Journal of Economic Behavior and Organization 185 (2021) 211–233

Contents lists available at ScienceDirect

Journal of Economic Behavior and Organization

journal homepage: www.elsevier.com/locate/jebo

Favoring your in-group can harm both them and you: Ethnicity and public goods provision in China☆

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ARTICLE INFO

Article history:
Received 4 August 2019
Revised 2 January 2021
Accepted 13 February 2021

JEL classification:
C93
D9
H41

Keywords:
Ethnic cooperation
Lab-in-the-field
Trust
Reciprocity
Punishment

ABSTRACT

Do people discriminate between co-ethnics and others in cooperative interactions? In an experiment in China, we find that participants in trust games send around 15% more to partners they know to be co-ethnics than to those whose ethnicity they do not know. Receivers' behavior is determined by amounts received and not by perceived ethnicity. In line with previous literature we find that subjects contribute more to public goods in ethnically homogeneous groups than in mixed groups. We find evidence for a new explanation that is not due to different intrinsic preferences for cooperation with ingroup and outgroup members. Instead, subjects' willingness to punish in-group members for free-riding is reduced when out-group members are present. This leads to lower contributions and net earnings in mixed groups. Thus favoritism towards co-ethnics can hurt both those engaging in favoritism and those being favored.

1. Introduction

How much do people allow the ethnic identity of others to influence their decisions to trust and cooperate with them? This project reports an experimental study of trust relations between and among members of ethnic minorities in South-West China. In May and June 2016, 31 experimental sessions were conducted with 576 subjects in five locations in Xishuangbanna, Yunnan Province. The region is home to 25 out of 55 official Chinese ethnic minorities, most of whom retain distinctive linguistic, cultural and vestimentary markers of ethnic identity. The purpose of the study was to discover whether ethnic identity influences a range of behaviors relevant to establishing cooperation: willingness to trust unknown others and

☆ Paul Seabright acknowledges IAST funding from the French National Research Agency (ANR) under the Investments for the Future (Investissements d'Avenir) program, grant ANR-17-EURE-0010. The authors would like to thank Xing Yang, Xingyu Chen, and Yi Zhao for outstanding research assistance in Yunnan, and seminar participants in Toulouse and at the 3rd PIREN workshop for helpful comments. CM and LZ have contributed equally as joint first authors to this project.

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https://doi.org/10.1016/j.jebo.2021.02.016
0167-2681/

to reciprocate their trust, willingness to contribute to public goods, and willingness to engage in costly punishment aimed at enforcing cooperative norms.

It is well known that human interactions are characterized by a demand for environmental cues (Snyder and Ickes, 1985). Among these cues, the capacity to establish boundaries defining an "in-group" and an "out-group" has been important throughout history in resource allocation problems involving public goods provision (Banerjee et al., 2005), team production (Björkman and Svensson, 2010; Kato and Shu, 2016) and warfare (Bowles, 2009). Heterogeneity within the group has often been found to undermine the attainment of socially efficient outcomes (Easterly and Levine, 1997; Cardenas, 2003; Zelmer, 2003; Alesina and Ferrara, 2005). In the case of public goods provision a very salient feature is ethnicity, one that has been found by Miguel and Gugerty (2005) to be important for the provision of education and health public services in Kenya.

In an influential study, Habyarimana et al. (2007) explore three possible mechanisms explaining the under-provision of public goods in the presence of ethnic diversity: preferences, strategy selection and technology. The preference mechanism may occur either through differences in the type of public goods that each group wants to be provided, as in the case of impure public goods (Cornes and Sandler, 1994), or through different intrinsic preferences of subjects for cooperation with in-group and out-group members. Strategy selection is very similar to what Arrow et al. (1973) defined as statistical discrimination. That is, in the absence of more reliable information, individuals may use observable characteristics (such as ethnicity) to infer a partner's expected behavior in a potential interaction. Finally, the technology mechanism refers to the greater ease with which subjects can find co-ethnics in the social network, enabling better coordination as well as more effective monitoring and punishment of free-riders.

Yunnan Province in China is a particularly good setting in which to explore such hypotheses, since different ethnic groups have lived in close proximity in this province for a long time without a major history of inter-ethnic violence, of the kind that would significantly complicate the study of inter-ethnic cooperation between, say, Hindus and Muslims in India, Sinhalese and Tamils in Sri Lanka, Sunnis and Shias in the Middle East. At the same time the inter-ethnic differences we study are not simply ones elicited in the laboratory but are real pre-existent differences of which all participants are aware and with unquestionable ecological validity. Our findings are therefore of interest not just for China but for the study of ethnic differences throughout the world – they can be interpreted as an indicator of the way ethnicity frames cooperative interactions even in the absence of significant historical enmities.

Our own study finds results that are broadly consistent with those of Habyarimana et al. (2007) but go substantially beyond them. We conducted a computerized lab in the field experiment comprising two blocks. Block 1 consists of multiple trials of a trust game with an underlying matching algorithm controlling the in-group or out-group information provided about the counterpart. Block 2 consists of a repeated public goods game with punishment in which the matching algorithm creates ethnically homogeneous and mixed groups. We document a reduced willingness of subjects to punish co-ethnics for free-riding when outsiders are present, a phenomenon that, when rationally anticipated by others, leads to lower levels of public good contribution in ethnically mixed groups.

Our findings are that first movers in the trust game do use ethnic information to judge whether to trust others, suggesting a significant role for strategy selection. Individuals who know that they share the same ethnic identity with the receiver are willing to make a transfer around 15% larger to the partner than to partners whose identity they do not know. However, there is great variation among ethnic groups in this regard, with the national majority Han showing no favoritism, and one group (the Hani) whose members actually send slightly less to their own group than to others (though the difference between amounts sent to their co-ethnics and to others is not statistically significant). The failure of the Hani to show the same favoritism to co-ethnics as the other groups suggests their behavior may be based on a rational anticipation of the fact that Hani members are on average less trustworthy than others. This would be consistent with strategy selection but not with the preference mechanism, in confirmation of the findings of Habyarimana et al. (2007). This interpretation is corroborated by the fact that amounts sent by second movers respond strongly to amounts received but not otherwise to information about shared ethnicity with the partner.

In the public goods game, individuals display a lower willingness to punish members of their own ethnicity (their "in-group") when in the presence of other ethnicities (their "out-group"). Specifically, when they play in mixed-ethnicity groups, they are more than 5 percentage points less willing to punish in-group members for free-riding than to punish out-group members, most of that representing a reduction relative to their willingness to punish in-group members when there are no out-group members present. This difference in punishment behavior in homogeneous versus mixed groups is crucial to explaining differences in public goods contributions. It seems that there is an element of preserving in-group solidarity in the presence of out-group members, which has been shown experimentally to be an important consideration in economic experiments in China (Eriksson et al., 2016). This partiality towards in-group members, as anticipated by players, has a paradoxical impact on levels of contribution in the public goods game. Players contribute less in mixed groups where their own ethnicity is in a majority, apparently anticipating a lower likelihood of punishment if they free ride.

Putting together the latter two results, we provide evidence in favor of one additional mechanism undermining public goods provision in the presence of ethnic diversity. That is, in-group favoritism erodes the credibility of punishment institutions. Alexander and Christia (2011) provide evidence that ethnic diversity contributes to under-investment in public goods principally when the institutional context leads punishment mechanisms to lose their credibility. Our results can be considered as identifying and characterizing such an institutional context.

The effect of inter-ethnic interactions on trust and cooperation has been explored in China in a laboratory setting. Zhang et al. (2019) provide evidence of lower levels of trust and cooperation between Uyghur and Han college students when they

interact with members of the other ethnicity. Morton et al. (2019) show that making salient ethnic identity between Han and Tibetan students leads to worse outcomes in a voting coordination game, compared to minimal group identities. We contribute to this literature by exploring inter-ethnic interactions outside the laboratory.

In our view our results can help to explain a number of general features of socially inefficient behavior, such as corruption. It is a commonplace that people complain about corruption on the part of the relatives and entourage of politicians and not just about the behavior of the politicians themselves. This may reflect as much a diminished willingness on the part of the politically powerful to discipline corrupt behavior by their in-group, as any conscious encouragement of venality on their part.

A similar phenomenon may explain why minority individuals feel uncomfortable and unsafe when in city neighborhoods dominated by another ethnic group. It may be not so much that they fear greater intrinsic hostility by the majority, rather as a reduced willingness on the part of majority individuals to punish opportunistic violence by their co-ethnics.

Our paper is structured as follows. Section 2 discusses our hypotheses in detail in the light of the literature on cooperation and ethnicity. Section 3 describes the experimental set-up and Section 4 the sampling procedure. Section 5 reports the results of the trust game. Section 6 does the same for the public goods game. Section 7 discusses more general implications of the findings. Section 8 concludes.

2. Experimental contributions on the under-provision of public goods: a review

The previous literature has sought to distinguish preference-based explanations for the influence of ethnic identity on cooperative behavior from those that appeal to strategy selection and punishment mechanisms. We survey each of these phenomena in turn.

2.1. Strategy selection and the trust game

The selection mechanism has its roots in the definition of statistical discrimination (Arrow et al., 1973), which is the use of observable characteristics of an individual to infer an expected behavior and respond appropriately to it. This is different from what Becker (1957) had previously defined as taste-based discrimination, in which there is a prejudice against interacting with subjects who have particular traits.

Fershtman and Gneezy (2001) disentangled statistical discrimination from taste-based discrimination using a trust game and a modified dictator game, in which the receiver keeps the triple of the transferred amount. Statistical discrimination can be disentangled from taste-based discrimination because the sender expects an action from the receiver in the trust game but not in the dictator game. Fershtman and Gneezy find that discrimination between Ashkenazic Jews and Eastern Jews in the trust game is statistical and not taste-based. This experimental design has gained popularity and has been used to test for both ethnic discrimination (Willinger et al., 2003; Fershtman et al., 2005; Buchan et al., 2006) and religious discrimination (Karlan, 2005; Tan and Vogel, 2008; Johansson-Stenman et al., 2009; Auriol et al., 2017).

Gupta et al. (2018) argue that in some of the previous evidence it is not possible to disentangle religion from the lower economic status derived from being part of a minority group. They execute a trust game in the border between West Bengal and Bangladesh to disentangle such effects: Hindus are the majority in West Bengal but the minority in Bangladesh, while Muslims are the minority in West Bengal but the majority in Bangladesh. Gupta et al. (2018) find that it is economic status rather than religion that dictates behavior in a trust game.

Identity priming has been shown to affect intellectual performance (Hoff and Pandey, 2014; Afridi et al., 2015), behavior in coordination and cooperation games (Chen et al., 2014; Jiang and Li, 2019), social preferences (Chen and Li, 2009) and discrimination against the out-group (Amira et al., 2019; Bauer et al., 2018). However, discrimination harming the out-group does not necessarily coexist with in-group favoritism (De Dreu et al., 2010).

2.2. Punishment in the public goods game

Punishment institutions have shown to be efficiency enhancing in social dilemmas if the number of interactions is sufficiently large, and if feedback does not lead to a rapid update of expectations about others' contributions (Fehr and Fischbacher, 2004; Gächter et al., 2008; Nikiforakis and Normann, 2008; Nikiforakis, 2010). Although punishment is costly for both the punisher and the punished, the mere threat tends to have a deterrent effect preventing the trespass of social norms. However, the institutional context is crucial, and there are substantial differences across cultures and countries with respect to the effectiveness of the punishment mechanism (Alexander and Christia, 2011). The punishment institution may also bring "by-products" that decrease its legitimacy. There is evidence that anti-social punishment and counter-punishment could also emerge (Nikiforakis, 2008; Balafoutas et al., 2014), in particular within societies with weak norms of civic cooperation (Herrmann et al., 2008). Similarly, when in-group and out-group payoffs are negative and strongly correlated, punishment tends to be efficiency decreasing (Abbink et al., 2010).

For studies conducted in China, the effect of punishment on efficiency is mixed. On the one hand, Wu et al. (2009) report that punishment decreased cooperation rates in a two-player Prisoner's Dilemma. On the other hand, Song and Zhou (2011) and Xu et al. (2013) report efficiency increasing effects of punishment in public good games with heterogeneous

marginal per capita returns (MPCR) and different group sizes, respectively. Finally, Li and Yang (2017) find laboratory evidence that subjects punish out-group members differently when they know that group identities will be revealed to punishes. The pool of subjects, in all four cases, consists of university students. In stark contrast, our study involves a rural, non-student population from South-West China.

3. Experimental design

3.1. Overall design

The experiment was programmed and executed using oTree (Chen et al., 2016). Participants engage in real-time interactions by making their decisions using tablets. The use of oTree allows us to involve populations who not only live far away from academic experimental laboratories, but also have no familiarity with computers and might be easily be intimidated by a laboratory.

Each session was made up of participants from two different ethnicities (the sampling procedure is explained in detail in Section 4). At the beginning of the session participants were asked to state with which of the ethnicities they felt more closely identified. This information was employed by a matching algorithm determining the interactions in Blocks 1 and 2, which are described in detail below. We sorted the participants by ethnicity and assigned them random identifiers. In the trust game, the first several participants of one ethnicity and the last several participants of the other played as senders. In each round, we matched some participants with the same ethnicity and the rest with the other ethnicity. In the public goods game, the first four participants of one ethnicity and the last four of the other were allocated to homogeneous groups. The rest of the participants were allocated to mixed groups. The fact that the randomization of both games was based on the same sorting algorithm resulted in a correlation between being sender/receiver and being in ethnically homogeneous/mixed groups. We did not notice this correlation until after the experiment, but as we explain below it reduces the statistical power of our tests that aim to discriminate between ethnic composition and prior trust game experience in explaining outcomes in the public goods game.

We also collected information about their religious affiliation using the same procedure. Although this information was not employed in the matching algorithm, it was employed in Block 1 as an alternative label to for the purposes of evoking in-group and out-group affiliations. We describe the results from disclosing religious affiliation in the trust game as an additional exercise.

In our experimental design we combine the use of a trust game (Block 1) followed by a public goods game with punishment (Block 2). Trust, and more generally social capital, are predictors of contributions in public goods games when using self-reported or incentivized trust measures (Anderson et al., 2004; Thöni et al., 2012; Kocher et al., 2015), so we could reasonably expect to find some correlation between how subjects played in one game and how they played in the other, a point we discuss in presenting the results below. We played the trust game before the public goods game, as we wanted to rule out the possibility that the experience of punishment in the public goods game might impact decisions in the trust game. However, this meant that we could not prevent the experience of the trust game from influencing behavior in the public goods game. This was a particular risk given that we decided to disclose the earnings of the trust game at the end of Block 1, to foster participant's attention and trust in the experimenters for Block 2, given the challenging field setting of our study. In fact, we see that behavior in the trust game is indeed significantly predictive of public goods game contributions, as we would expect if both types of experiments capture characteristics related to both trustingness and trustworthiness. We would not expect it to be predictive of punishment behavior, which responds to the previous behavior of other subjects – and indeed we find that it is not. In addition, including trust game behavior has almost no impact on the main coefficients in the punishment regressions, and although it reduces some of the coefficients in the contribution regressions they remain significant at conventional levels.

3.2. Block 1: trust game

In this pairwise interaction setting we define the first mover as the "sender" and the second mover as the "receiver." The sender is endowed with $e = 50$ points (i.e., tokens) and must choose an amount $x \in [0, 5, 10, \ldots, 50]$ to transfer to the receiver, who has a null endowment.[1] The sender knows that for each transferred unit his/her partner will receive the triple. The receiver gets a transfer of $3x$ and then he/she decides how much to send back to the sender. The receiver is free to choose any amount $y \in [0, 5, 10, \ldots, 3x]$ to transfer.

The sender knows that the receiver can transfer back any amount between 0 and $3x$. However, in the one-shot game with pure selfish preferences the sender anticipates that the receiver will choose $y = 0$ regardless of his/her initial transfer x. Therefore, the sender will choose $x = 0$. The socially efficient solution, on the other hand, is that the sender chooses $x = e$ and maximizes the pie of $3e$ that will be split by the receiver.

[1] Our decision to give a null endowment to the receiver is common in the literature, though it differs from the procedure in the trust game as introduced by Berg et al. (1995). In that first study the sender and receiver start with the same endowment. Our procedure is particularly common in field settings, and seems to us easier to understand in such settings.

The popularity of the trust game arises from the fact that it recreates the strategic complexity of incomplete contracts. The sender is aware that positive transfers are efficiency-enhancing, but he/she has no means to guarantee the appropriation of a share of the efficiency gains. The receiver, on the other hand, is equally unable to signal his/her willingness to send back a positive fraction of the received amount. Fershtman and Gneezy (2001) show that information allowing the categorization of the partner is employed as a signal affecting decision making. Here, our design aims at capturing the behavioral differences in the trust game depending on whether the partner belongs they refer to an insider or to an outsider.

Our experimental design comprises five interactions per player in the trust game, each one with a different level of information:

- Interaction 1: random matching – no information
- Interaction 2: in-group matching – ethnicity disclosed
- Interaction 3: in-group matching – religious affiliation disclosed
- Interaction 4: out-group matching – ethnicity disclosed
- Interaction 5: out-group matching – religious affiliation disclosed

We have within-subject variation on the partner's disclosed information {*ethnicity*, *religion*} and social distance {*in-group*, *out-group*}. However, the participants' role, sender or receiver, was fixed for the five interactions. The disclosed information was presented as follows: "Participant A/B identifies with the ☐ ethnic group" and "Participant A/B identifies with the ☐ religion." Here, "Participant A" refers to the sender and "Participant B" refers to the receiver (see the full protocol in the supplementary material). Besides, at the beginning of the block we made participants aware that we might give them some additional information about their partners.

We were interested in the transfers made by the sender, and how they varied based on the receiver's disclosed information; and also on the transfers made by the receiver, though the available information for the latter included the transfer x made by the sender. An alternative data collection strategy would have been to use the strategy method for the receivers (Ashraf et al., 2006; Brandts and Charness, 2011). That is, to ask for their transfers, contingent on every potential choice of the sender. We decided against this alternative given the larger set of choices that receivers would have needed to make (five choices in each one of the five trust games), a much more serious constraint for a lab-in-the-field experiment with subjects unfamiliar with such experiments, and even with the use of computers.

We also randomized the order of presentation to control for order effects at the between-subject level. In half of the sessions subjects are matched first with their in-group (interactions 2 and 3 correspond to rounds 2 and 3, respectively) and then with their out-group (interactions 4 and 5 correspond to rounds 4 and 5, respectively). In the other half of the sessions subjects are first matched with their out-group.

For the payment of this block of the game we randomly selected one of the five rounds and paid at the end of the whole experiment. Senders did not receive any feedback regarding the receivers' choices until the end of the block. Therefore, we can assume that the senders' decisions were independent across rounds. This is not necessarily the case for receivers, who were informed in each round of the transfer x made by their partner.

3.3. Block 2: public goods game

An additional advantage of conducting the lab-in-the-field experiment using oTree is the possibility to implement in Block 2 a repeated public goods game with punishment, an experimental setting typically belonging to the laboratory.

This game involves four symmetric players per group, who repeatedly interact for five rounds. Each round comprises the contribution stage and the punishment stage. In the contribution stage each participant is endowed with 10 points that can be invested in a private or a group account. The return of the private account is normalized to 1 and only benefits the player itself. In the group account, on the other hand, each invested point yields a return of 2 to be equally divided among group members. Hence, the individual's return for an invested point in the group account is 0.5, half of its return in the private account. Therefore, in the one-shot game subjects with selfish preferences do not have an incentive to invest in the group account even if it is efficient.

In the second stage participants decide whether they want to allocate a costly disapproval card to each one of the group members.[2] Each disapproval card costs 2 points for the punisher and decreases the earnings of the punished group member by 5 points. Prior to the binary punishment decision, the participants are informed about the individual contributions of the other group members and their ethnicity. After the punishment stage participants are informed on how many disapproval cards were assigned to them, but they do not know the punishers' identity. The payment for participant i after the two

[2] Standard public goods games consider multiple punishment levels instead of binary decisions. The simplification proposed in our design aims towards a clearer protocol after considering the low educational attainment in the targeted population. We use the term "disapproval card" instead of "punishment card" to reduce experimenter demand for punishment. For instance, Nikiforakis (2008) describes the punishment decision to participants as a "distribution of points."

stages of the round is given by:

$$\pi_i = (10 - c_i) + \frac{1}{2}\sum_{j}^{4} c_j - 2\sum_{j\neq i} p_{ij} - 5\sum_{j\neq i} p_{ji} \quad (1)$$

Where p_{ij} represents the punishment cards that i assigned to the other j group members and p_{ji} are the punishment cards that the other j group members assigned to i. As punishment is individually costly, in the one-shot game purely self-interested subjects would undertake zero expenditure on punishing other group members.

The matching protocol introduces between-subject variation in group composition that remains fixed over the five rounds. In every session two homogeneous groups (4+0) are created, one per ethnicity. The remaining subjects are matched in mixed groups. Mixed groups are balanced (2+2) in sessions with equal number of participants per ethnicity. Otherwise there are mixed groups (3+1). The latter case corresponds only to 7 percent of our observations. The random assignment of participants between homogeneous and mixed groups can be checked in Table A.1.[3]

It might have happened that group formation by itself created an additional sense of belonging (Tajfel et al., 1971), in addition to the ethnic identity. Nonetheless, random assignment to minimal groups tend to have less strong effects compared to group assignment involving real social interactions (Goette et al., 2012). We believe that identity effect from minimal groups are a small concern in our case. If they did occur, they would have created more cohesiveness in our ethnically mixed groups, yielding a lower-bound to our estimates.

4. Research site and sampling procedure

China has 56 ethnic groups, the dominant Han plus 55 minorities. As of 2010, the combined population of minority groups stood at about 115 million, 8.5% of the total mainland population.[4] Geographically, the ethnic minorities in mainland China are much more rural than urban, although the national population is slightly more urban (54%) than rural (46%). They are specially concentrated in the North-East (Koreans and Manchus), North-West (Uighurs, Tibetans and Hui) and South-West of the country (Zhuang, Dai, Hui, Hani and Bai, among others). These regions are less developed and urbanized in comparison to the Eastern Coast and the Central provinces. Yunnan province in South-West China is where the density of population for the minority ethnic groups is the highest. 34% of the provincial inhabitants belong to 25 different minorities, 15 of which have at least 80% of their population in Yunnan.

This study was conducted in Xishuangbanna (Banna hereafter), an autonomous prefecture of the Dai minority, in the south of Yunnan Province, where the Buddhism is the main religion. Banna extends over 19,600 km^2 and is bordered by Laos and Myanmar. Its total population is around 1.2 million inhabitants, among which around 78% correspond to ethnic minorities. The most populous ethnicities in Banna are the Dai, the Han, and the Hani (with 33%, 23%, and 21% of the whole population).[5] These three most representative ethnicities were included in our sample, in addition to the Bulang (4.19% of the whole regional population).[6] We choose these four ethnicities for three reasons. First, the Han are the national majority group, and the Dai are the regional majority group. Second, the Bulang share the same religion with the Dai, helping us to control for the effect of religion. Third, we chose the Hani because we needed enough village groups within reasonable distance (fifteen-minute daily transportation) to the sites of our experiment, and the local leaders were willing to help us with recruitment. The Hani also bring variation in religious beliefs.

The Dai, the Hani and the Bulang have their own languages and distinct cultural identities. However Mandarin Chinese can be understood almost everywhere even by those for whom it is not the language they use every day. The religious affiliations of these four minorities are closely linked to their ethnic identity. The Dai's culture is strongly based on its rather homogeneous religious belief in Theravada Buddhism, although there are still a few Dai villages where people are Christian exceptionally. The Bulang minority's religious beliefs are a mixture of Buddhism and other original religions. The Hani are mainly characterized by adherence to folk religion. The Han are mostly atheist, as elsewhere in the country, even if a few of them are Buddhists or Christians or practice other religions. The Han participants in our study are either atheist or Christian.

Thirty-one sessions of trust games and public good games were run with 576 participants in different areas of Banna between May and June, 2016. This period happened to coincide with the local elections. The experiment was conducted in a city (Jinghong) and seven village committees in four towns (Daluo, Menghun, Gasa, and Dadugang) where different ethnicities cohabit there. Fig. 1 displays, in red circles, the five locations where the sessions took place. In the administrative division in China, a village committee (administrative village) is in charge of several village groups (natural villages).[7] Each village committee for our experiment has 8–20 village groups, a village group has around 40–100 households, and each

[3] Demographics and religious affiliation are balanced. Ethnicity, on the other hand, is unbalanced with a greater proportion of Dai in homogeneous than in mixed groups. The greater proportion of Dai participants in homogeneous groups is the consequence of having two sessions in which all participants were Dai (with variation in religious affiliation).

[4] From the 6th national population Census undertaken in 2010.

[5] According to 2019 official data published by the local government. Click for the link.

[6] From the 6th national population Census undertaken in 2010.

[7] Natural villages are ones that spontaneously and naturally exist within rural area and are not an administrative division.

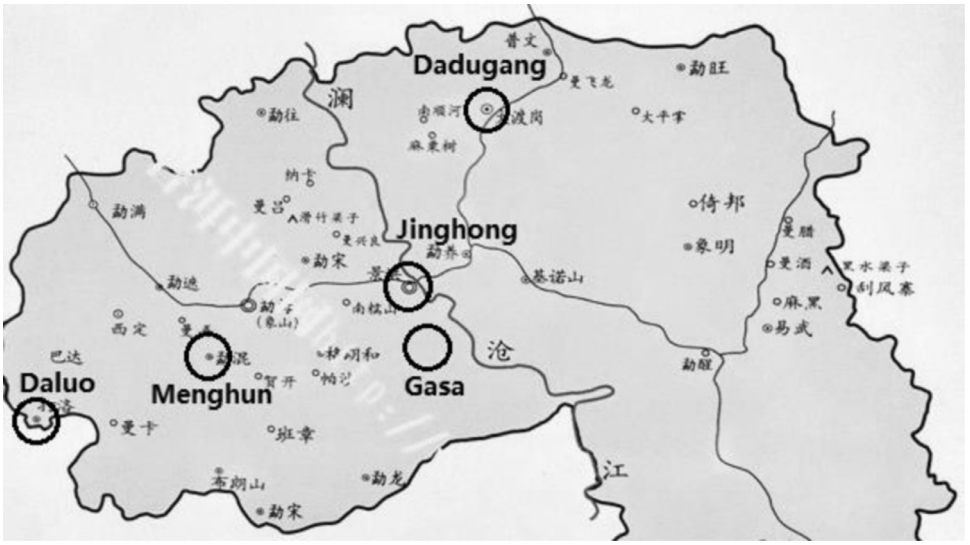

Fig. 1. Xishuangbanna locations where experimental sessions took place are marked in circles. Source: http://www.teapot.com.tw/

household has on average 4–5 persons.[8] Within a village committee, village groups are geographically separated and autonomous, but interact with each other in social life, e.g. in schools or markets. Running the experiment in different village committees increases the representativeness of our results and reduces information transmission between sessions.

We conducted 31 sessions including four different matching configurations of ethnicities: Dai-Bulang, Dai-Han, Dai-Hani, and Bulang-Hani. Table 1 reports, per location, the number of sessions conducted for each combination of ethnicities and the number of participants. The implemented matching configurations, and their frequency, were subject to geographical constraints which prevented us from implementing other pairings of ethnicities (e.g., Bulang-Han sessions).[9]

In each session we aimed to recruit twenty participants, ten for each configuration. Before each session, we contacted the leaders of village committees or village groups, and requested them to contact ten participants satisfying certain ethnicity. One exception was in Manxi village committee, where we asked a Bulang women, who could send messages to around 300 Bulang at the same time using the social network Wechat. In Jinghong, we contacted the pastors to recruit Christians. In two sessions in Jinghong, we also requested the locals to find participants, and the participants were scattered in Jinghong. In case of no show-up, we asked participants, the organizers, and neighbors to find subjects available immediately, or we started running the experiment. The details of session composition are summarized in Table A.3.

A common concern regarding sampling in lab-in-the-field experiments is whether the intended anonymity created by the experimental protocol is violated due to session composition. It is possible that subjects may guess more information about their interaction partners than is provided by the experimenter because they may recognize some of those who have shown up to the session. To address this concern we constructed a variable indicating the "closeness" between any pair of players. For sessions in which subjects were told the ethnicity of the others with whom they played, the closeness is the probability that a random member of the indicated ethnicity also belongs to the same village group. We control for closeness in our explanatory regressions below, where as will be seen it is rarely significant (only once at the 10% level). We define closeness formally in Appendix A.2. To improve accuracy of our ethnic self-reports, we cross-validate using experimental records, participants' self-reported source locations, government detailed records of ethnicity composition for each village group, and information from local leaders.

The sessions were conducted with the following procedure. At the beginning of each session subjects were randomly assigned to a seat. Then, each participant received the tablet employed to conduct the experiment using oTree (Chen et al., 2016). The game instructions were orally provided before each game, with additional written support in the subject's tablet. We placed special emphasis on the privacy of each participant's decision. Hence, they were not allowed to look at each others' tablets or to communicate. Participants were also informed that, in case of questions, they could raise their hand so that one of the experimental monitors could address the query in private. After instructions were understood, participants gave their written consent to participate. The next step for each participant was to submit in the tablet his or her own ethnicity and religious affiliation, if any. This information was used as an input for the matching protocol in the trust game and the public goods game.

[8] From http://ynszxc.gov.cn/S1/, a government website on villages in Yunnan Province.

[9] Table A.2 reports the distribution of religion by location.

Table 1
Number of sessions and subjects for each session configuration (per location).

Session configuration	# Sessions	# Subjects
Daluo		
Dai-Bulang	5	92
Bulang-Hani	5	92
Dai-Hani	1	20
Menghun		
Dai-Hani	4	76
Gasa		
Dai-Han	2	40
Dai (Christian)-Dai (Buddhist)	1	20
Jinghong		
Dai-Han	8	148
Dadugang		
Dai-Han	5	88
Total:	31	576

Table 2
Means and standard deviations of amounts sent by first movers in the trust game – by ethnicity and treatment.

	Amount of endowment sent (first mover)				
	No info.	Same ethn.	Same relig.	Other ethn.	Other relig.
Bulang (N=45)	18.33± 12.11	18.00± 13.03	21.33± 15.20	21.67± 14.42	22.56± 15.69
Dai (N=85)	20.06± 12.74	22.18± 15.38	22.53± 15.31	22.06± 14.91	24.24± 14.59
Han (N=64)	22.89± 13.45	24.69± 13.97	25.23± 15.16	25.86± 15.24	25.39± 16.07
Hani (N=47)	15.21± 12.72	14.79± 10.88	14.26± 13.55	17.55± 13.35	18.72± 15.41

Note: Among 288 senders, 241 of them played at least once with a different ethnicity. The table is based on the 241 participants.

We do not have much concern over information transmission between sessions, except in session 9.[10] In all the other sessions, it took time for participants to understand the rules, and a few needed extra explanations from the assistants.

Each session lasted between 100 and 120 min. Endowments and payments were expressed in terms of points. Participants were informed in advance of the exchange rate: one point equals 0.40 Chinese yuan (CNY). Participants were paid in cash after all the sessions finished. The total payment was on average 86 CNY, including a show-up fee of 40 CNY. The average earnings for participation were equivalent to about 12 euro at the time of the experiment.

5. Results: trust game

5.1. Sender's behavior

In the first round, in the absence of information, the average transfer x is 19.7 points with a median of 20 points. That is, subjects transfer on average 40% of their endowment. This amount is below the mean transfer reported in Johnson and Mislin's (2011)) meta-analysis. Nonetheless, previous studies conducted in China reveal similar average transfers (Johnson and Mislin, 2011). Table 2 provides details by treatment and ethnicity.

We focus now on understanding whether our treatments affect the sender's transferred amount. Fig. 2 shows, for the pooled sample and for each ethnicity, the point estimates and confidence intervals for the four variables of interest. That is, the effect of disclosing the receiver's ethnicity for the cases of in-group and out-group matching. The displayed coefficients correspond to an OLS regression with the following additional controls: session fixed effects, ethnicity (for the pooled sample), religious affiliation, and two binary variables indicating whether the partner was from the same ethnicity or religious affiliation.[11] Standard errors are clustered at the participant level. The regression results are reported in Table A.5.

Coefficients for the pooled sample (white circle) indicate in-group favoritism when the receiver's ethnicity (+3.3 points) is disclosed. This is a large effect, equivalent to just over 15% of the average amount transferred without information. In contrast, being matched with an out-group partner does not have a statistically significant effect for ethnicity. That is, out-group matching triggers neither favoritism nor hostility with respect to the situation with no information about the receiver.

The second finding that emerges from inspection of Fig. 2 is that ethnic in-group favoritism is subject to considerable variation across ethnicity. Bulang and Dai transfer on average 8.5 and 6.2 additional points to their co-ethnics respectively. The Han's additional transfer of −4.4 points is not statistically significant. The Hani do not show the same favoritism to

[10] Participants understood quickly the rules and performed well in the example question, and we were told afterwards that they already knew the rule. We chose to exclude this session from the analysis to avoid confounding effects.

[11] The indicator variable for shared ethnicity was introduced as control because the in-group treatment effects are obtained by interacting "same ethnicity" with the disclosure of "ethnic" information.

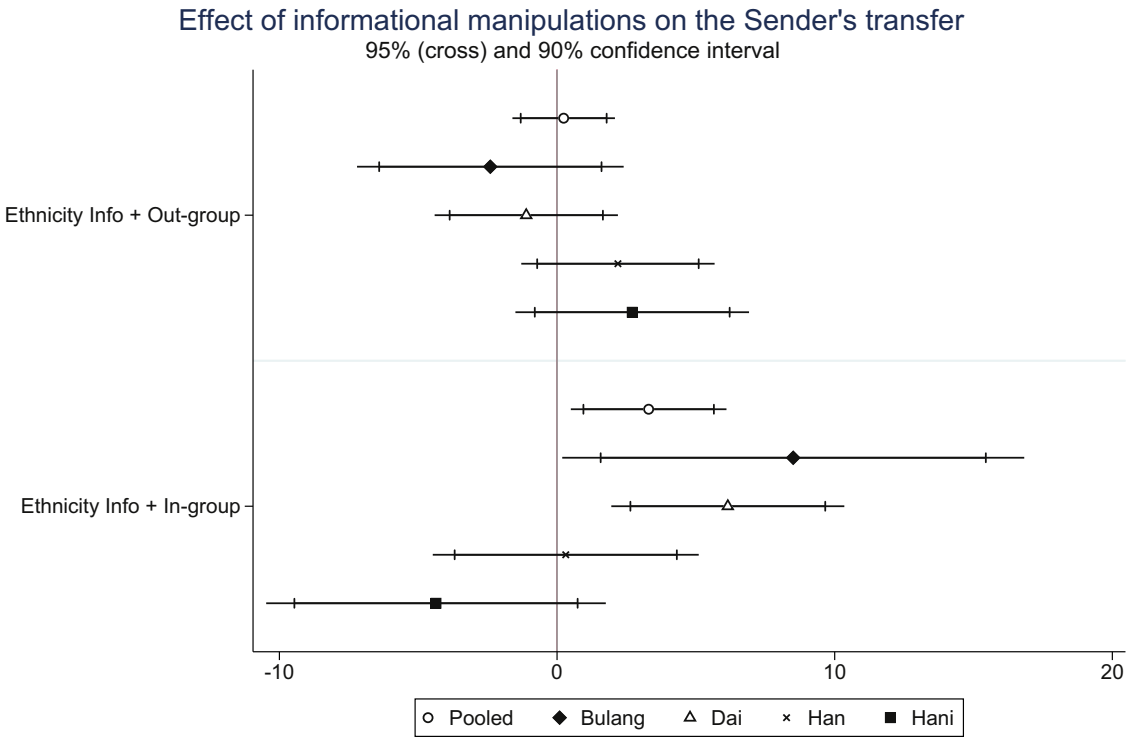

Fig. 2. OLS coefficients for the treatment variables on the transfer from the sender. The reported coefficients, for the effect of disclosing in-group and out-group ethnicity, correspond to five different estimations: a pooled regression with subjects from all ethnicities, plus one regression per ethnicity. For each point estimate is displayed the 95% (vertical line) and 90% (end of line) confidence intervals. Units are transferred points. The results are based on 241 participants who played at least once with a different ethnicity. **Note:** The dependent variable is the amount sent by a sender in a round × session. The analysis is based on the participants that at least played once with a different ethnicity in all the five rounds. That is, 241 senders. Ethnicity, religion and session FE are controlled. Geographical closeness (see the precise definition in Section A.2 in the Appendix) and individual characteristics including age, gender, education, marital status, self-perceived relative wealth, and a dummy of being farmer are controlled. The results are in Table A.5.

Table 3
Means and standard deviations of amounts returned by second movers in the trust game – by ethnicity and treatment.

	Percentage of received amount sent back (second mover)				
	No info.	Same ethn.	Same relig.	Other ethn.	Other relig.
Bulang (*N*=44)	33.53± 22.10	32.14± 20.92	29.69± 21.06	32.87± 21.01	35.40± 25.29
Dai (*N*=130)	35.13± 23.70	38.81± 27.76	36.70± 24.83	36.40± 24.29	36.64± 23.93
Han (*N*=60)	43.55± 27.08	40.43± 22.86	46.17± 31.81	46.14± 26.64	46.84± 28.04
Hani (*N*=41)	29.14± 24.26	30.72± 25.77	43.00± 30.41	36.70± 24.29	35.38± 22.55

Note: Among 288 receivers, 275 of them played at least once with a different ethnicity. The table is based on the 275 participants.

co-ethnics as the other groups, but this failure is not statistically significant after adding individual controls. As can be seen in Table A.5, column 2, the Hani send substantially and significantly less than other groups, but they do so to all receivers including their co-ethnics.

5.2. Receiver's behavior

For the analysis of the second mover, or receiver, our outcome of interest is the number of points transferred back to the sender $y' = y/3x$ with $x > 0$. On average receivers sent back 36% of what they received, with the median proportion being one third (33%). Table 3 provides details by treatment and ethnicity.

Fig. 3 displays, for the pooled sample and for each ethnicity, the point estimates and confidence intervals for five variables of interest. In addition to the four treatment variables involving information and in-group/out-group matching, we also report in this Figure the coefficient of the sender's transfer. The reason is that receivers were informed not only about their partners' ethnicity but also about his/her transfer x.[12] The displayed coefficients correspond to the OLS regressions

[12] This feature of our design makes it less likely that multiple observations from a subject are independent from each other, because the history of the game may have an effect. Nonetheless, the random payment of only one of the five rounds decreases the interdependency across the multiple observations per player.

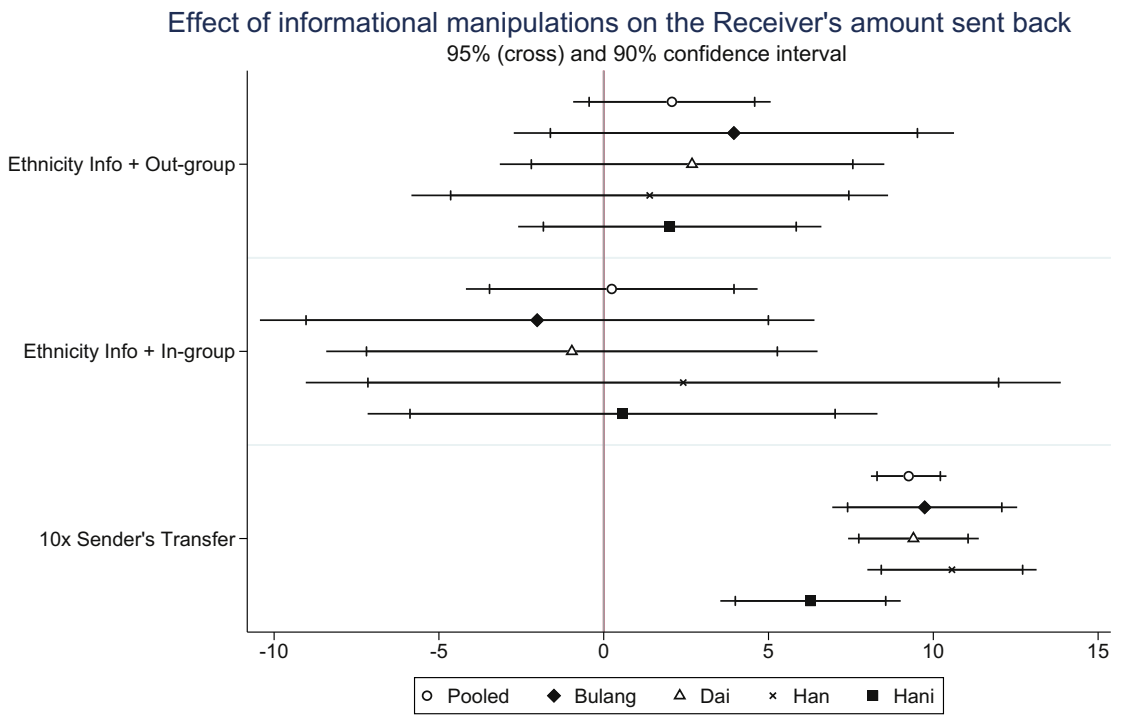

Fig. 3. OLS coefficients for the treatment variables on the amount sent back by the receiver. The reported coefficients, for the effect of disclosing in-group and out-group ethnicity and the effect of the sender's transfer, correspond to five different estimations: a pooled regression with subjects of different ethnicities, plus one regression for each ethnicity. For each point estimate we show the 95% (vertical line) and 90% (end of line) confidence intervals. The units are the points sent back. The dependent variable is the amount sent back by a receiver in a round × session. The analysis is based on the participants that at least played once with a different ethnicity in all the five rounds, i.e. 275 participants. We further exclude the rounds where the sender's transfer was null. Ethnicity, religion and session FE are controlled. Geographical closeness and individual characteristics including age, gender, education, marital status, self-perceived relative wealth, and a dummy of being farmer are controlled. The results are in Table A.6.

reported in Table A.6. We control for session fixed effects, ethnicity (for the pooled sample), religious affiliation, individual characteristics, geographical closeness, and a binary variable indicating whether the receiver shared ethnicity with the sender. Standard errors are clustered at the participant level.

We do not find an effect for any of our treatments that is significant at conventional levels. The disclosure of the sender's ethnicity does not have a significant impact on the amount transferred back by the receiver. The amounts returned appear to be proportional to the sender's transfer: we cannot reject proportionality for the sample as a whole, and can do so only for the Hani sub-sample whose amounts returned are less than proportional. Their behavior here is entirely consistent with the behavior of the Hani in the first stage when they know themselves to be playing against their co-ethnics.

Overall, the lack of statistical significance of the treatment variables and the high significance of the sender's transfer suggest that second movers give more weight to the game-specific information, namely the received transfer, than to the information about their partners' ethnicity. Hence, our insights regarding the relationship between trustworthiness and in-group/out-group ethnicity are limited and must be interpreted with caution.

5.3. Religion as an alternative cue for senders and receivers

Although our matching within the trust game was based on ethnicity, it was highly correlated with religious affiliation. One would expect this relationship given the description in Section 4 regarding the tight connection between ethnicity and religion in Banna. The main implication of this feature of the sampling is that, since to any player we disclose information either about ethnicity or about religion but not about both simultaneously, we are not able to test whether identity in this context is driven more strongly by religious identification than by ethnic identification. Either may be functioning as a signal of the other.

As a robustness test we therefore present the results of the trust game, for the sender and the receiver, when religious affiliation is disclosed.

Fig. 4 plots the coefficients of a regression analysis similar to the one for ethnicity, showing senders in the upper panel and receivers in the lower panel). In the upper panel, the results for the pooled sample of senders reveal a similar effect of in-group favoritism (+3.2 points, for ethnicity it was +3.3 points) when the disclosed receiver's religious affiliation is the same. Nonetheless, religious in-group favoritism is statistically significant only for the Dai (+8.0 points). Since the Dai

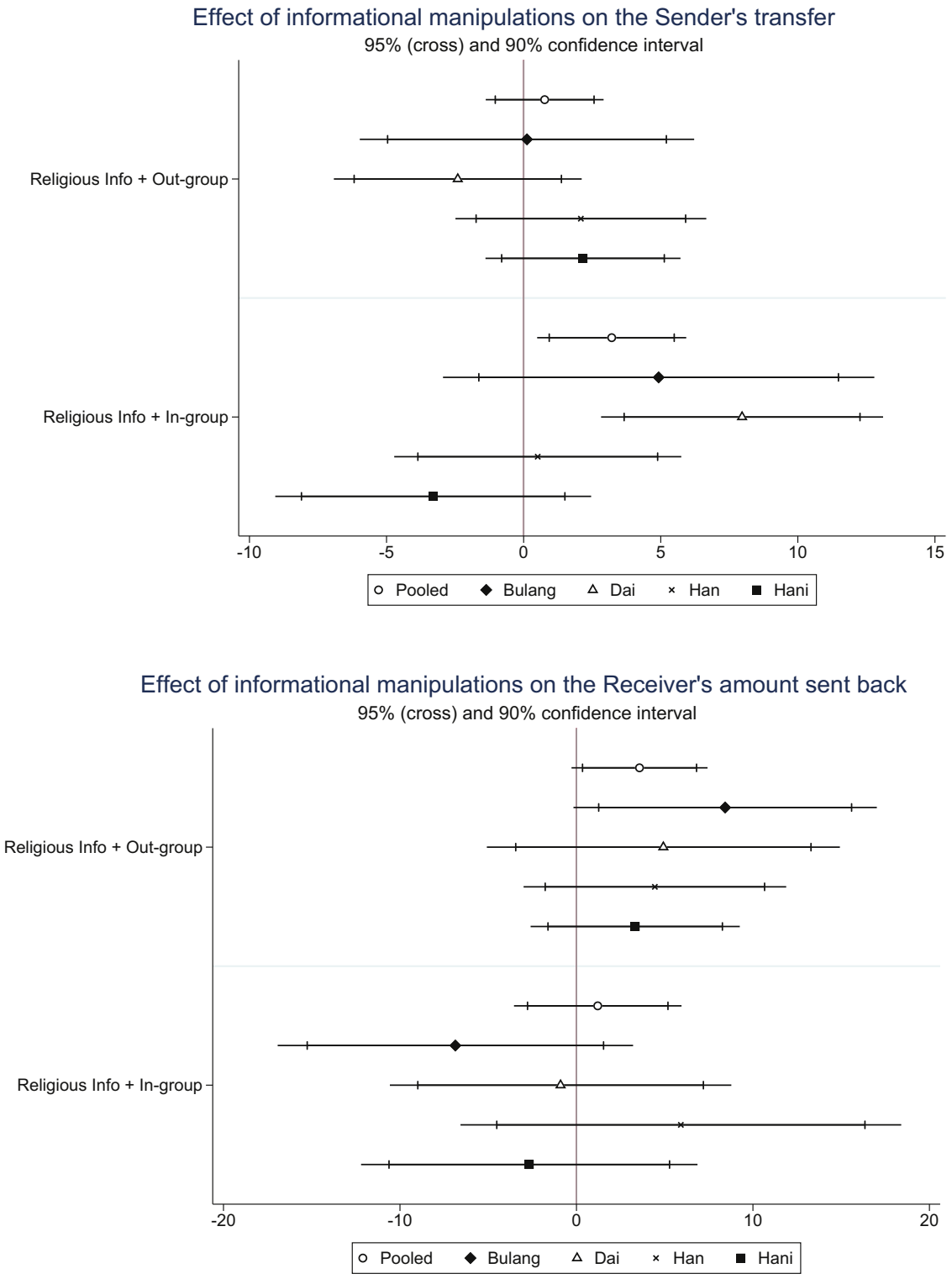

Fig. 4. OLS coefficients for the religion-related treatment variables on the transfer from the sender (top) and the amount sent back by the receiver (bottom). The reported coefficients, for the effect of disclosing in-group and out-group ethnicity and the effect of the sender's transfer, correspond to five different estimations: a pooled regression with subjects of different ethnicities, plus one regression for each ethnicity. For each point estimate we show the 95% (vertical line) and 90% (end of line) confidence intervals. The units are the points sent by senders and those sent back by receivers. The dependent variable is the amount sent by a sender (or sent back by a receiver) in a round × session. The analysis is based on the participants that at least played once with a different ethnicity in all the five rounds, i.e. 241 senders and 275 receivers. For the regressions on receivers, we further exclude the rounds where the sender's transfer was null. Ethnicity, religion and session FE, geographical closeness and individual characteristics are controlled. The results are in Tables A.5 and A.6.

Table 4
Means and standard deviations of amounts contributed and punishments inflicted in the public goods game – by round and group type.

	Contribution		Punishment inflicted	
	Round 1	Rounds 1–5	Round 1	Rounds 1–5
Homogeneous groups (N=300)	5.72±2.98	6.42±3.08	0.65±0.98	0.60±0.96
Balanced mixed groups (2+2) (N=236)	5.66±3.02	6.36±3.15	0.58±0.89	0.60±0.91
Unbalanced mixed groups (3+1) (N=40)	4.55±2.47	4.73±3.02	0.42±0.71	0.56±0.85

Table 5
OLS regressions explaining contribution levels for all the rounds and the first round in the public goods game.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Contribution – all rounds			Contribution – first round		
One non co-ethnic	−1.531***	−1.055**	−0.903*	−1.172**	−0.719	−0.526
	(0.503)	(0.530)	(0.518)	(0.515)	(0.586)	(0.581)
Two non co-ethnics	−0.563**	−0.166	0.0838	−0.297	0.0548	0.372
	(0.247)	(0.332)	(0.354)	(0.250)	(0.407)	(0.469)
Three non co-ethnics	−0.434	−0.0465	0.372	0.0932	0.434	0.923
	(0.894)	(0.851)	(0.847)	(0.899)	(0.851)	(0.902)
Sender		0.224	0.323		0.0141	0.144
		(0.427)	(0.437)		(0.545)	(0.560)
Amount sent × Sender		0.0459***	0.0443***		0.0580***	0.0552***
		(0.0108)	(0.0109)		(0.0142)	(0.0145)
Share sent back × Receiver		1.251***	1.256***		1.413***	1.359***
		(0.390)	(0.382)		(0.479)	(0.467)
Constant	7.275***	6.036***	5.931***	5.720***	4.428***	4.038***
	(0.710)	(0.759)	(0.878)	(0.771)	(0.847)	(1.082)
Observations	2445	2445	2445	489	489	489
R-squared	0.225	0.255	0.269	0.168	0.217	0.242
Individual controls			Yes			Yes

The dependent variable is the points contributed by each player in each round. The analysis is based on 489 out of 576 participants, after excluding problematic participants. Standard errors clustered at the group level, shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Session, round, and ethnicity fixed effects are controlled. The individual controls include age, gender, education, marital status, self-perceived relative wealth, a dummy of being farmer, and geographical closeness.

participants correspond to 47% of our sample, it is plausible that the effect in the pooled regression, which is just marginally statistically significant, is mostly driven by the Dai participants. The lower panel reveals that, for the pooled sample, the effects of disclosing religious affiliation are not statistically significant in predicting transfers to the in-group or out-group.

We thus conclude that disclosing religious affiliation has similar effects to the disclosure of ethnicity. Presumably this is because both are highly correlated in the context of our sample, and disclosing one dimension of identity conveys a strong signal about the other dimension.

6. Results: public goods games

6.1. Contributions to the public fund

Table 4 provides details of contributions and punishment levels by group type, distinguishing not just homogeneous and mixed groups but also the balanced from the unbalanced mixed groups. We also distinguish behavior in the first round from that in subsequent rounds where it is subject to the influence of prior punishment. Subjects contribute on average 63% of their endowment.

It can be seen from the table that the behavior of unbalanced mixed groups is very different from that of the other two types, in the sense that contribution levels are lower initially, do not rise after the first round (unlike in the other groups) and punishment levels are lower. Of course, group level variables are equilibrium outcomes of the interactions of individual decisions, and it is important to see how these are affected by many variables, including group composition and the behavior of fellow group members.

Table 5 reports OLS regressions that examine whether individual contribution behaviors vary by group composition.[13] We look at the levels of contributions of all rounds (columns 1–3) and the levels of contribution for the first round (columns 4–6). To disentangle the effect of being in a mixed group, we test the "intensity" of mixed groups by adding a variable that captures the number of non-co-ethnics in the group. This is useful to fully examine the heterogeneity in contribution

[13] These results are similar when conducting Tobit regressions that take into account the censoring problems due to the proportion of participants selecting full and null contributions.

Table 6
Linear probability model for the likelihood that i punishes j.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Positive contribution gap				Negative contribution gap		
Own contribution	−0.016***	−0.017***	−0.016***	−0.017***	−0.005	−0.005	−0.005	−0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Mixed group	0.004	0.020	0.016	0.021	−0.009	−0.020	−0.031	−0.029
	(0.027)	(0.042)	(0.045)	(0.045)	(0.025)	(0.036)	(0.041)	(0.038)
Mixed own ethnic.	−0.055***	−0.055***	−0.051**	−0.042	−0.007	−0.007		−0.009
	(0.021)	(0.021)	(0.025)	(0.026)	(0.020)	(0.021)		(0.023)
Contri. Gap i over j	0.030***	0.030***	0.030***	0.031***	0.004	0.004	0.004	0.007
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)
Mixed group × Gap				−0.001				−0.004
				(0.009)				(0.007)
Mixed own ethnic. × Gap				−0.006				−0.001
				(0.008)				(0.007)
Sender		−0.015	−0.027	−0.015		−0.049	−0.066	−0.048
		(0.057)	(0.056)	(0.057)		(0.049)	(0.049)	(0.049)
Amount sent × Sender		0.001	0.001	0.001		0.001	0.002	0.001
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Share sent back × Receiver		−0.027	−0.029	−0.027		−0.015	−0.026	−0.014
		(0.039)	(0.038)	(0.039)		(0.044)	(0.044)	(0.044)
Constant	0.374***	0.372***	0.521***	0.368***	0.265***	0.287***	0.470***	0.293***
	(0.088)	(0.101)	(0.118)	(0.100)	(0.079)	(0.094)	(0.123)	(0.095)
Individual controls			Yes				Yes	
Observations	4504	4504	4504	4504	4524	4524	4524	4524
Wald chi2	434.84	495.69	577.57	517.17	275.44	363.02	461.78	383.30

The dependent variable is whether a player punishes another player in a round×session. The analysis is based on 489 out of 576 participants, after excluding problematic participants. Positive contribution gap refers to the case where player j contributes no less than player i, vice versa. Standard errors are clustered at the group level, shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The round, ethnicity and session fixed effects and individual random effects are controlled. The individual controls include age, gender, education, marital status, self-perceived relative wealth, a dummy of being farmer, and geographical closeness.

behaviors, by group composition. The baseline is being in the homogeneous groups (zero non co-ethnics). We control the effect of being a sender and average earnings in the trust game previously played (Table A.4).

We find that the coefficients for the number of non co-ethnics increase monotonically. That is, the more non co-ethnics in the group, the less negative is the difference in contributions with respect to the homogeneous group. One interpretation is that the presence of more non co-ethnics is associated with more fear of being punished for a low contribution. With only one non-coethnic present contributions fall substantially (by about 25%).

Controlling for subjects' behavior in the trust game reduces the coefficient on one non-coethnic by about a third but it remains large and significant at the 5% level. Both the amount sent by senders and the proportion returned by receivers are strongly significant predictors of contributions in the public goods game, as would be expected if they capture trustingness and trustworthiness respectively.

6.2. Punishment

We now investigate the determinants of punishment, including the presence or absence of shared ethnic identity between fellow group members. Table 6 shows the results of OLS estimation of the probability that an individual i punishes an individual j, as a function of the difference in contribution levels between i and j, plus dummy variables indicating whether the two individuals are co-ethnics in a mixed group, or from different ethnicities (the omitted category is being in an homogeneous group). We include round, ethnic and session fixed effects. The latter are particularly important to control for any differences in the propensity to punish that might occur between sessions due to possible variations in the presentation by the experimenters, which are impossible to exclude completely in a field setting although experimenter training attempts to minimize them.[14] We run separate estimations for the cases where i contributes more than j (columns 1–4) and for the cases where i contributes less than j (columns 5–8). These two cases will reflect quite different motivations – the former involving punishment of free-riders and the latter involving punishment of high contributors, sometimes known as "anti-social punishment" (Herrmann et al., 2008). We find no evidence of systematic anti-social punishment.

Our most striking results come from patterns of punishment of free-riders. Here four findings stand out. First, subjects' behavior in the trust game is of negligible importance. This makes sense as punishment is about responding to recent behavior of the partner and should not be expected to reflect either trustingness or trustworthiness.

[14] The inclusion of fixed effects explains why we use OLS estimation rather than probit or logit, which would lead to biased parameter estimates due to the incidental parameters problem. Moreover, we added interaction terms that make the interpretation of non-linear models more convoluted (Ai and Norton, 2003).

Secondly, controlling for the gap between the subject and the partner, subjects who have contributed more are less likely to punish. This suggests a correlation between generous traits and tolerance of the lower contributions of others.

Thirdly, the greater the contribution gap between the subject's contribution and that of the partner, the greater is the likelihood of punishment, a result that has also been found in the literature (see Dreber et al., 2008).

Most strikingly, behavior in mixed groups is quite different from that in homogeneous groups – within mixed groups subjects are more than 5 percentage points less likely to punish in-group members than out-group members, a difference that is significant at 1% without controls and at 5% with controls. This is partly because they punish out-group members slightly more than subjects punish co-ethnics in homogeneous groups (by around 2 percentage point in columns 3 and 4, though this is not statistically significant). To a greater extent it is because they punish their co-ethnics less than do subjects in homogeneous groups. It is not because they respond with greater sensitivity to the contribution gap, as can be seen in column 4.

6.3. Robustness checks

6.3.1. Gender differences

In a similar public goods game with punishment involving a minority (Spanish *Gitanos*), Espín et al. (2019) find that women contribute less (resp. more) than men in homogeneous (resp. mixed) groups. Moreover, *Gitano* women did not punish in any group configuration while *Gitano* men only punished in mixed groups. By contrast, non-*Gitano* women punished more in homogeneous groups. Following Espín et al.'s (2019)) argument that these results are linked to culture-specific differential gender roles in norm enforcement, we explore whether a similar pattern emerges in the context of our study.

Tables A.7 and A.8 in the Appendix show gender effects on sender and receiver transfers in the Trust game. In keeping with the existing literature we find that women send less and return less, but there is no evidence of a gender difference in the effect of ethnicity or religion (an apparent effect in column 1 of Table A.7 disappears once session fixed effects are included).

We have similar findings in the public goods games, as can be see in Tables A.9 and A.10. There are no gender effects at all on contributions, and while there is a lower probability of punishment on average by female subjects. This reduced probability disappears when we add gender interactions with ethnicity.

6.3.2. Balanced mixed groups

A potential concern with having balanced and unbalanced mixed groups is that in those groups with a single player from one ethnicity the dynamics of punishment might be different (for instance, this participant might be more afraid of retaliations and punish less). We thus conduct again the regressions from Table 6, excluding the unbalanced mixed groups. The results are qualitatively identical (see Table A.11 in the Appendix), although the difference in probability of punishing own and other ethnics in mixed groups is 4.8 percentage points instead of 5.5 points, a difference that is significant at the 5% level. We thus argue that the results were not driven by the presence of unbalanced mixed groups.

7. Discussion

An important literature in economics and political science has identified ethnic diversity as a predictor of low cooperation and public good provision in many different social contexts (see Alesina et al., 1999). Habyarimana et al. (2007) find evidence in favor of two mechanisms that may explain this phenomenon: one is differences in strategy selection by individuals, while the other consists of differences in the sanctioning technology to which individuals have access, based on their differential closeness to others within the social network.

The experiments we conducted allow us to explore the preference and strategy selection mechanisms directly, by giving all subjects access to the same sanctioning technology regards of network closeness. We analyze whether individuals behave differently according to their counterpart's ethnicity. We find an in-group favoritism from the senders in the trust game towards co-ethnics: transfers are about 16% larger compared to the baseline situation without any type of information about the receiver. On the other hand, the transferred amounts do not indicate any hostility towards out-group members with respect to the baseline situation in which individuals know nothing about their interaction partner.

Most importantly, we interpret this in-group favoritism as evidence of strategy selection. Whereas the sender transferred more points in the presence of a cue of shared ethnicity with the receiver, this information was not predictive of the transfer made by the receiver. If the larger transfer were directly associated to preference differences, one would expect that the receiver also repay more to co-ethnics. Instead, a less noisy signal (i.e., the amount transferred by the sender) becomes the main predictor of receiver's behavior.

It is important to mention that the sender's in-group favoritism is subject to non-negligible variation across ethnic groups. Gupta et al. (2018) finds that senders from the minority exhibit a greater in-group bias. In our case, this bias is greater for one of the minorities (Bulang), followed by the local majority (Dai) and then by the country's majority (Han). So far, our findings are similar to Gupta et al.'s (2018)) results. However, for the other minority in our sample (Hani), we find slightly smaller transfers towards co-ethnics than in absence of information (though this difference is not statistically significant). This may reflect the fact that Hani senders returned systematically fewer points than the other ethnic groups to their senders for any given amount received. We thus replicate Gupta et al.'s (2018)) findings with subjects from ethnic groups

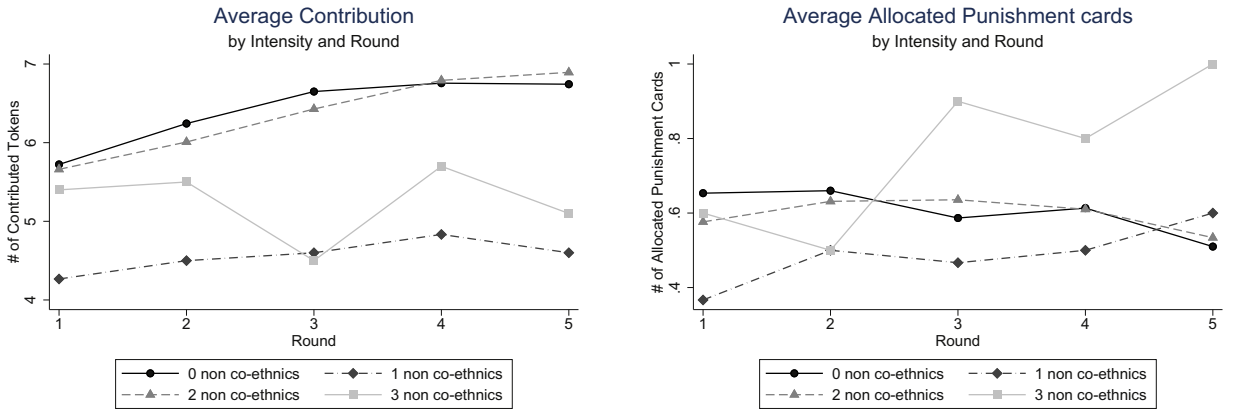

Fig. 5. Contribution levels and allocated disapproval cards by group composition and round.

Table 7
OLS regression for group's total earnings in the public goods game.

Variables	(1)	(2)	(3)	(4)
Mixed group	−10.31	−10.38*		
	(8.225)	(4.769)		
Mixed group: 2+2			−12.43	−7.740
			(8.796)	(5.931)
Mixed group: 3+1			1.311	−24.87**
			(29.96)	(6.338)
Total punishment cards allocated		−7.390***		−7.455***
		(0.385)		(0.372)
Constant	394.2***	400.1***	395.5***	398.6***
	(4.935)	(2.885)	(5.277)	(3.648)
Observations	144	144	144	144
R-squared	0.527	0.920	0.528	0.921

The dependent variable is the total earnings of a group in the five rounds. There are 144 groups, formed by 576 participants. Session fixed effects included in the regressions. Standard errors clustered at the location level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

that did not behave differently in the baseline, while leaving open the possibility that Hani players behave less generously towards their own in-group because of knowledge about the lower general reciprocal tendencies of their own in-group.

The symmetric punishment opportunities in our public goods game allow us to abstract from real-world differences in punishment opportunities, and to study other mechanisms present during the punishment stage of the game. In Habyarimana et al.'s (2007)) argument, the greater closeness in the social network for co-ethnics than for non co-ethnics creates more chances to coordinate and to sustain credible threats in homogeneous groups. Miguel and Gugerty (2005) make a similar point, arguing that the lack of access to social sanctions in mixed settings contributes to the negative association between ethnic diversity and public goods provision.

In our experiment, in contrast, the access to a punishment technology is the same for co-ethnics and non co-ethnics. We find that the likelihood of punishing a group member changes in mixed groups, with in particular a lower probability of punishing in-group members. This may be related to the behavior reported in Eriksson et al. (2016). In an intergroup context subjects are willing to incur in a cost to avoid the public exposure of the worst performer in their group. While not the same behavior as that observed in our setting (notably because punishment does not become public information), it indicates that preserving in-group solidarity may be an important consideration, at least in ethnically mixed contexts among our populations.

Such differences in punishment behavior are likely to have a greater effect on contribution levels in groups in which one ethnic group is in a majority. In such groups there are three majority members and only one minority member. The majority members can count on a lower punishment risk from two of the other three players.

Fig. 5 let us explore this behavior. The left panel shows that average contributions in the homogeneous and balanced mixed groups are initially higher than in unbalanced mixed groups and that the difference grows over time, whereas average contributions for the latter group composition remains roughly constant over time. It is worth noting that our public goods games lasted for only five periods; over a longer period of interaction the differences, if extrapolated, might well have become substantially greater.

The right panel in Fig. 5 shows that punishment levels early in the game are substantially lower in mixed heterogeneous groups (3+1) than in the other two groups, only catching up in later rounds. This catching up is driven by the substantial increase of punishment from the single member of an ethnicity playing with three group-members from the other

ethnicity in the session. Recall from Table 5 that participants in mixed groups were more likely to reduce their contribution in presence of a single non co-ethnic. Thus, the increase in punishment is the response of the single member of an ethnicity within a group. Presumably, once she updates the expectations of a low likelihood of anti-social punishment. Nonetheless, contribution rates remain stable because the other group members do not engage in costly punishment.

Table 7 verifies that these differences in contribution levels lead, as we might expect, to lower final earnings for the participants in mixed groups, though the differences are not statistically significant without the inclusion of additional controls. When we separate asymmetric (3+1) from symmetric (2+2) mixed groups the difference in earnings from the homogeneous groups is three times as great for the asymmetric as for the symmetric groups. The effect once again depends on the inclusion of likely endogenous controls (notably the amount of punishment inflicted in the group) so the conclusions concerning earnings must necessarily be tentative. In any case the outcomes at group level are the result of interactions between individuals and so can be expected to be less well identified than individual behavioral responses to treatments. Nevertheless, it seems plausible that the favoritism that individuals in our study show towards co-ethnics in mixed groups may lead to a lower level of group discipline and therefore be harmful for those it purports to help.

8. Conclusion

Yunnan Province in China is a context in which relations between ethnic groups are largely harmonious in spite of substantial social, economic, linguistic and cultural differences between groups. That our study has nevertheless found tendencies to favoritism towards in-group members is striking. This favoritism includes notably a diminished willingness to discipline free-riders in mixed public goods games, with potentially adverse effects on cooperation in such games.

It remains to be seen how general are such findings. One possible application is to corruption, which in many countries includes corrupt behavior not just by those in power, but also (and particularly) by their relatives, friends and co-ethnics. It is often when the President's *relatives*, rather than just the President, help themselves to the spoils of office that the outrage provoked by corruption is strongest. If part of the reason is that those in power are reluctant to discipline corrupt behavior by other members of their in-group, the phenomenon we have uncovered may have a much wider application than just to the provision of public goods.

Another possible application may be to understanding the physical insecurity felt by minority individuals in city neighborhoods dominated by another ethnic group. It may be not so much that they fear greater intrinsic hostility by the majority, rather as a reduced willingness on the part of majority individuals to punish opportunistic violence by their co-ethnics. This possibility remains an interesting subject for future research.

Declaration of Competing Interest

- This manuscript has not been submitted to, nor is under review at, another journal or other publishing venue.
- The authors have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript.

Appendix A

A.1. Additional tables

Table A.1
Balance check on observable characteristics in the treatment assignment for the public goods game.

	Group composition		Difference	*p*-value
	Homogeneous	*Mixed*		
Demographics				
Age	32.576	33.065	−0.489	0.635
Gender (1=female)	0.490	0.491	−0.001	0.981
Farmer	0.529	0.513	0.016	0.720
Education (1=secondary degree)	0.206	0.220	−0.014	0.714
Religious affiliation				
Atheist	0.191	0.250	−0.059	0.113
Buddhist	0.545	0.522	0.023	0.609
Christian	0.222	0.190	0.032	0.382
Original religions	0.043	0.039	0.004	0.824
Ethnicity				
Bulang	0.136	0.181	−0.045	0.175
Dai	0.553	0.422	0.130***	0.004
Han	0.183	0.237	−0.054	0.141
Hani	0.128	0.159	−0.031	0.328

The table is based on 489 out of 576 participants, after excluding problematic participants. explained in Table A.3. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.2
Distribution of religion by location.

Location	Atheist	Buddhist	Christian	Original
Dadugang	35	42	11	0
Daluo	31	150	0	23
Gasa	2	31	27	0
Jinghong	21	21	106	0
Menghun	20	44	0	12

Table A.3
Composition of subjects by session. The table summarizes the composition of players by ethnicity, religion (B:Buddhist, A:Atheist, O:Original and C:Christian), and village group (VG). Due to privacy concern, we replace village names by numbers.

Day	Session	City/Town	Composition				Problematic
			ethnicity1	religion (by VG)	ethnicity2	religion by VG	
1	1	Daluo	10 Dai	10B(VG1)	10Bulang	10B(VG2)	
1	2	Daluo	10 Dai	10B(VG1)	6Bulang	6B(VG2)	
2	3	Daluo	6 Bulang	1B(VG4), 4B+1O(VG3)	6Hani	3A+3O(VG3)	
2	4	Daluo	10 Bulang	3B(VG4),7B(VG3)	10 Hani	2O+3B*+3A(VG3) 1O+1A (other)	
2	5	Daluo	11 Bulang	8B(VG3), 3B(VG4)	9Hani	1B+1O+7A(VG3)	1 Hani
3	6	Daluo	10 Bulang	9B+1O(VG6)	10 Dai	10B(VG5)	1 Bulang
3	7	Daluo	10 Bulang	5B+1O(VG6), 4B(VG4)	10 Dai	10B(VG5)	
4	8	Daluo	6 Bulang	5B(VG6), 1B(other)	10 Dai	10B(VG5)	
4	9	Daluo	11 Bulang	11B(VG4)	9 Hani	5O(VG3), 4O(VG7)	
5	10	Daluo	10 Bulang	4B+1O(VG2), 4B(VG8), 1B(other)	10Hani	2O+8A(VG9)	
5	11	Daluo	10 Dai	10B(VG10)	10 Hani	1O+9A(VG9)	
6	12	Menghun	10 Dai	10B (5 VGs)	10Hani	2B+2O+6A(VG12)	
6	13	Menghun	10 Dai	3B(other), 6B+1O(VG11)	10 Hani	2A+8O(VG12)	
6	14	Menghun	9 Hani	8A+1O(VG14)	11Dai	10B+1A(VG13)	
6	15	Menghun	5 Hani	3A+2B(VG14)	11Dai	11B(VG13)	
7	16	Gasa	20 Dai	10B(VG15), 10C(VG16)			1 Dai
8	17	Gasa	10 Han	7C+2A(VG17), 1C(VG18)	10 Dai	10B(VG15)	2 Han
8	18	Gasa	9 Han	9C(VG18)	11 Dai	10B(VG15)	3 Han
9	19	Jinghong	10 Dai	10C(Church1)	6 Han	6C(Church1)	2 Han
9	20	Jinghong	8 Dai	8C(Church1)	12 Han	12C(Church1)	
10	21	Jinghong	12 Dai	10C(Church1), 1B+1A(other)	8Han	7C(Church1), 1A(other)	1 Dai
10	22	Jinghong	10 Han	1C(Church1), 9A(other)	10 Dai	1C(Church1), 9B(other)	
10	23	Jinghong	9 Han	2C(Church1), 2B+5A(other)	7 Dai	7B(other)	
11	24	Mengman	13 Dai	2C+11B(VG19)	7 Han	5C+2A(VG20)	1 Han
11	25	Mengman	16 Dai	5A+11B(VG19)	4 Han	1A in(VG21), 1B(VG22) 2C(VG19)	2 Dai, 1 Han
11	26	Mengman	9 Dai	1C+6B(VG19), 2B (other)	7 Han	5A+2B(VG19)	3 Han
11	27	Mengman	8 Dai	4B+4A(VG19)	8 Han	1C+7A(VG19)	
11	28	Mengman	7 Dai	2A+5B(VG19)	9 Han	4A(VG23), 2A(VG21), 2A+1B(VG19)	
12	29	Jinghong	11 Han	10C+1A(Church2)	9 Dai	8C+1A(Church2)	3 Dai, 1 Han
12	30	Jinghong	10 Han	10C(Church2)	10 Dai	10C(Church2)	5 Han
12	31	Jinghong	8 Han	5C(church2), 1B+2A(other)	8 Dai	7C+1A(Church2)	

Notes: The composition is based on subjects' reported village, experiment records, and government detailed records of ethnicity composition of each village group. The "problematic participants" refer to the participants in three sessions (session 9 and session 20 with large-scale misreporting of ethnicity and session 11 where participants talked aloud to coordinate) and 27 participants with mismatched ethnicity (the ethnicity reported at the beginning of the game does not match that in the questionnaire) or other accidents (one participant left in the middle due to family pressure).

Table A.4
Treatment assignment for the public goods game with respect to the role in the trust game.

	Homogeneous group	Mixed group	Difference	*p*-value
Sender	0.837	0.121	−0.716***	0.000

The table is based on 489 out of 576 participants, after excluding problematic participants. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.5
OLS Regression results for the Sender's transfer.

	(1) Pooled	(2)	(3) Bulang	(4)	(5) Dai	(6)	(7) Han	(8)	(9) Hani	(10)
Ethnicity info	0.158	0.238	−3.255	−2.403	−1.524	−1.109	2.548	2.193	2.668	2.707
	(0.944)	(0.937)	(2.442)	(2.383)	(1.710)	(1.660)	(1.795)	(1.743)	(1.983)	(2.090)
Same ethnicity	0.297	0.114	−0.808	−1.160	−2.915*	−3.510**	2.260	1.983	4.116	4.477**
	(1.074)	(0.959)	(2.521)	(2.208)	(1.739)	(1.599)	(1.894)	(1.592)	(2.506)	(2.188)
Ethnicity info × Same ethnicity	3.404**	3.299**	10.407**	8.507**	7.211***	6.150***	0.206	0.313	−4.252	−4.360
	(1.485)	(1.423)	(4.197)	(4.128)	(2.419)	(2.110)	(2.605)	(2.397)	(2.959)	(3.039)
Religious info	0.700	0.767	−0.074	0.122	−2.478	−2.402	3.015	2.087	2.226	2.164
	(1.097)	(1.091)	(2.895)	(3.025)	(2.345)	(2.273)	(2.363)	(2.289)	(1.702)	(1.767)
Same religion	−0.280	−0.171	−4.227	−2.620	−1.312	1.661	−0.705	−1.648	2.351	2.881
	(1.224)	(1.106)	(3.286)	(3.168)	(2.374)	(1.921)	(1.943)	(1.910)	(2.017)	(2.009)
Religious info × Same religion	3.260**	3.212**	5.295	4.924	8.173***	7.967***	−0.474	0.514	−3.505	−3.299
	(1.439)	(1.380)	(3.801)	(3.903)	(2.725)	(2.586)	(2.642)	(2.619)	(2.911)	(2.862)
Closeness	−1.863	−1.336	2.856	6.486*	−4.984	−4.256*	2.868	−1.026	−2.305	−1.577
	(1.696)	(1.606)	(3.568)	(3.647)	(3.158)	(2.421)	(3.040)	(2.742)	(4.351)	(3.942)
Dai	0.500	1.073								
	(1.968)	(2.545)								
Han	0.865	3.604								
	(2.944)	(3.573)								
Hani	−4.001	−5.841**								
	(2.675)	(2.850)								
Constant	26.342***	25.565***	16.816***	12.724**	23.342**	37.712***	38.966***	41.338***	31.035***	25.033**
	(4.775)	(5.020)	(5.715)	(5.513)	(9.308)	(10.744)	(9.027)	(10.735)	(9.664)	(10.025)
Observations	1205	1205	225	225	425	425	320	320	235	235
R^2	0.105	0.249	0.184	0.294	0.083	0.419	0.172	0.339	0.272	0.350
Session FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Religion FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the amount sent by a sender in a round × session. The analysis is based on the participants that at least played once with a different ethnicity in all the five rounds, i.e. 241 senders. Standard errors clustered at the individual level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The geographical closeness and individual characteristics including age, gender, education, marital status, self-perceived relative wealth, and a dummy of being farmer are controlled.

Table A.6
OLS Regression results for the Receiver's transfer.

	(1) Pooled	(2)	(3) Bulang	(4)	(5) Dai	(6)	(7) Han	(8)	(9) Hani	(10)
Ethnicity info	2.231	2.069	4.616	3.950	4.095	2.681	1.403	1.397	1.855	2.005
	(1.477)	(1.521)	(3.204)	(3.314)	(2.718)	(2.932)	(3.538)	(3.618)	(2.301)	(2.284)
Same ethnicity	1.540	0.422	−0.388	−0.154	−2.058	−3.427	9.946*	9.000*	0.015	−0.724
	(1.947)	(1.985)	(3.673)	(3.549)	(2.900)	(2.991)	(5.121)	(5.071)	(2.268)	(2.740)
Ethnicity info × Same ethnicity	−0.355	0.245	−3.093	−2.018	−4.031	−0.965	1.574	2.414	0.817	0.572
	(2.200)	(2.246)	(4.098)	(4.174)	(3.493)	(3.747)	(5.769)	(5.731)	(3.933)	(3.840)
Religious info	3.761**	3.573*	8.977**	8.426*	6.419	4.924	4.441	4.444	3.156	3.328
	(1.822)	(1.956)	(4.110)	(4.264)	(4.519)	(5.028)	(3.494)	(3.723)	(2.899)	(2.942)
Same religion	−0.582	−1.192	1.780	0.354	−1.671	−2.607	−2.966	−4.009	2.911	2.061
	(1.761)	(1.915)	(5.295)	(4.398)	(3.532)	(3.685)	(3.713)	(4.170)	(2.030)	(2.130)
Religious info × Same religion	0.520	1.206	−7.519	−6.860	−3.604	−0.899	5.056	5.915	−2.484	−2.674
	(2.287)	(2.409)	(4.748)	(4.996)	(4.400)	(4.864)	(5.859)	(6.248)	(4.768)	(4.732)
10× Sender's transfer	9.864***	9.253***	9.571***	9.740***	10.491***	9.397***	10.765***	10.566***	5.754***	6.275***
	(0.635)	(0.582)	(1.512)	(1.392)	(1.081)	(0.996)	(1.173)	(1.285)	(1.144)	(1.359)
Dai	0.779	−3.167								
	(1.950)	(2.008)								
Han	1.094	−0.648								
	(2.594)	(2.626)								
Hani	−2.107	−3.134								
	(2.427)	(2.176)								
Closeness	3.208*	3.518	−2.735	−6.267*	9.541***	6.892	6.677	8.282	1.498	3.080
	(1.779)	(2.191)	(3.444)	(3.631)	(3.218)	(4.473)	(4.657)	(5.363)	(2.444)	(4.734)
Constant	2.903	6.727	6.258	9.563	0.024	1.295	−2.553	−1.070	−1.155	1.196
	(4.502)	(4.092)	(7.222)	(6.277)	(7.731)	(9.064)	(11.036)	(9.980)	(4.824)	(6.457)
Observations	1147	1147	211	211	411	411	308	308	217	217
R^2	0.387	0.438	0.417	0.442	0.378	0.453	0.458	0.491	0.325	0.355
Session FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Religion FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the amount sent back by a receiver in a round × session. The analysis is based on the participants that at least played once with a different ethnicity in all the five rounds, i.e. 275 receivers. We further exclude the rounds where the receiver receives zero. Standard errors clustered at the individual level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The geographical closeness and individual characteristics including age, gender, education, marital status, self-perceived relative wealth, and a dummy of being farmer are controlled.

Table A.7
OLS Regression results for the Sender's transfer with gender interactions.

	(1) Pooled	(2)	(3) Bulang	(4)	(5) Dai	(6)	(7) Han	(8)	(9) Hani	(10)
Female	−4.976***	−3.415**	−8.575**	−6.729*	0.084	3.328	−5.628*	−6.986***	−9.391***	−7.375*
	(1.539)	(1.494)	(3.406)	(3.568)	(2.839)	(2.466)	(2.843)	(2.504)	(2.965)	(3.677)
Ethnicity info × Same ethnicity	1.403	1.962	3.492	2.096	3.475	3.101	1.788	2.739	−1.799	−1.739
	(1.616)	(1.487)	(4.527)	(4.525)	(3.066)	(2.485)	(2.598)	(2.410)	(2.328)	(2.475)
Ethnicity info × Same ethnicity × Female	3.509*	2.303	3.509	4.471	0.701	0.907	1.573	−0.601	4.233	3.184
	(1.828)	(1.740)	(5.486)	(5.629)	(2.976)	(2.589)	(3.350)	(3.115)	(3.094)	(3.156)
Religious info × Same religion	2.664	3.694**	2.512	3.252	4.282	5.990**	4.027	4.194	0.686	0.792
	(1.808)	(1.620)	(4.144)	(4.190)	(3.153)	(2.606)	(2.775)	(2.685)	(3.739)	(3.670)
Religious info × Same religion × Female	1.685	0.012	3.289	2.218	0.911	−0.684	−3.692	−4.104	−0.145	−0.596
	(2.095)	(1.901)	(4.919)	(4.853)	(3.399)	(2.804)	(3.478)	(3.191)	(5.252)	(5.327)
Dai	0.555	1.116								
	(1.964)	(2.551)								
Han	0.994	3.642								
	(2.914)	(3.578)								
Hani	−3.939	−5.839**								
	(2.651)	(2.846)								
Constant	27.075***	26.098***	14.459**	10.773**	20.892**	36.018***	41.221***	42.860***	33.302***	26.783**
	(4.818)	(5.065)	(5.909)	(5.239)	(9.186)	(10.823)	(8.965)	(10.416)	(9.706)	(10.365)
Observations	1205	1205	225	225	425	425	320	320	235	235
R^2	0.107	0.249	0.170	0.290	0.076	0.410	0.169	0.337	0.260	0.334
Session FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Religion FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the amount sent by a sender in a round × session. The analysis is based on the participants that at least played once with a different ethnicity in all the five rounds, i.e. 241 senders. Standard errors clustered at the individual level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The geographical closeness and individual characteristics including age, gender, education, marital status, self-perceived relative wealth, and a dummy of being farmer are controlled.

Table A.8
OLS Regression results for the Receiver's transfer with gender interactions.

	(1) Pooled	(2)	(3) Bulang	(4)	(5) Dai	(6)	(7) Han	(8)	(9) Hani	(10)
female	−3.056*	−3.310**	−6.333*	−6.094	−0.326	3.905	−4.101	−3.104	−2.196	−4.028*
	(1.735)	(1.434)	(3.576)	(4.222)	(3.848)	(2.820)	(3.243)	(2.778)	(1.715)	(2.111)
Ethnicity info × Same ethnicity	1.418	1.378	−6.897*	−5.949	−1.879	1.374	7.322	7.092	3.813	2.774
	(2.626)	(2.678)	(3.588)	(3.674)	(4.245)	(4.627)	(7.595)	(7.811)	(4.869)	(4.615)
Ethnicity info × Same ethnicity × Female	−0.320	−0.794	9.305*	8.457	−3.586	−5.782	1.714	1.330	−4.058	−3.323
	(3.173)	(3.196)	(5.050)	(5.043)	(5.308)	(5.579)	(8.469)	(8.644)	(5.423)	(5.287)
Religious info × Same religion	3.834	4.382	−5.287	−5.180	2.076	6.015	13.119**	13.596**	4.150	2.572
	(2.749)	(2.685)	(5.490)	(5.623)	(4.519)	(4.417)	(5.742)	(5.979)	(6.150)	(6.142)
Religious Info × Same religion × Female	−1.407	−2.109	6.783	6.858	−4.865	−8.297	−3.938	−4.509	−6.563	−5.102
	(3.299)	(3.217)	(6.587)	(6.626)	(5.313)	(5.246)	(7.070)	(7.285)	(7.120)	(7.249)
10× Sender's transfer	9.896***	9.288***	9.527***	9.750***	10.544***	9.461***	10.963***	10.717***	5.888***	6.381***
	(0.639)	(0.584)	(1.543)	(1.387)	(1.111)	(1.008)	(1.203)	(1.325)	(1.173)	(1.340)
Dai	0.907	−3.089								
	(1.955)	(2.015)								
Han	1.327	−0.625								
	(2.633)	(2.632)								
Hani	−1.782	−3.064								
	(2.450)	(2.161)								
Constant	4.528	8.225*	12.925*	15.318**	0.482	−0.124	0.187	1.441	−0.278	2.402
	(4.592)	(4.197)	(7.550)	(6.912)	(6.480)	(9.003)	(10.716)	(9.340)	(4.805)	(6.493)
Observations	1147	1147	211	211	411	411	308	308	217	217
R^2	0.384	0.436	0.414	0.439	0.372	0.449	0.441	0.477	0.325	0.354
Session FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Religion FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The dependent variable is the amount sent back by a receiver in a round × session. The analysis is based on the participants that at least played once with a different ethnicity in all the five rounds, i.e. 275 receivers. We further exclude the rounds where the receiver receives zero. Standard errors clustered at the individual level are shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The geographical closeness and individual characteristics including age, gender, education, marital status, self-perceived relative wealth, and a dummy of being farmer are controlled.

Table A.9
OLS regressions explaining contribution levels in the public goods game with gender interactions).

Variables	(1)	(2) Contribution – all rounds	(3)	(4)	(5) Contribution – first round	(6)
One non co-ethnic	−1.431**	−1.181*	−1.040	−0.403	−0.211	−0.0639
	(0.634)	(0.670)	(0.647)	(0.902)	(0.970)	(0.945)
Two non co-ethnics	−0.689*	−0.252	0.0936	−0.229	0.136	0.592
	(0.358)	(0.426)	(0.448)	(0.398)	(0.520)	(0.592)
Three non co-ethnics	1.522	1.428	1.594	1.997	1.729	1.857
	(2.048)	(1.688)	(1.540)	(2.377)	(1.946)	(1.774)
Female	−0.185	−0.168	−0.147	−0.0381	−0.00520	0.0205
	(0.262)	(0.252)	(0.253)	(0.331)	(0.323)	(0.324)
One non co-ethnic × Female	−0.137	0.235	0.226	−1.244	−0.858	−0.803
	(0.912)	(0.923)	(0.895)	(0.904)	(0.973)	(0.947)
Two non co-ethnics × Female	0.239	0.192	0.0134	−0.157	−0.214	−0.434
	(0.379)	(0.368)	(0.379)	(0.501)	(0.493)	(0.504)
Three non co-ethnics × Female	−2.556	−1.881	−1.594	−2.537	−1.751	−1.301
	(2.211)	(1.871)	(1.723)	(2.541)	(2.088)	(1.876)
Sender		0.208	0.302		−0.00614	0.123
		(0.427)	(0.440)		(0.550)	(0.569)
Amount sent × Sender		0.0459***	0.0446***		0.0572***	0.0548***
		(0.0108)	(0.0110)		(0.0144)	(0.0147)
Share sent back × Receiver		1.184***	1.210***		1.380***	1.355***
		(0.380)	(0.375)		(0.474)	(0.462)
Constant	7.428***	6.197***	6.017***	5.768***	4.490***	3.912***
	(0.718)	(0.766)	(0.922)	(0.794)	(0.843)	(1.100)
Observations	2445	2445	2445	489	489	489
R-squared	0.228	0.257	0.269	0.173	0.220	0.244
Individual controls			Yes			Yes

The dependent variable is the tokens contributed by each player in each round. The analysis is based on 489 out of 576 participants, after excluding problematic participants. Standard errors clustered at the group level, shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Session, round, and ethnicity fixed effects are controlled. The individual controls include age, gender, education, marital status, self-perceived relative wealth, a dummy of being farmer, and geographical closeness.

Table A.10
Linear probability model for the likelihood that i punishes j with gender interactions.

	(1)	(2)	(3)	(4)
	Positive contribution gap		Negative contribution gap	
Own contribution	−0.016***	−0.016***	−0.005	−0.005
	(0.005)	(0.005)	(0.005)	(0.005)
Mixed group	0.016	0.016	−0.018	−0.008
	(0.045)	(0.055)	(0.039)	(0.049)
Mixed own ethnic.	−0.051**	−0.050	−0.013	−0.031
	(0.025)	(0.032)	(0.021)	(0.032)
Contri. gap i over j	0.030***	0.030***	0.004	0.004
	(0.004)	(0.004)	(0.004)	(0.004)
Female	−0.049**	−0.048	−0.044**	−0.043
	(0.024)	(0.030)	(0.022)	(0.030)
Mixed group × Female		−0.001		−0.013
		(0.049)		(0.045)
Mixed own ethnic. × Female		−0.003		0.031
		(0.032)		(0.042)
Sender	−0.027	−0.027	−0.066	−0.066
	(0.056)	(0.057)	(0.049)	(0.049)
Amount sent × Sender	0.001	0.001	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Share sent back × Receiver	−0.029	−0.029	−0.026	−0.027
	(0.038)	(0.038)	(0.044)	(0.044)
Constant	0.521***	0.521***	0.470***	0.467***
	(0.118)	(0.121)	(0.123)	(0.127)
Individual controls	Yes	Yes	Yes	Yes
Observations	4504	4504	4524	4524

The dependent variable is whether a player punishes another player in a round×session. The analysis is based on 489 out of 576 participants, after excluding problematic participants. Positive contribution gap refers to the case where player j contributes no less than player i, vice versa. Standard errors are clustered at the group level, shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The round, ethnicity and session fixed effects and individual random effects are controlled. The individual controls include age, gender, education, marital status, self-perceived relative wealth, a dummy of being farmer, and geographical closeness.

A.2. Definition of closeness

- For a pair of players (i,j), if i and j are from the same village group in the sessions running in the rural area or the same church in those in Jinghong city, we consider i and j are known to each other. Formally, if $S_i = S_j$ $(S_i, S_j \in \{VG1, \ldots, VG23, Church1, Church2\})$, i and j know each other.
- Closeness measures the probability that j and i know each other given the revealed information to i about j (T_j, including ethnicity and religion), i.e. $P_{j,i}(S_j = S_i | T_j)$
- In the trust game and the punishment part of the public goods game, the closeness of j for i is measured by:

$$closeness_{j,i} = \frac{\sum_{k\neq i}^{N} \mathbb{1}\{T_k = T_j\} \times \mathbb{1}\{S_k = S_i\}}{\sum_{k\neq i}^{N} \mathbb{1}\{T_k = T_j\}}$$

- In the contribution part of the public goods game, the closeness of the three players js (j_1, j_2, j_3) for i is measured by:

$$closeness_{js,i} = \frac{1}{3} \sum_{m,2,3} \frac{\sum_{k\neq i}^{N} \mathbb{1}\{T_k = T_{j_m}\} \times \mathbb{1}\{S_k = S_i\}}{\sum_{k\neq i}^{N} \mathbb{1}\{T_k = T_{j_m}\}}$$

Table A.11
Linear probability model for the likelihood that i punishes j (excluding 3+1 groups).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Positive contribution gap				Negative contribution gap			
Own contribution	−0.017***	−0.017***	−0.017***	−0.017***	−0.003	−0.004	−0.003	−0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Mixed group	0.009	0.034	0.025	0.032	0.002	−0.002	−0.007	−0.014
	(0.028)	(0.044)	(0.047)	(0.046)	(0.025)	(0.038)	(0.041)	(0.040)
Mixed own ethnic.	−0.048**	−0.048**	−0.043	−0.030	0.002	0.002	0.001	−0.002
	(0.021)	(0.021)	(0.027)	(0.026)	(0.023)	(0.023)	(0.022)	(0.026)
Contri. gap i over j	0.031***	0.031***	0.031***	0.032***	0.003	0.003	0.002	0.006
	(0.004)	(0.004)	(0.004)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)

(*continued on next page*)

Table A.11 (*continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Positive contribution gap				Negative contribution gap		
Mixed group × Gap				0.001				−0.006
				(0.009)				(0.008)
Mixed own ethnic. × Gap				−0.008				−0.002
				(0.009)				(0.008)
Sender		−0.002	−0.017	−0.002		−0.052	−0.070	−0.051
		(0.059)	(0.058)	(0.059)		(0.052)	(0.052)	(0.052)
Amount sent × Sender		0.001	0.002	0.001		0.002	0.002	0.002
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Share sent back × Receiver		−0.014	−0.020	−0.013		−0.033	−0.046	−0.031
		(0.038)	(0.038)	(0.038)		(0.045)	(0.044)	(0.044)
Constant	0.341***	0.322***	0.494***	0.320***	0.241***	0.266***	0.455***	0.274***
	(0.090)	(0.103)	(0.124)	(0.102)	(0.081)	(0.098)	(0.127)	(0.097)
Individual controls			Yes				Yes	
Observations	4204	4204	4204	4204	4236	4236	4236	4236
Number of groups	441	441	441	441	446	446	446	446

The dependent variable is whether a player punishes another player in a round×session. The analysis is based on 454 out of 576 participants, after excluding problematic participants and groups with "3+1" composition. Positive contribution gap refers to the case where player *j* contributes no less than player *i*, vice versa. Standard errors are clustered at the group level, shown in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The round, ethnicity and session fixed effects and individual random effects are controlled. The individual controls include age, gender, education, marital status, relative wealth, a dummy of being farmer, and geographical closeness.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jebo.2021.02.016.

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