Rice Farming and the Emergence of Cooperative Behavior

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Abstract

This paper explores the origins of observed differences in cooperativeness across societies and cultures. In particular, we provide evidence that rice cultivation gives rise to a more cooperative social norm. The rationale behind the hypothesis is that unlike cultivating other crops, such as wheat or corn, farming rice historically required extensive cooperation among farmers. We travelled to four typical rice and non-rice provinces in China and recruited a total of 524 local university students as subjects. We find that rice subjects contribute more than their non-rice counterparts in the Public Goods Game with and without punishment, with the effect being a lot more pronounced in the former. Further analyses reveal a significant difference in frequency, though not in magnitude of punishment, but no difference in how the two groups react to punishment. It follows that the different levels of cooperativeness observed in the punishment treatments are a direct effect of the significant differences in frequency of punishment. Furthermore, as there is no difference between the two groups in the ultimatum and in the dictator game, we interpret from our results that rice cultivation does not make people more cooperative per se. Instead, it is more likely the case that people in rice regions understand the nature of public goods differently than their non-rice counterparts. We attribute the differences to a cultural norm resulting from a history of farming that affects the whole population living in that society.

1 Introduction

There is a large literature showing that people's social preferences, risk preferences, and cooperativeness differ across societies and countries.[1] However, less is known about the origins of these differences. Understanding what factors make people more trustworthy, altruistic, and cooperative etc., is important because studies have documented that these preferences are associated with various economic and political outcomes, such as market integration (Henrich et al., 2001), economic development (Knack and Keefer, 1997), norms of civic cooperation and rules of law (Herrmann et al., 2008), and the quality of institution (La Porta et al., 1997).

In this paper, we investigate whether workplace organisation shapes individual's level of cooperativeness. The workplace is one of the most important part of every society. Since people spend a large amount of time at work, the environments of the workplace might have substantial influences on their preferences. Workplace environments differ in numerous aspects. One important dimension is to the extent that the production process relies on cooperation among workers. The frequent involvement of teamwork might lead to a cooperative norm.

The workplace in the present paper refers to rice cultivation. Two features of rice cultivation distinguishes itself from other crops, such as wheat and corn. First, rice grows on standing water instead of dry land and farmers in a village traditionally share the same water reserves. This resulted in the need to cooperate in the management of the common resource and the maintenance of the irrigation system. In addition, rice farming requires a large amount of labour. Farmers first need to grow rice seedlings in separate lands and then transplant rice seedlings into paddy fields. This necessitated a large amount of labour. Indeed, agricultural anthropologists found that the amount of labour required in rice cultivation is at least twice as the number needed in farming wheat (Buck, 1937). Therefore, families with a only a

[1] See Roth et al. (1991) and Henrich et al. (2001) for differences in ultimatum games; Herrmann et al. (2008) and Henrich et al. (2006) for differences in punish behavior; Gächter et al. (2010) and Gächter and Herrmann (2009) for differences in cooperation in the Public Goods Game; Jackson and Xing (2014) for differences in coordination and Hsee and Weber (1999) for differences in risk preferences.

few labor forces would not be able to survive if they rely on rice farming (Hsiao-Tung and Chih-i, 1945). To solve the shortage of labour supply during farming and harvesting seasons, farmers in rice villages form cooperative labour exchanges. Farmers also summon their relatives who live in neighbor villages to deal with the labour shortage issue. In sum, farming rice historically requires extensive cooperation among farmers. Thus, we hypothesize that centuries of rice farming lead to a cooperative social norm that has been transmitted from generation to generation.

To test this hypotheses, we travelled to typical rice and non-rice provinces in China and conducted lab experiments in local universities. Following Talhelm et al. (2014), we categorize rice and non-rice regions base on the proportion of cultivated land devoted to rice paddy fields. We use the earliest available data from the Bureau of Statistics web site because we do not want the farming statistics to be affected by recent advances in technologies, but rather to reflect, as close as possible, the traditional farming choices.

We recruit local, Han Chinese, first year university students based on their Hukou. By local students we mean that their Hukou was registered at the province of experiment. For example, if the experiment was conducted in Hebei, which is a typical non-rice province, subjects with Hebei Hukou were recruited.[2]

There are several important features of our experimental design worth mentioning. First and foremost, the subjects were not farmers but university students who have minimal farming experiences.[3] Therefore, the present study goes beyond merely testing the effect of rice farming on individual's preferences. In fact, we aim to investigate whether hundreds of years of rice farming is capable of creating a cooperative social norm that affects everyone in the society and that transmits fairly unchanged from generation to generation. Second, instead of choosing one University in Beijing and recruiting students from all over China, we travelled to the selected rice and non-rice provinces and recruited local students. We believe that

[2]Please see to the experimental section for a detail discussion of the recruitment criteria and their advantages.

[3]See the experiment design section for a discussion of why this is the case.

our sample is more representative and has less selection issues. And last, by recruiting Han Chinese University students, a number of potential confounds are controlled by design, such as education background, language, culture, and political institutions.

To measure the difference of cooperativeness between rice and non-rice subjects, we implement the Public Goods Game (PGG) with and without punishment. In order to gain a deeper insight of what might be the underlying factors that drive the differences in the PGGs, if any, we also ask the subjects to take part in a dictator game (DG), an ultimatum game (UG), and a coordination game.

We find that rice subjects contribute more than non-rice subjects in both the PGG with and without punishment. Further analyses of the data suggest that rice cultivation does *not* make people more cooperative per se, instead, it is more likely the case that people in rice regions understand the nature of the public goods better than their non-rice counter parts. This conclusion is drawn from three findings. First, although rice subjects contribute more in the PGG without punishment, the difference is mainly driven by the higher contribution in the middle periods. Moreover, rice subjects experience a stronger end game effect and the contribution unravels to the same level as non-rice subjects in the last period. Second, in the presence of punishment, the difference in contribution between rice and non-rice is more substantial. More importantly, the difference sustains in the last period. Third, rice subjects are more likely to punish free-riders compared to their non-rice counterparts. However, there is no difference in how they respond to punishment. Results from the UG and DG indicate that the difference in contribution is not due to differences in social preferences. We also show that the results are not driven by self-selection and are robust to the inclusion of a set of control variables.

To the best of our knowledge, this is the first paper that investigates the effect of cultivation on individual's level of cooperativeness and punishment behavior in a repeated social dilemma situation. The paper most related to ours is Talhelm et al. (2014), who found that people from rice and wheat areas in China have

different thinking styles, measured by the Triad task.[4] However, unlike Talhelm et al. (2014), we focus our attention on economically relevant behavior in strategic situations. More importantly, the rice and non-rice subjects in our sample have similar level of thinking style and our results are not attenuated by controlling for it. This suggests that our results are mediated from a different channel other than thinking styles. The methodological difference is that we used validated and incentivized games from the experimental economics literature, while they, following the accepted standard in the psychological literature, used non-incentivized questionnaires.

Our paper contributes to the emerging literature that aims to explain what factors cause people's social preferences differ across societies and countries. There are very few studies that utilize experimental methods to investigate this question. In another closely related paper, Soo Hong et al. (2015) find that the amount of rice paddy field is associated with higher level of cooperativeness, measured by a one shot PGG. The present paper differs from Soo Hong et al. (2015) in three important ways. First, we study behavior in repeated PGGs, while they focused on one shot games. We also implement the PGG with punishment while they did not. More importantly, we focus on the underlying mechanism of why people from rice regions are more cooperative. Second, they did not control for the thinking style, which is the main dependent variable of Talhelm et al. (2014). This implies that their results might be driven solely by the thinking style. Third, we travelled to the selected rice and non-rice province and conducted our experiments locally, while they conducted their experiment in Beijing.[5] We believe that our sample is more representative and has less selection.

Gneezy et al. (2013) and Leibbrandt et al. (2013) find that sea fishermen are more cooperative and less competitive than lake fishermen. They argue that this is

[4]We use the rice and non-rice terminology instead of rice and wheat. This is because in additional to wheat, there are other types of crops that require less cooperation to farm, such as corn. However, the categorization of rice and non-rice provinces is exactly the same as rice and wheat.

[5]They stated that they conducted two waves of experimental sessions in Beijing. The first wave in 2010 and the second wave in 2012.

because the difference in work place organisation between the two groups: sea fishing requires intensive team work among crew members in order to survive in the sea, while lake fishing is usually an individual activity. However, they do not find any behavioral differences among women in the two societies who do not fish. They conclude that "... suggestive evidence that norms of cooperation learnt at the workplace do not spread to other society members" (Gneezy et al., 2013, p. 2). This is in sharp contrast to our finding because subjects in our experiment are all university students who are very unlikely to have participated in farming before.

There are a number of empirical studies that use survey measures, especially from the World Value Survey, to investigate the root of cross social differences in preferences. Alesina et al. (2013) investigates the origins of cross-cultural differences in norms about gender roles. They find that societies which historically practice plough agriculture has less equal gender norms. Plough requires considerable level of upper body strength. Thus, men have a relative advantage to women in workplace in those societies. Galor and Özak (2016) find that participation of agriculture affects people's time preferences. In particular, the higher but delayed return feature of agriculture makes people less present biased.

The remainder of the paper is structured as follows: Section 2 illustrates the experimental design. Non-parametric and regression results are presented in section 3. Section 4 discusses alternative explanations to the Rice theory. Section 5 concludes.

2 Experimental Design

The idea of the design is to compare subjects who have similar backgrounds but live in regions that differ sharply in the type of cultivation.

The most important feature of the design is that the subjects were university students instead of farmers. Thus, the present paper aims to investigate whether rice farming is capable of creating a cooperative social norm that transmits fairly unchanged from generation to generation. Another important feature of the design

is that we travelled to the selected rice and non-rice provinces and conducted the experiments locally. We believe that the sample in our study is more representative than studies that conduct experiments in universities located in Beijing and recruit subjects from all over China (A large proportion of subjects in Talhelm et al. (2014) were recruited in Beijing and all the subjects were recruited in Beijing in Soo Hong et al. (2015)). The reason is first, subjects who are willing to travel hundreds of miles from home to live and study in Beijing might have different preferences than those who want to stay close to home. Second, Beijing universities set small quotas for students from provinces other than Beijing, therefore, non-Beijing students who intend to study in Beijing face stronger competition. Consequently, those who are accepted by Beijing universities might be more competitive or have higher ability than those who aim for local universities.

2.1 Province selection

We conducted lab experiments in four universities that are located in four provinces across China. By restricting the sample to Chinese subjects, a number of potential confounds are controlled by design, such as language, institutional, and other cross country cultural differences.

Since we are investigating the intergenerational transmission of social norm created by rice farming, the categorization of rice and non-rice provinces should be based on the type of crops farmers historically cultivate. For this purpose, we use the earliest available cultivation data (1996) on the Bureau of Statistics Web site.[6] Following Talhelm et al. (2014), a province is classified as rice if more than half of its cultivated land is devoted to rice paddy field. The two rice provinces we chose were Hunan and Zhejiang province, which devoted more than 78% of the cultivated lands to paddy fields. Also note that these two provinces has been prominent rice production provinces since Song Dynasty (Fan, 2007). The percentage was less than 2.5% in the non-rice provinces: Hebei and Shandong.

[6] http://www.stats.gov.cn

2.2 Subject Recruitment

We recruited local, Han, first year university students. We believe that our subjects have minimal farming experiences. The reason is twofold. Firstly, about 40% of the subjects in our sample hold a urban Hukou, which, according to the policy their families do not have the legal right to possess farming lands.[7] Second, since high schools are generally located in larger cities, commuting between school and home might be too costly, in terms of time and money, for students who have a rural Hukou. Therefore, they might choose to live on campus during school days. One might argue that they can help their families during weekends or holidays. However, we doubt this limited time of working in farming is able to modify their preferences. In addition, rice cultivation nowadays probably requires less cooperation due to advances in technology, therefore, even if subjects spent sufficient time in rice farming, the norms of cooperation might not be strong enough to alter their preferences. Thus, if there is any difference in the preference for cooperation between rice and non-rice subjects, it is unlikely due to their personal farming experiences but the intergeneration transmission of social noms related to the crops that used to be predominantly cultivated in their regions.

By local university students we mean that their Hukou was registered at the province of experiment.[8] For example, if the experiment was conducted in Hebei province, students who had a Hebei Hukou were recruited.[9] There are three impor-

[7]Hukou is a household registration system used in China. According to the policy, people with Rural Hukou are entitled with farming land. Additionally, farmers can receive financial compensation if their lands are occupied by the government for other purposes.

[8]Hukou is a household registration system employed in China. The policy requires that each individual must register their Hukou at the residence city and each individual can only have one place assigned as Hukou place.

[9]When analyzing the data, we found that a few subject's Hukou was not from the province of experiment. This is because we asked for the list of first year students and some universities had just finished collecting students' demographic information. There were some mistakes in the collection process. In order to utilized as many observations as possible, we chose to drop subjects whose Hukou was from a different farming province. For example, if the experiment was conducted in rice provinces, we drop subjects who had Hukou from non-rice farming provinces. Please note that a province was classified as a rice province if more than 50% of its cultivated land is devoted to rice farming. The results are the same if we drop subjects whose Hukou province was different from the experiment province. Please note that in the latter case, more observations are dropped.

tant reasons to recruit local students. First, this reduces the chance of recruiting subjects from less typical provinces. For example, in Sichuan and Jiangsu province, the percentage of farming land devoted to rice and non-rice crops are very close between each other. Second, since reciprocity is an important motivation in the PGGs (Fischbacher et al., 2001), behavioral norms might be hard to emerge if rice and non-rice subjects interact. Third, having a local Hukou suggests that the subject is more likely to have been living in the area for a long time and hence are more affected by the social norm.

We choose Han Chinese because Wen et al. (2004) discovers that Han Chinese have the same culture origin. We also recruited first year students because they had just graduated from high school. Chinese high schools have a busy schedule: students stayed in classroom more than seven hours every day and study similar materials. Therefore, subjects had similar experience prior to university. Moreover, first year students are free from the indoctrination effect of their field of study.[10]

The recruitment process was the following. A list of qualified students was provided by each university, and we randomly draw subjects from the list. Selected subjects were then contacted by the administrative staffs of each university. We provided a script about how to recruit the students. We emphasized that it was a economic study, they would receive money payments to compensate for their time, their decisions in the study would be anonymous and would not affect their records related to university in any way, and most importantly, participation was *not* compulsory.

2.3 Experimental Games

To compare the level of cooperation between rice and non-rice areas, we conducted a repeated public goods game (PGG) with and without punishment. We believe that historically, the situation farmers encountered everyday was very similar to the PGG: each farmer had the incentive to free-rider on other farmers during plant-

[10]There were 9 subjects who were not first year students. Including or excluding them do not affect our results and hence we include them in the analyses.

ing or harvesting seasons. However, the society reaches the most efficient outcome if all farmers exert maximum effort.

Subjects first played eight periods under the no punishment condition followed by eight periods of the punishment condition. They knew that there would be another game after the no punishment condition, but they were not informed about its content until the no punishment condition was completed.

In the no punishment condition, subjects were randomly divided into groups of four and the group composition was fixed throughout the eight periods. In each period, each subject had an endowment of 20 points and was asked to decide how many points to contribute to a group account (the remaining points were allocated to their individual account). The total points in the group account were multiplied by 1.6 and then evenly distributed among all group members. In particular, each subject faced the following payoff function:

$$u_i = (20 - c_i) + (1.6 * \sum_{j=1}^{4} c_j) \ / \ 4$$

in which u_i is i's payoff, c_i is i's contribution to the group account, and $\sum_{j=1}^{4} c_j$ is the sum of contribution made by all group members. Please note that the contributor only gains 0.4 points for each point contributed to the group account. Therefore, contributing nothing will always give subjects the highest material payoff regardless of other group member's contribution. On the other hand, each point contributed to the group account increases the payoff of the whole group by 1.6 points, and hence the earning for each group as a whole is highest if all group members contribute 20 points. In the latter case, each subject will earn 32 points, which is higher than the self interested outcome, 20 points.

After all subjects made their decisions, the amount of contribution of each subject, their earning from the group account, and their total earning in the current period was shown on their computer screen. The contribution of each group member was randomly displayed on the computer screen in each period, therefore, subjects

cannot associate contribution with a particular group member.[11] Subjects need to press the 'CONTINUE' button to proceed to the next round.

After the no punishment condition, subjects randomly regrouped and played eight periods of the punishment condition. The first part of the punishment condition was the same as the no punishment condition: each subject had an endowment of 20 points and needed to decide how many points to contribute to a group account. After this decision was made, subjects were informed about their earnings from the first stage and were asked to proceed to punishment stage, in which subjects could assign punishment tokens to other group members. In the punishment stage, other group members' contributions in the present period were displayed on subjects' computer screen. Based on this information, subjects could assign punishment tokens, which were restricted between zero and ten inclusive, to other group members. Each punishment token costs one point to the punisher and reduces the earnings of the punished subject by three points.[12] Next was the information display stage in which subjects' final earnings were shown. They were informed about their earnings in the first stage, total punishment tokens received and total punishment tokens assigned to others in the punishment stage, and their final earnings. Please note that subjects only knew the total punishment tokens received but not who made punishment.

To get a deeper understanding of which social preference model is better in explaining the behavioral difference in the PGGs, we also had the subjects participate in a dictator game, an ultimatum game, and a stag hunt game.

In the dictator game, subjects were randomly assigned to the role of proposers or responders. Proposers had to decide how to divide a total of 60 points between themselves and a randomly matched, anonymous responder. Responders

[11] Other group members' contribution were displayed because subjects were also asked to play the PGG with punishment, in which case group members' contributions must be revealed. We intended to make the design of the two games as close as possible.

[12] Subjects were informed that their earning could only be reduced to zero no matter how many punishment tokens they receive. However, negative earning was possible if ones earning was reduced to zero due to receiving too many punishment tokens and he also assigned punishment tokens to others. This design was also used in Herrmann et al. (2008).

were asked to state how many points they expected to receive. Please note that responders' answers would not affect the outcome of the dictator game.

Subjects' roles in the ultimatum game were the same as in the dictator game, but they were randomly regrouped. This design allows us to study the effect of strategic concerns on subjects' behavior. The difference between the ultimatum game and the dictator game is that in the ultimatum game responders had the power to reject or accept offers made by proposers. We employed a minimal acceptable offer (MAO) method. When proposers were making offers, responders simultaneously stated their minimal acceptable amount. If the offer made by the proposer was lower than the minimal acceptable amount, the allocation would be automatically rejected, in which case both of them earn nothing. If the offer was larger or equal to the minimal acceptable amount, the proposal would be automatically accepted, in which case both of them get the amount according the division.

The stag hunt game is a two-player simultaneous move coordination game. The payoff matrix is presented in table 1. Subjects could choose between hunting a stag or a hare. Stag is harder to catch but more valuable. Both players need to choose the same action to make the hunt successful. If they mis-coordinate, the one who choose stag will fail and hence obtain the lowest payoff. Hare, on the other hand, is easy to catch and is therefore a safe choice: it yields a payoff of 22 points regardless of other player's choice.

Table 1: Payoff matrix of the Stag Hunt Game

	Stag (@)	Hare (#)
Stag (@)	(30, 30)	(12, 22)
Hare (#)	(22, 12)	(22, 22)

Subjects' risk preferences were elicited using the Holt and Laury type lotteries (Holt and Laury, 2002). They were informed that this task was not incentivized. We also implemented the triad task, which is the main dependent variable in Talhelm et al. (2014). The Triad task is designed to measure people's thinking styles.

The questionnaire presents subjects with lists of three objects, and subjects are asked to choose the two items that they think are more related to each other. For example, one of the questions is panda, banana, and monkey. Panda and monkey is an analytic choice because they are both animals. On the other hand, monkey and banana is a holistic choice since monkeys eat banana. As mentioned previously, the percentage of holistic and analytic thinking in the two rice provinces are not significantly different from the two non-rice provinces.

Since the literature in psychology suggests that collective societies value group membership, we conducted a priming treatment in half of the sessions. The procedure was simple. In Hebei for example, after all subjects had sat down and were waiting for instructions, the experimenter stated: please note that all of you are from Hebei province.[13] In the other sessions, subjects were not informed about this information. However, the effect of priming on behavior is minimal, we therefore pool the data from priming and no-priming sessions in the analyses.

2.4 Experimental Procedure

After all subjects sat in the lab and prior to getting any instructions of the study, they were asked to sign a formal consent. Participants knew that each session consists several parts, but they did not know the content of the future parts until the corresponding instructions were provided.

First, subjects were asked to fill out a questionnaire, which consists the unincentivized lottery task and the triad task. Then, they played the dictator game, ultimatum game, stag hunt game, the PGG no punishment condition, and the PGG punishment condition, in that order. The PGGs were the last part of the experiment because we aimed to avoid the effect of punishment on subjects' behavior in other games. Participants were not informed about the results in the first three games because we did not want the feedback influence their behavior in the PGG. This is another reason that we put the PGG in the last because it is

[13]In some sessions, few subjects stated that they were not from the local province. In this case, the experimenter explained that they cannot participate in the experiment and were free to leave. Of course, the show-up fee was paid to them.

impossible to withheld the results of the PGG from the subjects, especially for the punishment condition. After all the games were concluded, subjects were asked to fill out a post experiment questionnaire. Last, they received their payment and were free to leave.

One of the five games was randomly selected for payment. If the PGGs were chosen, the experimenter would draw one period out of the eight periods. Subjects' earning were exchanged to Chinese Yuan at the rate: 1 points = 0.5 Yuan (about 8 US Cents).

There were a total of 524 subjects. 116 subjects for Hebei province, 156 subjects in Shandong province, 128 subjects in Hunan province and 124 subjects in Zhejiang province. The experiment were conducted between Oct 2015 and Jan 2016 in China. We ran 6 sessions per province. All the sessions were conducted on Saturdays and Sundays because students' schedule was busy during weekdays. Each session lasted about 2 hours. Subjects earned on average 30 Yuan (about 5 US dollars), including a 15 Yuan show-up fee. Subjects' earning was similar to China's minimal hourly wage.[14]

3 Experimental Results

If the tradition of rice farming has resulted in the creation of a more cooperative cultural norm and this norm is transmittable from generation to generation, one should observe that subjects from rice farming provinces contribute more than subjects from non-rice provinces in the public goods games. This is exactly what we find. The following result summarizes the findings in the PGG without punishment.

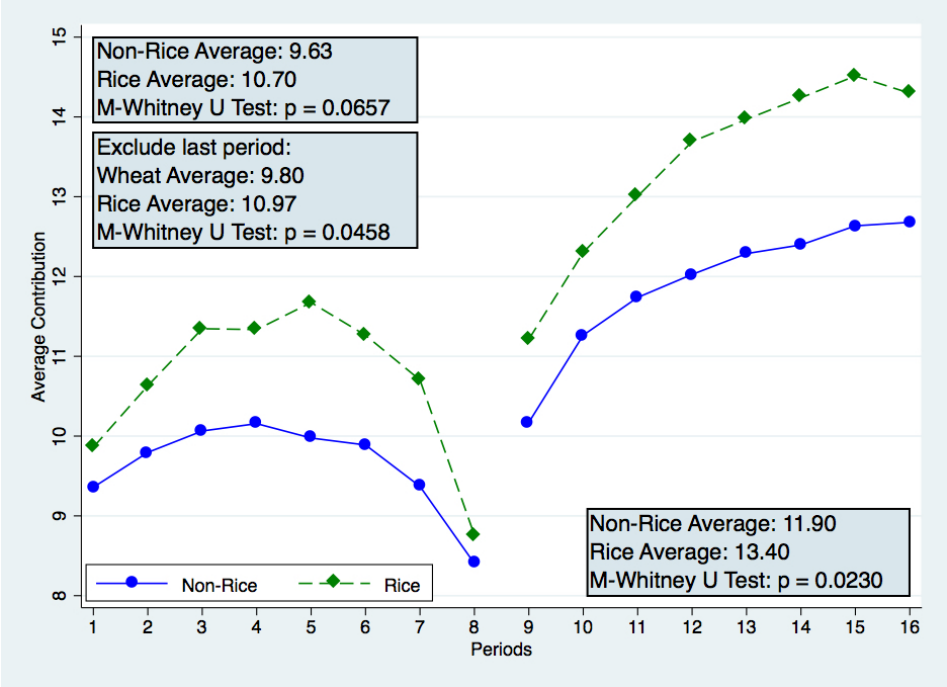
Result 1 *In the PGG without punishment, rice subject's contribution is higher than non-rice subject's contribution. However, the difference does not sustain in*

[14]See Appendix A.1 for the experimental instructions. Please note that the instructions are in English, as they were used for a pilot session conducted in Royal Holloway, University of London. Moreover, we abandoned the sliding bar in the DG, UG, and PGGs for the sessions in China. Input boxes were used instead.

the last period.

Support for result 1 is presented in figure 1. Figure 1 illustrates the evolution of average contribution over time. In the no punishment condition (periods 1 - 8), the average contribution over the eight periods is 10.70 and 9.63 points for rice and non-rice regions respectively. The difference is marginally significant (Mann-Whitney U test, each group as an independent observation: p = 0.0657).[15]

Figure 1: Average contribution in each period in PGG and PGG with Punishment



Notes: The x-axis is period number and y-axis is the average contribution. Periods 1-8 are public goods game without punishment. After period 8, subjects randomly regroup and play another eights rounds of public goods game with punishment (periods 9-16).

Although the difference in average contribution in the PGG without punishment between rice and non-rice is only marginally significant, the difference in the pattern of contribution over time is dramatic. Rice and non-rice subjects start at similar level of contribution in the first period (Mann-whitney U test, each group

[15]We use group level average and conduct statistical tests based on group level to control for with-in group dependency. However, the group level average is not exactly the same as the individual level average due to the fact that some subjects are dropped from the analyses. Please note that the results do not change if we conduct Bootstrapped ttest on group level clusters.

as an independent observation: p = 0.0937). However, difference begins to emerge over time. Contribution of non-rice subject increases modestly over interaction. In contrast, rice subjects manage to increase contribution dramatically. However, rice subjects also experience a stronger end game effect, as the contribution unravels to the same level as non-rice subjects in the last period (Mann-whitney U test, each group as an independent observation: p > 0.66).[16]

The different contribution pattern between rice and non-rice is also confirmed in the random effects panel regression showed in table 2. Both the Period and Period squared are highly significant, suggesting that the contribution pattern of non-rice subjects exhibits a inverted-U shape. The interaction terms between Rice dummy and the period terms are also signifiant, which implies that rice subjects have a more curvature contribution pattern.

Table 2: Different contribution patterns in rice and non-rice provinces

	(1)	
Rice	-0.292	(0.535)
Period	0.827***	(0.208)
Rice x period	0.761**	(0.337)
Period squared	-0.105***	(0.0215)
Rice x period squared	-0.0810**	(0.0342)
Constant	8.588***	(0.348)
Observations	4136	

Notes: The regression is a random effects panel regression. The dependent variable is the contribution in the PGG without punishment condition. There are 4136 observations, which implies 517 subjects are included in the analysis. As mentioned previously, 7 out of 524 subjects are dropped from the analyses because they come from a province that the main type of crop is different from the province of experiment. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

The stronger end game effect of rice subjects compared to non-rice subjects suggests that rice farming might not make people more cooperative per se, instead, it might be the case that people from rice areas understand the public goods situation better. In other words, they understand that it is profitable to contribute to the public good so long as there are future interactions.

[16]The difference in contribution between rice and non-rice in the PGG without punishment becomes significant if the last period is excluded because of the strong end game effect (Mann-Whitney U test, each group as an independent observation: p = 0.0458).

If it is indeed the case that rice subjects are more familiar with the public good situation, one should expect the difference in contribution between rice and non-rice is more substantial in the PGG with punishment, since punishment has proven to be highly effective in fostering cooperation (Fehr and Gächter, 1999; Masclet et al., 2003). Subject's behavior in the PGG with punishment is summarized in result 2.

Result 2 *In PGG with punishment, rice subject's contribution is significantly higher than non-rice subject's contribution. The difference is larger towards the end.*

The results of the PGG with punishment are presented in period 9-16 of figure 1. The average contribution over the eight periods is 11.90 points for non-rice and 13.40 points for rice; the difference is significant (Mann-Whitney U test, each group as an independent observation: $p = 0.02$). Note that the difference in contribution is already significant in the first period (Mann-Whitney U test, each group as an independent observation: $p = 0.02$). More importantly, in the presence of punishment opportunities, the difference not only sustains but also enlarges towards the end, which is in stark contrast to the no-punishment condition.

One important feature of figure 1 is that the contribution increases sharply from the no-punishment condition to the punishment condition. We elaborate on this observation in more detail in the following.

Result 3 *The presence of punishment opportunity significantly increases contribution for both rice and non-rice subjects. The increment is slightly higher for subjects from rice regions.*

Non-rice subjects on average contribute 9.63 points in the no punishment condition. This number increases to 11.87 in the presence of punishment opportunities. The difference, 2.24 points, is highly significant. For rice subjects, the increment is 2.73 and is also highly significant (Wilcoxon sign-ranked tests: $p < 0.01$ for

both rice and non-rice subjects).[17] The results also suggest that punishment has a stronger effect for rice subjects, since the difference in contribution between the no-punishment and punishment condition of PGG is larger for rice subjects. The difference is marginally significant (Mann-Whitney U test: $p = 0.0572$).

Additionally, the mere anticipation of punishment also has a strong effect on subject's behavior. If we compare the last period of the no-punishment condition to the first period of punishment condition, contribution in the latter is significantly higher. This is true for both rice and non-rice subjects (Wilcoxon sign ranked tests: $p < 0.01$ for rice and non-rice). In addition, we find that the increment is higher for rice subjects though the difference is not significant (Mann-Whitney U test: $p > 0.39$).[18]

The previous results imply that punishment opportunities work better for rice subjects. There are three possible explanations underlying this observation. First, it could be the case that rice subjects understand that punishment works better and hence are more willing to exercise it to enhance and sustain contribution. Second, rice subjects might be more responsive to punishment, that is, rice subjects increase their contribution more compare to non-rice subjects after receiving *the same amount* of punishment. Or third, the mere presence of punishment opportunities is suffice to increase contribution for rice subjects, in other words, rice subjects contribute more for fear of punishment.

We discuss each of the possibilities in the following. The results suggest that the explanation bears on the differences between rice and non-rice subjects in the willingness to punish free-riders. There is no difference in how subjects react to actual punishment or to the anticipation of punishment between the two groups.

[17] Since subjects randomly regroup after the no-punishment condition, it is impossible to conduct paired tests based on the group level. Therefore, these two tests are based on individual level.

[18] We also contrast contribution in period 1 to contribution in period 9, that is, compare the first period of the no punishment condition to the first period of punishment condition. The difference is also significant for both rice and non-rice (Wilcoxon sign ranked tests: $p < 0.01$ for rice and non-rice). The increment is insignificantly higher for rice (Mann-Whitney U test: $p > 0.22$).

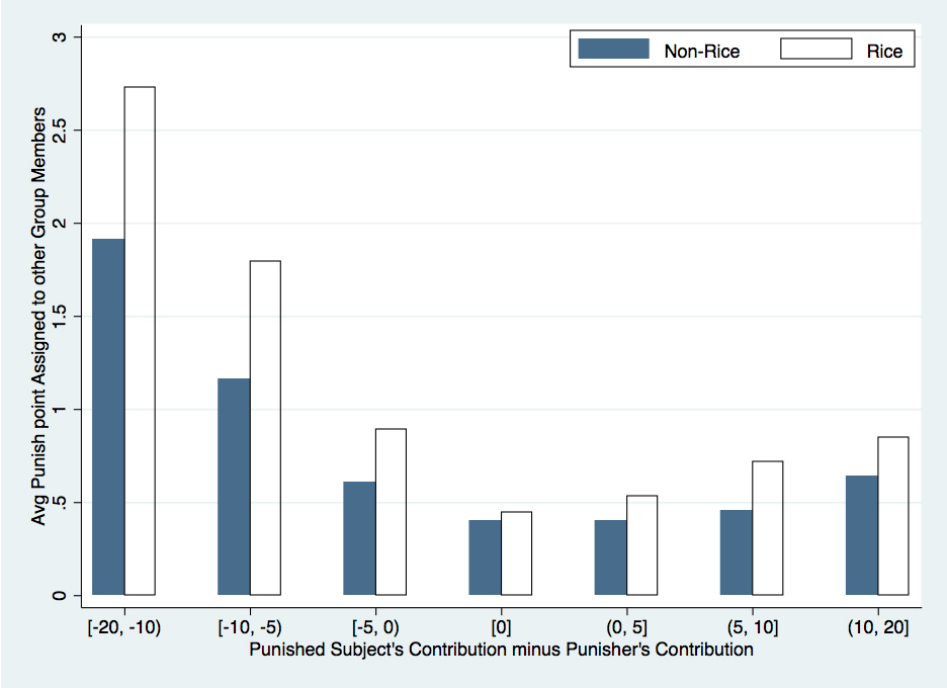
First, we provide evidence regarding punishment behavior. We distinguish between pro-social punishment and anti-social punishment. Pro-social punishment is defined as assigning punishment points to subjects who contribute less than the punisher. We label this behavior pro-social punishment because the punisher is willing to sacrifice her own payoff to punish free-riders, and free-riders who receive punishment are more likely to increase their contribution in following periods (Fehr and Gächter, 1999; Gächter et al., 2008; Masclet et al., 2003; Nikiforakis, 2008). Therefore, pro-social punishment is beneficial to the whole group. Anti-social punishment is defined as punishing group members that contribute more than or equal to the punisher. This behavior is labelled anti-social punishment because the punished subject behaved more pro-socially than the punisher (Herrmann et al., 2008).

Result 4 *Rice subjects make significantly more pro-social punishments than non-rice subjects. There is no difference in antisocial punishment.*

Evidence for Result 4 is provided in figure 2. Figure 2 depicts the average punishment points assigned to others as a function of deviation from the punisher's contribution. For example, the [-20,-10) category implies that the punished subject contributes from 10 to 20 points *less* than the punisher. Therefore, all the categories to the left of [0] are pro-social punishment, and all the other categories are anti-social punishment. The results confirm that rice subjects assign significantly more punishment points to free-riders. The difference is significant for categories [-10, -5) and [-5, 0) (Mann-Whitney U test, $p < 0.01$ for [-10,-5) and $p = 0.02$ for [-5,0)) and is weakly significant for the [-20,-10) category (Mann-Whitney U test: $p = 0.08$). If we merge all the three free-riding categories into one category, the difference between rice and non-rice becomes highly significant (Mann-Whitney U test, $p < 0.01$). On the other hand, there is no significant difference between rice and non-rice areas in the anti-social categories (Mann-Whitney U test: $p > 0.22$ for all relevant categories: [0], (0, 5], (5, 10], and (10, 20]).[19]

[19]If we merge all the four positive deviation categories into one category, the difference between rice and non-rice is only weakly significant (Mann-Whitney U test, $p = 0.08$).

Figure 2: Punish Behavior



Notes: This figure shows how subjects punish those who contribute less, more, or equal to themselves. The x-axis shows the difference between ones own contribution and one of her group member's contribution. The y-axis is the average punishment point subjects assigned to each category.

The percentage of cultivated land devoted to rice farming also predicts pro-social punishment among rice regions. Table 3 presents the evidence from Tobit regressions. The first column shows that, even among rice farming regions, a 10% increase in rice paddy field is associated with about 0.7 more punishment points assigned to free-riders. There is no such relation among non-rice regions (column 3).

In the next result, we show that the difference in pro-social punishment between rice and non-rice is mainly driven by the probability of punishing free-riders.

Result 5 *Rice subjects are more likely to punish free-riders than non-rice subjects. There is no such difference in anti-social punishment.*

Table 4 shows the results on the probability of assigning punishment points to other group members. We separate the cases for pro-social punishment and anti-social punishment. In columns 1-4, the dependent variable equals 1 if the punisher

assign punishment points to a subject who contributed less than the punisher and equals 0 otherwise. Similarly, in columns 5-8, the dependent variable equals 1 if the subject makes an anti-social punishment and equals 0 otherwise.
According to table 4, rice subjects are more likely to punish free-riders than non-rice subjects. However, there is no difference in anti-social punishment. Column 1 suggests that rice subjects are about 8% more likely to punish free-riders. In column 3, we use the municipality rice data and the results are the same: a 10% increase in rice fields is associated with a 1% increase in the likelihood of punishing free-riders. Columns 5 and 7 suggest that there is no difference in the probability of punishing cooperative subjects. In table A.1 of Appendix A.3, we show that the results are the same if we use the panel Probit model.

The previous result provide evidence that rice subjects makes more pro-social punishment than non-rice. In the following, we show that there is no difference between rice and non-rice subjects in the response to actual punishment as well as to the anticipation of punishment.

Result 6

There is no difference between rice and non-rice in how subjects respond to actual punishment.

There is no difference between rice and non-rice in how subjects respond to the anticipation of punishment.

Table 5 demonstrates the results on how subjects respond to actual punishment. Results in column 1 indicate that non-rice subjects significantly increase their contribution after receiving pro-social punishment. In particular, they increase 0.675 points for each pro-social punish point received. The interaction term "Punish Receive $\times$ Rice" is not significant, suggesting that there is no difference between rice and non-rice with regard to responsiveness to pro-social punishment. The result for antisocial punishment is shown in column 3. The "Punishment Received" is now significantly negative, which implies that non-rice subjects decrease their contribution after receiving antisocial punishment. The interaction term "Punish Receive $\times$ Rice" is not significant, which means rice and non-rice subjects also behave similarly in response to anti-social punishment.

Next, we show that there is no difference in the reaction to the anticipation of punishment between rice and non-rice subjects. First, if rice subjects are more averse to punishment, they should increase their contribution from the last period of PGG without punishment to the first period of PGG with punishment more in comparison to non-rice subjects. We have already shown in result 3 that this is not the case. Second, the percentage of free-riding choices, defined as contributing less than or equal to 2 points, in the first period of PGG is similar between rice and non-rice subjects. There is also no significant difference in the proportion of subjects who contributes less than 10 points between the two groups (Mann-whitney U test, each group as an independent observation: $p > 0.3$ for both tests).[20]

In sum, the results suggest that rice farming does not make people more cooperative per se, instead, people from rice areas understand the public goods situation better and make more pro-social punishment in order to increase and sustain contribution.[21]

3.1 Regression Analyses

In the previous section, we show that rice subjects contribute more in the PGG with and without punishment and make more prosocial punishment compared to non-rice subjects. All the results are based on comparing rice average to non-rice average. In the following, we use the municipality level cultivation data, which is a continuous variable, to replace the rice dummy variable. We run a series of regressions to validate the non-parametric tests conducted in the previous section. Moreover, we show that our results are robust to the inclusion of a set of control variables. The set of control variables and their descriptions are presented in table 6.[22] Note that in regressions regarding punishment behavior, we also controlled for the punished subject's and the punisher's contribution.

[20] The results are the same if we use individual level proportion tests: $p > 0.2$.

[21] Subject's welfare in the PGG with punishment is shown in Appendix A.2.

[22] Please note that one did not provide their Hukou place at the municipality level, we cannot match him to the rice statistic. One subject did not state whether he has a Rural or Urban Hukou. One subject need to leave early, so she did not answer the social style questionnaire.

Table 7 confirms that rice subjects contribute more in the PGG with and without punishment. Column 1 indicates that a 10% increase in percentage of cultivated land devoted to rice paddy fields is associated with a 1.5% increase in contribution and the result is significant at 10% level. This result is not attenuated by the inclusion of control variables (column 2). The results regarding contribution in the PGG with punishment are presented in column 3 and 4. The difference is stronger in the punishment condition, which is inline with result 2.[23]

The regression results concerning punishment behavior is presented in table 8. In column 1, the percentage of paddy field is positively significant, suggesting that rice farming is associated with higher pro-social punishment. More or Equal is a dummy variable equals 1 if the punished subject contributed more than or equal to the punisher, which represents cases of anti-social punishment. In column 2, the results are not affected by including the set of control variables.[24]

Table 3 column 1 shows that the percentage of cultivated land devoted to rice farming also predicts pro-social punishment among rice regions. This result is also robust to the inclusion of the set of control variables (column 2).

In table 4, we show that rice subjects are significantly more likely to punish free-riders in comparison to non-rice subjects, and there is no difference in the probability of punishing cooperators. According to columns 2, 4, 6, and 8, the results are not attenuated by the inclusion of the set of control variables.

[23]The results are the same if we replace the municipality level rice data with a rice dummy variable, which equals if the subject come from a rice farming province and equals 0 otherwise. See table A.2 in Appendix A.3.

[24]The results are the same if we replace the municipality level rice data with a rice dummy variable, which equals 1 if the subject come from a rice farming province and equals 0 otherwise. See table A.3 in Appendix A.3.

4 Alternative Explanations

4.1 Rice farming and Social Preferences

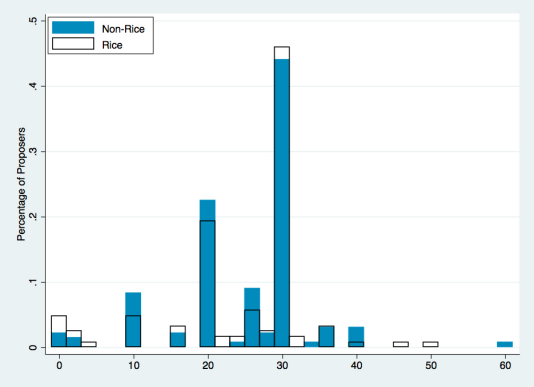
There are a number of well known social preference models that can potentially rationalize the contribution gap in the PGG with and without punishment as well as the gap in pro-social punishment. This includes: pure altruism, inequality aversion models (Bolton and Ockenfels, 2000; Fehr and Schmidt, 1999), models that incorporate social welfare or efficiency concerns (Charness and Rabin, 2002), and reciprocity models (Falk and Fischbacher, 2006; Rabin, 1993). In this section, we discuss the explanatory power of each model.

Results from the dictator game and ultimatum game, which are presented in figure 3, suggest that pure altruism and inequality aversion is not the main difference between rice and non-rice subjects. Panel (a) and panel (c) of figure 3 present the histogram of offers in the dictator game and ultimatum game respectively. The distribution between rice and non-rice is very similar (Kolmogorov-Smirnov test: $p > 0.95$ for dictator game and ultimatum game). The responder's behavior in the two games is presented in panel (b) and (d). There is also no significant difference between rice and non-rice subjects (Kolmogorov-Smirnov test: $p > 0.66$ for the dictator game and ultimatum game).

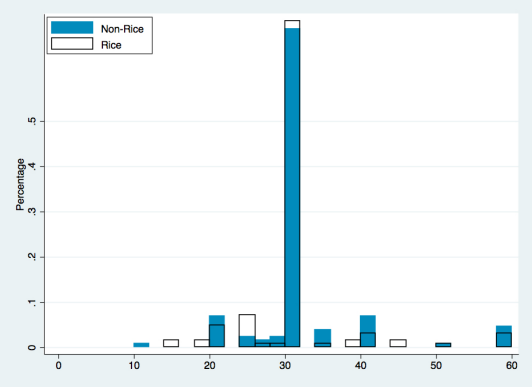
In reciprocity models, beliefs about other's behavior play an important role. However, we did not elicit subjects' beliefs or ask subjects to make a contingent contribution plan based on other group members contribution as in Fischbacher et al. (2001). This is because we employed a repeated PGG and each session already lasts about 2 hours. Nevertheless, in the following, we present four pieces of evidence showing that the difference in beliefs might not be an important factor in explaining the results.

First, if rice and non-rice subjects hold different beliefs, we should observe that rice's contribution is different to non-rice in the very first period of the PGG. We have already shown in the previous section that the difference is very weak. More-

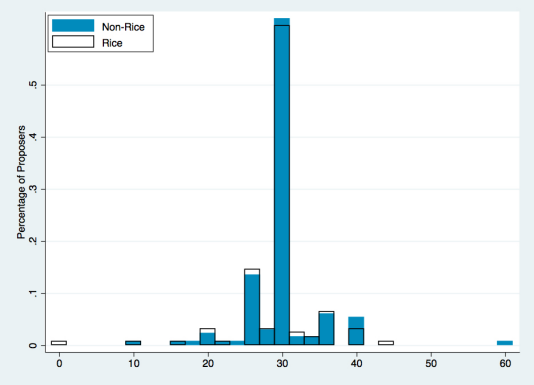
Figure 3: Behavior in the Ultimatum Game and Dictator Game



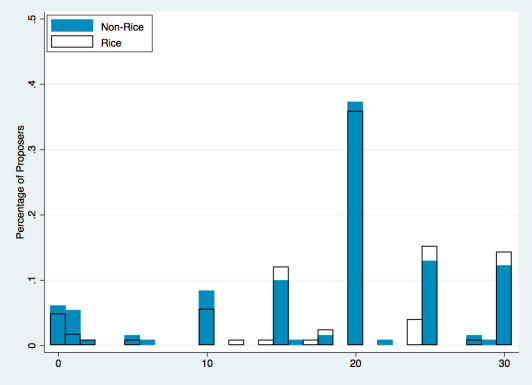
(a) Proposal in the DG



(b) Expected to Receive in DG



(c) Proposal in the UG



(d) Responder Behavior in the UG

Notes: In the DG, while proposers were making decisions, responders were asked to specify the amount they expect to receive from the proposer. Responders know that this would not affect the outcome of the dictator game. In the UG, responders minimal acceptable offer was elicited. Minimal acceptable offer implies that before knowing the actual offer made by proposers, responders specify a number. If the proposer's offer is higher than or equal to this number, the offer is automatically accepted. Otherwise, the offer is rejected by the program.

over, the difference in the second period is also minor (Mann whitney U test, each group as an independent observation: $p = 0.07$). Second, in the dictator game, the amount responders expect to receive from the dictators does not different between rice and non-rice regions. Third, in the post experimental questionnaire, we ask subjects to what extend they believe that people from the local province obey public order, for example, do not jump queues, do not spit, and do not shout in public spaces (10 points scale, 1 = completely disobey, 10 = completely obey). The average score in the the scale between rice and non-rice regions is not signifi-

cantly different from each other (Mann whitney U test: $p > 0.2$ for both scales). Last but not least, the proportion of the efficient choice in the stag hunt game is very similar between rice and non-rice subjects (Two-sample test of proportions: Non-Rice = 72.7%; Rice = 72.4%; $p > 0.94$). Please note that 'stag' is the best response if one believes that her opponent will also choose the efficient action. Since both rice and non-rice subjects coordinate so well on the efficient outcome, it is reasonable to attribute this to the fact that they hold similar beliefs about others' level of cooperativeness.

Reciprocity models also incorporate cases in which subjects reciprocate on final outcomes. Relating to the PGGs, subjects might contribute more if other group members contributed more in the previous period. To test whether rice and non-rice subjects differ in this regard, we conduct two random effects panel regressions similar to Croson (2007).

The results in table 9 illustrate that there is no difference in the level of reciprocity between rice and non-rice subjects. Column 1 is the no punishment condition. The lag of other group member's Min, Median, and Max are all positively signifiant. However, regarding the interaction terms, only the "lag of others' max $\times$ Rice" is significant at 10% level. This suggests that rice subjects are slightly more responsive to the maximum of other's contribution. None of the interaction terms is significant in the punishment condition (column 2). This result alongside with the finding that rice and non-rice subjects hold similar beliefs suggest that the reciprocity models might not be able to account for the differences between the two regions.

The findings that rice farming does not alter people's social preferences also suggest that rice farming does not make people more cooperative, instead, it teaches people how to increase cooperation in the public goods environment.

4.2 Differences other than Rice Cultivation

The rice and non-rice provinces in our sample differ in other aspects besides the type of cultivation. Therefore, our finding might be a manifestation of other differences instead of the difference in cultivation. In this section we discuss several potential explanations in detail and show that our results are less likely driven by omitted variable bias.

Note that a number of factors are already controlled by design. Nearly all of the subjects are first year, Han Chinese University Students. Therefore, they all speak Mandarin, have similar education background, share the same culture origin (Wen et al. (2004) find that Han Chinese share a common culture), and have lived in the same political institution. [25]

Our results might be driven by the level of economic development and market integration since Henrich et al. (2001, 2010) find that these variables are positively associated with cooperation and trust. However, in the previous section, we showed that our results are not affected by controlling for the municipality level GDP per capita as well as whether the subject came from rural or urban areas.

Climate might also have an effect on people's behavior. Since rice areas in our sample are southern provinces while non-rice regions are in the north of China, we are unable to control for temperature due to perfect collinearity. In the following, we present two pieces of evidence to show that our results are less likely driven by climate. First, all the provinces have similar climate. According the Koppen climate classification, which is the mostly widely used method, three of the provinces in our sample belong to the same group C temperate climate category. Second, according to the Pathogen Prevalence theory, diseases are easier to spread in warm areas and hence it is more dangerous to interact with strangers. Consequently, people from warmer areas becomes more collectivistic. We administrated

[25] See Guiso et al. (2006) for a review of the effect of culture on economic outcomes. Chen (2013) find that the necessity to grammatically distinguish future and present events leads to more a present biased time preference. Bó et al. (2010) discover that people are more cooperative in social dilemma situations under democratic institutions.

the Individualism and Collectivism questionnaire and find no difference between rice and non-rice subjects.We also controlled for the social styles in the regression analyses.

If there are other unobservable differences that might affect subject's contribution and punishment behavior, there should be differences between the two rice farming provinces as well as differences between the two non-rice farming provinces. The results in table 10 suggest this is not the case. Column 1 contracts Shandong subject's contribution in the PGG with punishment to Hebei subject's contribution (Shandong and Hebei are both non-rice provinces). The difference is not significant. The difference between the two rice provinces is also not signifiant (column 2). Column 3 and 4 suggest there is no significant difference in punishment behavior between the two non-rice provinces and the two rice provinces, respectively. These results suggest that other unobservable cross province factors are less likely driving our main results.

At the very least, we believe it is very unlikely that the factors that confound rice cultivation are only able to affect subject's behavior in the PGGs but not other measures, such as behavior in DG, UG, Stag Hunt, as well as the answers in the Triad task and Social styles questionnaires.

4.3 Self selection into rice and non-rice regions

The contribution gap between rice and non-rice in our study might be a consequence of sorting. In other words, if a family does not like the social norm of a rice region, they can move to a non-rice province, or vice versa. We address this issue by further excluding observations whose father's birth place was a rice province but themselves have Hukou from a non-rice province or vise versa. Differently put, we drop subjects who have very likely been migrated from a non-rice province to a rice province or vice versa. This strategy can control for the self selection issue because prior to 1990, the Chinese government enforced laws that restricted im-

migration and travel within China.[26] Also note that China has strict immigration control since the Qin Dynasty (221 to 206 BC). This is because people are a scare resource. Both women and men are needed to tend the farming lands and men are required to form armies (See Jinguang (2004) for the documentation of the policy in Qin Dynasty; see the Book of Han for immigration policy in Han Dynasty; See the Tang Code for the policy in Tang Dynasty; See the Collected Regulations of the Great Ming for the policy in Ming Dynasty.)

We did not ask subjects for their father's age, but it is reasonable to assume that their father had born before the time when the immigration law was lifted.[27] Consequently, the birth place of subject's father was not due to selection and subjects who still have the same Hukou as their father's should be free of selection issues. About 8 subjects are dropped due to immigrating in or out of rice regions and the results are not affected by excluding them. As a further check, we drop 9 subjects whose grow up province has different type of cultivation than their father's birth place. Our results are also robust in this specification.

5 Conclusion

In this paper, we examined whether the practice of rice cultivation give rise to a cooperative social norm. We travelled to four typical rice and non-rice provinces and recruited local university students as subjects. We find that rice subjects contribute more than their non-rice counterparts in PGG with and without punishment. Further analyses of the data suggest that rice cultivation probably does *not* make people more cooperative per se, instead, people in rice regions understand the nature of the public goods better than their non-rice counter parts. Since our subjects are university students who are unlikely to have participated in agriculture themselves, we attribute this difference to the intergenerational transmission of a cultural norm, created by hundreds of years of farming, that effect

[26] See Qian (2008) and the references therein for the details about the policy.

[27] The normal age for the first year undergraduate student is 18 years old. Therefore, their parents had born before the lift of the immigration law as long as they had their children after 8 years old.

the overall population living in that society.

Analyzing subjects' behavior in the dictator game, ultimatum game, stag hunt game, and the questionnaire data suggests that neither differences in social preferences nor differences in beliefs could rationalize the main findings. Additionally, our results are not driven by self-selection and are robust to the inclusion of a set of control variables.

Table 3: Punish Behavior (Intensity Margin)

	Rice		Non Rice	
	(1)	(2)	(3)	(4)
Perc. Paddy Field (Municipality)	6.981**	6.752**	-1.668	-1.787
	(3.180)	(3.283)	(2.605)	(2.223)
Perc Rice X More or Eq.	0.363	0.00698	3.484	2.494
	(3.159)	(2.949)	(2.330)	(2.023)
More or Eq.	-2.818	-2.319	-1.508***	-1.307***
	(2.618)	(2.475)	(0.215)	(0.286)
Punsher Contribution		-0.0274		0.0121
		(0.0490)		(0.0458)
Punished Contribution		-0.0229		-0.0291
		(0.0417)		(0.0335)
GDP per cap. (Municipality)		0.0289		-0.109**
		(0.0584)		(0.0471)
Holistic Thinking		-0.644		-1.285**
		(0.807)		(0.650)
From Rural (Dummy)		0.317		0.0869
		(0.356)		(0.343)
Relative Income		0.338		-0.275
		(0.258)		(0.274)
Risk Preference		-0.0828		0.207*
		(0.114)		(0.112)
Male		0.763*		-0.353
		(0.441)		(0.251)
Natural Science (Dummy)		0.324		-0.261
		(0.310)		(0.343)
Priming (Dummy)		0.204		0.790**
		(0.508)		(0.382)
Single Child (Dummy)		-0.567		0.0290
		(0.473)		(0.327)
Collectivistic		0.645		-0.233
		(0.458)		(0.433)
Individualistic		0.266		0.660*
		(0.446)		(0.373)
Trustworty (Belief)		-0.147		-0.00820
		(0.102)		(0.0960)
Public Order (Belef)		0.0638		-0.0375
		(0.0926)		(0.0698)
Period	-0.746	-0.668	0.253	0.239
	(0.696)	(0.687)	(0.506)	(0.506)
Period Squared	0.0215	0.0188	-0.0187	-0.0180
	(0.0278)	(0.0274)	(0.0208)	(0.0207)
Constant	-0.617	-3.599	-1.233	-0.861
	(4.546)	(4.873)	(2.971)	(3.295)
Observations	6000	6000	6336	6336

Notes: Tobit Regression. The dependent variable is the punishment points assigned to other group members. Perc. Paddy Field is municipality level of cultivation data. More or Eq. is a dummy variable which equals 1 if the punished subject contributed more than or equal to the punisher. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

Table 4: Regression Analyses of Probability of Punishment

	Pro-Social Punishment				Anti-Social Punishment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rice	0.0825**	0.0813**			0.00586	-0.00622		
	(0.0404)	(0.0371)			(0.0317)	(0.0300)		
Perc. Paddy Field (Municipality)			0.111**	0.106**			0.0172	0.00278
			(0.0500)	(0.0461)			(0.0399)	(0.0378)
Punsher Contribution		0.00897*		0.00899*		0.00130		0.00127
		(0.00472)		(0.00472)		(0.00327)		(0.00327)
Punished Contribution		-0.0232***		-0.0231***		0.00434*		0.00431*
		(0.00290)		(0.00290)		(0.00233)		(0.00232)
GDP per cap. (Municipality)		0.00203		0.00199		-0.00297		-0.00291
		(0.00547)		(0.00546)		(0.00320)		(0.00319)
Holistic Thinking		-0.161**		-0.157*		-0.0927		-0.0924
		(0.0803)		(0.0803)		(0.0646)		(0.0647)
From Rural (Dummy)		0.0126		0.0127		-0.00469		-0.00530
		(0.0418)		(0.0416)		(0.0288)		(0.0287)
Relative Income		0.0104		0.00972		-0.0212		-0.0217
		(0.0263)		(0.0265)		(0.0192)		(0.0193)
Risk Preference		0.0121		0.0120		0.00509		0.00500
		(0.00896)		(0.00895)		(0.00744)		(0.00746)
Male		0.0119		0.0124		-0.0162		-0.0166
		(0.0341)		(0.0341)		(0.0225)		(0.0225)
Natural Science (Dummy)		0.0143		0.0144		-0.0196		-0.0193
		(0.0327)		(0.0328)		(0.0226)		(0.0226)
Priming (Dummy)		0.0622*		0.0628*		0.0602*		0.0603*
		(0.0358)		(0.0357)		(0.0311)		(0.0311)
Single Child (Dummy)		-0.0191		-0.0190		-0.0131		-0.0144
		(0.0363)		(0.0364)		(0.0253)		(0.0252)
Collectivistic		-0.00615		-0.00577		0.00706		0.00670
		(0.0392)		(0.0392)		(0.0287)		(0.0286)
Individualistic		0.0932**		0.0932**		0.0461*		0.0463*
		(0.0382)		(0.0381)		(0.0250)		(0.0250)
Trustworty (Belief)		-0.0101		-0.00972		-0.0134**		-0.0130**
		(0.0104)		(0.0104)		(0.00597)		(0.00595)
Public Order (Belef)		0.00227		0.00193		0.00243		0.00224
		(0.00809)		(0.00810)		(0.00494)		(0.00496)
Period	-0.0786	-0.0215	-0.0783	-0.0214	-0.0136	-0.0236	-0.0136	-0.0235
	(0.0562)	(0.0539)	(0.0562)	(0.0539)	(0.0430)	(0.0441)	(0.0430)	(0.0441)
Period Squared	0.00284	0.000809	0.00283	0.000802	-0.000340	-0.00000637	-0.000339	-0.0000103
	(0.00222)	(0.00213)	(0.00222)	(0.00213)	(0.00170)	(0.00174)	(0.00170)	(0.00174)
Constant	0.888**	0.374	0.881**	0.364	0.440*	0.454	0.436*	0.450
	(0.345)	(0.400)	(0.345)	(0.399)	(0.261)	(0.285)	(0.261)	(0.285)
Observations	3756	3756	3756	3756	8580	8580	8580	8580

Notes: Random Effects Panel regression. The dependent variable is a dummy variable which equals 1 if assigned punish points to a free-rider (columns 1-4) or to a subjects who contributed more than the punisher (columns 5 - 8). Therefore columns 1-4 compare the probability of a pro-social punishment between rice and non-rice, whereas columns 5-8 compare the probability of anti-social punishment between rice and non-rice. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

Table 5: How subjects respond to punishment

	Pro-Social Punishment (1)		Anti-Social Punishment (2)	
Punish Receive	0.675***	(0.110)	-0.374**	(0.164)
Punish Rec. X Rice	0.0287	(0.172)	0.319	(0.223)
Rice	0.0744	(0.290)	-0.0288	(0.135)
Period	-0.951**	(0.467)	-0.0708	(0.365)
Period Squared	0.0371*	(0.0197)	-0.000560	(0.0152)
Constant	6.730**	(2.705)	0.574	(2.153)
Observations	1461		2137	

Notes: Random effects Panel regression. The dependent variable is the change in contribution from t to t+1. Punish receive is the total number of punishment points received in period t. Regressions are made separately for pro-social punishment (columns 1 and 2) and anti-social punishment (columns 3 and 4). Pro-social punishment means that subject get punished for contributing less than other group members' average contribution. Anti-social punishment means that subject get punished for contributing more than other group members' average contribution. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

Table 6: The Set of Control Variables

Variable Name	Description
GDP per capita (Municipality)	GDP per capita at the municipality level. The latest data available (2014) from the province level Bureau of Statistics websites and matched with subject's Hukou place.
Holistic Thinking	Percentage of holistic choices in the Triad task. The main dependent variable in Talhelm et al. (2014).
From Rural (Dummy)	Having a Rural Hukou.
Relative Income	Relative income assesses subjects income level relative to their town of residence. There are four levels, "Way Above", "Above", "Same", "Below", and "Way Below".
Risk Preference	The number of risk seeking choices in the non-incentivized lottery task.
Male	
Single Child (Dummy)	Whether the subjects is a single child.
Natural Science (Dummy)	According to China's Education Policy, students in senior high school need to choose between two screams, the social-science-oriented area, which focuses on history, politics and geography and the natural-science-oriented area, which focuses on physics, chemistry and biology. In the National Higher Education Entrance Examination, the two streams have separate exam papers. Please note that students who choose the social-science-oriented also need to study physics, chemistry and biology, but to a lesser degree. This is also true for students in the natural-science-oriented.
Collectivistic & Individualistic	Social Styles: Individualism and Collectivism. See Oyserman et al. (2002) for a review of studies using this questionnaire.
Trustworthy (Belief)	To what extend subjects believe that people from the local province are trustworthy.
Public Order (Belief)	To what extend subjects believe that people from the local province obey public order, for example, do not jump queues, do not spit, and do not shout in public spaces.

Table 7: Contribution in the PGG with and without punishment

	PGG without Punishment		PGG with Punishment	
	(1)	(2)	(3)	(4)
Perc. Paddy Field (Municipality)	1.252*	1.211*	1.803**	1.657**
	(0.726)	(0.696)	(0.785)	(0.733)
GDP per cap. (Municipality)		-0.0321		0.0454
		(0.0596)		(0.0608)
Holistic Thinking		1.375*		0.374
		(0.772)		(0.735)
From Rural (Dummy)		-0.265		-0.392
		(0.412)		(0.413)
Relative Income		-0.566**		-0.296
		(0.281)		(0.238)
Risk Preference		0.0727		0.160
		(0.117)		(0.106)
Male		2.042***		2.179***
		(0.462)		(0.370)
Natural Science (Dummy)		0.651*		1.311***
		(0.380)		(0.393)
Priming (Dummy)		-0.461		-0.148
		(0.542)		(0.569)
Single Child (Dummy)		-0.345		-0.0580
		(0.477)		(0.409)
Collectivistic		0.499		0.692
		(0.443)		(0.466)
Individualistic		-0.629		-0.433
		(0.428)		(0.390)
Trustworty (Belief)		0.0784		0.123
		(0.0900)		(0.105)
Public Order (Belef)		-0.0358		-0.0469
		(0.0919)		(0.0807)
Period	1.191***	1.191***	2.244***	2.244***
	(0.171)	(0.171)	(0.301)	(0.302)
Period sqaured	-0.144***	-0.144***	-0.0746***	-0.0746***
	(0.0173)	(0.0174)	(0.0115)	(0.0115)
Constant	7.926***	7.284***	-4.118**	-7.531**
	(0.429)	(2.552)	(1.772)	(3.077)
Observations	4112	4112	4112	4112

Notes: Random effects Panel regression. The dependent variable is the contribution in the PGGs. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

Table 8: Punish Behavior

	(1)		(2)	
Perc. Paddy Field (Municipality)	1.120**	(0.473)	1.105**	(0.455)
Perc Paddy X More or Eq.	-0.837**	(0.378)	-0.804**	(0.386)
More or Eq.	-1.573***	(0.222)	-1.377***	(0.273)
Punsher Contribution			-0.0102	(0.0339)
Punished Contribution			-0.0373	(0.0281)
GDP per cap. (Municipality)			-0.0291	(0.0374)
Holistic Thinking			-0.958*	(0.523)
From Rural (Dummy)			0.0435	(0.260)
Relative Income			-0.0169	(0.191)
Risk Preference			0.130	(0.0821)
Male			0.275	(0.267)
Natural Science (Dummy)			0.0426	(0.232)
Priming (Dummy)			0.517	(0.329)
Single Child (Dummy)			-0.312	(0.298)
Collectivistic			0.124	(0.326)
Individualistic			0.653**	(0.310)
Trustworty (Belief)			-0.107	(0.0713)
Public Order (Belef)			0.0277	(0.0557)
Period	-0.195	(0.434)	-0.125	(0.435)
Period Squared	-0.000810	(0.0176)	-0.00313	(0.0176)
Constant	1.086	(2.607)	-0.764	(2.888)
Observations	12336		12336	

Notes: Tobit Regression. The dependent variable is the punishment points assigned to other group members. More or Eq. is a dummy variable which equals 1 if the punished subject contributed more than or equal to the punisher. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

Table 9: Reciprocity in the PGGs

	(1) No Punishment	(2) Punishment
Rice	0.0991	0.432
	(0.649)	(0.775)
Other Median (Lag)	0.152***	0.442***
	(0.0503)	(0.0606)
Rice x Other Median	-0.0856	-0.0139
	(0.0715)	(0.0714)
Other Max (Lag)	0.154***	0.130**
	(0.0288)	(0.0510)
Rice x Other Max	0.0824*	0.0480
	(0.0481)	(0.0710)
Other Min (Lag)	0.251***	0.141***
	(0.0465)	(0.0376)
Rice x Other Min	0.0329	-0.0373
	(0.0631)	(0.0483)
Period	0.675***	-0.276
	(0.201)	(0.317)
Period square	-0.0944***	0.00818
	(0.0205)	(0.0120)
Punish Receive (Lag)		-0.290***
		(0.0638)
Constant	3.827***	6.068***
	(0.563)	(2.148)
Observations	3619	3619

Notes: Random effects panel regression. The dependent variable is contribution in the PGGs. Other Max (lag) is the maximum of other group members contribution in the previous period. Other Median and Min (Lag) are defined analogously. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

Table 10: Similarity within Rice and Non-Rice provinces

	Contribution		Punishment	
	(1)	(2)	(3)	(4)
Shandong	-0.534		0.326	
	(0.781)		(0.391)	
Zhejiang		0.319		-0.0986
		(0.989)		(0.717)
Shandong x More or Eq.			-0.239	
			(0.325)	
Zhejiang x More or Eq.				0.518
				(0.506)
More of Eq.			-1.244***	-2.598***
			(0.257)	(0.457)
Constant	-6.757	-6.853*	-0.849	3.412
	(4.661)	(3.929)	(3.236)	(4.637)
Additional Controls	Yes	Yes	Yes	Yes
Period Controls	Yes	Yes	Yes	Yes
Observations	2112	2000	6336	6000

Notes: Random effects panel regressions for columns 1 and 2; Tobit regressons for column 3 and 4. Note that Hebei and Shandong are non-rice provinces whereas Hunan and Zhejiang are rice provinces. Additional Controls are the variables explained in table 6. Period Controls consist if Period and Period Squared. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

A Appendix

A.1 Experimental Instructions

Thank you for participating.

Please note that communication with other participants is prohibited during the study. If you have a question once the study has begun, please raise your hand and an assistant will come to your desk to answer it. Violation of this rule can lead to immediate exclusion from the study and from all payments.

Today we will do 5 studies. The instructions for the first study are attached. Once a study is completed, you will receive instructions for the next study.

During the study we will not speak in terms of GBP, but in points. Your entire earnings will be calculated in points. At the end of the study the total amount of points you have earned will be converted to RMB at the following rate:

1 point = 0.4 GBP

At the end of today's study, one out of 5 study will be randomly selected for payment. After you completed all the studies, a card will be drawn from a bag, containing cards numbered from 1 to 5. The number on the card determines which study is for payment.

You will receive GBP 4 as a show-up fee for participating. Therefore, your total earning is:

Total Earning = Show-up fee + money you earned in the randomly chosen study

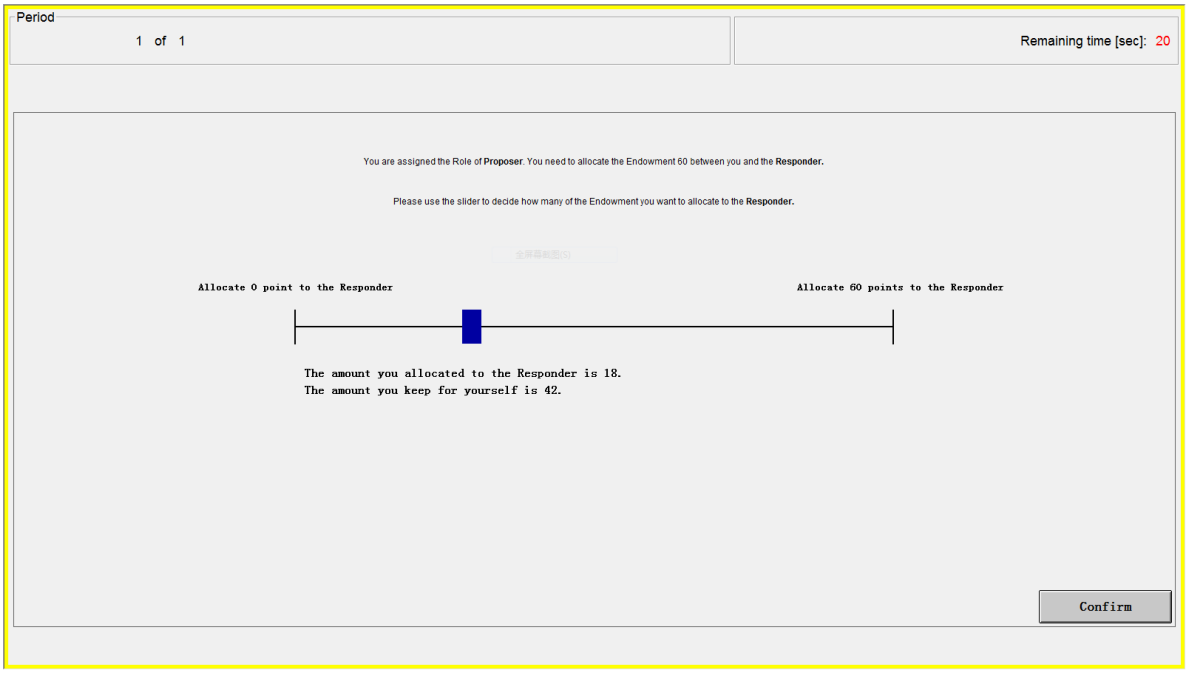
Please read the instructions carefully, because your earnings in each study depends on how well you understand the instructions.

Instructions for the First Study

In this study, first you will be assigned a role. You will be either a Proposer or a Responder. If you are a Proposer, you will be randomly and anonymously paired with a Responder. If you are a Responder, you will be randomly and anonymously paired with a Proposer. This way, half of the people in the room will be Proposers and half of them will be Responders.

DECISION OF PROPOSER

The Proposer's role is to allocate **a total of 60 points** between the Proposer and Responder. The input screen for the Proposer is presented below:



The Proposer needs to use the slider to allocate points between him or her and the Responder. The more points the Proposer allocates to the Responder the less points he or she keeps. The amount of points allocated to the Responder as well as the points remaining for the Proposer are both shown on the screen.

DECISION OF RESPONDER

In the current study the responder can only accept the allocation made by the Proposer. In other words, the allocation made by the Proposer is implemented regardless of whether the Responder agrees or disagrees.

EARNINGS

The Proposer and the Responder receive the amount according to the allocation made by the Proposer.

Control questions

1. Suppose the Proposer allocated 20 points to the responder.

What are the earnings for the Proposer?.....

What are the earnings for the Responder?.....

What can the Responder do if he/she is not satisfied with the allocation? ……..

……

2. Suppose the Proposer allocated 40 points to the responder.

What is the earnings for the Proposer?.....

What is the earnings for the Responder?.....

What can the Responder do if he/she is not satisfied with the allocation? ……..

……

Instructions for the Second Study

This study is very similar to the previous one.

Your role in this study remains the same as in the previous study. If you were a Proposer, you will also be a Proposer in this one. If you were a Responder, you will also be a Responder in this one.

Again . If you are a Proposer, you will be randomly and anonymously paired with a Responder. If you are a Responder, you will be randomly and anonymously paired with a Proposer. This way, half of the people in the room will be Proposers and half of them will be Responders. Your pair in this study **need not be** the same as in the previous study.

DECISION OF PROPOSER

The decision of the Proposer is exactly the same as in the previous study. The Proposer needs to allocate a total of 60 points between the Proposer and the Responder. In this study, the Responder can accept or reject the offer.

NEW IN STUDY 2: DECISION OF RESPONDER

Responders need to enter the **minimum acceptance amount** while the Proposers are making their decisions. The minimum acceptance amount is a number such that if the Proposer allocates a number **less** than the minimum acceptance amount, the allocation will be **automatically rejected**. On the other hand, if the Proposer allocates a number **more or equal** to the minimum acceptance amount, the allocation will be **automatically accepted**. For example, if a Responder stated 20 as the minimum acceptance amount and the Proposer allocates 19 or less to the Responder, then the allocation is automatically rejected. If the Proposer allocates 20 or more points to the Responder, then the allocation is automatically accepted. Important, Responders and Proposers are making decisions simultaneously. Therefore, Proposers will **NOT** know Responders' minimum acceptance amount while making the allocation. Similarly, Responders will **NOT** know Proposers' allocation while entering minimum acceptance amount.

While Proposers are making decisions, Responders need to enter a number between 0 and 60. This number is called the "**Minimum Acceptance Amount.**" If the points that Proposer allocated to Responder are **less** than this "Minimum Acceptance Amount", Proposer's allocation will be **automatically rejected**. On the other hand, if the points that Proposer allocated to Responder are **more or equal** to this "Minimum Acceptance Amount", Proposer's allocation will be **automatically accepted**. For example, if a Responder stated 20 as the minimum acceptance amount and the Proposer allocates 19 or less to the Responder, then

the allocation is automatically rejected. If the Proposer allocates 20 or more points to the Responder, then the allocation is automatically accepted. Important, Responders and Proposers are making decisions simultaneously. Therefore, Proposers will **NOT** know Responders' minimum acceptance amount while making the allocation. Similarly, Responders will **NOT** know Proposers' allocation while entering minimum acceptance amount.

The input screen for the Responder is presented below.

EARNINGS

If the allocation made by Proposer is **accepted**, both receives the points allocated to them.

If the allocation made by Proposer is **rejected**, both receive **zero points**.

Please answer the questions in the next page. They serve as a test for you understanding of the task.

Control questions

1. Suppose the Proposer allocated 20 points to the Responder.

If Responder enter the minimal acceptance amount 15, what is the earnings for the Proposer?.....

What are the earnings for the Responder?.....

If Responder enter the minimal acceptance amount 45, what is the earnings for the Proposer?.....

What are the earnings for the Responder?.....

2. Suppose the Proposer allocated 40 points to the responder.

If Responder enter the minimal acceptance amount 15, what is the earnings for the Proposer?.....

What are the earnings for the Responder?.....

If Responder enter the minimal acceptance amount 45, what is the earnings for the Proposer?.....

What are the earnings for the Responder?.....

Instructions for the Third Study

In this study, participants are randomly divided into groups of two. You will therefore be in a group with another participant.

DECISIONS

You and the other participant in your group need to pick one out of two possible choices simultaneously. The choices are labelled @ and #. When you make your choice you will not know what the other participant will choose. The other participant will not know your choice either. In other words, no participant will know what action the other player chose when making a decision.

EARNINGS

The following table shows earning for all possible combination of choices made by you and the other participant in your group.

		Other's Choice	
		@	#
Your Choice	@	(**30**, 30)	(**10**, 22)
	#	(**22**, 10)	(**22**, 22)

Note that, the numbers that are **Bolded** in each cell are **earnings for you**. The other number in each cell indicates the earning for the other participant.

For example, suppose your choice is "@" and the other's choice is "#", then the earning are (**10**, 22). Therefore, you earn **10** points and the other participant earns 22 points. If you choose "#" and the other's choice is "#", then the earning are (**22**, 22). Therefore, you earn **22** points and the other participant earns 22 points too.

Keep in mind: You and the other participant make your choices simultaneously without knowing what the other participant chooses.

Control questions:

1. Suppose you choose @ and the other participant choose @.

What is the earning for you?.....

What is the earning for the other participant?.....

2. Will you know what the other participant chose when you chose? ….

Will the other participant know what you chose once he or she choses? …

3. Suppose you earn 22 and the other participant earn 10.

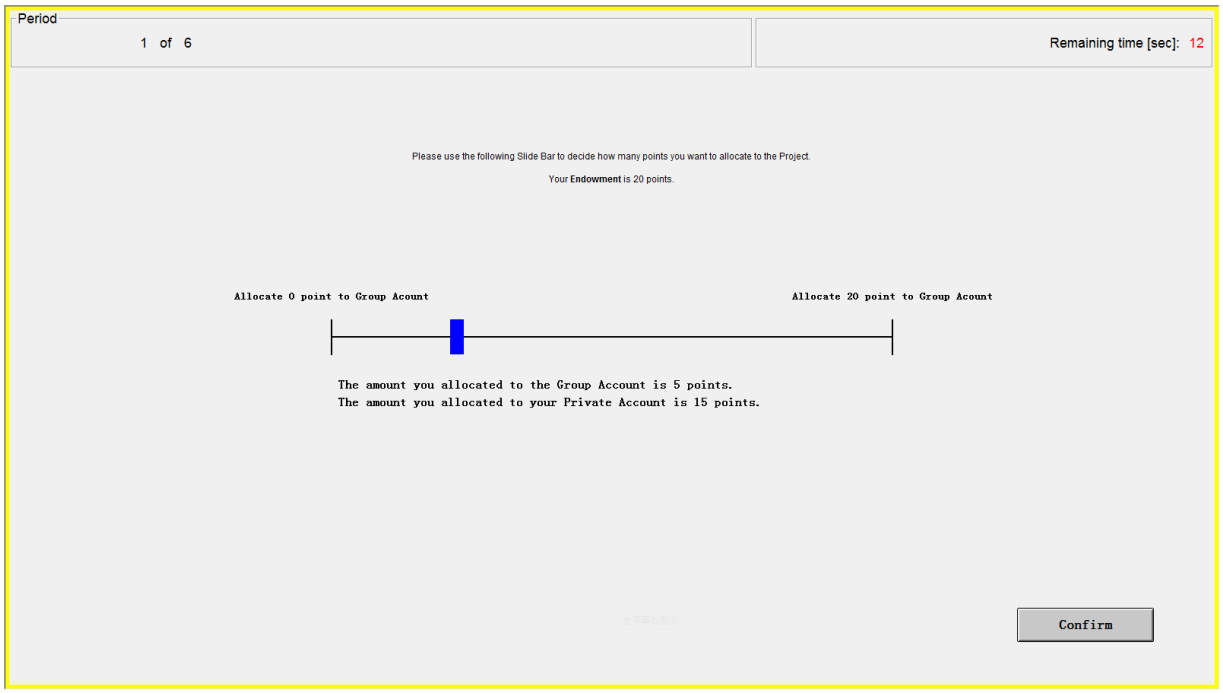
What was your choice?.....

What was the other participant's choice?.....

Instructions for the Fourth Study

In this study, participants are randomly divided into groups of four. You will therefore be in a group with 3 other participants. You will remain in the same group for the duration of this study. There will be a total of 6 periods, each participant will face the same decision in each period.

At the beginning of each period, each participant receives 20 points. We call this your endowment. In each period you will be asked to decide how many points of your endowment you want to allocate to a **Group Account.** You may allocate any integer number of points between 0 and 20. The remainder of your endowment will be automatically allocated to your **Individual Account**. The input screen is presented below:



You can use the slide bar to decide how many points of your endowment you want to allocate to the **Group Account**. The amount allocated to your **Private Account** is also shown on the screen.

EARNINGS

After all the participants have made their decisions, your earnings for the period are calculated. Your earnings consist of two parts:

(1) Your earnings from the **Individual Account**.

(2) Your earnings from the **Group Account.**

Your earnings from the Individual Account equal the points that you keep for yourself, and are thus independent of others' decisions. For every point you keep for yourself in your Individual Account, you earn 1 point.

Your earnings from the Group Account depend on the total number of points allocated to the Group Account by the 4 group members (including yourself). This total amount is multiplied by 1.6 and then distributed equally amongst the four group members – each member receives a quarter of it (25%). In other words, each point that you allocate to the Group Account turns into 1.6 points, which are distributed equally to four members i.e. 0.4 points each.

So, for each point that you or any of your group members allocate to the Group Account, you and the other three group members receive 0.4 points each.

In summary, your earnings in each period are calculated as follows:

Your earnings =

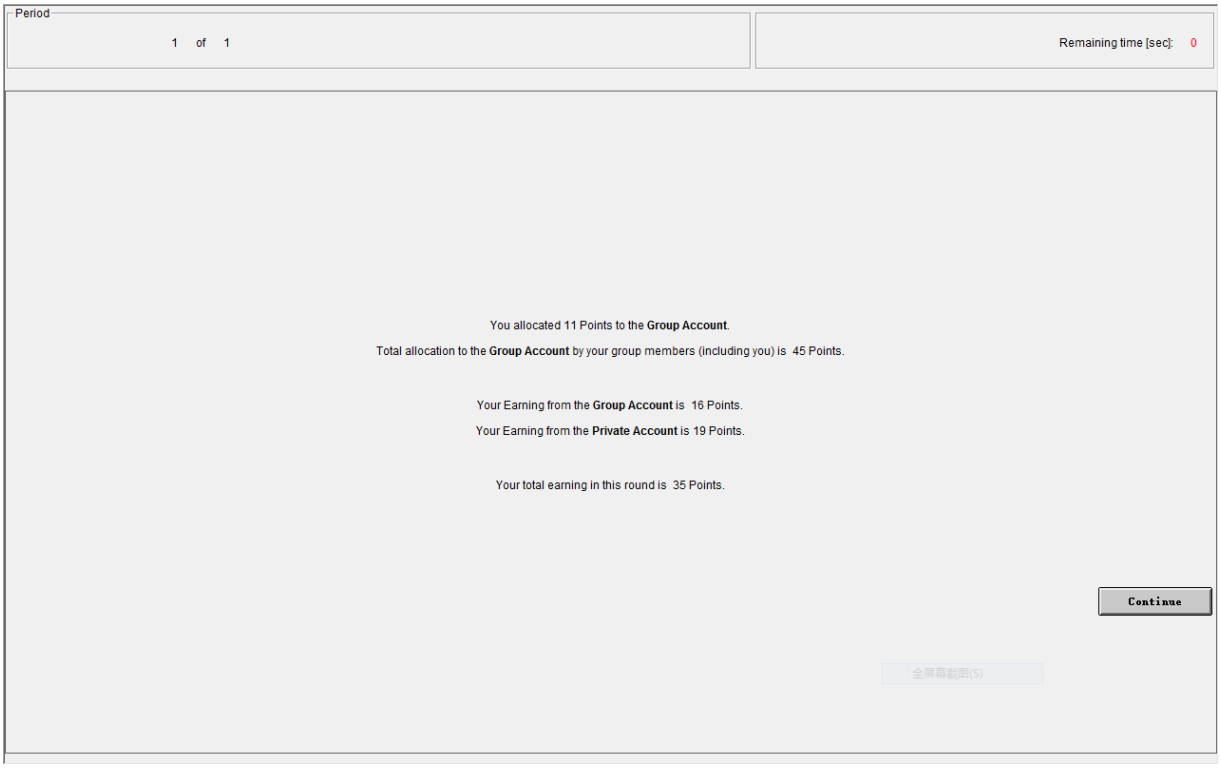
Earnings from Individual Account + Earnings from the Group Account =

20 - (Your allocation to the Group account) + 0.4 x (Total points allocated to Group Account by all group members)

Example: Suppose in one period that you allocated 8 points to the Group Account and that the other three members of your group allocated a total of 22 points. This makes a total of 30 points in the Group Account. In this case each member of the group receives earnings from the Group Account of 0.4×30 = 12 points. In addition, you also receive 12 points from your Individual Account. Therefore, your earning in this period is: (20 – 8) + 0.4 x 30 = 24 points.

RESULTS SCREEN

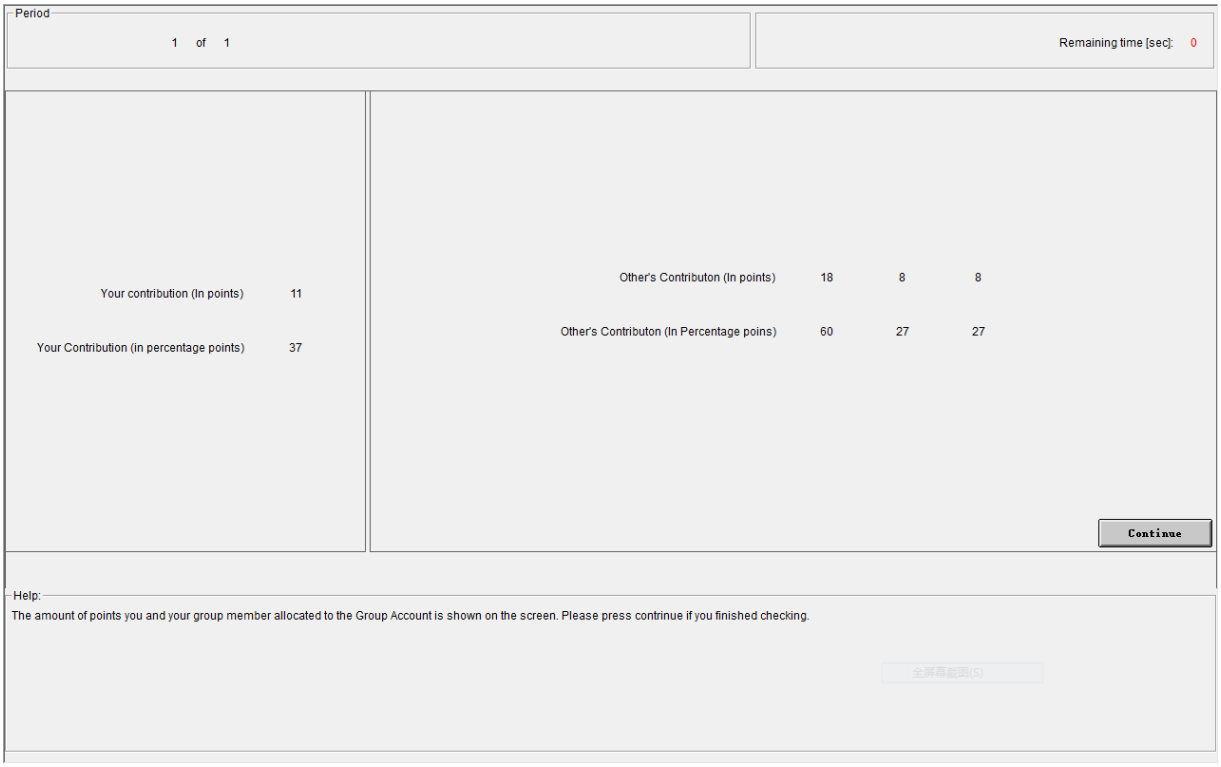
After all your group members have made their decision, your allocation and the sum of all allocations in your group are reported on the Result Screen as shown below. To aid you in your calculation, your earnings from your individual account and your earnings from the group account are both presented on the screen.



Please press the Continue button after you have read all the information.

INFORMATION SCREEN

Next the information screen appears, which reveals the contributions of the other group members.



This screen shows how many points each group member allocated to the Group Account. Your allocation is displayed in the first column, while the allocations made by the other group members are shown in the remaining three columns. Please note that **the order in which other group member's allocations are displayed changes randomly in every period.** The allocation in the second column, for example, generally represents a different group member each time. The same holds true for the allocations in the other columns. **That way you are informed about the contributions but not about the identities of the other group members.**

A new period will start shortly after pressing the Continue button. You will again receive 20 points as endowment and you will be asked again to decide how many points of your endowment you want to allocate to a Group Account.

If this study is randomly chosen for payment, we will randomly pick 1 period out of the 6 periods and your payments will be calculated by your decisions in that period

Please answer the questions in the next page. They serve as a test for your understanding of the task.

Control questions

1. Each group member has an endowment of 20 points. Suppose nobody (including you) contributes any points to the Group Account. What is:

Your earnings from the Group Account?.....

Your earnings from the Individual Account?.....

Your total earnings?.....

Other group members earnings from the Group Account?.....

Other group members earnings from the Individual Account?.....

Other group members total earnings?.....

2. Each group member has an endowment of 20 points. Suppose you contribute 8 points to the Group Account. All other group members each contribute 12 points to the Group Account. What are:

Your earnings from the Group Account?.....

Your earnings from the Individual Account?.....

Your total earnings?.....

Other group members earnings from the Group Account?.....

Other group members earnings from the Individual Account?.....

Other group members total earnings?.....

3. Each group member has an endowment of 20 points. Suppose the other three group members contribute **a total of 30** points to the Group Account.

a) If you contribute 5 points to the Group Account.

Your earnings from the Group Account?.....

Your earnings from the Individual Account?.....

Your total earnings?.....

Other group members earnings from the Group Account?.....

b) What are your earning if you contribute 15 points to the Group Account?

Your earnings from the Group Account?.....

Your earnings from the Individual Account?.....

Your total earnings?.....

Instructions for the Fifth (Last) Study

This study is similar to the previous study. First you will be randomly divided into a new group of four. The **new** group composition will **not** change throughout this study.

Each participant receives a lump sum payment of **10 Points** at the beginning of this study. This one-off payment can be used to pay for eventual losses during this study**. However, you can always evade losses with certainty through your own decisions**.

This study consists of 10 periods and there are **2 stages in each period**. The first stage is identical to the previous study. At the beginning of each period each participant receives 20 points as his or her endowment. You need to decide how many points of your endowment you want to allocate to a **Group Account** (and hence the remainder of your endowment will be automatically allocated to your **Individual Account**). Your earnings from the first stage will be calculated exactly in the same way as in the previous part.

Your earnings from the **First Stage** =

Earnings from Individual Account + Earnings from the Group Account =

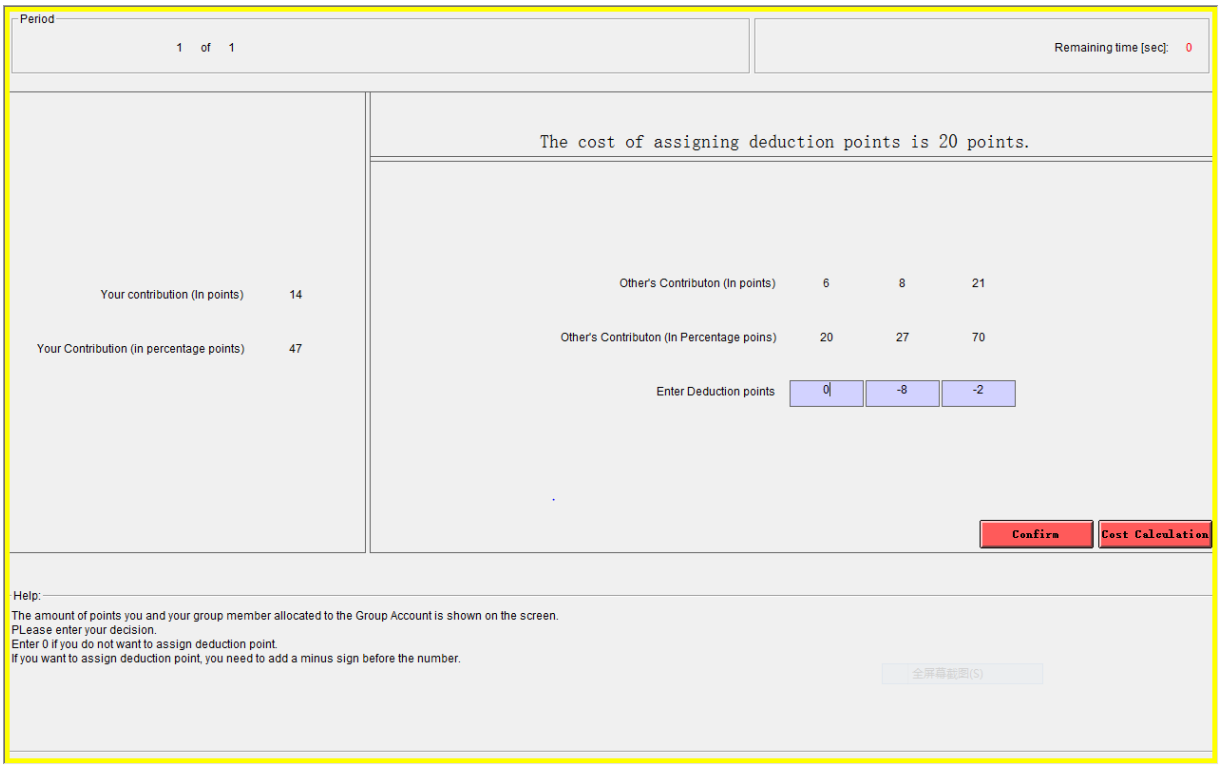
20 - (Your allocation to the Group account) + 0.4 x (Total points allocated to Group Account by all group members)

THE SECOND STAGE

There will be a new **second stage** introduced after all participants have made their decisions in the first stage.

At the second stage you can observe how many points each group member allocated to the Group Account. In addition, in this stage you can **decrease** the earning of each group member by assigning **deduction tokens** to him/her. If you do not want to decrease the other's earning, you simply do not assign any deduction tokens to him/her. Note that other group members can also decrease your earnings if they wish to do so.

The input screen for the second stage is presented below:



The screen shows how many points each group member allocated to the Group Account at the first stage. Your allocation is displayed in the first column, while the allocations made by the others are shown in the remaining three columns. Please note that **the order in which allocations are displayed changes randomly in every period**. The allocation in the second column, for example, generally represents a different group member each time. The same holds true for the other columns. This way you are informed about the contributions but not about the identities of the other group members.

You now have to decide whether, and if so how many, deduction tokens to assign to each of the other three group members. If you do not wish to change the income of a specific group member then you must enter 0. If you want to distribute deduction tokens, you must put a negative sign in front of the number (without spaces between them).

You can assign between 0 and 10 deduction tokens to each group member. However, each deduction token **costs you 1 point**. Therefore, the larger the amount of deduction tokens that you assign to other group members, the larger your costs. The total cost of assigning deduction tokens is calculated as follows:

Total cost of assigning deduction tokens = Sum of assigned deduction tokens x 1

You can move from one input field to the other using the mouse.

Example: If you assign 2 deduction tokens to one member (enter -2), assign 8 deduction tokens to another member (enter -8), and you assign 0 deduction token to the last group member (enter 0), the sum of assigned deduction tokens is 2 + 9 + 0 = 11 and the total cost is 11 x 1 = 11 points.

Each deduction token assigned to a participant reduces his/her earnings by 3 points. A participant's total received deduction tokens equal the sum of deduction tokens other group members assigned to him/her. Consequently, the amount of earnings decreased by the received deduction tokens is calculated as follows:

Total amount of earnings decreased by received deduction tokens = Sum of received deduction tokens x 3

Important: By receiving deduction tokens, each participant's earning can only be reduced to **ZERO**.

Example: If a participant received 2 deduction token from one group member, 9 deduction tokens from another group member, and 0 deduction token from the last group member, then the participant received a total of 2 + 9 + 0 = 11 deduction tokens. Consequently, his/her earnings will be decreased by 11 * 3 = 33 points. If this participant earned 40 points in the **First Stage**, then his/her earnings will be 40 – 33 = 7 points**. If this participant earned less than 33 in the First Stage, his/her earning will only be reduced to 0 point.** It is possible that one can earn a negative amount: if your earnings were reduced to ZERO by receiving deduction tokens **and you distributed 5 deduction tokens to others**, your final earnings will be 0 – 5 = -5 points. **However, you can always evade losses with certainty through your own decisions**.

EARNINGS

After all participants have made their decisions in the second stage, your earnings for the period are calculated.

The earnings from the First Stage are the same as in the previous part. These are the earnings from your Individual Account and the earnings from the Group Account.

The earnings from the **Second Stage** depend on the total deduction tokens you assigned to other group members as well as the total deduction tokens you received from other group members.

In sum, your earnings in each period are calculated as follows:

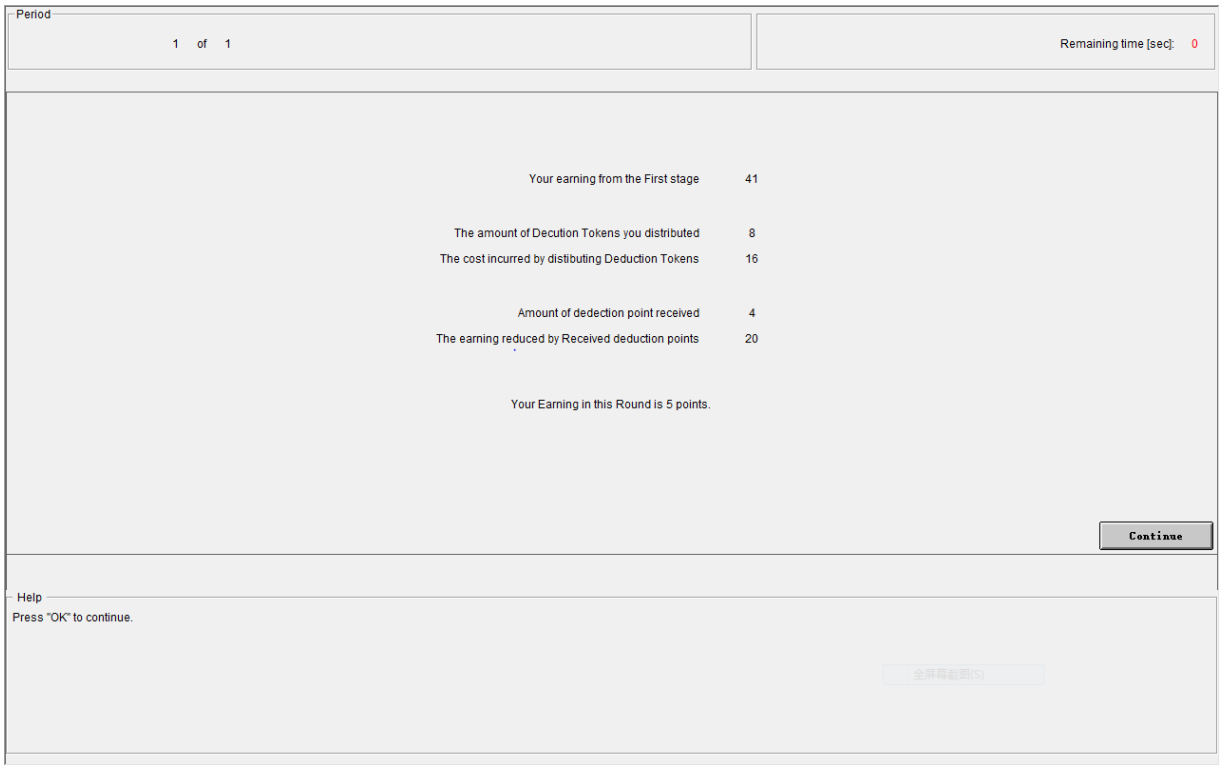
Your earnings at the end of the second stage = income per period

= **Earnings in the First stage**
- (Sum of deduction tokens received from other participants x 3)
- (Sum of deduction tokens assigned to other participants)

Please remember that your earnings at the end of the second stage can be negative, if the cost of your points used to distribute deduction tokens exceeds your (possibly reduced) income from the first stage. You can however avoid such losses with certainty through your own decisions!

RESULTS SCREEN

At the end of the second stage, your allocation and the sum of all allocations in your group are reported on the outcome screen as shown below. The sum of deduction tokens you assigned to others as well as the sum of deduction tokens you received are also presented on the screen.



Please press the Continue button after you have read all the information. A new period will start shortly.

If this study is randomly chosen for payment, we will randomly pick 1 period out of the 10 periods and your payments will be calculated by your decisions in that period

Please answer the questions in the next page. They serve as a test for you understanding of the task.

Control questions

1. Suppose at the second stage you assign the following deduction tokens to your three other group members: -9, -5, and 0. What is the total cost of your assigned deduction tokens?.....

2. What is your cost if you assign a total of 0 points?.....

3. Suppose you earn 10 points in the First stage. By how many points will your income from the first stage be reduced if you receive a total of 1 deduction tokens from the other group members?.....

4. Suppose you earn 20 points in the First stage. By how many points will your income from the first stage be reduced if you receive a total of 5 deduction tokens from the other group members?.....

5. Suppose you earn 30 points in the First stage. If you received 1 deduction token and assigned a total of 5 deduction tokens. What are your final earnings?.....

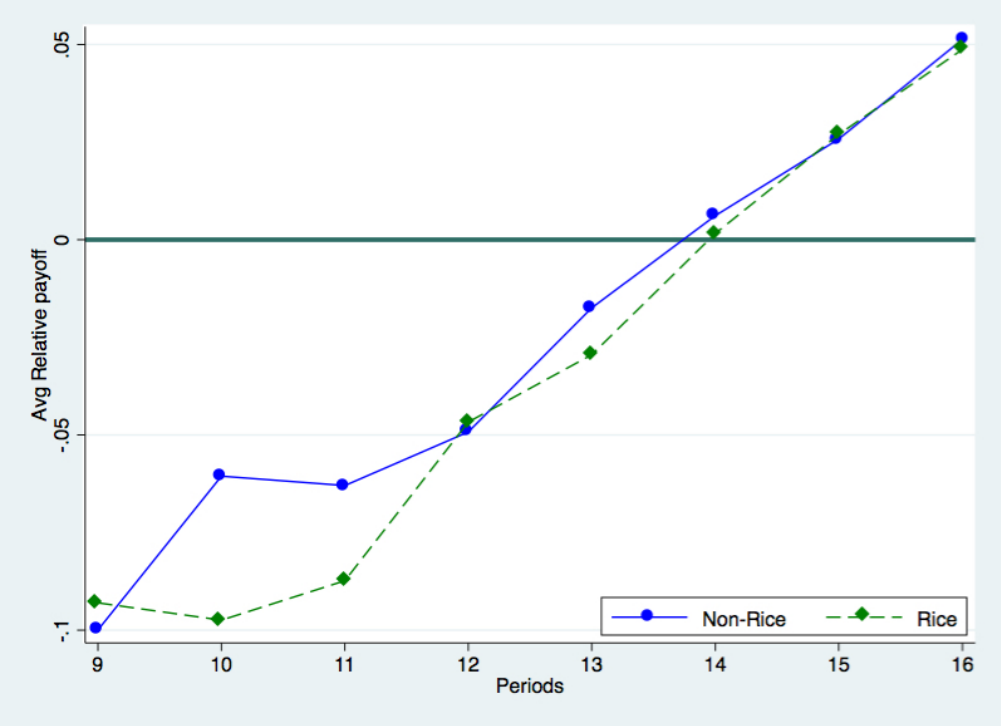
6. Suppose you earn 20 points in the First stage. If you received 7 deduction tokens and assigned a total of 5 deduction tokens. What are your final earnings?.....

7. Suppose you earn 10 points in the First stage. If you received 2 deduction tokens and assigned a total of 8 deduction tokens. What are your final earnings?.....

A.2 Relative Welfare

The relative welfare in the PGG with punishment is presented in figure A.1. The relative welfare is constructed as the following. We first compute the average payoff in each period of the no-punishment condition. This is done separately for rice and non-rice subjects. We then subtract this average from individual's payoff in the punishment condition. Finally, the difference is normalized by the average payoff in the no-punishment condition. This yields the evolution of payoff in the punishment condition relative to the no-punishment condition.[28]

Figure A.1: Evolution of relative welfare



Notes: This figure presents the relative welfare in the punishment condition with respect to the no punishment condition. This is constructed by first calculating the welfare difference between the two conditions and normalize the difference by the welfare in the no punishment condition.

In the first period of the punishment condition, rice and non-rice subjects earn about 10% less compared to the first period of the no punishment condition. The

[28]Fehr and Gächter (1999) uses the group level average payoff to calculate the relative payoff. We cannot compare group level difference between the two conditions because subjects randomly regroup after the no-punishment condition.

difference becomes smaller over time and subjects in both regions start to make a relative payoff gain from period fourteen onwards. Taking all periods together, the average relative payoff is -2.6% in non-rice and -3.5% in rice. The difference is not significant at any conventional level (Mann-Whitney U test based on group level averages: $p > 0.72$). Moreover, in periods 10 and 11, in which the difference between rice and non-rice is the largest, the differences are also not significant (Mann-Whitney U test based on group level averages: $p > 0.25$ for both periods).

A.3 Additional Regression Analyses

Table A.1: Regression Analyses of Probability of Punishment

	Pro-Social Punishment				Anti-Social Punishment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rice	0.370**	0.385**			0.0902	0.0497		
	(0.188)	(0.175)			(0.171)	(0.164)		
Perc. Paddy Field (Municipality)			0.498**	0.502**			0.169	0.120
			(0.232)	(0.217)			(0.213)	(0.204)
Punsher Contribution		0.0456**		0.0457**		0.0131		0.0130
		(0.0214)		(0.0215)		(0.0159)		(0.0159)
Punished Contribution		-0.112***		-0.112***		0.0197*		0.0195*
		(0.0136)		(0.0136)		(0.0114)		(0.0114)
GDP per cap. (Municipality)		0.00850		0.00831		-0.00829		-0.00802
		(0.0273)		(0.0272)		(0.0192)		(0.0192)
Holistic Thinking		-0.847**		-0.827**		-0.593*		-0.587*
		(0.387)		(0.386)		(0.327)		(0.328)
From Rural (Dummy)		0.0210		0.0214		-0.0399		-0.0427
		(0.203)		(0.202)		(0.158)		(0.157)
Relative Income		0.0615		0.0587		-0.0863		-0.0892
		(0.128)		(0.129)		(0.104)		(0.104)
Risk Preference		0.0691		0.0687		0.0441		0.0439
		(0.0444)		(0.0444)		(0.0393)		(0.0394)
Male		0.0354		0.0375		-0.143		-0.145
		(0.170)		(0.170)		(0.124)		(0.124)
Natural Science (Dummy)		0.0794		0.0800		-0.144		-0.143
		(0.156)		(0.156)		(0.124)		(0.124)
Priming (Dummy)		0.276		0.278		0.327*		0.328*
		(0.174)		(0.174)		(0.174)		(0.174)
Single Child (Dummy)		-0.138		-0.138		-0.133		-0.139
		(0.179)		(0.180)		(0.141)		(0.141)
Collectivistic		-0.0498		-0.0475		-0.00658		-0.00858
		(0.194)		(0.194)		(0.163)		(0.163)
Individualistic		0.504***		0.505***		0.295**		0.296**
		(0.186)		(0.186)		(0.139)		(0.139)
Trustworty (Belief)		-0.0489		-0.0469		-0.0648*		-0.0625*
		(0.0500)		(0.0502)		(0.0354)		(0.0354)
Public Order (Belef)		0.00223		0.000528		0.0127		0.0113
		(0.0387)		(0.0387)		(0.0291)		(0.0292)
Period	-0.366	-0.130	-0.365	-0.129	-0.0440	-0.108	-0.0441	-0.107
	(0.252)	(0.250)	(0.252)	(0.250)	(0.236)	(0.241)	(0.236)	(0.241)
Period Squared	0.0133	0.00515	0.0133	0.00511	-0.00309	-0.00103	-0.00308	-0.00105
	(0.00993)	(0.00984)	(0.00993)	(0.00984)	(0.00950)	(0.00966)	(0.00950)	(0.00966)
Constant	1.792	-0.501	1.762	-0.553	-0.262	-0.212	-0.287	-0.243
	(1.552)	(1.886)	(1.550)	(1.885)	(1.408)	(1.552)	(1.407)	(1.550)
Observations	3756	3756	3756	3756	8580	8580	8580	8580

Notes: Panel Probit Model. The dependent variable is a dummy variable which equals 1 if assigned punish points to a free-rider (columns 1-4) or to a subjects who contributed more than the punisher (columns 5 - 8). Therefore columns 1-4 compare the probability of a pro-social punishment between rice and non-rice, whereas columns 5-8 compare the probability of anti-social punishment between rice and non-rice. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

Table A.2: Contribution in the PGG with and without punishment

	PGG without Punishment		PGG with Punishment	
	(1)	(2)	(3)	(4)
Rice	1.086*	1.021*	1.577**	1.437**
	(0.583)	(0.556)	(0.624)	(0.581)
GDP per cap. (Municipality)		-0.0316		0.0464
		(0.0596)		(0.0608)
Holistic Thinking		1.328*		0.311
		(0.766)		(0.734)
From Rural (Dummy)		-0.275		-0.410
		(0.410)		(0.412)
Relative Income		-0.564**		-0.295
		(0.279)		(0.237)
Risk Preference		0.0726		0.159
		(0.117)		(0.106)
Male		2.029***		2.159***
		(0.462)		(0.369)
Natural Science (Dummy)		0.653*		1.313***
		(0.382)		(0.392)
Priming (Dummy)		-0.468		-0.158
		(0.541)		(0.567)
Single Child (Dummy)		-0.364		-0.0905
		(0.478)		(0.409)
Collectivistic		0.488		0.676
		(0.443)		(0.465)
Individualistic		-0.629		-0.431
		(0.427)		(0.388)
Trustworty (Belief)		0.0777		0.123
		(0.0897)		(0.104)
Public Order (Belef)		-0.0336		-0.0448
		(0.0922)		(0.0796)
Period	1.191***	1.191***	2.244***	2.244***
	(0.171)	(0.171)	(0.301)	(0.302)
Period sqaured	-0.144***	-0.144***	-0.0746***	-0.0746***
	(0.0173)	(0.0174)	(0.0115)	(0.0115)
Constant	7.911***	7.365***	-4.147**	-7.435**
	(0.419)	(2.544)	(1.772)	(3.057)
Observations	4112	4112	4112	4112

Notes: Random effects Panel regression. The dependent variable is the contribution in the PGGs. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

Table A.3: Punish Behavior

	(1)		(2)	
Rice (Dummy)	0.844**	(0.379)	0.825**	(0.363)
Rice X More or Eq.	-0.713**	(0.309)	-0.669**	(0.317)
More or Eq.	-1.569***	(0.218)	-1.381***	(0.270)
Punsher Contribution			-0.0101	(0.0341)
Punished Contribution			-0.0366	(0.0281)
GDP per cap. (Municipality)			-0.0291	(0.0376)
Holistic Thinking			-0.981*	(0.523)
From Rural (Dummy)			0.0484	(0.261)
Relative Income			-0.0114	(0.190)
Risk Preference			0.131	(0.0819)
Male			0.274	(0.266)
Natural Science (Dummy)			0.0407	(0.232)
Priming (Dummy)			0.512	(0.331)
Single Child (Dummy)			-0.302	(0.299)
Collectivistic			0.125	(0.326)
Individualistic			0.649**	(0.311)
Trustworty (Belief)			-0.112	(0.0716)
Public Order (Belef)			0.0310	(0.0555)
Period	-0.200	(0.435)	-0.132	(0.436)
Period Squared	-0.000604	(0.0176)	-0.00284	(0.0176)
Constant	1.159	(2.611)	-0.647	(2.888)
Observations	12336		12336	

Notes: Tobit regressions. The dependent variable is the punishment points assigned to other group members. More or Eq. is a dummy variable which equals 1 if the punished subject contributed more than or equal to the punisher. Cluster Standard errors (PGG group level) are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$

References

Alesina, A., P. Giuliano, and N. Nunn (2013). On the origins of gender roles: Women and the plough. *The Quarterly Journal of Economics 128*(2), 469–530.

Bó, P. D., A. Foster, and L. Putterman (2010). Institutions and behavior: Experimental evidence on the effects of democracy. *The American economic review 100*(5), 2205–2229.

Bolton, G. E. and A. Ockenfels (2000). Erc: A theory of equity, reciprocity, and competition. *American economic review*, 166–193.

Buck, J. L. (1937). *Land Utilization in China: A Study of 16,786 Farms in 168 Localities, and 38,256 Farm Familites in Twenty-two Provinces in China, 1929-1933–Statistics*, Volume 2. Commercial Press, Limited, Agents in the United States, The University of Chicago Press.

Charness, G. and M. Rabin (2002). Understanding social preferences with simple tests. *Quarterly journal of Economics*, 817–869.

Chen, M. K. (2013). The effect of language on economic behavior: Evidence from savings rates, health behaviors, and retirement assets. *The American Economic Review 103*(2), 690–731.

Croson, R. T. (2007). Theories of commitment, altruism and reciprocity: Evidence from linear public goods games. *Economic Inquiry 45*(2), 199–216.

Falk, A. and U. Fischbacher (2006). A theory of reciprocity. *Games and Economic Behavior 54*(2), 293–315.

Fan, J. (2007). *Geography*. People's Education Press.

Fehr, E. and S. Gächter (1999). Cooperation and punishment in public goods experiments. *Institute for Empirical Research in Economics working paper* (10).

Fehr, E. and K. M. Schmidt (1999). A theory of fairness, competition, and cooperation. *Quarterly journal of Economics*, 817–868.

Fischbacher, U., S. Gächter, and E. Fehr (2001). Are people conditionally cooperative? evidence from a public goods experiment. *Economics Letters 71*(3), 397–404.

Gächter, S. and B. Herrmann (2009). Reciprocity, culture and human cooperation: previous insights and a new cross-cultural experiment. *Philosophical Transactions of the Royal Society B: Biological Sciences 364*(1518), 791–806.

Gächter, S., B. Herrmann, and C. Thöni (2010). Culture and cooperation. *Philosophical Transactions of the Royal Society B: Biological Sciences 365*(1553), 2651–2661.

Gächter, S., E. Renner, and M. Sefton (2008). The long-run benefits of punishment. *Science 322*(5907), 1510–1510.

Galor, O. and Ö. Özak (2016, October). The agricultural origins of time preference. *American Economic Review 106*(10), 3064–3103.

Gneezy, U., A. Leibbrandt, and J. List (2013). Ode to the sea: Workplace organizations and norms of cooperation. Technical report, Monash University, Department of Economics.

Guiso, L., P. Sapienza, and L. Zingales (2006). Does culture affect economic outcomes? *The journal of economic perspectives 20*(2), 23–48.

Henrich, J., R. Boyd, S. Bowles, C. Camerer, E. Fehr, H. Gintis, and R. McElreath (2001). In search of homo economicus: behavioral experiments in 15 small-scale societies. *American Economic Review*, 73–78.

Henrich, J., J. Ensminger, R. McElreath, A. Barr, C. Barrett, A. Bolyanatz, J. C. Cardenas, M. Gurven, E. Gwako, N. Henrich, et al. (2010). Markets, religion, community size, and the evolution of fairness and punishment. *science 327*(5972), 1480–1484.

Henrich, J., R. McElreath, A. Barr, J. Ensminger, C. Barrett, A. Bolyanatz, J. C. Cardenas, M. Gurven, E. Gwako, N. Henrich, et al. (2006). Costly punishment across human societies. *Science 312*(5781), 1767–1770.

Herrmann, B., C. Thöni, and S. Gächter (2008). Antisocial punishment across societies. *Science 319*(5868), 1362–1367.

Holt, C. A. and S. K. Laury (2002, 12). Risk aversion and incentive effects. *The American Economic Review 92*(5), 1644–1655.

Hsee, C. and E. U. Weber (1999). Cross-national differences in risk preference and lay predictions. *Journal of Behavioral Decision Making 12*(2), 165–179.

Hsiao-Tung, F. and C. Chih-i (1945). *Earthbound China: a study of rural economy in Yunnan*. University of Chicago Press.

Jackson, M. O. and Y. Xing (2014). Culture-dependent strategies in coordination games. *Proceedings of the National Academy of Sciences 111*(Supplement 3), 10889–10896.

Jinguang, Z. (2004). *Qin Zhi Yan Jiu*. Shang Hai Guji.

Knack, S. and P. Keefer (1997). Does social capital have an economic payoff? a cross-country investigation. *The Quarterly journal of economics*, 1251–1288.

La Porta, R., F. Lopez-de Silanes, A. Shleifer, and R. W. Vishny (1997). Trust in large organizations. *The American Economic Review*, 333–338.

Leibbrandt, A., U. Gneezy, and J. A. List (2013). Rise and fall of competitiveness in individualistic and collectivistic societies. *Proceedings of the National Academy of Sciences 110*(23), 9305–9308.

Masclet, D., C. Noussair, S. Tucker, and M.-C. Villeval (2003, 03). Monetary and nonmonetary punishment in the voluntary contributions mechanism. *The American Economic Review 93*(1), 366–380.

Nikiforakis, N. (2008). Punishment and counter-punishment in public good games: Can we really govern ourselves? *Journal of Public Economics 92*(1), 91–112.

Oyserman, D., H. M. Coon, and M. Kemmelmeier (2002). Rethinking individualism and collectivism: evaluation of theoretical assumptions and meta-analyses. *Psychological bulletin 128*(1), 3.

Qian, N. (2008). Missing women and the price of tea in china: The effect of sex-specific earnings on sex imbalance*. *The Quarterly journal of economics 123*(3), 1251–1285.

Rabin, M. (1993). Incorporating fairness into game theory and economics. *The American economic review*, 1281–1302.

Roth, A. E., V. Prasnikar, M. Okuno-Fujiwara, and S. Zamir (1991). Bargaining and market behavior in jerusalem, ljubljana, pittsburgh, and tokyo: An experimental study. *The American Economic Review*, 1068–1095.

Soo Hong, C., R. P. Ebstein, and L. Yunfeng (2015). The rice culture theory of cooperative behavior: Evidence from incentivized decision making tasks in china. *Working Paper*.

Talhelm, T., X. Zhang, S. Oishi, C. Shimin, D. Duan, X. Lan, and S. Kitayama (2014). Large-scale psychological differences within china explained by rice versus wheat agriculture. *Science 344*(6184), 603–608.

Wen, B., H. Li, D. Lu, X. Song, F. Zhang, Y. He, F. Li, Y. Gao, X. Mao, L. Zhang, et al. (2004). Genetic evidence supports demic diffusion of han culture. *Nature 431*(7006), 302–305.