Does culture matter to prosocial behavior? Evidence from a cross-ethnic lab experiment

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45 ## cross-ethnic lab experiment

46 ### *Abstract*

47 ***Abstract: Objectives:*** Recent investigations have uncovered large, consistent
48 deviations from the predictions of Homo economicus that individuals are entirely
49 self-regarding. Our study undertook a cross-cultural study of behavior search for the
50 evidences of other-regarding behaviors and its ethnic difference, and accounted for by
51 anatomy of culture.

52 ***Method:*** This study recruited 90 subjects of three ethnic groups from market
53 trade-based (ethnic Han), nomadism-based (ethnic Zang) and agriculture-based
54 (ethnic Bouyei) areas in China and conducted public good provision experiment with
55 stranger-treatment design.

56 ***Results:*** Under the assumption of self-regarding preferences, the Nash equilibrium is
57 zero contribution by all in public account using backward induction. However, we
58 found contributions did not reduce to zero over all three sessions. Besides, the
59 differences in contributions between ethnicities strongly depended on the degree of
60 ethnic dominance, and Zang harbored the strongest reciprocal preference generally
61 over all group structures. A particular set of measurable factors was identified as
62 proxies for cultural influences on behavioral differences observed in experiments
63 between ethnicities. The results showed all of the cultural factors accounted for the
64 behavioral differences between the ethnic Han and the other two minor ethnicities.
65 However, behavioral difference between minor ethnicities was attributed to group
66 structure only.

67 ***Conclusions:*** (1) People may harbor various forms of prosocial emotions in economic
68 affairs, and especially exhibit stronger at the initial phase rather than what canonical
69 model assumes. (2) Behavioral differences between ethnicities are prominent and can
70 be explained by differences in cultural influence.

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72 **Keywords:** Prosocial behavior
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74 Culture
75 Ethnicity
76 Group structure

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1. Introduction

A number of recent contributions have shown the consistent deviations from the predictions of orthodox economics of *Homo economicus* by detecting the other-regarding behaviors, i.e., prosocial behavior, in economic affairs (Andreoni, 1990; Camerer, 1997; Henrich, 2000; Glaeser et al., 2000). According to cultural psychological theories, fundamental differences in how culture affects people's perception of the world might predict differences in how people make economic decisions (Miller, 1984; Shweder, 1990; Triandis, 1995; Levinson et al., 2007). In recent years, much experimental work has focused on cultural effects on prosocial behaviors (e.g., Burlando and Hey, 1997; Ockenfels and Weimann, 1999; Henrich, 2000; Glaeser et al., 2000; Fershtman, Gneezy, 2001; Castro, 2008). However, these studies merely report the differences in prosocial behavior between ethnic groups and naturally attribute the effects culture has on behavior to the individual level. Culture is difficult to univocally define, although most commonly this term is used for tribes or ethnic groups (in anthropology) or for nations (in political science, sociology and management) (Hofstede, 2011). Until recently, economists have been reluctant to rely on culture as a possible determinant of economic phenomena. Much of this reluctance stems from the very notion of culture: it is so broad and the channels through which it can enter the economic discourse are so ubiquitous (and vague) that it is difficult to design testable (i.e., refutable) hypotheses (Guiso et al., 2006). A very small amount of research has conducted analysis of the economic anatomy of culture. The work of Chuah S. W., Hoffmann R., Jonesb and Williams (2009) examines bargaining behavior in an experimental ultimatum game with Malaysian and UK subjects and assesses to what extent attitudes in terms of culture may be responsible for the prosocial behavioral differences using a number of comprehensive attitudinal surveys of individuals sourced from the fourth wave (1999-2000) of the World Values Survey (*WVS*, see Inglehart, 1997). Other research has mainly focused on the effects of religions (Sosis and Ruffle 2004; Benjamin, Norenzayan A, Shariff A F, 2008; Choi and Fisher, 2013).

In this study, we defined culture in a sufficiently narrow manner (i.e., the culture of a particular people is a shared set of beliefs, values, conventions, ethnic affiliations and way of economic life) to make it easier to identify the causal links from culture to prosocial behavior. This study proceeded as follows: (1) We framed the standard linear public good provision games and conducted three treatments based on the games by manipulating the ethnic composition of the experimental groups, and then, detected the prosocial behavioral differences between ethnicities. (2) We next assess whether, and if so, in what ways, our subjects' different cultural backgrounds generated any observed behavioral differences between ethnicities. Based on our definition of culture, we collected a number of survey questions, including questions sourced from *WVS* and regarding family status information, to combine with our own questions (Prosocial Preference Survey, *PPS*. See *Table 7*). All the questions were grouped into five independent sections that can provide measurements of dimensions

129 of culture in terms of prosocial preferences[1]: people's attitudes toward participation,
130 outgroup rejection (desirability as neighbors), religion, market interaction, and
131 centralization of power of a family. After the completion of the experimental game,
132 we distributed the questionnaire to collect the survey data from every subject during
133 an interval of 30 to 40 min. Then, we assess whether the differences in various
134 corresponding dimensions of culture exist between ethnicity. This study is intended to
135 account for the ethnic behavioral difference by more enriched anatomy of culture
136 (including both potential cultural dimensions- attitude and objective way of economic
137 life- according to the results of related studies) in order to reveal the pattern of cultural
138 influence on the ethnic behavioral difference more completely.

139   This paper is structured as follows: Section 2 introduces our experimental design.
140 Section 3 first provides the results of investigations into behavioral differences in
141 public good provision games and then identifies to what extent dimensions of culture
142 may be responsible for the behavioral differences in contributions observed in
143 experiments associated with different ethnicities. Finally, we present the conclusions
144 and discussion in Section 4.
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[1] *WVS* includes a broad scope and wide-ranging poll of socio-economic and political values and consists of more than 200 individual questions.

2. **Experimental Design**

The experiment was conducted at the Southwest University for Nationalities, China. A total of 90 subjects were equally divided between three ethnicities. Our sampling has the following considerations. First, we selected subjects from the ethnic Han group, which is the majority, and from two ethnic minority groups, the ethnic Zang, which is the largest minority group, and the ethnic Bouyei, which is a relatively small minority group in China, to make a greater variation in ethnic population scales[2]. Second, these ethnicities exhibit different economic conditions. The ethnic Zang and Bouyei practice nomadism and agriculture respectively, while the ethnic Han live in a commercial economic society. Third, the participants are almost entirely freshmen who have entered into college for less than three months and grew up in the original regions of the ethnicities[3]. This is expected to reduce the influences from other cultures and customs. Fourth, our recruitment proceeded in the following manner: after obtaining the subject's file from the dean's office, we contacted their counselors to inform the subjects to take part in the experiment rather than put up advertisements, which would likely have induced sample selection bias; i.e., those who came to the game could have had stronger cooperative tendencies. Additionally, we recruited from a wide range of fields such as Economics, Ethnology, Sociology, Chemistry, Biology, Psychology, Physics, Linguistics and Business.

The whole experiment was divided into two phases with 45 participants in each phase. In the first phase, we conducted 3 consecutive treatment sessions, each composed of 10 decision-making rounds. In other words, participants played 30 rounds of public good provision games in total. In the first treatment session, all the subjects were randomly divided into 9 groups, and every group had 5 subjects who were aware that they played in a group comprised of different ethnicities (labeled 'diverse group'). In the second treatment session, the subjects were randomly divided within a sample of their own ethnicity (labeled 'homogeneous group'). In the third treatment session, we firstly randomly selected 9 subjects equally from three ethnicities and then matched every subject with 4 other subjects different from his/her ethnic affiliation from the rest of the subjects (labeled 'one ethnicity dominant group'). To avoid the order effect, in the second phase, we conducted the treatment sessions in the following order: the 'homogeneous group,' the 'one ethnicity dominant group' and then the 'diverse group'. Most experiments usually provide predictions of behavior by playing repeated games with subjects as many one-shot games. However, the results from Botelho, Harrison, Pinto Costa and Rutström (2009) argue that there is some chance that subjects will meet in multiple rounds, and the assumption that subjects treat random strangers designs as if they were one-shot experiments is false; thus, a reputation effect may develop. Therefore, the group structures were public information over all sessions, although the subjects were not allowed to obtain the

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[2] The population proportion in China of Han, Zang and Bouyei are 91.6%, 0.47% and 0.22%, respectively (National Bureau of Statistics of China. China Statistical Yearbook. http://www.stats.gov.cn/tjsj/pcsj/rkpc/6rp/indexch.htm).

[3] Five participants quit the experiment for personal emergencies and another five subjects who shared their same ethnicities, but study in higher grade were in stead.

information on recruitment numbers of any ethnicity and types of ethnicities to make them feel there was no chance that they would meet the same person in any other round to rule out reputation effects as well as effects of ethnic stereotype, and thus develop an instinct towards prosocial behavior (Fershtman and Gneezy, 2014).

All sessions used the standard linear public good provision game including both neutrally worded and written instructions (See *Appendix B*). Five subjects in a group were endowed with 50 tokens each at the beginning of each round and each token was converted into money using an exchange rate of 1RMB (0.16US$)[4] at the end of the experiment. They decided on the allocation of their endowment between a private and public good. Each token held in private earned one token for the participant only whereas each token placed in the public good earned 0.5 times the token for each member of group. Let $g_i (0 \le g_i \le 50)$ be the subject i' contribution to the group account and let π_i be the payoff given by

$$\pi_i = 50 - g_i + 0.5 \sum_{i=1}^{5} g_i \quad (1)$$

We followed the experimental design of Neugebauer, Perote, Schmidt and Malte (2009) and asked subjects to report the guess values of the mean group contribution after the decision-making in each round, and they received information feedback about the actual mean group contribution at the end of each round. Note that by requiring the reporting of the expected mean contributions, we might be forcing subjects to think more carefully about his/her economic decision than they otherwise would have. The total payoffs of a subject in each round included the payoffs from the group project as well as from guessing (*Appendix B* provides the computational formula of the payoffs). At the end of the experiment, the final payoff each subject received was his/her average payoff over 30 rounds[5].

3 Results

In this section, we provide detailed descriptions and statistical tests of the results. We focused on the behavioral differences from the experiment in Section 3.1. In section 3.2, we assessed to what extent the corresponding indicators from *PPS* were responsible for the behavioral differences associated with ethnicity observed in the experiment. A description of the variables is presented in *Table 1*.

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[4] 'RMB' is the Chinese currency, and the exchange rate was 6.1 RMB per dollar in November, 2014. Herein, we provide both values as RMB (US$).
[5] The final payoff each subject received was determined by the total payoff of the whole game (e.g., Putterman L and Anderson, 2006; Neugebauer, Perote, Schmidt and Malte, 2009) rather than in a random manner (e.g., Anderson, Mellor and Milyo, 2008) because in each round, participants may believe that there is a low possibility (1/30) that this round will be selected and hence do not treat it carefully. Hence, the final payoff is determined by the average payoff of 30 rounds in our experiment.

3.1 Results from experiment on behavioral differences

A. Are there any differences in the trends of the contributions over time between ethnicities?

Result A: The results from the ethnic Bouyei and Han are supportive of declining trends of contributions, whereas the results from ethnic Zang show a roughly increasing trend. Moreover, the guess values gradually decrease over time for all ethnicities.

The three ethnicities exhibited distributions with no contributions at full-riding and full cooperation. The results from the total sample did not strongly support the declining trend of contributions, and trends were prominently different between ethnicities. Interestingly, the contributions in the first round over all three sessions were very close among ethnicities and are approximately 1/3 of the endowments (17RMB (2.8US$)), which demonstrated an imprinted tendency to cooperate. Afterwards, the ethnic Bouyei and Han exhibited a declining trend with strong regularity, as observed in previous studies. We believed that this less cooperative behavior arose from the gradual mistrust in others over time rather than out of punishment of others [6]. The mistrust led to the instinctive human desire for self-preservation which is the fundamental behavioral principle of humanity under 'Hobbes Jungle' that approximates our design with absence of formal social norm (such as no design of punishment rules) argued by Hobbes T and Jean-Jacques Rousseau (this argument is cited from Meng Li, 2013). However, even under the mechanism of information feedback, the cooperation level of the ethnic Zang roughly showed a rising trend. Additionally, in contrast to the ex ante unknown number of periods (Fehr and Gächter, 2000), we deliberately designed the experiment with ex ante known and found that the most generous cooperation occurred at the final round for the ethnic Zang and Bouyei. Some other studies have also detected the same phenomenon in experiments and explained that many subjects are willing to have a final attempt (Zhou and Song, 2008). Nevertheless, we provided a plausible reason, on the basis of our informal return visit, that some subjects who contributed less over time would feel guilt that they had reduced the group's payoff once. This may led to the highest contributions of them out of the intention of compensation at the final round.

B. Do behavioral differences between group structures exist? And ethnic difference in contribution depends on group structure?

Result B: Ethnic diversity did not necessarily reduce the level of cooperation, and

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[6] However, another possible reason to explain the reduction in contribution over time is that subjects are willing to punish free-riders. The less contribution he/she makes to the group account, the less payoff is received by the free-riders from free-riding. This is a potential way to punish free-riders in public good experiments without a punishment mechanism design, and humans reciprocate wrongs by harming the offender, even at a cost to themselves (Fehr and Gächter, 2000; de Quervain, Fischbacher, Treyer, Schellhammer, Schnyder, Buck, Fehr, 2004). However, we believe subjects' motivation to reduce contributions is out of gradual mistrust in others rather than punishment of free-riders, according to our informal callback survey that inquired about the motivation of subjects to reduce contributions.

ethnic dominance may pose a greater barrier to cooperation. However, ethnic dominance merely had an overall effect; i.e., it decreased contributions of all subjects in GS3 and did not change the subjects' relative contribution between the group structures in which his/her ethnicity was designed as dominant and minor ones. There were remarkable ethnic differences in contributions in most situations, and the two largest differentiations both appeared in the GS3 (between the Zang and other two ethnicities). However, when subjects acted as minor ethnicities in GS3, the differences between ethnicities vanished.

A few studies have shown that ethnic diversity frequently reduces team performance in both public and private sectors (Watson, Kumar and Michaelsen, 1993; Pelled, Eisenhardt and Xin, 1999; Pitts and Jarry, 2007; Castro, 2008; Hur, 2013), whereas the conservative estimates of the experimental study by Waring and Bell (2013) indicates that ethnic dominance has a much larger negative effect on contributions in the public goods experiment than does caste diversity in India. We found multi-faceted results for different ethnicities in our study. Statistical power analysis of the non-parametric Mann-Whitney U*(MWU)* test cannot reject the null hypothesis that contributions of the ethnic Zang between group structures come from the same distribution, which means ethnic diversity has no significant effect on the level of cooperation of ethnic Zang (the mean contributions in *GS1*, *GS2* and *GS3* were 16.7RMB (2.74US$), 17.4RMB (2.85US$) and 16.9RMB (2.77US$), respectively). However, we found that contributions were significantly different between all group structures for ethnic Bouyei, which confirms group structure-bias (the mean contributions in *GS1*, *GS2* and *GS3* were 15.0RMB (2.46US$), 18.5RMB (3.03US$) and 13.2RMB (2.16US$), respectively). The mean level of contribution in *GS2* was the statistically highest, which suggests that the ethnic Bouyei regard a group structure composed of their own ethnicity members more favorably than the other two group structures. By contrast, ethnic diversity promoted the cooperation of ethnic Han (the mean contributions in *GS1*, *GS2* and *GS3* were 17.5RMB (2.87US$), 15.8RMB (2.59US$) and 13.6RMB (2.23US$), respectively). We may thus conclude that the ethnic interactions entail additional complexities rather than one single law. The statistical results from the ethnic Han conflict with the conjecture that the lowest level of cooperation would appear in *GS1*: *GS1* had the highest degree of diversity but prior researchers have suggested that humans cooperate more with in-group members (de Cremer and Vugt 1999; Goette et al., 2006). In contrast, ethnic dominance may pose a greater barrier to cooperation than ethnic diversity, and cooperation is much more likely to be determined by interactions at a finer scale (Posner, 2004; Waring and Bell, 2013); we found that mean contributions in *GS3* were lower than the other two group structures for the ethnic Bouyei and Han. We further computed *P-values* from *MWU* to compare the contributions of subjects when acting as a dominant and as a minor affiliation in *GS3*. We found an interesting result: although ethnic dominance decreased cooperation, contributions under the two situations were not significantly different (p=0.14, 0.56 for the ethnic Bouyei and Han, respectively). This result revealed that the only overall effects of ethnic dominance were that selfish-bias was more likely to be elicited by all members and the reduction in contributions affects all

members rather than only the subjects from minor affiliations. This leaves open the possibility that people may be sensitive to the terms of the group structure (in terms of being a 'diverse group', 'homogeneous group' or 'one ethnic affiliation dominant group') rather than his/her ethnic affiliation status in terms of the composition of ethnic population.

We also found the evidence that group structure played an important role in determining the ethnic difference in contribution. The two greatest contribution gaps appeared in *GS3* (between the ethnic Zang and Bouyei, differences in mean contributions in *GS1*, *GS2* and *GS3* were 1.7RMB (0.28US$), -1.1RMB (-0.18US$) and 3.7 RMB (0.61US$), respectively) and between the ethnic Zang and Han, and the greater contribution gaps appear in *GS2* than *GS1* (differences in average contributions in *GS1*, *GS2* and *GS3* were -0.8RMB (-0.13US$), 1.6RMB (0.26US$) and 3.3RMB (0.54US$), respectively). Besides, we found an interesting result that acting as the minor ethnicity in *GS3*, there were insignificant differences in contribution between ethnicities, i.e., the behaviors of all ethnicities exhibited consistency (p=0.19 between Zang and Bouyei, and p=0.64 between Bouyei and Han). The evidence from our experiment confirmed the importance of degree of ethnic diversity (or ethnic dominance) in determining ethnic differences on cooperative behavior.

C. What forms of prosocial preferences are elicited in the experiment and was there any difference in their intensity between ethnicities?

Result C: Reciprocity preference was generally observed over all group structures for all ethnicities, and it appeared to be stronger in GS1 than in GS2. The ethnic Zang generally showed larger coefficient of Guess than the other two ethnicities, which indicated their stronger reciprocity preference. Moreover, the results showed that subjects may harbor other forms of prosocial preferences besides reciprocity as the significant coefficients of AVReal$_{it-1}$, and a comparison of coefficients' size indicated that ethnic Bouyei and Zang reacted more intensively than the ethnic Han.

We divided the panel data by ethnic affiliation and estimated the following *Eq.(2)*, which captured the panel data dynamics for the contributions. *Eq.(2)* explained subject's contributions in terms of their own past contributions, their guesses about average contributions and the lagged average contribution of group members. We used generalized method of moments (*GMM*) to ensure the consistency of the parameter estimates of the corresponding dynamic panel data structures.

$$CB_{i,t} = \alpha + \beta_1 CB_{i,t-1} + \beta_2 Guess_{i,t} + \beta_3 AVReal_{i,t-1} + \varphi_i + \varepsilon_{i,t} \ (2)$$

Ashraf, Bohnet and Piankov (2005) decompose prosocial preferences in dictator and trust games by phase-sequence design and define trustor's expected value of the fraction returned by trustee as an independent variable of trust, which we infer may explain the conditional preference, i.e., reciprocity. Similarly, the guess value was regarded as a proxy indicator measuring the intensity of reciprocal preference in our experiment. More contributions would be made as a result of more expected contributions from others. The results showed that reciprocal preference was observed

over nearly all group structures and was strongest in *GS1* for all ethnicities, which remarkably indicated that subjects reciprocated more in ethnically diverse than in ethnically homogeneous groups (*See Table 4*). This result contradicted our expectation that the strongest reciprocity would occur in *GS2*. Although acting as minor affiliations in *GS3,* the ethnic Bouyei and Han also exhibited strong reciprocal preferences. By contrast, for the ethnic Zang, the contributions were uncorrelated with the guesses, which demonstrated the constant intensity of this preference: no matter how much the dominant ethnicity contributed to the group account, the contributions elicited by reciprocity preferences remained unchanged (p=0.28). On the whole, the ethnic Zang may have a stronger reciprocal preference because the coefficients of '*Guess*' were generally larger in magnitude than other two over all group structures.

We were able to trace unconditional prosocial preferences by specifying lagged *AVReal$_{it-1}$* in regression models. The lagged *AVReal$_{it-1}$* was expected to be uncorrelated with *CB* because the groups were randomly assigned in each round. However, the result conflicted with our expectation in *GS2*. The negative sign of the coefficients of lagged *AVReal$_{it-1}$* demonstrate that the lower average contribution to the group account in the last round increased one's contribution in the following round even if the group had been randomly reassigned. The subjects may harbor unconditional emotions such as earning inequality aversion, hoping that earning was fairly assigned to the members of his/her own ethnicity when they lie in a homogeneous group, and this allowed us to conjecture that a shared ethnic affiliation may serve as coordination devices for shared expectations, namely the pursuit of earning equality. A comparison of the size of the coefficients between the ethnicities suggests that the ethnic Bouyei and Zang reacted more intensively than the ethnic Han.

3.2 The results of assessing the explanatory power of culture

After discussing the differences in prosocial behavior between ethnicities based on the public good provision experiment, next we identified the cultural explanatory variables for the behavioral differences, and we conducted our analysis as follows: (1) First we examined whether the ethnic affiliation itself predicted the observed behavioral difference. To accomplish this task, we regressed the contribution to the group account exclusively on subject ethnic affiliation and other variables controlling for individual characteristics because ethnic affiliation is considered to be aggregative predictor for culture and is normally characterized in terms of culture (Betancourt and Lopez, 1993) (See results of *Model 1* in Table 6). Regressing the contribution on a dummy variable for subject ethnic affiliation resulted in coefficients with strong explanatory power (the ethnic affiliation predicted differences in contributions between the ethnic Zang and Bouyei at 1% significance and between the ethnic Zang and Han at 5% significance). Additionally, we also found that two variables of individual characteristics, major and gender, were responsible for the cooperative behavior.

(2) Although ethnic affiliation per se provided strong explanatory power, our task

was to investigate how culture operated. We decomposed the conception of culture into five dimensions grouped by measurable variables and then measured their ability to explain behavioral differences (*'Participation', 'Outgroup Rejection', 'Religion', 'Market Interaction' and 'Centralization of Power'*). Before carrying out this measurement, we assessed to what extent cultural differences exist between ethnicities in terms of their responses to these cultural questions. We subjected each group of items to separate factor analysis and used the Varimax rotation method to obtain parsimonious factor solutions and retained only those with eigenvalues greater than 1.5 (these factors and the individual items that constitute them are outlined in *Appendix A*). Afterwards, a series of Mann-Whitney tests were conducted on differences in scores between ethnicities (See *Table 5*). The results showed that there was no significant difference in terms of *PC* (*'Participation'*) in a range of voluntary associations (p= 0.26 for Zang vs. Bouyei; p= 0.13 for Bouyei vs. Han; p=0.71 for Han vs. Zang) as well as *OR* (*'outgroup rejection'*) in a range of living environments with different types of neighbors (p=0.86 for Zang vs. Bouyei; p=0.18 for Bouyei vs. Han; p=0.28 for Han vs. Zang) between all ethnicities. Moreover, we found the ethnic Zang and Han were statistically the most and least religious respectively based on the comparison of *RL* (*'Religion'*). We also found that the ethnic Han showed the highest level of involvement in market economies (*'Market Interaction'*), but there was no evidence of differences between the ethnic Bouyei and Zang (p= 0.9 for Zang vs. Bouyei; p=0.10 for Bouyei vs. Han; p=0.09 for Han vs. Zang). Finally, the ethnic Zang also exhibited a higher degree of centralization of power of family (*'Centralization of Power'*, p= 0.04 for Zang vs. Bouyei; p= 0.57 for Bouyei vs. Han; p<0.01 for Han vs. Zang). We dropped the insignificant cultural factors, *PC* and *OR*, and then regressed the contribution on the remaining ones and their interaction terms with ethnic affiliation, while still keep ethnic affiliation and other variables controlling for individual characteristics in the regression model (see the results of Model 2 in *Table 6*),

$$CB_i = \alpha + \beta_1 RL_i + \beta_2 MI_i + \beta_3 CP_i + \beta_4 EA_i \times RL_i + \beta_5 EA_i \times MI_i$$
$$= \beta_6 EA_i \times CP_i + \beta_7 EA_i + \beta_8 MJ_i + \beta_9 GD_i + \beta_{10} EP_i + \beta_{11} EY_i + \beta_{12} GS + \varepsilon_i \quad (3)$$

By decomposing culture, The results showed that the cultural factors also provided powerful predictors, based on the observed significant values of interaction terms (cultural factors interacted with ethnic affiliation); however, once they are specified in the regression model, the values of the coefficients of *EA* (ethnic affiliation) varied significantly, but the *adjusted R²* varied relatively little (the *adjusted R²* of *Model 1* and *Model 2* were 0.29 and 0.35, respectively, and the coefficients of individual characteristic variables were not sensitive to this change). This may imply multicollinearity, and therefore we next regressed *EA* on all cultural factors and found all of them were significantly correlated to *EA*. This result may suggest that a particular set of measurable variables identified in our survey is capable of serving as proxies for the cultural influences on economic behavior[7]. Interestingly, we found the

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[7] The adjusted R^2 of the regression model is far below 1 also indicated there were still other potential variables accounting for culture that we did not identify.

differences in the three dimensions of culture, *RL*, *MI* and *CP* may not give rise to the behavioral differences between the two minor ethnicities (the ethnic Zang and Bouyei (all the coefficients of the three dimensions interacted with ethnic affiliation were insignificant at 10%)), whereas the impacts of cultural differences on behavioral differences are generally strong between the two minor ethnicities and the ethnic Han (the coefficients of $EA \times RL$ and $EA \times MI$ are significant at 1%, and the coefficients of $EA \times CP$ is significant at 10% between the ethnic Zang and Han). The negative effect of its interaction with ethnic affiliation indicates that religious attitudes of the minor ethnicity may influence economic prosocial behavior more strongly than among the ethnic Han. Although the role of a religion might depend highly upon ethnic affiliation, it operates in different ways. Ethnic Zang believe in Mahayana Buddhism that people pray for delivering all living creatures from torment as the highest priority of spiritual practice rather than for themselves (which is the practice of ethnic Han) (Hua Z, 2013) that may induce stronger economic prosociality. Ethnic Bouyi practice polytheistic worship (State Nationalities Affairs Commission, 2008) and we conjecture this religious sentiment that reveres the nature influences the prosocial disposition. The result from the negative sign and strong significance of the coefficients for *MI* deviates from the finding of Henrich et al (2001) and suggests that more self-regarding preferences may be elicited by higher level of market interactions. Nevertheless, a self-regarding preference is elicited less for the two minor ethnicities compared to the ethnic Han by market interaction because only the interaction effect between EA^3 and *MI* is significant and has a positive coefficient. The same is true for centralization of power of a family. The larger magnitude of *CP* indicates that the subjects who suffer more from tyranny in family relations may behave in a more other-regarding manner because we found the sign of *CP* was positive and significant at 1%, and the effect of *CP* on prosocial behavior differed weakly depending on the subject's ethnic affiliation. The negative sign of the interaction effect between ethnic affiliation and centralization of power of a family ($EA^3 \times CP$) means *CP* had less impact on the two minor ethnicities compared to the ethnic Han.

(3) Actually, we had not addressed *GS* (group structure), which we viewed as a very important implicit cultural factor for measuring ethnic identity (ethnic prejudice). We generated various composition of groups in terms of ethnic proportions to determine indirectly how ethnic identity (or prejudice) as an additional cultural factor accounts for behavioral differences. To accomplish this task, we ran another regression model including group structure as a dummy variable (See results of *Model 3* in Table 6). We noticed that the results of *Model 2* and *Model 3* were robust in terms of sign, magnitude and statistical significance of coefficients for the previous five cultural factors and their interactions with ethnic affiliation and variables of individual characteristics as well. However, the values of the coefficients of *EA* (ethnic affiliation) varied significantly accordingly, whereas the *adjusted R^2* of the model varied only slightly (the *adjusted R^2* of *Model 2* and *Model 3* were 0.35 and 0.42, respectively). We then regressed *EA* on all the cultural factors as well as *GS* and found that *EA* had a significant correlation with *GS*. This also suggest that *GS* is capable of accounting for *EA*. These results of analysis from *Model 3* confirmed what we detected from the

economic experiment in a statistical manner that group structure was responsible for the behavioral differences on the basis of the significant coefficients of the interaction term *(EA×GS)*. For example, the statistical results showed that as the differences in contributions in *GS1* between the ethnic Zang and other two ethnicities are defined as reference points ($EA^2 \times GS^1$, $EA^3 \times GS^1$), the switch of group structure from *GS1* to *GS2* induced an increase in contribution differences between the ethnic Zang and Bouyei (the coefficient is 3.16 significance at 5%) and a decrease in contribution differences between the ethnic Zang and Han (the coefficient is -2.62 significance at 10%). The plausible reason was the sentiment towards ethnic composition vary in ethnic affiliation that lead to behavioral difference. As a whole, all cultural factors were responsible for behavioral differences between the ethnic Han and the two minor ethnicities (the interaction effect between any of the cultural factors was significant at 10% at least), and it was interesting that the behavioral difference was attributed to the group structure between the two minor ethnicities only.

4 Conclusions and Discussion

A number of public good provision experiments confirm the existence of prosocial behavior because the contribution proportions are more than nothing, but interestingly, it declines with repetition and converges to lower levels (Isaac, Walker and Thomas, 1984; Andreoni, 1988; Andreoni, 1995; Sonnemans, Schram and Offerman, 1999; Fischbacher, Gächter and Fehr, 2001). Other mechanisms need to be developed to prevent the reduction of public good provisions in the game, such as voluntary punishment (Forsythe, Horowitz, Savin and Sefton, 1994; Fehr and Gächter, 2002; Andreoni and Miller, 2002; Falk, Fehr and Fischbacher, 2005; Bochet, Page and Putterman, 2006; Carpenter, Bowles, Gintis and Hwang, 2009; Choi and Ahn,2003) and full refund rules (Isaac, Schmidtz, Walker, 1989; Bagnoli and McKee, 1991). However, we found evidence of a roughly increasing trend over time for ethnic Zang in a game without any anti-declining mechanism [8], even if they expected self-regarding behavior in strangers. In contrast, the other two ethnicities presented clearly declining trends of contributions, which exhibited the more self-regarding preference over time in comparison. Group structure varying in ethnic composition strengthen the fascination regarding human nature. It appears, based on our data, that three distinct degrees of ethnic diversity (or ethnic dominance), i.e., compositions of groups in terms of ethnic proportions, influence cooperative behavior in different ways, and we found diverse results. Evolutionary theory suggests that humans have evolved to create ethnic groups for stabilized cooperation and solving collective action problems related to adaptive challenges (Wilson and Wilson, 2007; Waring and Bell, 2013). However, ethnic dominance posed a remarkably greater barrier to cooperation than ethnic divisions between group structures for the ethnic Bouyei and Han. Reduction in ethnic diversity to homogeneous groups (from *GS1* to *GS2*) did not

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[8] Actually, we designed an aid-declining mechanism in the game, namely an information feedback mechanism, in which subjects received information about payoffs and partners' contributions until the end of the experiment, and the evidence from Neugebauer T, Perote J, Schmidt U and Malte L (2009) suggest that this mechanism is destructive to efficiency.

increase contributions for the ethnic Zang and Han compared to the increase for the ethnic Bouyei. Moreover, it was noteworthy that the term of ethnic composition ('diverse', 'homogeneous' or 'dominant' which can be collectively termed as 'group structure-bias') may play a more important role in determining behavioral patterns than 'individual-bias'(due to identity or prejudice to individuals out of his/her ethnic affiliation as some studies claim (Becker, 1957, 1993; Fershtman and Gneezy, 2001)) because we found that subjects of the two minor ethnicities acting as the dominant ethnicity in *GS3* contributed much less than they did in *GS1*. Meanwhile, we also found that the ethnic Han contributed more in *GS1* than in *GS2*, in contrast to the argument that ethnic identity is a means to create boundaries that enable a group to distance themselves from one another (Barth, 1969). Additionally, by using guess values as an independent variable to isolate reciprocity preferences from other possible forms of prosocial preference using model regression, we found clear evidence that the reciprocity norm was behaviorally relevant. The reciprocity preference exists in all ethnicities across all group structures because marginal effects of $Guess_{it}$ were generally over 0.5; overall, the ethnic Zang exhibited the strongest reciprocity preference. Moreover, there was clear evidence in our data that were other forms of prosocial preference besides reciprocity, as demonstrated by the negative correlation between CB_{it} and *lagged AVReal$_{it-1}$* in *GS2*. In general, we have shown based on the results of the experiments that people may harbor various forms of prosocial emotions in economic affairs, and especially exhibit stronger at the initial phase rather than what the textbook representation of Homo economicus predicts.

Culture is a useful variable to uncover economic behavior, and a stream of studies are in favor of this viewpoint (e.g., Chuah, Hoffmann, Jonesb and Williams, 2009). We found supportive evidence from our empirical results that a particular set of measurable factors identified as proxies for cultural influence statistically accounted for ethnic differences in prosocial behavior. A wave of recent studies confirm the impact of religion on prosociality; religious people demonstrate highly prosocial behavior (Georgianna, 1984; Darley and Batson, 1973, Bushman et al., 2007; Saroglou et al., 2009). However, it facilitates in different manners as the differences in doctrine and variability in concerned deities and this may also influence prosociality.

Our results on the market interaction from the whole sample contradicted the findings of Henrich et al. (2001), which found strong evidence that prosocial norms increase with greater market integration and other studies also confirm the positive impact of market-based elements, such as competitiveness and market-centric language, on prosocial preferences (Chen, 2010; Al-Ubaydli et al., 2013). However, when we regressed the three ethnic affiliation samples separately, the results were multi-faceted. The results showed that the coefficients of *MI* are negative (-1.54 (p<0.01) for the ethnic Zang and -0.65 (p=0.09) for the ethnic Bouyei), whereas it is positive for the ethnic Han (1.33 (p<0.01)). We made an informal return visit to subjects to inquire about their views on this. Interestingly, we received the unanimous response of two minor ethnicities that they did not have faith in the power of the market economy to develop prosocial norms. They considered the market economy to be filled with

571 deception, mistrust and mutual hurt, and expect it to induce indifference,
572 callousness and the moral decline of human nature. However, the ethnic Han stated
573 that the market economy achieves reciprocity. As the ethnic Han are more involved in
574 the market economy, based on the larger magnitude of *MI*, we believed it may give
575 rise to stronger reciprocal preferences. Few studies have addressed the impact of
576 centralization of family authority with reference to the impact of democracy and
577 freedom on individual prosocial preference, as we have learned. Weber, Unterrainer
578 and Schmid (2009) investigate whether organizational democracy influences the
579 development of a social-moral climate and prosocial behavioral orientation, and the
580 findings suggest that as the level of participation in decision-making processes
581 increase, higher levels of prosocial and community-related behavioral orientations
582 (characterized by behaviors such as mutual help and solidarity) are exhibited. By
583 contrast, other research on children's prosocial behavior claims that the degree of
584 democracy in the family is irrelevant to prosociality (Li, 2000). However, our results
585 from this economic experimental study suggest on the contrary that lower
586 participation in decision-making of significant family affairs induced by centralized
587 authority was associated with higher levels of economic prosociality and may impact
588 minor ethnicities more because the results showed a positive sign of coefficient of *CP*
589 and a negative sign of coefficient of the interaction term, $EA^3 \times CP$, although it is
590 relatively weak. These findings from the economic anatomy of culture support the
591 contention that some dimensions of culture play an important role in affecting the
592 cooperative behavior, and more crucially, they may have different marginal effects in
593 magnitude between ethnicities and may even affect in opposite ways as what we have
594 detected from the results of *MI*. It shows the diverse ways of cultural influence in
595 shaping prosocial behaviors between ethnicities.

596 The research limitations of our study lie particularly in the design of the
597 questions on religion, market interaction and centralization power of family, which
598 were relatively crude and therefore may have impacted or influenced the
599 interpretation of the findings. The definition of the word 'god' varies throughout the
600 various religious traditions of China; for example, the ethnic Zang believe in the
601 Indian Mahayana form of Buddhism, whereas the ethnic Bouyei believes in many
602 gods (e.g., River, Lake or Pond). There are probably different affect and
603 comprehension of gods across ethnicities; further work is necessary to make
604 distinguishing questionnaires on the basis of notions of god. We merely selected
605 necessary questions to measure market interaction and ignored other economic
606 variables such as capital loans. The centralized authority of family may take the form
607 of imposing values on family members, and it should also be considered. Additionally,
608 we only addressed some dimensions of culture in terms of prosociality by measurable
609 variables; more complete approach is required to explore the missing dimensions of
610 culture.

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Table 1
Descriptions of variables.

Variable		Description
CB Contribution to group account	*Z-CB*	Mean contribution to group account of all ethnic Zang subjects over 10 rounds in all sessions
	By-CB	Mean contribution to group account of all ethnic Bouyei subjects over 10 rounds in all sessions
	H-CB	Mean contribution to group account of all ethnic Han subjects over 10 rounds in all sessions
	Total-CB	Mean contribution to group account of all subjects over 10 rounds in all sessions
Guess Guess value of mean group contribution	*Z-Guess*	Mean guess value of all ethnic Zang subjects over 10 rounds in all sessions
	By-Guess	Mean guess value of all ethnic Bouyei subjects over 10 rounds in all sessions
	H-Guess	Mean guess value of all ethnic Han subjects of over 10 rounds in all sessions
	Total-Guess	Mean guess value of all subjects over 10 rounds in all sessions
AVReal		Mean contribution to group account of five subjects in a group
GS Group Structure		*GS1*='diverse group'; *GS2*='homogeneous group'; *GS3*='one ethnic affiliation dominant group'
EA		Ethnic affiliation
PC		Cooperation
OR		Outgroup Rejection
RL		Religion
MI		Market interaction
CP		Centralization of power of a family
MJ		Major
GD		Gender
EP		Expenditure monthly
EY		Average years of education of family members
t, t-1		The *t* period, one period lagged

Table 2

Test on differences in contributions between three group structures.

Group Structures	GS1 VS. GS2			GS2 VS. GS3			GS3 VS. GS1		
Ethnicity	Zang	Bouyei	Han	Zang	Bouyei	Han	Zang	Bouyei	Han
Mann-Whitney Test	-0.37 (0.70)	-3.70 (0.00)***	1.36 (0.17)	0.36 (0.71)	6.16 (0.00)***	3.01 (0.00)***	-0.02 (0.98)	1.91 (0.05)**	3.94 (0.000)***

[a] Z-values in parentheses. [*] coefficient is significantly different from zero at 0.10 level. [**] coefficient is significantly different from zero at 0.05 level. [***] coefficient is significantly different from zero at 0.01 level.

Table 3

Test on differences in contributions between ethnicities in various group structures.

Ethnicity	Zang vs. Bouyei			Bouyei vs. Han			Han vs. Zang		
Group Structure	GS1	GS2	GS3	GS1	GS2	GS3	GS1	GS2	GS3
Mann-Whitney Test	2.03 (0.04)**	-1.186 (0.235)	3.89 (0.00)***	-1.78 (0.07)*	3.82 (0.00)***	0.14 (0.88)	0.27 (0.78)	1.78 (0.07)*	4.21 (0.00)***

[a] P-values in parentheses. [*] coefficient is significantly different from zero at 0.10 level. [**] coefficient is significantly different from zero at 0.05 level. [***] coefficient is significantly different from zero at 0.01 level.

Table 4

Results of panel data regression.

Ethnicity	Zang			Bouyei			Han		
Dependent variable									
CB$_{it}$	GS1	GS2	GS3 Minor	GS1	GS2	GS3 Minor	GS1	GS2	GS3 Minor
Independent Variable									
CB$_{it-1}$	0.18 (0.00)***	0.17 (0.00)***	-0.17 (0.13)	-0.08 (0.12)	0.39 (0.00)***	-0.28 (0.00)***	0.35 (0.00)***	0.16 (0.01)***	0.24 (0.10)*
Guess$_{it}$	0.95 (0.00)***	0.82 (0.00)***	0.16 (0.28)	0.77 (0.00)***	0.63 (0.00)***	0.76 (0.00)***	1.10 (0.00)***	0.60 (0.00)***	0.54 (0.00)***
AVReal$_{it-1}$	-0.10 (0.27)	-0.23 (0.05)**	0.09 (0.59)	-0.20 (0.33)	-0.29 (0.04)**	-0.33 (0.01)***	-0.33 (0.23)	-0.19 (0.07)*	-0.08 (0.67)
Intercept	0.04 (0.98)	3.93 (0.07)*	13.94 (0.00)	9.04 (0.00)***	6.30 (0.02)**	11.36 (0.00)***	-1.04 (0.62)	4.87 (0.00)***	4.57 (0.24)

[a] '*GS3 Minor*' refers to samples that consist of subjects as minor ethnicities in *GS3*.

[b] P-values in parentheses. *coefficient is significantly different from zero at 0.10 level. **coefficient is significantly different from zero at 0.05 level. ***coefficient is significantly different from zero at 0.01 level.

Table 5

Results of the factor analysis of social survey.

Factor	Eigenvalue of Factor1	Mean Score of Factor 1		
		Zang	Bouyei	Han
PC	2.06	0.07	-0.22	0.14
OR	1.84	-0.06	-0.11	0.17
RL	4.68	0.84	-0.25	-0.59
MI	1.51	-0.17	-0.13	0.27
CP	2.32	0.46	-0.11	-0.30

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Table 6

Ordinary least squares regression result for contribution.

Independent Variable		Dependent Variable: Contribution Regression Models		
		Model 1 (Ethnic affiliation only)	Model 2 (Ethnic affiliation + Culture)	Model 3 (Ethnic affiliation + Culture + Group structure)
EA×RL	EA^2×RL		-0.41 (0.65)	-0.41 (0.64)
	EA^3×RL		-2.86 (0.00)***	-2.86 (0.00)***
EA×MI	EA^2×MI		0.09 (0.87)	0.09 (0.87)
	EA^3×MI		2.07 (0.00)***	2.07 (0.00)***
EA×CP	EA^2×CP		0.15 (0.80)	0.15 (0.80)
	EA^3×CP		-0.77 (0.06)*	-0.77 (0.06)*
RL			1.52 (0.00)***	1.52 (0.00)***
MI			-0.93 (0.04)**	-0.93 (0.04)**
CP			1.28 (0.00)***	1.28 (0.00)***
EA	EA^2	-1.16 (0.00)***	-0.42 (0.00)***	1.04 (0.00)***
	EA^3	-1.10 (0.02)**	-0.35 (0.04)**	0.77 (0.07)*
MJ		-3.57 (0.00)***	-2.37 (0.00)***	-2.37 (0.00)***
GD		1.97 (0.00)***	2.38 (0.00)***	2.38 (0.00)***
EP		0.0004 (0.46)	-0.00005 (0.93)	-0.00005 (0.93)
EY		-0.08 (0.23)	-0.05 (0.48)	-0.05 (0.48)
GS	GS^2			0.41 (0.69)
	GS^3			0.31 (0.76)
EA×GS	EA^2×GS^2			3.16 (0.02)**
	EA^3×GS^2			-2.62 (0.06)*
	EA^2×GS^3			-1.60 (0.26)
	EA^3×GS^3			-3.69 (0.00)***
Constant		17.26 (0.00)***	15.16 (0.00)***	14.92 (0.00)***

[a] '*EA*' is a dummy variable and ethnic Zang is defined as a reference, '*EA^2*' and '*EA^3*' refer to the ethnic Bouyei and Han, respectively.

[b] '*GS*' is a dummy variable and the group structure *GS1* is defined as a reference, '*GS^2*' and '*GS^3*' refer to the group structures, *GS2* and *GS3*.

[c] we classify all the majors as two categories, art and science. Thus, '*MJ*' is a dummy variable and the majors belonging to art are defined as the reference.

[d] '*GD*' is a dummy variable and male is defined as the reference.

[e] P-values in parentheses. *the coefficient is significantly different from zero at the 0.10 level. **the coefficient is significantly different from zero at the 0.05 level. ***the coefficient is significantly different from zero at the 0.01 level.
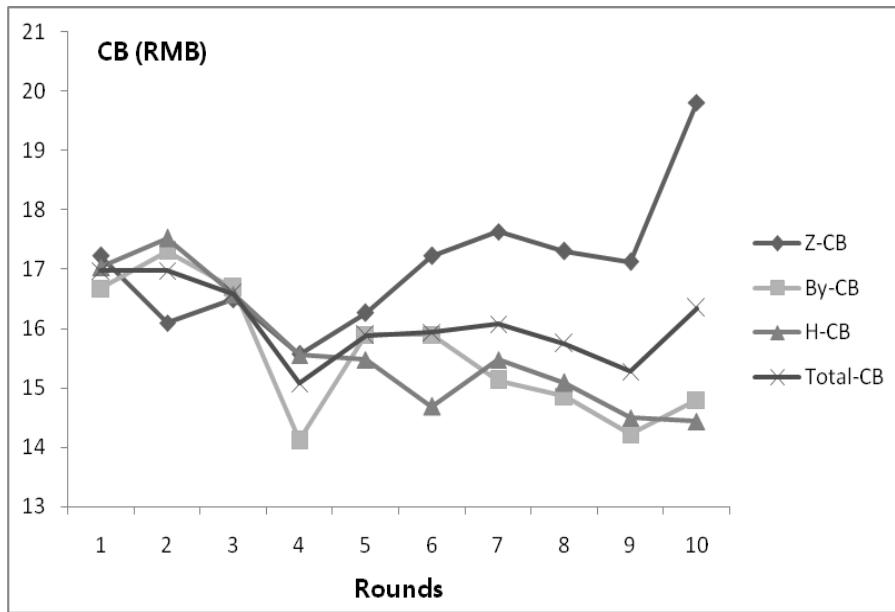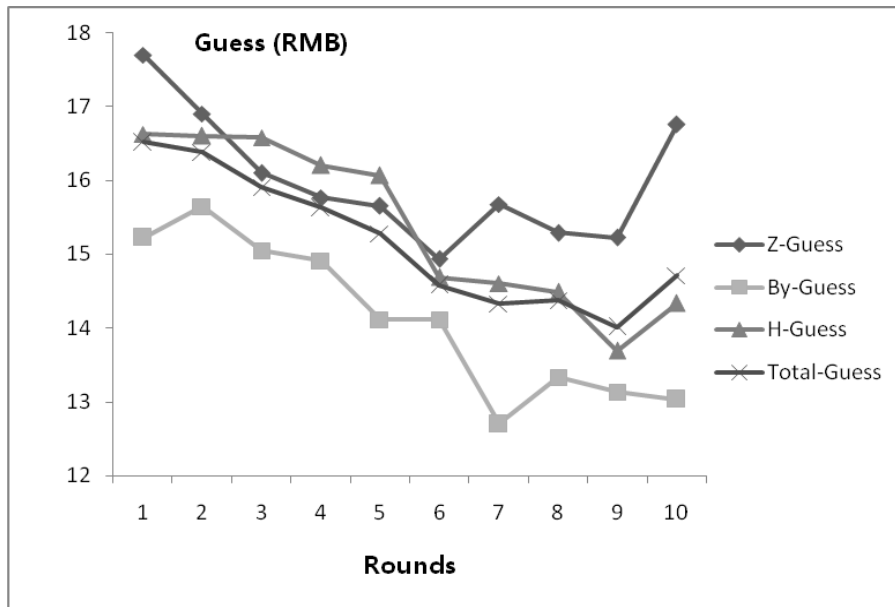
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850 **Fig 1. Trends of contributions to group account over 10 rounds**

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853 **Fig 2. Trends of guesses over 10 rounds**

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Appendix A

Prosocial Preference Survey

Part A	*Participation*		
	Answer for each organization and each activity (1=Active; 2=Inactive; 3=No):		(a1) Church or religious organization: (a2) Sport or recreational organization: (a3) Art, music or educational organization: (a4) Environmental organization: (a5) Petition signing: (a6) Boycotts:
Part B	*Outgroup Rejection*		
	Do you mind if you have these types of people as neighbors? (1=I don't mind; 2= I don't know; 3=Prefer not)		(b1) Criminals: (b2) Heavy drinkers: (b3) Immigrants/foreign workers: (b4) People who have AIDS: (b5) Drug addicts: (b6) Homosexuals: (b7) People significantly different in social status: (b8) People significantly different in wealth:
Part C	*Religion*		
	Extent of agreement on these conceptions: (1=Strongly disagree; 2= Disagree; 3=Neutral; 4=Agree; 5=Strongly agree)		(c1) Belief in absoluteness of good and evil: (c2) Belief in necessity of religious upbringing: (c3) Belong to a religious denomination: (c4) Belief in god: (c5) Belief in life after death: (c6) Belief in soul: (c7) Belief in heaven and hell: (c8) Belief in importance of religion in life: (c9) Belief in necessity of religion for human: (c10) Deriving comfort and strength from religion:
Part D	*Market Interaction*		
	What proportions of these necessities are purchased from markets (0% indicates the necessity is self-sufficient, while 100% is totally purchased from market)		(d1) Clothing; (d2) Food (Rice/noodle); (d3) Vegetables
Part E	*Centralization of Power*		
	Has some family member who makes decisions of these home affairs alone according to his/her		(e1) Significant economic affairs: (e2) Children's education: (e3) Children's marriage:

	family status (1= has; 0=has not)		
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Appendix B

Experimental Instruction

The instructions were read aloud by an experimenter as the students followed
along on their computer screens.

This is an experiment, funded by a research foundation to study decision making. The instructions are simple. If you follow them carefully, you may earn a considerable amount of money which will be paid to you in cash at the end of experiment and the amount you earn will depend on you and other's decisions. Please make sure you understand the decision process and remember any communication is forbidden.

Group

You are about to participate experiment of a group decision-making that consists of three sessions, and every session includes 10 rounds, in other words, you will complete 30 rounds. During each round, you will be placed in a group with other four participants (a group of five). You will not know the identities of the other four members of your group in any given decision round, nor will you be told their identities after the experiment is over. At the beginning of each round, groups will be randomly assigned that you have no chance to meet the same person in any other round, i.e., group composition will be randomly changed from round to round. Moreover, you will not know additional information that we will not provide during the whole process.

Earnings

You will receive an initial endowment of 50 token (1 token= 1RMB (0.16US$)) in each round and have to decide on the allocation of your endowment between a private and public good. Each token placed in private one earns one token back while each token placed to public good earn 0.5 times token to each member of group. Your payoff will be determined as:

$$(amount\ in\ personal\ account) + (0.5)(total\ in\ group\ account)$$

In addition to, you will be asked to guess the mean group contribution after decision-making in allocation in each round. Your payoff from guessing will be determined as follows (in RMB):

$$\left(\frac{1}{400}\right) \times (100 - |your\ guess - the\ actual\ average\ group\ contribution|)^2$$

However, the calculation may be kind of complicated, note that the closer your guess is to the average group contribution, the higher is your payoff. Your total payoff in each round includes the payoff from the group decision as well as from guessing. At the end of the experiment, your earning is the average total payoff in 30 rounds. In each round, you will allowed to have 2 minutes to make decision, and if it is not enough, please let us know and more minutes will be allowed.

Scenarios

You belong to a different ethnicity. The experiment includes three sessions and

each session corresponds to a single scenario. The scenario in the first session is that all of you are randomly divided into several groups and have to be aware that you play in a group probably with participants from different ethnicities. In the second session, you play in a group in which all the other participants belong to the ethnicity of your own. At the beginning of each round in third session, we will randomly select several participants. If you are selected, you will play in a group with other four participants belong to an ethnicity different from yours, and if not, you will play in a group with four other participants, only one of whom belongs to a different ethnicity from yours.

There will be some key questions which test whether you are familiar with the experiment institution. Our experimenters will check your answers and rectify the wrong ones with explanation, and if you have any more questions, please ask them before the experiment begins.
GOOD LUCK!

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