a formal exogenous and weak punishment/reward design that is meant to resemble real-life situations in rural China. In addition, we used an incentive-compatible method to elicit subjects' social preference profiles through three binary-choice dictator games.

Although our findings are in line with the existing literature showing that most subjects prefer reward, about a quarter of our subjects prefer punishment. Considering the possible impact of institutional preferences on the effect of formal institutions on contributions in a public goods game, we do not find any statistically significant effects of institution mismatch on contributions, neither among subjects who prefer the punishment institution nor among those who prefer the reward institution. Moreover, we find that subjects who prefer the punishment institution contribute significantly less than those who prefer the reward institution. Neither strategic concerns nor game history can fully explain subjects' preference for punishment or reward, nor can they explain why subjects who prefer the punishment institution contribute less than those who prefer the reward institution. We further find that "low" contributors are more likely to prefer

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of getting 0 yuan. Subjects choosing the lottery are more risk-seeking than those who choose the sure payment. The estimated results are similar regardless of the variables we use to measure subjects' risk attitudes.

punishment, and the preference for punishment is significantly related to certain efficiency-reducing or anti-social social preference profiles. This relationship is robust to the inclusion of various individual, household, and village characteristics, and to the game history indicators. This finding provides some additional insights into the "anti-social" punishment behavior identified in the literature (Herrmann, Thöni, and Gächter 2008; Thöni 2014). People may choose to punish others not only because of strategic concerns or to enforce social norms, but also because of certain intrinsic "anti-social" preferences or to simply enjoy the "pleasure of being nasty" (Abbink and Sadrieh 2009).

The lack of response to the exogenously imposed institutions may be the result of the typical top-down governance regimes in rural China. Farmers who are used to the exogenously imposed rules might not have learned how to take their own preferences into account. In an experiment with Chinese college students and migrant workers, Vollan et al. (2017) do not find any "democracy premium" in terms of contributions in PGGs, but they find that subjects who are more obedient to authority are more cooperative under top-down governance. In terms of policy-making, this implies that, in certain contexts, the effects of exogenously imposed policies or policy changes on outcomes may not be affected by people's policy preferences. Moreover, our findings may also provide some insights into endogenous policy-making processes. Active support of a particular institution or policy from certain groups in the society does not necessarily represent their commitment to the socially desirable outcomes that the institution or policy in question aims to achieve, or their willingness to comply if it is ever implemented. The preference for an institution could be driven by underlying preferences, beliefs, or ideologies, instead of belief in the effectiveness of such an institution in achieving the goals.

This study offers some insights into the relationship between institutions, preferences, and cooperation, although we would like to be cautious when generalizing the results to other situations. The punishment and reward institutions in our experiment are designed to be formal (determined by the experimenter, not by other subjects), non-deterrent (with an incentive to free-ride), and exogenously imposed (regardless of individuals' institutional preferences). The lack of response to the institution mismatch might not apply to other institutional settings. Future studies should be expanded to alternative institutions and should examine whether the relationship between institutional preferences and the effect of implemented institutions still holds, especially for endogenously determined institutions. Moreover, we are looking at farmers carrying experiences from their own context, specifically the availability of irrigation. The context of irrigation agriculture may contribute to ineffective findings, because irrigation is found to be associated with centralization of governance structures and less democratic attitudes

(Bentzen, Kaarsen, and Wingender 2017). People from other backgrounds could react differently, which is left for studies in the future. At last, the relationship between preferences for the punishment institution and "anti-social" or "efficiency-reducing" social preference profiles is only correlational, not causal. Future studies are needed to uncover the mechanisms behind this correlation.

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**Table 1. Summary Statistics of Individual and Household Characteristics**

| Variable name | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| *Individual characteristics* | | | | | |
| Household head (dummy) | 0.97 | 0.16 | 0 | 1 | 312 |
| Age | 51.4 | 4.96 | 35 | 66 | 312 |
| Years of schooling | 6.63 | 2.62 | 0 | 15 | 312 |
| Party member (yes=1) | 0.24 | 0.43 | 0 | 1 | 312 |
| Off-farm job dummy (have any=1) | 0.39 | 0.49 | 0 | 1 | 312 |
| Time at home in 2015 (month) | 8.24 | 3.45 | 1 | 12 | 312 |
| Risk attitude (1-10 scale) | 5.23 | 2.71 | 1 | 10 | 310 |
| *Household characteristics* | | | | | |
| No. of siblings | 4.07 | 1.97 | 0 | 11 | 312 |
| Majority Family name dummy (yes=1) | 0.83 | 0.38 | 0 | 1 | 312 |
| Household size (person) | 4.09 | 1.35 | 1 | 8 | 312 |
| Farm size (mu) | 18.36 | 10.94 | 2.5 | 72 | 312 |
| Gross income per capita (1000 yuan) | 22.06 | 56.23 | 0.06 | 753.41 | 312 |
| *Village characteristics* | | | | | |
| Village arable land size (mu) | 4959 | 2265 | 1500 | 11200 | 312 |
| Distance to town seat (km) | 5.17 | 2.58 | 1 | 11 | 312 |
| Distance to county seat (km) | 13.79 | 99.51 | 0 | 40 | 312 |
| Village enterprise dummy | 0.35 | 0.48 | 0 | 1 | 312 |
| Share of local nonfarm labor (%) | 19.01 | 11.54 | 0.75 | 50.61 | 312 |
| *Social preferences indicators in survey* | | | | | |
| General trust | 7.28 | 2.07 | 1 | 10 | 312 |
| Trust toward villagers | 7.15 | 2.06 | 1 | 10 | 312 |
| Take advantage of others | 2.77 | 1.04 | 1 | 5 | 312 |
| Ready to help | 3.15 | 1.04 | 1 | 5 | 312 |

Note: Figures in the table are calculated by the authors. Risk attitude is self-reported risk attitude on a 1-10 scale, 1 as absolutely risk-averse and 10 as absolutely risk-loving. The *general trust* and *trust toward villagers* indicators are subjects' attitudes toward the statements "most people are trustworthy" and "people in the same village are trustworthy." The answers are on a 1-10 scale, 1 as absolutely disagree and 10 as absolutely agree. The *take advantage of others* and *ready to help* variables are the answers to "how many people in society do you think will take advantage of others if given the chance?" and "how many people in society do you think are ready to help?" respectively. The answers are on a 1-5 scale, 1 as "almost no one" and 5 as "the vast majority."

**Table 2. Subjects' Contributions Conditional on their Institutional Choices**

| Contribution in the first round in standard PGG | (1) No. of Subjects | (2) No. of subjects who prefer the punishment institution | (3) % in each type |
|---|---|---|---|
| Low | 52 | 23 | 44.2% |
| Medium | 147 | 33 | 22.4% |
| High | 113 | 24 | 21.2% |
| | 312 | 80 | 25.6% |

Note: We define subjects who contributed from 0 to 3 yuan in the first round of the standard PGG as low contributors (Low); those who contributed from 4 to 6 yuan as medium contributors (Medium); and those who contributed from 7 to 10 yuan as high contributor (High).

**Table 3. Choice Patterns in the Three Dictator Games and Institutional Choices**

| Preference profile | Choice combination | (1) No. of Subjects | (2) No. (%) of subjects who chose Punishment |
|---|---|---|---|
| Inequality aversion (IA) | (l, l, l) | 92 | 16 (17.4%) |
| Altruism (AL) | (l, r, l), (l, r, r) | 110 | 23 (20.9%) |
| Envious (EV) | (l, l, r), (r, l, l), (r, l, r) | 63 | 26 (41.3%) |
| Selfish (SE) | (r, r, l) | 12 | 1 (8.3%) |
| Equality aversion (EA) | (r, r, r) | 35 | 14 (40.0%) |
|  |  | 312 | 80 (25.6%) |

Note: Figures are calculated by the authors. In choice combinations, l and r correspond to the left arm and right arm in the decision tree depicted in Figure 1. For instance, choice combination (r, r, l) stands for a subject choosing (26, 20) in dictator choice 1, (26, 35) in dictator choice 2, and (25, 25) in dictator choice 3.

**Table 4. Social Preference Profiles and Preference for the Punishment Institution**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Social preference profiles | | | | | |
| Inequality averse | -0.0394 | -0.0221 | -0.0275 | -0.0486 | -0.0433 |
| | (0.0558) | (0.0604) | (0.0616) | (0.0612) | (0.0623) |
| Selfish | -0.175 | -0.231 | -0.268 | -0.240 | -0.255 |
| | (0.185) | (0.177) | (0.167) | (0.165) | (0.166) |
| Envious | 0.180*** | 0.170*** | 0.162*** | 0.141** | 0.149*** |
| | (0.0543) | (0.0541) | (0.0554) | (0.0600) | (0.0554) |
| Equality averse | 0.170* | 0.126 | 0.109 | 0.109 | 0.144* |
| | (0.0875) | (0.0869) | (0.0859) | (0.0883) | (0.0831) |
| General trust | | | 0.0165 | 0.0169 | 0.0225 |
| | | | (0.0134) | (0.0132) | (0.0137) |
| Trust toward villagers | | | 0.00181 | 0.00400 | 0.00174 |
| | | | (0.0127) | (0.0130) | (0.0131) |
| Take advantage of others | | | 0.0380* | 0.0394* | 0.0364* |
| | | | (0.0227) | (0.0225) | (0.0220) |
| Ready to help | | | -0.0118 | -0.0143 | -0.0146 |
| | | | (0.0238) | (0.0231) | (0.0220) |
| 1st round Contri. in Standard PGG | | | | -0.0245* | |
| | | | | (0.0144) | |
| Positive gap in 1st round Con. (own-other) | | | | 0.0250* | |
| | | | | (0.0147) | |
| Negative gap in 1st round Con. \| own-other \| | | | | 0.0121 | |
| | | | | (0.0169) | |
| 5th round Contri. in Standard PGG | | | | | -0.0370*** |
| | | | | | (0.00852) |
| Positive gap in 5th round Con. (own-other) | | | | | 0.0176 |
| | | | | | (0.0154) |
| Negative gap in 5th round Con. \| own-other \| | | | | | -0.00357 |
| | | | | | (0.00709) |
| Risk attitude | | 0.0125 | 0.0120 | 0.0131 | 0.00827 |
| | | (0.0108) | (0.0106) | (0.00945) | (0.0107) |
| Age | | 0.000123 | -0.000599 | -0.00130 | -0.000558 |
| | | (0.00461) | (0.00487) | (0.00475) | (0.00465) |
| Years of schooling | | -0.0251*** | -0.0263*** | -0.0230** | -0.0288*** |
| | | (0.00899) | (0.00918) | (0.00988) | (0.00864) |
| Party member | | 0.0492 | 0.0472 | 0.0289 | 0.0394 |
| | | (0.0535) | (0.0550) | (0.0549) | (0.0544) |
| Size of contracted land | | -0.000269 | -0.000544 | -0.00117 | -0.000909 |
| | | (0.00230) | (0.00227) | (0.00202) | (0.00225) |
| No. of siblings | | 0.00948 | 0.00974 | 0.00662 | 0.00492 |
| | | (0.00917) | (0.00979) | (0.00881) | (0.00861) |
| Household size | | -0.0188 | -0.0180 | -0.00901 | -0.0169 |
| | | (0.0176) | (0.0169) | (0.0181) | (0.0176) |
| Have an apartment | | -0.0435 | -0.0319 | -0.0399 | -0.0488 |
| | | (0.132) | (0.128) | (0.121) | (0.128) |
| Water scarcity: village | | -0.0790 | -0.0766 | -0.00652 | -0.0228 |
| | | (0.0937) | (0.0975) | (0.0829) | (0.0945) |
| Dummy for enterprise in village | | 0.0524 | 0.0589 | 0.0751* | 0.0698 |
| | | (0.0512) | (0.0532) | (0.0425) | (0.0496) |
| Share of non-farm labor in village | | 0.136 | 0.108 | 0.0748 | 0.00672 |
| | | (0.177) | (0.185) | (0.165) | (0.172) |
| Distance to town seat | | 0.00178 | -0.000273 | 0.00265 | 0.00333 |
| | | (0.00965) | (0.00990) | (0.00860) | (0.00952) |
| Distance to county seat | | 0.00134 | 0.00167 | -0.000438 | 0.00132 |
| | | (0.00261) | (0.00276) | (0.00267) | (0.00252) |
| Observations | 312 | 310 | 310 | 310 | 310 |
| Pseudo $R^2$ | 0.051 | 0.097 | 0.110 | 0.143 | 0.153 |

Note: Robust standard errors clustered at village level are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Marginal effects are reported. The "altruistic" preference profile is used as the reference group for social preference profile dummies. The individual and household characteristics variables include age, years of schooling, party membership, risk attitude, number of siblings, household land size, household size, and whether the household owns an apartment in town (as a proxy for wealth). The village characteristics variables include village land size, water scarcity indicator, dummy for village enterprise, share of population engaged in off-farm labor, distance to nearest town seat, and distance to the county seat.

**Figure 2. Evolution of Contributions, by PGG Institution Assignment**
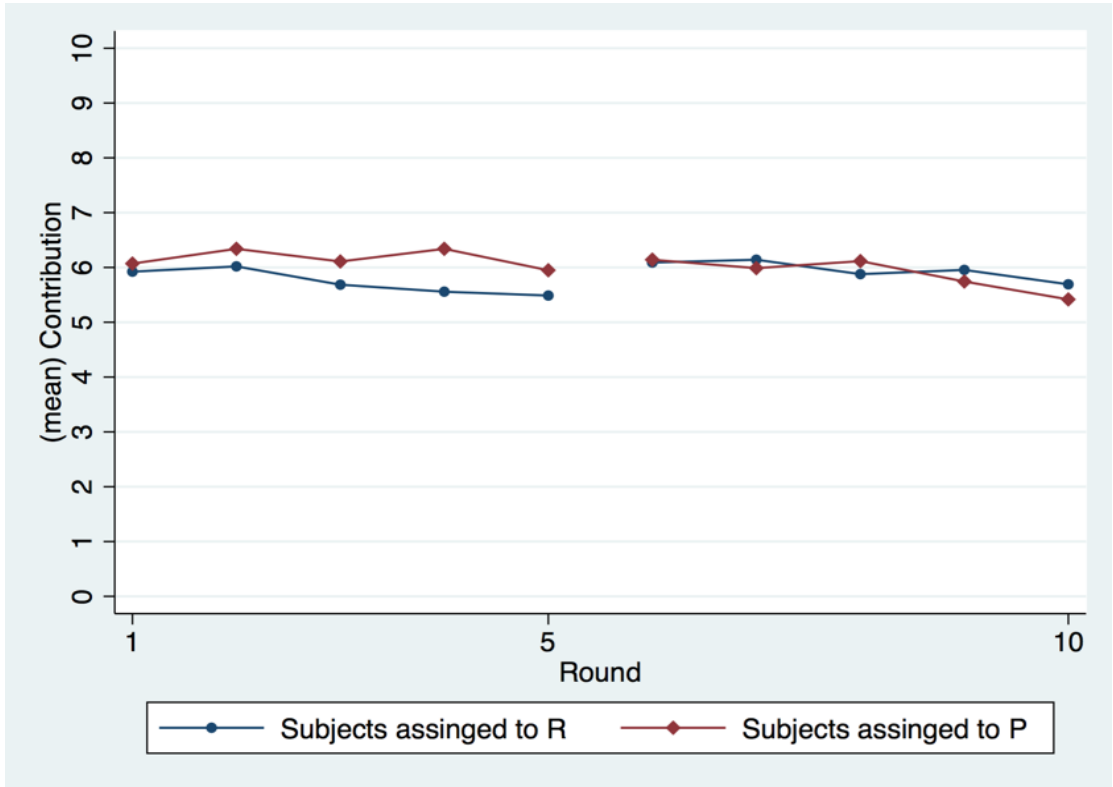


The blue line with circle symbols shows contributions of subjects who were assigned to the punishment institution; the red line with diamonds shows contributions of subjects who were assigned to the reward institution.

**Figure 3. Mean Contribution Over 5 Rounds of Different Stages of PGGs, by the Combinations of Institutional Preferences and Institution Assignment**
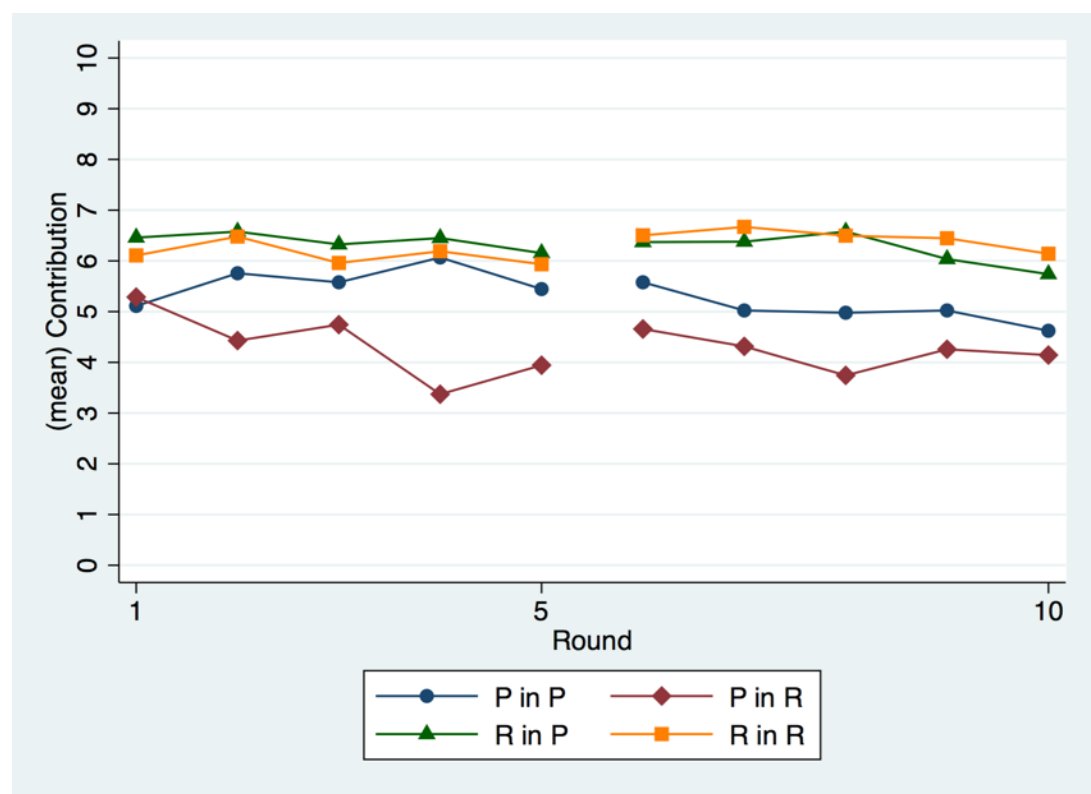


The blue line with circle symbols shows contributions of subjects who chose punishment and were assigned to the punishment institution (P in P); the red line with diamonds shows contributions of subjects who chose punishment and were assigned to the reward institution (P in R); the green line with triangles shows contributions of subjects who chose reward and were assigned to the punishment institution (R in P); the orange line with squares shows contributions of subjects who chose reward and were assigned to the reward institution (R in R).

**Figure 4A. Contributions in each Round of the Standard PGG, by Institutional Preferences**
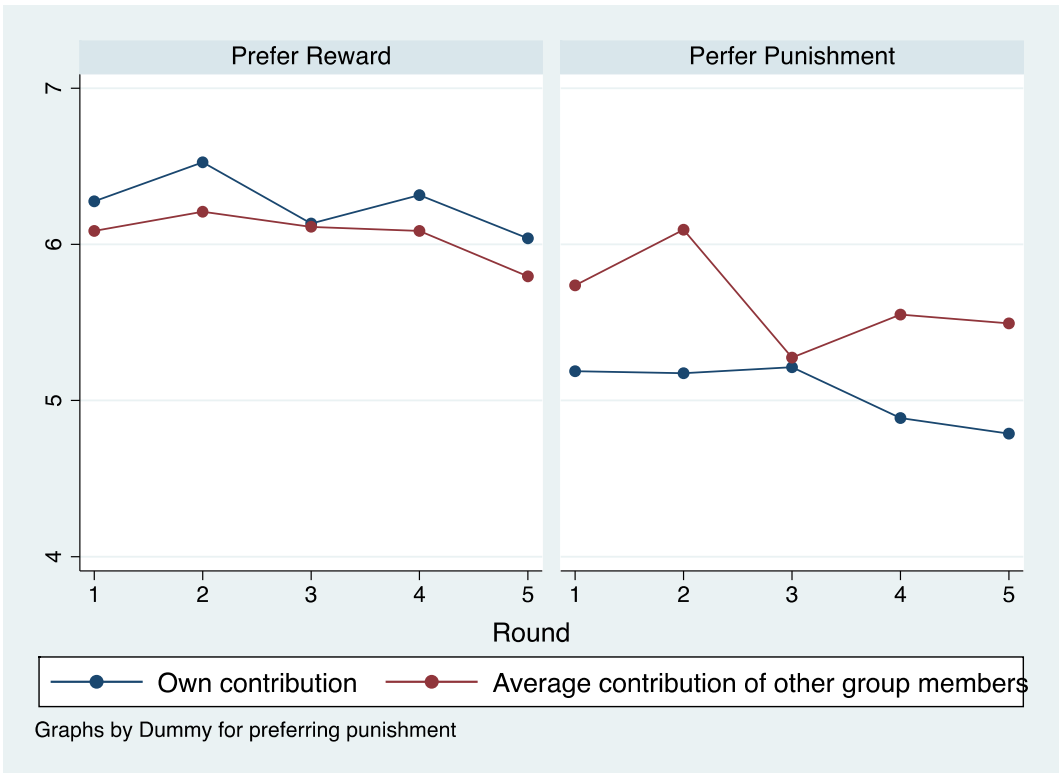


The panel on the left is for the subjects who preferred the reward institution and the panel on the right is for the subjects who preferred the punishment institution.

**Figure 4B. Payoffs in each Round of the Standard PGG, by Institutional Preferences**
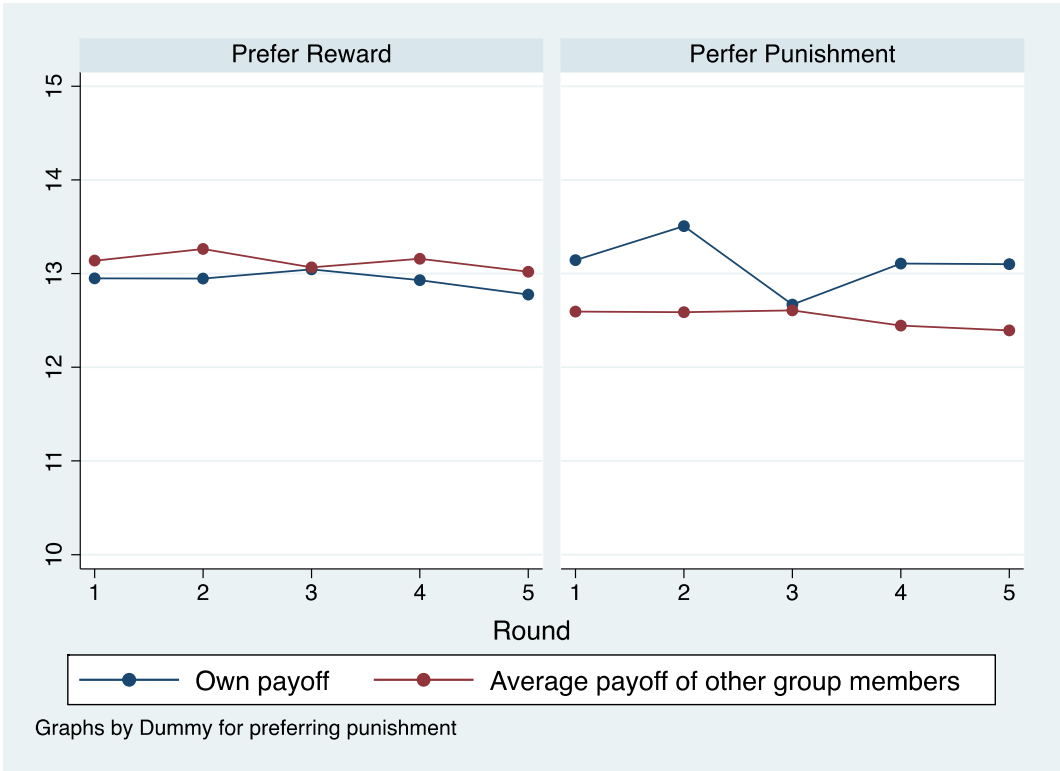


The panel on the left is for the subjects who preferred the reward institution and the panel on the right is for the subjects who preferred the punishment institution.

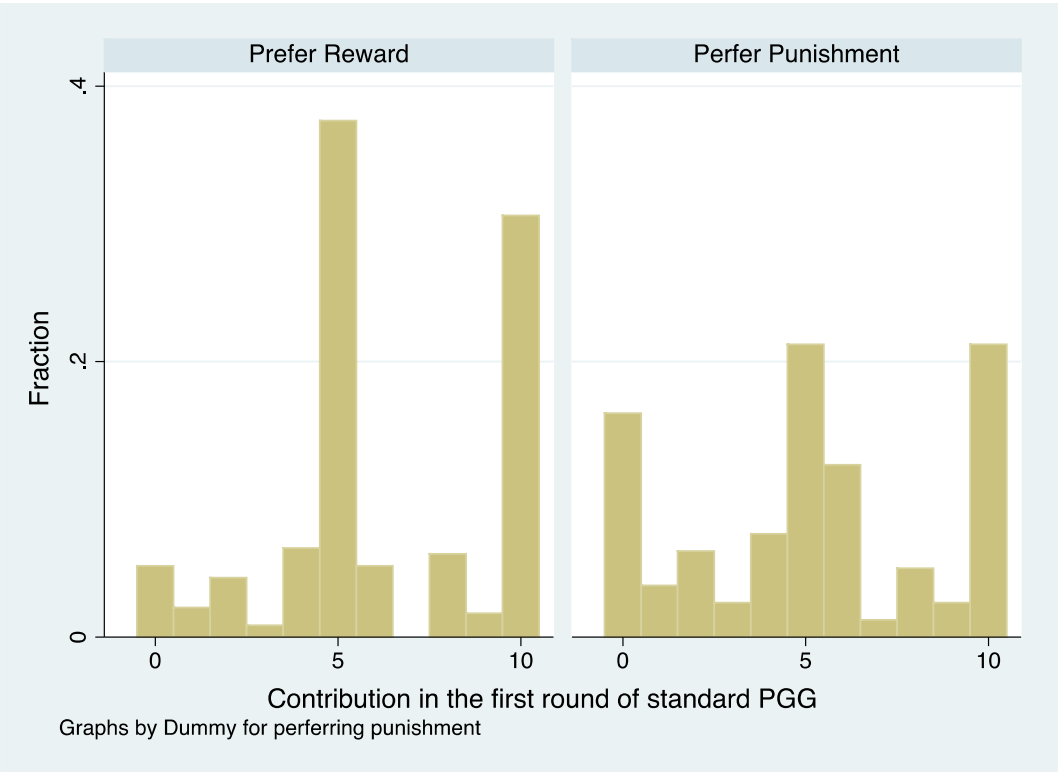**Figure 5. Distribution of First-Round Contributions in Standard PGG**



The panel on the left is for the subjects who preferred the reward institution and the panel on the right is for the subjects who preferred the punishment institution

**Appendix**

### A1. The Contributions in PGGs Under the Reward and Punishment Institution

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Standard PGG | PGG with P/R | (2)-(1) Mean difference (t-statistics) | Diff. in mean difference (t-statistics) |
| Contribution in the first round | | | | |
| Subjects assigned to R | 5.923 | 6.090 | 0.167 (0.47) | -0.096 (-0.15) |
| Subjects assigned to P | 6.071 | 6.141 | 0.071 (0.13) | |
| Contribution over five rounds | | | | |
| Subjects assigned to R | 5.735 | 5.951 | 0.217 (1.21) | -0.497 (-1.51) |
| Subjects assigned to P | 6.162 | 5.881 | -0.281 (-1.01) | |

Note: Figures in this table are calculated by the authors using difference-in-difference regressions, controlling individual fixed effects and round fixed effect. Standard errors clustered at village level are used to calculate t-statistics. *** if p<0.01, ** if p<0.05 and * if p<0.10.

**A2. Contributions Conditional on Institutional Preferences and Exogenously Imposed Institutions**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Standard PGG | PGG with P/R | (2)-(1) Mean diff. (t-statistics) | Institution mismatch effect (t-statistics): Same preference, different assignment | Institution mismatch effect (t-statistics): Different preference, same assignment |
| **Contributions in the first round** | | | | | |
| Subjects prefer P, assigned to P (P in P) | 5.111 | 5.578 | 0.467 (0.37) | Mean diff. P in R – Mean diff. P in P: | Mean diff. R in P – Mean diff. P in P: |
| Subjects prefer P, assigned to R (P in R) | 5.286 | 4.657 | -0.629 (-1.01) | -1.095 (-0.71) | -0.557 (-0.37) |
| Subjects prefer R, assigned to P (R in P) | 6.459 | 6.369 | -0.090 (-0.14) | Mean diff. R in P – Mean diff. R in R: | Mean diff. P in R – Mean diff. R in R: |
| Subjects prefer R, assigned to R (R in R) | 6.107 | 6.504 | 0.397 (0.90) | -0.487 (-0.63) | -1.025 (-1.33) |
| **Contributions over five rounds** | | | | | |
| Subjects prefer P, assigned to P (P in P) | 5.591 | 5.044 | -0.547 (-1.30) | Mean diff. P in R – Mean diff. P in P: | Mean diff. R in P – Mean diff. P in P: |
| Subjects prefer P, assigned to R (P in R) | 4.354 | 4.223 | -0.131 (-0.50) | 0.415 (0.89) | 0.374 (0.82) |
| Subjects prefer R, assigned to P (R in P) | 6.393 | 6.22 | -0.173 (-0.54) | Mean diff. R in P – Mean diff. R in R: | Mean diff. P in R – Mean diff. R in R: |
| Subjects prefer R, assigned to R (R in R) | 6.134 | 6.451 | 0.317 (1.46) | -0.490 (-1.27) | -0.449 (-1.31) |

Note: Figures in this table are calculated by the authors using difference-in-difference style regressions, controlling individual fixed effects and round fixed effect. Standard errors clustered at village level to calculate t-statistics. *** if p<0.01, ** if p<0.05 and * if p<0.10.

## A3. Subjects' Contributions Conditional on their Institutional Choices

### A. Standard PGG

| | Prefer reward (N=232) | | Prefer Punishment (N=80) | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Round | Own contribution | Average contribution of other group members | Own contribution | Average contribution of other group members | Mann-Whitney test z-statistics (1) vs. (3) | Wilcoxon matched-pairs signed-ranks test z-statistics (1) vs. (2) | Wilcoxon matched-pairs signed-ranks test z-statistics (3) vs. (4) |
| 1 | 6.28 | 6.09 | 5.19 | 5.74 | 2.246** | 0.379 | -1.315 |
| 2 | 6.53 | 6.21 | 5.18 | 6.09 | 3.089*** | 1.534 | -1.966** |
| 3 | 6.13 | 6.11 | 5.21 | 5.28 | 1.885* | 0.282 | -0.017 |
| 4 | 6.31 | 6.09 | 4.89 | 5.55 | 3.163*** | 1.228 | -1.212 |
| 5 | 6.04 | 5.80 | 4.79 | 5.49 | 2.935*** | 0.957 | -1.889* |
| Total | 6.26 | 6.06 | 5.05 | 5.63 | 6.003*** | 1.932* | -2.896*** |

### B. PGG with reward/punishment institution

| | Prefer reward N=232 | | Prefer Punishment N=80 | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Round | Own contribution | Average contribution of other group members | Own contribution | Average contribution of other group members | Mann-Whitney test z-statistics (1) vs. (3) | Wilcoxon matched-pairs signed-ranks test z-statistics (1) vs. (2) | Wilcoxon matched-pairs signed-ranks test z-statistics (3) vs. (4) |
| 1 | 6.44 | 6.08 | 5.17 | 6.22 | 3.129*** | 1.512 | -2.409** |
| 2 | 6.53 | 6.09 | 4.71 | 6.00 | 4.607*** | 2.216** | -2.865*** |
| 3 | 6.53 | 5.98 | 4.44 | 6.04 | 5.343*** | 2.869*** | -3.712*** |
| 4 | 6.25 | 5.87 | 4.69 | 5.79 | 3.377*** | 1.630 | -2.220** |
| 5 | 5.95 | 5.55 | 4.41 | 5.58 | 3.648*** | 1.780* | -2.744*** |
| Total | 6.34 | 5.91 | 4.69 | 5.93 | 8.926*** | 4.429*** | -6.173*** |

Note: Calculated by the authors from the experimental data. *** if p<0.01, ** if p<0.05 and * if p<0.10.