Cultural Identities and Resolution of Social Dilemmas*

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Abstract: We report an experiment on payoff-equivalent provision and appropriation games with high-caste and low-caste Indian villagers. A central question is whether caste identities affect resolution of social dilemmas. Making caste salient in the experiment elicits striking changes in behavior compared to the baseline treatment with no information about others' castes. Homogenous groups with high caste subjects are more successful in resolving social dilemmas than homogenous groups with low caste subjects. The success of mixed groups in resolving such dilemmas is somewhere between, which is inconsistent with in-group vs. out-group identity models. Absent salient information on caste, behavior is inconsistent with unconditional social preferences but as predicted by reciprocity.

JEL Classification codes: C93, C70, H41, Z10

I. INTRODUCTION

Our central question is whether information on cultural identities affects resolution of social dilemmas. The identity distinctions we include in our research are among the world's most profound: two thousand year old caste differences that are endemic in rural villages in India. The classic social dilemmas we study are central to research and policy: positive externalities from contributions to public goods and negative externalities from extractions from common pools.

The socio-economic hierarchy of the caste system remains a prominent feature of Indian society, especially in rural India. For a natural study of the caste system in our experiment we chose the environment of rural Indian villages.[1] To maintain control over integrity of the experimental protocol, we chose villages in West Bengal so that one of the coauthors who speaks Bengali could personally conduct the experiment.[2] Previous studies have reported caste identity effects on behavior when information on caste is salient (Hoff and Pandey 2006, Fehr et al. 2008).[3] Even in Kerala, a reportedly progressive Indian state,

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[1] The strength of the Indian caste system can be witnessed even in urban environments in areas such as marital matching (Dugar, Bhattacharya and Reiley, 2012).

[2] Most villagers did not speak English and some (52 out of 808) were illiterate in Bengali. The experiment was conducted verbally in Bengali.

[3] In an experiment in rural Uttar Pradesh, Hoff and Pandey (2006) find no inter-caste performance difference while solving puzzles in a no-caste information case yet public revelation of caste led to a 20 percent drop in performance among lower caste subjects. Fehr et al. (2008) find that high caste

prominent disparity is found among some low caste groups (Deshpande, 2000). In this paper we focus on caste effects on behavior in economic interactions characterized by social dilemmas.

A social dilemma exists when actions motivated by individual incentives produce sufficiently strong externalities on others to render such actions inefficient. Social dilemmas arise with positive externalities from contributions in a provision game and negative externalities from extractions in an appropriation game. One important question is whether under-provision in a provision game is a more or less serious problem than over-appropriation in an appropriation game. Phrased in this way, the question has no general answer because the feasible actions and payoffs in the provision and appropriation games may not be the same. We ask more specific questions that do have answers. In *payoff-equivalent* provision and appropriation games: (1) is under-provision a more or less serious problem than over-appropriation and (2) is resolution of social dilemmas affected by salient information about caste identities.

Cox, Ostrom, Sadiraj, and Walker (2013) addressed the first question using two types of payoff-equivalent provision and appropriation games.[4] They conducted their experiment with a convenience sample of undergraduate subjects at American universities. We here use the same types of social dilemma games to research how Indian caste identities affect efficiency of play in provision and appropriation games with asymmetric power.

We report results from asymmetric-power, sequential provision and appropriation experiments that directly reveal economic surplus foregone or destroyed by failure of cooperation. We compare the behavior of West Bengali villagers in a baseline treatment with no information provided about others' castes to behavior in several treatments in which caste configurations of groups are made salient.

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subjects in rural Uttar Pradesh are more likely to inflict punishment when the norm violator belongs to a low caste.

[4] In Cox et al. 2013 two types of payoff-equivalent provision and appropriation games are implemented as: (a) simultaneous-move, symmetric-power games; and (b) sequential-move, asymmetric-power games. Their sequential-move games include treatments in which the second mover observes the first movers' contributions in the provision game or extractions in the appropriation game and, subsequently, may choose to increase efficiency of the final allocation or reduce it, possibly to zero.

By design, the provision game and the appropriation game in our study are payoff equivalent, therefore behavior is predicted to be the same *across the two games* by conventional models of social preferences regardless of whether they are spiteful (Fehr and Schmidt 1999; Bolton and Ockenfels 2000) or altruistic (Andreoni and Miller 2002; Cox and Sadiraj 2007). In contrast, reciprocal preferences theory (Cox, Friedman, and Sadiraj 2008) predicts more altruistic (or less spiteful) behavior by second movers in a provision game than in a payoff-equivalent appropriation game at any information set. Furthermore, in-group vs out-group theory predicts second mover's allocation to the group fund (in either a provision or appropriation game) is: (a) always at the minimum feasible when low and high castes interact, and (b) game invariant in the two payoff-equivalent games. We test hypotheses derived from the alternative models.

The rest of the paper is organized as follows. Section II provides an exposition of payoff equivalence between the provision and appropriation games. Section III reports implications of alternative theoretical models for these games. Section IV explains the experimental design and protocol. Section V compares and contrasts behavior of villagers who are *not* informed about other participants' castes or are informed of alternative homogeneous or heterogeneous caste compositions of subjects. Section VI concludes.

II. PAYOFF-EQUIVALENT PROVISION AND APPROPRIATION GAMES

We report experiments with the "king" versions of the provision game and appropriation game included in Cox, et al. (2013).

A. Provision game

This game has n players consisting of n-1 first movers and one second mover. The first movers simultaneously choose how much to provide, p_j to a Group Fund from their endowments in their Individual Funds. Each individual is endowed with e "tokens" in her Individual Fund and can allocate any portion of it (in integers) to the Group Fund. Contributions to the Group Fund create surplus; each token added to the Group Fund decreases the value of the Individual Fund of the contributor by 1 rupee and Increases the value of the Group Fund by m rupees, $n > m > 1$.

After observing the first movers' choices, the second mover (player s) can choose to contribute any non-negative number of tokens up to his endowment, e to the Group Fund. Alternatively, the second mover can choose to take (in integer amounts) any part of the tokens previously contributed by the n-1 first movers. Thus, the second mover's feasible set is $\Psi^{pg} = \{-\sum_{j \neq s} p_j, -\sum_{j \neq s} p_j + 1, \cdots, 0, 1, \cdots, e\}$.

Let $\boldsymbol{p} = (p_1, \cdots, p_n)$ denote the vector of numbers of tokens contributed to the Group Fund good by the n players.[5] The payoff to player i in the provision game equals the amount of her endowment, e less the amount contributed to the Group Fund, p_i plus an equal (1/n) share of m times the amounts contributed to the Group Fund by all players:[6]

$$(1)\quad \pi_i^{pg}(\boldsymbol{p}) = e - p_i + m\sum_{j=1}^{n} p_j / n$$

B. Appropriation game

The game has n players consisting of n-1 first movers and one second mover. The Group Fund is endowed with ne tokens worth m rupees each, for a starting total value of mne rupees. The first movers simultaneously choose how much to appropriate from the Group Fund. Each first mover can choose an amount, z_j from the feasible set $\{0, 1, \cdots, e\}$ to appropriate from the Group Fund. Extractions from the Group Fund destroy surplus; each token removed from the Group Fund increases the value of the Individual Fund of the appropriator by 1 rupee but reduces the value of the Group Fund by m rupees where, as above, $n > m > 1$.

After observing the first mover choices, the second mover decides how many of the remaining $ne - \sum_{j \neq s} z_j$ tokens to appropriate. The second mover (player s) chooses an amount z_s to extract from the feasible set $\Psi^{ag} = \{0, 1, \cdots, e, \cdots, ne - \sum_{j \neq s} z_j\}$.

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[5] We use bold letters for vectors.

[6] Note the asymmetry between the most selfish choices for the first and second movers. The most selfish choice for a first mover is 0 whereas it is $-\sum_{j \neq s} p_j \leq 0$ for the second mover.

Let **z** denote the vector of numbers of tokens appropriated from the Group Fund by the *n* players. The payoff to player *i* equals the number of tokens he appropriates from the Group Fund plus an equal (1/*n*) share of the remaining value of the Group Fund after the appropriations by all players (which is *m* times the total number of tokens *left in* the Group Fund by all players):[7]

$$(2)\ \pi_i^{ag}(\mathbf{z}) = z_i + m(ne - \sum_{j=1}^{n} z_j)/n$$

C. Payoff Equivalence

The provision and appropriation games are constructed to be payoff equivalent. Indeed, for each vector of appropriations, $\mathbf{z}$ transferred to Individual Funds in the appropriation game there exists a vector of provisions, $\mathbf{p}(=\mathbf{e}-\mathbf{z})$ transferred to the Group Fund in the provision game such that the payoff to any player is the same in both games.[8]

III. IMPLICATIONS OF ALTERNATIVE THEORIES FOR PROVISION AND APPROPRIATION GAMES

Several testable hypotheses, for social preferences as well as in-group vs. out-group preferences, will be derived in this section. For unconditional (social or *homo economicus*) preferences, the payoff equivalent provision and appropriation games are also strategically equivalent and therefore efficiency is the same in the two game forms. Because the first movers' choices are known to the second mover, the latter's choice can be modeled as determining the final amount of a public good (Varian 1994). First movers' amounts *put in* (provision game) or *left in* (appropriation game) the Group Fund serve as "income" (in the budget constraint) for the second mover. The second mover's final choice of allocation to the Group Fund (as a normal good) then increases in income, i.e., in first movers' total Group Fund allocation.

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[7] The maximum extraction for a first mover is e whereas for the second mover is $ne - \sum_{j \neq s} z_j \geq e$.

[8] Use statements (1) and (2) to verify that $\pi_i^{pg}(\mathbf{e}-\mathbf{z}) = \pi_i^{ag}(\mathbf{z})$ for all $i = 1, \cdots, n$.

Group Composition and Altruism. Consider two groups of individuals, say, group 1 and group 2. Suppose that individuals in group 2 are sufficiently more altruistic than individuals in in group 1.[9] The question we ask is: How does efficiency of play vary when first and second movers come from the same group or from different groups?

Revealed Altruism. Next, suppose that an individual's preferences are affected by others' actions. What are implications of reciprocal preferences (Cox, Friedman, and Sadiraj 2008) for play across games? Proposition 1 provides theoretical statements that are informative for these questions and are empirically testable; proofs are relegated to Appendix I.

Proposition 1. Let group 2 be sufficiently more altruistic than group 1. In payoff-equivalent, sequential provision and appropriation games, efficiency of play:

1. Between games is:
   a. game invariant for unconditional preferences
   b. higher in the provision game for reciprocal preferences
2. Within a game is:
   a. largest when all first and second movers are from group 2
   b. smallest when all first and second movers are from group 1
   c. somewhere between when first and second movers are from different groups.

Proof: See Appendix I.

Our first testable hypotheses for play efficiency across games come from Proposition 1.1. Part 1.1a provides the null hypothesis for efficiencies across games whereas revealed altruism theory (part 1.1b) provides an alternative hypothesis. That is:

Hypothesis 1.N: Efficiency of play is the same in payoff-equivalent, sequential provision and appropriation games.

[9] We say that a type 2 player (from Group 2) is *sufficiently* more altruistic than a type 1 player (from Group 1) if the positive (type 2 – type 1) difference between the demands for the public good of the two types increases with income.

Hypothesis 1.A: Efficiency of play is higher in the sequential provision game than in the payoff-equivalent sequential appropriation game.

In our second hypothesis we keep the game fixed and look at effects of group composition on efficiency of play for groups with different levels of altruism. It follows from parts a-c of Proposition 1.2 that:

Hypothesis 2: In either game, efficiency is:

a. Highest (lowest) in the more (least) altruistic homogenous group;
b. Somewhere between in a mixed-caste group.

Next, we look at implications of a group identity model developed in Appendix I. Let the population be composed of two distinct groups of individuals. We assume that people care not only about their own Individual Fund but also about externalities: positive when providing to the Group Fund or negative when appropriating from it. Following literature on modeling in-group vs out-group attitudes[10] we assume that individual preferences over externalities are characterized by *goodwill* towards *insiders* (one's own caste) but by *animosity* towards *outsiders* (another caste). We call such preferences "identity-contingent" and model them with individuals' utilities increasing in insiders' payoffs but deceasing in outsiders' payoffs. These identity-contingent preferences are game-invariant, and therefore the first implication is that play be the same in the payoff-equivalent provision and appropriation games. In the case of cross-caste play by mixed groups in our experiment, all first movers are from the same cast whereas the second mover is from a different cast. It follows from animosity towards outsiders in mixed groups, and $m/n < 1$, that the second mover's optimal decision is to take all tokens in the Group Fund. Hence in subgame perfect equilibrium it is optimal for the first movers to provide nothing or appropriate everything in cross-caste play with mixed groups.

[10] Seminal papers on social identity include Tajfel and Turner (1979), Akerlof and Kranton (2000), and Benabou and Tirole (2006). Experiments on social identity include Eckel and Grossman (2004), Hoff and Pandey (2006), Chen and Li (2009), and Eaton, Eswaran, and Oxoby (2011).

Proposition 2: Identity-contingent preferences imply:

1. Efficiency of play is game invariant for any given group composition of first movers and second mover;
2. Null final allocation to the Group Fund when second mover is from different group than first movers.

Proof: See Appendix I.

An implication of Proposition 2.1 is the same as the one stated in Hypothesis 1.a above. An implication of Proposition 2.2 (within-caste favoritism) offers an alternative to Hypothesis 2.b, which is our last hypothesis.

Hypothesis 3: Efficiency is lower in mixed-caste play than in homogeneous-caste play.

IV. EXPERIMENTAL PROTOCOL

A. Experimental Treatments

The treatments in this experiment cross the provision or appropriation game form with caste configurations in a 2 X 5 design. The caste configurations are as follows:

1. No caste information ("No-Info")
2. Three high caste first movers and one high caste second mover ("High-High")
3. Three high caste first movers and one low caste second mover ("High-Low)
4. Three low caste first movers and one high caste second mover ("Low-High")
5. Three low caste first movers and one low caste second mover ("Low-Low")

B. Procedures

We have a total of 808 subjects: 788 of them are Hindu (434 low-caste and 354 high-caste) and 20 are Muslim.[11] Each subject participated in only one treatment. Twenty-one experimental sessions were conducted with each session lasting 3-4 hours. Each experimental session was planned for approximately 40 subjects; however some sessions had 44-48 subjects and one session had 32 subjects. The sessions were conducted in West Bengal, India with assistance from three Non-Government Organizations (NGOs).[12] At each village, volunteers from the NGO visited people's homes a few days before the experiment and read aloud the invitation script written by us (in Bengali). The volunteers invited only one individual from each family.

At the beginning of each session, the experimenter (U. Sen) was introduced to the assembled participants by the Secretary of the NGO and thereafter she read aloud (in Bengali) the consent form for the subjects. Subjects indicated their willingness to participate by either signing the form or putting in a thumb print (for subjects unable to read or write). Information on caste was collected and used in treatment group assignments. Other demographics (such as years of education, gender, marital status) were also collected. Every subject was a member of a four-person group and made only one decision.

After the experiment began, the experimenter read the instructions in Bengali and answered questions. An individual subject's decision was recorded privately in a separate room by the experimenter. The final payment at the end of the experiment was handed out to each subject privately and separately. Each subject was paid according to what decision he or she had made in the experiment as well as the decisions made by the other group members in addition to the Rs 50 show-up fee.

In each of the five provision game treatments, each individual was endowed with Rs150 in an Individual Fund. The first movers' decision task was whether to move money from their Individual Funds to the Group Fund. Each of the three first movers could

[11] Our "High Caste" grouping includes Brahmins, Kshatryias, and Vaishyas while our "Low Caste" grouping includes Sudras and Untouchables. All 20 Muslim subjects participated in the No Information treatment.
[12] Locations for the West Bengal experiments were: (1) Sagar Island, South 24 Parganas, West Bengal, (2) Panarhat, Falta area, South 24 Parganas, West Bengal, and (3) Jharkhali, Canning & Basanti block, South 24 Parganas, West Bengal.

contribute anything from zero to Rs150 (their entire endowment) to the Group Fund in increments of Rs15.[13] Any amount of money moved to the Group Fund reduced the value of the decision maker's Individual Fund by that amount and increased the value of the Group Fund by three-times that amount. The second mover could contribute some or all of her own Rs150 Individual Fund endowment to the Group Fund or she could withdraw some or all of the contributions of the three first movers.

In each of the five appropriation game treatments, a group was endowed with Rs1,800 in their Group Fund. The choice of each individual was whether to move money from the Group Fund to his or her Individual Fund. A first mover could move any amount from 0 to Rs150 into her Individual Fund in increments of Rs15. Any amount of money appropriated from the Group Fund increased the value of the Individual Fund by that amount and reduced the value of the Group Fund by three-times that amount. The second mover could withdraw none, some, or the entire amount left in the Group Fund by the first movers.

In both provision and appropriation treatments, an individual's earnings equal the end value of his Individual Fund plus one-fourth of the end value of the Group Fund. Note that the above amounts of money are economically significant: the minimum wage for unskilled workers in West Bengal at the time of this study was Rs110-130 *per day*.[14] Subjects were informed about the (single blind) payoff procedures. Further details on the procedures used in conducting the experiment are reported in Appendix II.

V. HOW SALIENT CASTE INFORMATION AFFECTS BEHAVIOR

A central question is the effect of salient information about caste identity on cooperation in the presence of positive or negative externalities. What effect does knowledge of other players' castes have on the ability of group members to generate surplus in a provision game or not destroy latent surplus in an appropriation game?

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[13] The Rs15 unit of divisibility was chosen in order to make the feasible set of choices in India the same as in an earlier experiment in the U.S. (Cox, et al., 2013) in which a subject could choose an integer from {0,1, …,10} when deciding on the number of dollars to transfer between accounts.

[14] Source: http://labour.nic.in/wagecell/Wages/WestBengalWages.pdf

We will report outcomes from experimental treatments with a measure of efficiency of play. The minimum possible payoff to a group of subjects in a provision or appropriation game is *ne*, where *n* is the number of subjects and *e* is the Private Fund endowment of each subject in the provision game. The actual payoff to subject *i* is π_i. Hence the actual surplus to a group *generated by playing* a provision or appropriation game is $\sum_{i=1}^{n} \pi_i - ne$. The maximum possible group payoff in either type of game is *mne*, where *m* is the multiplier on Group Fund contributions in the provision game and *mne* is the value of the Group Fund endowment in the appropriation game. The maximum possible surplus that can be *generated by playing* a game is $mne - ne$. Hence, the observed efficiency of play is:

$$(3)\ \alpha = 100 \times \frac{\sum_{i=1}^{n} \pi_i - ne}{mne - ne}$$

A. Caste-Uninformed Play

We first compare behavior in the two payoff-equivalent games by subjects who are not informed about caste(s) of others in their game. Data suggest strong game form effects on efficiencies, with provision games eliciting more cooperative behavior than appropriation games. As shown in the first row of Table 1, the (mean) efficiency in the provision game is 44.9% (21 groups) for the No Caste Information provision game treatment. In contrast,

<Table 1 about here>

in the No Caste Information appropriation treatment the (mean) efficiency is about half as much, 20.7% (18 groups). Our data reject game invariance efficiency (Hypothesis 1N) in favor of provision game eliciting more cooperation than the appropriation game (Hypothesis 1A).[15] Our first finding is:

[15] The null hypothesis of observed efficiencies in the two games being drawn from the same distribution is rejected at 1% level of significance; p-values are 0.002 for the Kolmogorov-Smirnov test and 0.006 for the Mann-Whitney test.

> *Result 1:* Inefficiencies from social dilemmas are more severe in the appropriation game than in the payoff-equivalent provision game for caste-*uninformed* villagers.

Interestingly, this appropriation vs. provision game effect for caste-uniformed villagers is similar to the finding for student subjects at American universities reported by Cox, Ostrom, Sadiraj, and Walker (2013).

Before we examine behavioral effects of making information on caste identity salient, we inquire on levels of generosity across high and low caste villagers in the No-caste Information treatments using the tobit estimator. [16] The list of explanatory variables includes decision maker's caste (High caste dummy), game form (Appropriation dummy), interaction of the two (Appropriation x High), gender (Male), marital status (Married dummy) and two education levels: Lower education (less than 7 years of study) and Higher education (more than 10 years of study).

Using first mover data,[17] the tobit estimated coefficient for High caste rejects the null hypothesis of similar generosity (trust and/or altruism) in favor of higher generosity for high caste villagers: 64.89 (one-side p-value=0.054). Another significant variable is marital status (68, p-value=0.048 for Married). The tobit regression for second mover choices[18] (nobs. = 33, 9 left-censored, 13 right-censored) adds the sum of first movers' choices to the list of explanatory variables used in the FM tobit. Tobit estimate of High (caste second mover) coefficient is not significantly different from 0 (-107, p-value=0.603). Significant variables for second movers' decisions are game form (-368, p-value=0.077 for Appropriation dummy) and education (-413, p-value=0.037 for Lower education dummy). It should also be noted that the null hypothesis of no effect of sum of first movers' choices is rejected in favor of a positive effect as the tobit estimated coefficient for it is 1.11 (one sided p-value=0.059).

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[16] Data from Muslim villagers (14 first movers and 6 second movers) are not included.

[17] Total number of observations is 103; 32 left-censored (at 0) and 26 right-censored (at 150). Data from 14 (Muslim) first movers who were not Hindu are not included for better comparability across treatments.

[18] Dependent variable is the final amount left in the Group Fund. Total number of observations is 33; 9 left-censored (at 0) and 13 right-censored (at 150 plus sum of first movers' choices). Data from 6 (Muslim) second movers who were not Hindu are not included.

B. Within-Caste and Between-Caste Play

Behavioral responses to making information on caste salient is provided in Table 1. The Efficiency columns show how the efficiency of play between games, given by equation (3), varies with subject caste configurations. The First Mover Total columns report the total number of tokens allocated to the Group Fund by (the three) first movers whereas the Second Mover Final columns show the number of tokens in the Group Fund after the second movers make their choices.[19] Figures in parentheses are standard deviations. Entries in each column correspond to play across different caste compositions within the same game. The largest and the smallest values in each column are in bold. To help visual detection of any patterns on realized efficiency, Figure 1 displays efficiency distributions for each of the five caste-composition treatment and the two games.

Caste Effect. Visual inspection of the left panel (provision game) in Figure 1 reveals that compared to the no-caste information (solid line) efficiency distribution in the homogenous low-caste treatment (short-dashed line) is a shift-left but in the homogenous high-caste treatment (long-dashed line) is a right-shift. Similar patterns appear in the right panel (appropriation game) but performance in the baseline appears to be closer to the play of homogenous low caste groups. Average efficiencies are above 55 percent in the homogenous high caste groups (High-High row in Table 1), but below 17 percent in homogenous low caste groups (Low-Low row in Table 1); efficiencies in the mixed-caste groups are somewhere between. Mann-Whitney test rejects the null hypothesis of equal efficiency between homogenous and mixed groups in favor of: (1) *higher* efficiency in the homogenous high-caste groups (p-value is 0.018), and (2) *lower* efficiency in the homogeneous low-caste groups (p-value is 0.002).[20] Note that efficiency in mixed-caste groups being larger than in homogeneous low-caste is inconsistent with the group-contingent preferences (Hypothesis 3); the pattern is consistent with Hypothesis 2 if high-

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[19] Recall that the value of the Group Fund in rupees is three times the total number of tokens in the Group Fund.

[20] When conducting this test we pool data from both games. The mean efficiencies are 0.57 (33 observations, High-High), 0.17 (46 observations, Low-Low) and 0.39 (84 observations, mixed groups).

caste villagers are more altruistic than low-caste villagers, a supposition that seems to be supported by our data.[21] We conclude that:

Result 2a. Homogenous groups with high caste subjects are more successful in resolving social dilemmas than homogenous groups with low caste subjects. The success of mixed groups in resolving such dilemmas is somewhere between.

<Figure 1 about here>

Game effect. Absent information on caste the provision game elicits more cooperation than the appropriation game, as summarized in Result 1. But providing information on caste identity seems to mute any game effects; for all homogeneous and mixed caste compositions, play efficiencies across provision and appropriation games in our experiment are similar.

Result 2b. Resolutions of social dilemmas by caste-informed villagers are similar across provision and appropriation games.

There is some evidence, however, for a game effect. Mixed groups have higher efficiency than No-caste Information groups in the appropriation game but not in the provision game.[22]

These findings on play efficiencies raise some additional questions. Are high caste subjects better at resolving social dilemmas because of a higher level of trust? Or is it due to different social norms (reciprocity, altruism) among villagers from different castes? We next turn our attention to the effect of information about caste on first mover and second mover actions.

C. Effects of Caste Information on First Mover Behavior Across Games

[21] See Table 2 (first row) and Table 4 (second row), model specification (3).
[22] Compare the low of 20.7 percent, absent caste information, to 38.7 percent for the *pooled* (High-Low and Low-High) mixed caste groups; these differences are significant according to Mann-Whitney test (p-value= 0.061).

Final Group Fund allocation increases in total contributions of first movers when the Group Fund is a normal good[23] making trusting or altruistic behavior of first movers vital for resolution of social dilemmas. For game comparison purposes we consider the decisions of FMs as the token amounts allocated to the Group Fund in the provision game or token amounts left in (not extracted from) the Group Fund in the appropriation game. Aggregated figures (means and standard deviations) of the first movers are reported in the middle two columns of Table 1. In provision games, average total amounts contributed by FMs vary from a low of 192 (out of 450, or 43%) in the Low-High treatment to a high of 284 (63%) in the High-Low treatment. In the appropriation game, average total amounts *not* extracted vary from a low of 115 (26%) in the Low-Low treatment to a high of 280 (62%) in the High-High treatment. Kruskal-Wallis rank test rejects the null hypothesis of similar first mover behavior across treatments: p-values are 0.016 (provision) and 0.001 (appropriation). [24]

To control for individual characteristics and get a better understanding of first movers' behavior we look closely at individual level data. Overall, twenty-eight percent[25] (169 out of 606) of first movers allocated 0 to the Group Fund but we also see a comparable figure for high contributions with twenty-seven percent[26] (165 out of 606) of first movers allocating all 150 to the Group Fund. Figure 2 shows distributions of first movers' allocations to the Group Fund across the ten treatments; the top and bottom panels show data for provision and appropriation games, respectively.

<Figure 2 about here>

For any given caste composition (including the No-caste Information control treatment), the number of FMs choosing 0 is larger in the appropriation game than in the provision game, indicating presence of extensive margin effects of game form. Table 2 shows detailed percentage figures on left-censoring (at 0) and right-censoring (at 150) of allocations to the Group Fund across our ten treatments. Tobit estimated coefficients are

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[23] See Appendix I for a theoretical discussion, Table 4 and Appendix III (Figure A.2) for empirical evidence.

[24] Significance increases (p-values are 0.008 (provision) and 0.0002 (appropriation)) if data from caste-uninformed groups are excluded.

[25] 18.27% (provision) and 38.10% (appropriation).

[26] 27.88% (provision) and 26.53% (appropriation).

reported in Table 2. The control treatment is the No-caste Information treatment. The dependent variable is amount put in (provision game) or left in (appropriation game) the Group Fund. The left-censoring and right-censoring are at 0 and 150.

<Table 2 about here>

Caste identity effects in treatments with Information. Caste identity effects on generosity (trust and/or altruism) levels when caste information is made salient are of particular interest. Tobit estimated coefficients reported in Table 2 indicate treatment effects compared to the baseline (No-caste Information); we will discuss implications of these estimates in the following paragraph. First consider the bottom three rows of the table where we report tests on equality of the estimated coefficients across caste information treatments. Entries in these rows are differences between estimated coefficients for model (2) with demographics; for example 48.78 in the High-Low row and left-side Low-High column for the provision game is the difference between 32.524 and -16.256. P-values are reported in parentheses; Holm-Bonferroni adjusted significance levels are marked with asterisks (Holm, 1979). In the appropriation game, Low-Low elicits less generosity than any other treatment.[27] We conclude that:

> *Result 3*. First mover generosity is lowest in the Low-Low appropriation game treatment.

Comparison to No-Information treatment. Table 3 reports average marginal effects for tobit specification (2) in Table 2. The MinChoice column of Table 3 reports average marginal effects of caste identities on probability of positive allocations. The MaxChoice column reports average marginal effects of caste identities on probability of allocations being smaller than 150. Entries in Table 3 are interpreted as follows, using figures reported for the Low-Low treatment for the appropriation game (fourth row, right three columns) as examples. The -0.214 entry in the MinChoice column indicates that, on average, the likelihood of leaving a positive amount in the Group Fund is lower by 21.4 percent in the Low-Low treatment compared to the No-caste Information treatment. The 0.144 entry in the MaxChoice column says that, on average, the likelihood of leaving less than the

[27] See also Figure A.1, top panel for predicted extensive margins with 95% C.I. across treatments.

maximum of 150 in Low-Low treatment is 14.4 percent higher than in the No-caste Information treatment. The -6.637 entry in the Linear column means that uncensored subjects, on average, are predicted to extract about 6.6 more from the Group Fund in the Low-Low treatment then in the No-caste Information treatment. Figures in these three columns show how FM behavior contributes to the low efficiency observed in the Low-Low treatment. The FMs in this treatment are more likely to leave 0, less likely to leave the maximum of 150, and leave less in the Group Fund when their allocations are from the interior of the feasible choice set.

<Table 3 about here>

For the provision game, the High-Low treatment (second row, left three columns of Table 3) shows an opposite pattern of comparison to the No Caste Information treatment. FMs in the High-Low treatment are 8.4 percent more likely to make a positive contribution to the Group Fund, 11.5 percent more likely to contribute the maximum amount, and contribute about 6.4 more, on average, when choosing on the interior of the feasible choice set. These results are summarized by:

Result 4. Making information on caste salient, induces:

a. Lower generosity in the Low-Low appropriation game treatment
b. Higher generosity in the High-Low provision game treatment

Some of the demographic characteristics of subjects have significant effects on FM behavior. In the provision game, compared to villagers with 7 to 10 years of study, subjects with Lower Education (less than 7 years) are less likely to make a positive contribution, less likely to contribute 150, and contribute less when in the interior of the feasible set. Thus, villagers with less than 7 years of study are less generous in the provision game. In the appropriation game, however, trust levels are not significantly different across education levels. The "Lower Education" demographic group is not confounded with low caste; perhaps surprisingly, there is no significant difference between the distributions of educational attainment for the low caste and high caste subject samples in our experiment.[28] This effect of this subject characteristic may reflect low education, *per se*, or low income resulting from low education or some combined effect.[29] Married subjects are more generous; they are more likely to make a positive contribution, more likely to contribute the maximum, and contribute more when in the interior of the feasible set in both games. Finally, when opportunities for surplus creation are available in provision games, contributions, reported in Table 1, are highest among groups with high caste FMs: 284 (High-Low) and 265 (High-High). This pattern is also observed in the presence of surplus destruction prospects in appropriation games with the high caste FMs showing much greater restraint by leaving a larger quantity (280 to a high caste SM and 250 to a low caste SM) in the Group Fund. Pooling all first mover data from the caste information treatments, we find that high caste first movers contribute on average 53 percent more than low caste FMs, indicating higher generosity among high caste villagers. The pattern remains when controlling for demographics. Tobit estimated coefficient for High Caste FM (Table 2, first row, specification (3)) is significantly positive using all of the data.

Result 5. High caste first movers are more generous than low caste first movers.

D. Effects of Caste Information on Second Mover Behavior Across Games

The first movers' total allocation to the Group Fund is known to the second mover when she makes her decision. Furthermore, the total amount put in or left in the Group Fund by the first movers is available to the second mover to allocate between the Group Fund and her Individual Fund; in that way first movers' total allocation is added to the second mover's endowment to determine the budget constraint on second mover's choice. The second mover's choice determines the final level of the Group Fund, which can be characterized as the second mover's "demand" for the public good (Varian 1994). Thus, while generosity of first movers is a necessary condition for efficiency it is not sufficient

[28] Distribution for the low caste first movers is: 26.23% (lower education), 49.07% (base) and 24.69% (higher education). For the high caste first movers these figures are: 29.10% (lower education), 44.03% (base) and 26.87% (higher education). Differences are insignificant according to Pearson test (chi2(2)=1.51, p=0.471).

[29] See Appendix II for difficulties on collecting reliable information on income.

as the second mover can appropriate all there is in the Group Fund, driving efficiency to 0. This is clearly the optimal choice for a selfish individual, but it is also the prediction for socially-oriented individuals with in-group vs. out-group identity preferences in our mixed-cast treatments (Proposition 2.2).

The total first movers' allocation to the Group Fund and the second movers' choices of final amounts of the Group Fund are shown on the horizontal and vertical axes of Figure 3.[30] The horizontal lines at 0 and the upward sloping lines show the lower and upper censoring limits on second movers' choices of final amounts of the Group Fund, respectively, at 0 and 150 plus sum of first movers' contributions. Allocations in the provision games are shown in the top panel and allocations in the appropriation games are shown in the bottom panel of Figure 3. We observe substantial variations in binding censoring limits across caste compositions and game forms, indicating treatment effects at extensive margins. For example, in the provision game for the High-High treatment

<Figure 3 about here>

(top panel, second figure from left) only one observation is at the lower censoring limit of 0 whereas seven observations are at the upward censoring limits (150 plus aggregate FMs allocations). Furthermore, all except two of the observations are at or close to the upward censoring limits. In contrast, consider the appropriation game for the Low-Low treatment in the bottom right figure. Here, there is only one observation at the upper censoring bound while there are seven observations at the lower bound (i.e., leaving nothing in the Group Fund).

The scatter diagrams illustrate why special care needs to be used in regression analysis of the data. Our approach is to use tobit estimator that can accommodate the fixed lower bound at 0 and the variable upper bound. Tobit estimated coefficients are reported in Table 4 whereas average marginal treatment effects are reported in Table 5. The control group is the No-caste Information treatment.

[30] The second movers' choices of final amounts of the Group Fund are also reported in Table 1, but because such choices depend on variable first movers' total allocations it is hard to use these averages for inferences on second mover behavior.

<Table 4 about here>

Tobit estimated coefficients for FM total allocation to the Group Fund for both the provision and appropriation games are positive and highly significant for all models, both with and without treatment dummies and demographics, as shown in the top row of Table 4.[31] These positive estimates reveal that second movers' choice of final amount in the Group Fund increases in "income" (i.e., first movers' total allocation to the Group Fund plus 150).[32] We conclude that:

Result 6. SM's final choice for the Group Fund increases in total allocation of FMs to the Group Fund.

Caste identity effects in treatments with information. Next, we inquire about second mover behavior across treatments with salient information on caste. In the last three rows of Table 4 we report tests for equality of tobit estimated coefficients across four caste composition treatments. P-values are reported in parentheses; Holm-Bonferroni adjusted significance levels are marked with asterisks (Holm, 1979). Data from our experiment indicate significantly higher SM generosity in the homogenous high caste provision game treatment than in the homogenous low caste provision game. That is:

Result 7. Second movers are less cooperative in the Low-Low provision treatment than in the High-High provision treatment.

Comparison to No-Caste Information treatment. Average treatment effects are reported in Table 5 using tobit specification (2) in Table 4. In comparison to the No-caste Information treatment, SMs in the Low-Low provision treatment are 34 percent more likely to appropriate all that is in the Group Fund, 40.5 percent less likely to choose the maximum

[31] While significantly different from 0 neither estimate is statistically different from 1.

[32] For effects at the margins see Figure A.2 in Appendix III. Margins for positive provisions (left figures) and uncensored provision levels (right figures) increase with FM total allocations whereas margins for less than maximum provisions (middle column figures) decrease. These patterns are robust across all treatments but the magnitudes of response depend on caste-composition and game form. We see largest response for High-High (long dashed lines) groups and weakest response for the Low-Low (short dashed lines) provision treatment and No-caste information (solid lines) appropriation treatment.

feasible provision level, and for uncensored provisions, the expected level is 51 tokens less. Qualitatively similar patterns of second mover choices are observed in mixed caste (High-Low and Low-High) treatments. Behavior of SMs in the High-High and No-caste information treatment is similar in the provision game. In contrast, in the appropriation game SMs in High-High are 28.6 percent more likely to refrain from taking everything, 34.3 percent more likely to take nothing, and uncensored takes are, on average, 30.6 tokens less than in the No Caste Information treatment. A qualitatively similar but less significant pattern of SM choices is observed in the Low-High appropriation treatment. We conclude that:

Result 8. Making information on caste salient induces second movers to:

a. Reduce provision in mixed and homogenous low-caste provision game treatments;
b. Appropriate less in homogenous high-caste appropriation game treatment.

<Table 5 about here>

VI. CONCLUDING REMARKS

We experiment with provision and appropriation games that directly reveal economic surplus foregone or destroyed by failure of cooperation. In the provision game, each subject has an endowment in his or her Individual Fund. Amounts transferred to the Group Fund generate surplus. In the appropriation game, the group has an endowment in the Group Fund. Amounts transferred to Individual Funds destroy latent surplus. Our provision and appropriation games incorporate a type of power asymmetry that provides ample opportunity for failure of cooperation. Three first movers simultaneously decide how much to contribute to the Group Fund (provision game) or extract from it (appropriation game). One second mover makes the final allocation to the Group Fund after observing choices made by the first movers. In both games, the second mover can increase or decrease the allocation to the Group Fund by the first movers.

The provision and appropriation games in our experiment are payoff equivalent. They are strategically equivalent for all models of unconditional (selfish or social) preferences as well as for caste-identity-contingent preferences for fixed group compositions (homogenous or mixed). Revealed altruism theory (Cox, Friedman and Sadiraj 2008) predicts specific differences in play between the games: that second movers will behave more altruistically in the provision game than in the appropriation game. Caste-identity-contingent preferences predict null allocation to the Group Fund by mixed-caste groups in both provision and appropriation games. Tests of these predictions reveal the following. Observed play by villagers who are informed about the caste identities of others is inconsistent with in-group and out-group behavior based on caste identity. In the No-Caste Information treatment, observed differences in play of second movers across provision and appropriation games are consistent with the predictions of revealed altruism theory but inconsistent with implications of unconditional (social or selfish) preferences as well as caste-identity-contingent preferences.

Behavioral patterns are heterogeneous in treatments in which the Indian villagers are informed about the caste identities of other subjects. The highest efficiency is obtained in both provision and appropriation games when three high caste first movers are matched with a high caste second mover (High-High treatment). The lowest efficiency is observed in both games when three low caste first movers are matched with a low caste second mover (Low-Low treatment). Within-group behavior by low caste subjects failed to resolve social dilemmas: they forwent 83 percent of available surplus in the provision game and destroyed 84 percent of latent surplus in the appropriation game. In the provision game, low efficiency is implemented through absence of reciprocal altruism by low-caste second movers towards low-caste first movers (Table 5, fourth row). In the appropriation game, low efficiency is triggered by absence of trust and altruism by low-caste first movers towards low-caste second movers (Table 3, fourth row). Similar behavior of low-status groups has previously been observed in many other cultures.

Fershtman and Gneezy (2001) reports an experiment in which Israeli university subjects are identified to each other using names that distinguish Ashkenazic Jews (of European descent) from Eastern Jews (of Asian and African descent). Using the investment game (Berg, et al. 1995), they detected a systematic mistrust toward men of Eastern origin. The systematic mistrust of subjects of Eastern origin was common not only among

Ashkenazic players, but also among Eastern subjects who discriminate against others from their own group.

Hanna and Linden (2012) recruited Indian children to compete for a large financial prize (55.5 percent of the parents' monthly income) by completing exams. Local teachers were recruited to grade the exams. Fictitious "child characteristics" (age, gender, and caste) were randomly assigned to the exams. Authors report no difference in test scores assigned by high caste teachers to exams identified with high caste or low caste students. In contrast, low caste female teachers assigned lower grades to exams identified with low caste students.

In a field experiment on door-to-door solicitation of charitable contributions in North Carolina, List and Price (2009) find that minority male fundraisers raise less money than majority males, majority females, and minority females. By far the least amount of money is donated when minority male fundraisers approach minority households.

In a study of the behavior of high school students in South Africa, Burns (2006) uses Polaroid photos to reveal the race and gender of students paired across schools to play the investment game. She reports that black first movers send significantly lower amounts than white or mixed-race students. Burns finds that black second movers receive significantly lower amounts than those who are white or mixed-race. This difference comes largely from black first-movers, who are substantially less likely to trust black counterparts than others.

In an experiment with undergraduates at American universities, Eckel and Wilson (2006) report results from a discrete form of the investment game in which a first mover chooses to send all or none of their endowment to a paired second mover. The experiment was conducted across two sites: a subject at one site observed the photograph of the paired subject at the other site. Photographs taken during the experiment were subsequently rated for skin tone by a separate set of individuals. Eckel and Wilson report that the likelihood a first mover sends money to a second mover varies by the skin tone of the second mover: subjects with darker skin tones were less likely to receive money. They find no evidence of an in-group/out-group effect: all subjects, including those with darker skin, were less likely to send money to a recipient with darker skin shade.

Pecenka and Kundhlande (2013) report an experiment in South Africa using a dictator game in which a subject can take money from the endowment a paired subject earned during the experiment. Dictators at one university were all black. Non-dictators at another university were about equally divided between black and white. Surnames were used to convey racial identity. The authors report that racial identity significantly affects decisions: black participants on average took 15 percent more from other black participants than from whites.

Cox and Orman (2015) report an Internet experiment with the moonlighting game (Abbink, et al. 2002) involving first-generation immigrants (group I) and native-born Americans (group N). There are four treatments involving the following first mover, second mover matchings: N-N, N-I, I-N, I-I. The data does *not* conform to subjects' discriminating between native-born and immigrant subjects according to an in-group, out-group dichotomy. Native born first movers do *not* send significantly different amounts to immigrant second movers than to native born second movers. Furthermore, when paired with a native born second mover, immigrant first movers do *not* send significantly different amounts than do native born first movers. The highly significant treatment effect comes from the immigrant-immigrant (I-I) matching. Immigrant first movers in the I-I treatment send significantly lower amounts to the immigrant second movers than do first movers in any other treatment. Furthermore, first movers in the I-I treatment are significantly more likely to take money than first movers in any other treatment.

Data from experiments in all of these papers include interactions within and between members of a low status group and a high status group. All experiments were run with subjects from societies with long-standing discrimination against members of the low status group. All experiments produce data inconsistent with in-group vs. out-group discrimination in which members of in-groups favor each other over members of out-groups. Instead, the experiments provide many environments in which members of low status groups are unwilling to choose actions that reflect altruism, trust, or reciprocity towards other low status individuals. These patterns of behavior exhibit a tragedy in which members of a low status group behave as if they accept prejudicial stereotypes about their own group.

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TABLE 1
Effects of Caste Identity on Resolution of Social Dilemmas

	Efficiency		**First Mover Total Allocation**		**Second Mover Final Allocation**	
Treatment	PG	AG	PG	AG	PG	AG
No Caste Info.	0.449	0.207***	220.7	190.8	269.3	124.4***
21 (PG), 18(AG)	(0.241)	(0.322)	(103.3)	(129.7)	(144.8)	(193.2)
High-High	**0.572**	**0.560**	265	**280**	**343.3**	**336**
18 (PG),15 (AG)	(0.256)	(0.408)	(111.1)	(142.6)	(153.5)	(245.0)
High-Low	0.451	0.365	**284.3**	249.6	270.7	219.2
22 (PG),25 (AG)	(0.400)	(0.385)	(128.6)	(136.0)	(240.3)	(231.2)
Low-High	0.302	0.413	**192.4**	212.2	181.5	248
17(PG), 20 (AG)	(0.308)	(0.298)	(122.1)	(132.5)	(184.6)	(179.1)
Low-Low	**0.169**	**0.161**	209.4	**115.5***	**101.7**	**96.75**
26(PG) 20 (AG)	(0.213)	(0.186)	(107.7)	(105.7)	(128.0)	(111.7)

On bold, largest and smallest values in a column. Number of observations for each game are below the treatment name in the first column; St. Dev. in parenthesis; Game effect significant (Mann-Whitney test) at 10% (*), 5% (**), 1% (***).

TABLE 2
Tobit Regression of FM Allocations to the Group Fund

	Provision Game			Appropriation Game		
	(1)	(2)	(3)	(1)	(2)	(3)
High Caste FM			43.263***			62.925***
			(0.000)			(0.002)
High-High	21.914	24.057		56.787*	40.691	
	(0.239)	(0.195)		(0.098)	(0.234)	
High-Low	33.155*	32.524*		45.846	42.629	
	(0.065)	(0.067)		(0.132)	(0.158)	
Low-High	-18.396	-16.256		14.472	1.617	
	(0.328)	(0.384)		(0.651)	(0.959)	
Low-Low	-9.102	-5.019		-76.415**	-83.017**	
	(0.591)	(0.766)		(0.022)	(0.012)	
Lower Education		-25.642*	-25.951**		-25.003	-23.047
		(0.054)	(0.048)		(0.299)	(0.344)
Higher Education		17.591	15.900		12.589	19.204
		(0.261)	(0.302)		(0.639)	(0.475)
Male		-4.941	-3.553		28.313	39.520*
		(0.702)	(0.779)		(0.218)	(0.087)
Married		30.950*	28.616		78.902***	80.549***
		(0.085)	(0.106)		(0.004)	(0.003)
Constant	79.128***	57.000***	47.878**	45.184*	-11.512	-47.560
	(0.000)	(0.009)	(0.013)	(0.053)	(0.739)	(0.124)
Censored Obs.[a]		{57, 168, 87}			{112, 104, 78}	

	nobs	{left, right} censored in %	nobs	{left, right} censored in %
No Info	63	{17.46, 26.98}	54	{40.74, 27.78}
High-High	54	{12.96, 31.48}	45	{26.67, 31.11}
High-Low	66	{18.18, 40.91}	75	{26.67, 32.00}
Low-High	51	{21.57, 17.65}	60	{38.33, 30.00}
Low-Low	78	{20.51, 21.79}	60	{58.33, 11.67}

Model (2)	**High-Low**	**Low-High**	**Low-Low**	**High-Low**	**Low-High**	**Low-Low**
High-High	-8.47	40.31	29.08	-1.94	39.07	123.71***
	(0.647)	(0.038)	(0.102)	(0.951)	(0.236)	(0.000)
High-Low		48.78*	37.54		41.01	125.65***
		(0.010)	(0.027)		(0.163)	(0.000)
Low-High			-11.23			84.63**
			(0.531)			(0.008)

[a]{left, un-, right} censored obs.; All regressors are binary; Control group is no Information treatment; Lower Bound is 0, Upper Bound 150; Lower (Higher) Education is a dummy for less (more) than 7 (10) years of study; pval in parentheses: *** p<0.01, ** p<0.05, * p<0.1. In the bottom three rows, entries are differences in estimated coefficients and Holm-Bonferroni adjusted critical values are used for significance (Holm, 1979).

TABLE 3
Average Marginal Effects on FM Allocations to the Group Fund

	Provision Game			Appropriation Game		
	MinChoice[b]	MaxChoice[c]	Linear[d]	MinChoice[b]	MaxChoice[c]	Linear[d]
Treatment						
High-High	0.065	-0.083	4.725	0.094	-0.094	3.283
	(0.192)	(0.196)	(0.196)	(0.230)	(0.234)	(0.237)
High-Low	0.084*	-0.115*	6.373*	0.099	-0.098	3.440
	(0.070)	(0.066)	(0.069)	(0.159)	(0.149)	(0.160)
Low-High	-0.052	0.048	-3.201	0.004	-0.003	0.130
	(0.386)	(0.380)	(0.383)	(0.959)	(0.959)	(0.959)
Low-Low	-0.015	0.015	-0.989	-0.214***	0.144**	-6.637**
	(0.766)	(0.767)	(0.766)	(0.009)	(0.013)	(0.013)
Demographics						
Lower Education	-0.078*	0.079**	-5.036*	-0.060	0.051	-2.005
	(0.058)	(0.048)	(0.055)	(0.298)	(0.288)	(0.298)
Higher Education	0.044	-0.063	3.435	0.029	-0.027	1.011
	(0.245)	(0.268)	(0.261)	(0.637)	(0.641)	(0.639)
Male	-0.014	0.016	-0.968	0.067	-0.059	2.273
	(0.702)	(0.702)	(0.702)	(0.215)	(0.216)	(0.221)
Married	0.087*	-0.102*	6.064*	0.186***	-0.166***	6.335***
	(0.083)	(0.082)	(0.085)	(0.002)	(0.003)	(0.005)
Observations		312			294	
Censored Obs.[a]		(57, 168, 87)			(112, 104, 78)	

[a](left, un-, right) censored obs.; [b]Pr(FM Choice>0); [c]Pr(FM Choice<150); [c]E(FM Choice | uncensored). All regressors are binary; Control group is no Information treatment; Lower Bound is 0, Upper Bound 150; Lower (Higher) Education is a dummy for villagers with less (more) than 7 (10) years of study; pval in parentheses; *** p<0.01, ** p<0.05, * p<0.1

TABLE 4
Tobit Regression of SM Final Allocations to the Group Fund

	Provision Game			**Appropriation Game**		
	(1)	(2)	(3)	(1)	(2)	(3)
FM Choice Sum	0.965***	0.948***	0.968***	1.299***	1.349***	1.427***
	(0.001)	(0.002)	(0.004)	(0.000)	(0.000)	(0.000)
High Caste SM x			0.374			0.112
FM Choice Sum			(0.178)			(0.742)
High-High	6.703	4.117		345.528**	343.921**	
	(0.949)	(0.969)		(0.026)	(0.035)	
High-Low	-157.709	-178.374*		129.593	124.338	
	(0.131)	(0.091)		(0.308)	(0.341)	
Low-High	-189.082*	-219.083**		220.102*	217.966	
	(0.079)	(0.050)		(0.094)	(0.103)	
Low-Low	-341.304***	-359.906***		73.734	94.566	
	(0.001)	(0.001)		(0.578)	(0.491)	
Lower Education		-85.440	-100.401		-94.260	-83.858
		(0.240)	(0.207)		(0.369)	(0.434)
Higher Education		7.545	-7.872		-11.894	-14.933
		(0.943)	(0.944)		(0.907)	(0.887)
Male		17.366	-25.549		-61.745	-56.103
		(0.804)	(0.738)		(0.475)	(0.531)
Married		128.566	27.293		27.213	86.957
		(0.202)	(0.797)		(0.788)	(0.398)
Constant	168.502*	111.355	19.239	-212.439*	-183.798	-108.858
	(0.088)	(0.429)	(0.893)	(0.077)	(0.205)	(0.376)
Censored Obs.[a]		{25, 46, 33}			{31, 36, 31}	
	nobs	**{left, right} censored in %**		**nobs**	**{left, right} censored in %**	
No Info	21	{ 9.52, 52.38}		18	{40.44, 22.22}	
High-High	18	{ 5.56, 38.89}		15	{26.67, 66.67}	
High-Low	22	{36.36, 40.91}		25	{32.00, 40.00}	
Low-High	17	{23.53, 17.65}		20	{20.00, 30.00}	
Low-Low	26	{38.46, 11.54}		20	{35.00, 5.00}	
Model (2)	**High-Low**	**Low-High**	**Low-Low**	**High-Low**	**Low-High**	**Low-Low**
High-High	182.49	223.20	364.02***	219.58	125.96	249.36
	(0.084)	(0.047)	(0.001)	(0.122)	(0.392)	(0.110)
High-Low		40.71	181.53		-93.63	29.77
		(0.704)	(0.063)		(0.433)	(0.816)
Low-High			140.82			123.40
			(0.165)			(0.339)

[a]{left, un-, right} censored obs.; With the exception of FM Choice Sum, all regressors are binary; Control is no Info treatment; Lower Bound (0), Upper Bound (FM Choice Sum +150); Lower (Higher) Education dummies for villagers with less (more) than 7 (10) years of study; pval in parentheses; *** p<0.01, ** p<0.05, * p<0.1. In the bottom three rows, entries are differences in estimated coefficients and Holm-Bonferroni adjusted critical values are used for significance (Holm, 1979).

TABLE 5
Average Marginal Effects on SM Final Allocations to the Group Fund

	Provision Game			Appropriation Game		
	MinChoice[b]	**MaxChoice[c]**	**Linear[d]**	**MinChoice[b]**	**MaxChoice[c]**	**Linear[d]**
Treatment						
High-High	0.002	-0.006	0.551	0.286**	-0.343**	30.581**
	(0.969)	(0.969)	(0.969)	(0.023)	(0.026)	(0.038)
High-Low	-0.135*	0.231*	-24.876*	0.118	-0.109	11.263
	(0.095)	(0.075)	(0.086)	(0.340)	(0.327)	(0.342)
Low-High	-0.176*	0.278**	-30.743*	0.197*	-0.205*	19.629
	(0.057)	(0.035)	(0.050)	(0.099)	(0.088)	(0.113)
Low-Low	-0.340***	0.405***	-51.096***	0.090	-0.081	8.576
	(0.000)	(0.000)	(0.001)	(0.485)	(0.485)	(0.492)
Demographics						
Lower Education	-0.077	0.095	-12.029	-0.080	0.088	-8.372
	(0.236)	(0.233)	(0.239)	(0.367)	(0.352)	(0.368)
Higher Education	0.006	-0.009	1.049	-0.010	0.012	-1.049
	(0.942)	(0.943)	(0.942)	(0.907)	(0.906)	(0.907)
Male	0.015	-0.019	2.434	-0.052	0.059	-5.470
	(0.803)	(0.803)	(0.804)	(0.470)	(0.470)	(0.474)
Married	0.113	-0.144	18.023	0.023	-0.026	2.411
	(0.195)	(0.190)	(0.199)	(0.787)	(0.787)	(0.787)
Censored Obs.[a]		(25, 46, 33)			(31, 36, 31)	
Observations		104			98	

[a](left, un-, right) censored obs.; [b]Pr(SM Choice >0); [c]Pr(SM Choice<FM Choice Sum+150); [c]E(SM Choice | uncensored).With the exception of FM Choice Sum, all regressors are binary; Control group is no Information treatment; Lower Bound is 0, Upper Bound is (FM Choice Sum +150); Lower (Higher) Education is a dummy for villagers with less (more) than 7 (10) years of study; pval in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

FIGURE 1
Efficiencies for Caste and Game Form Treatments

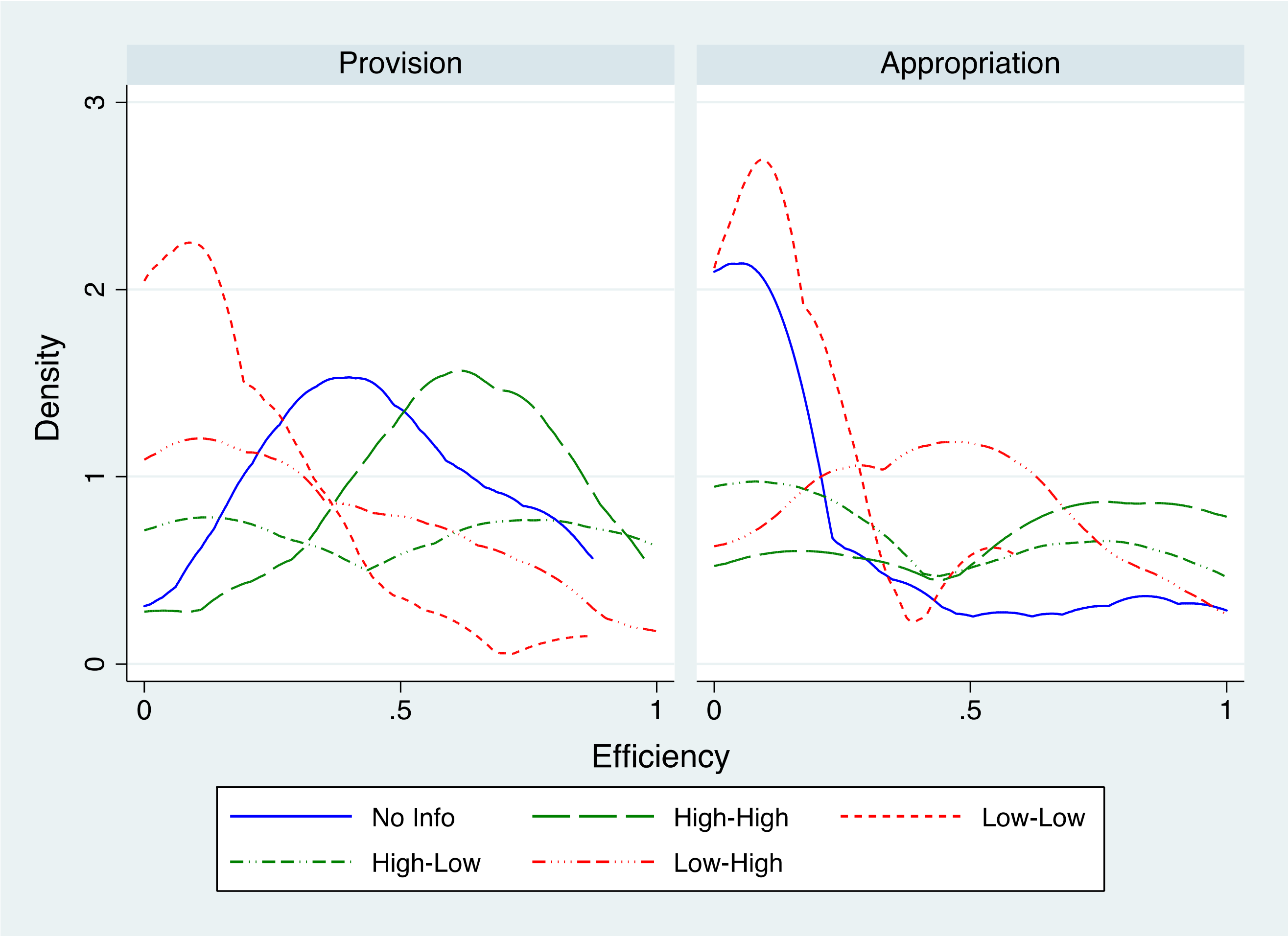


FIGURE 2
First Movers' Choices across Caste and Game Form Treatments

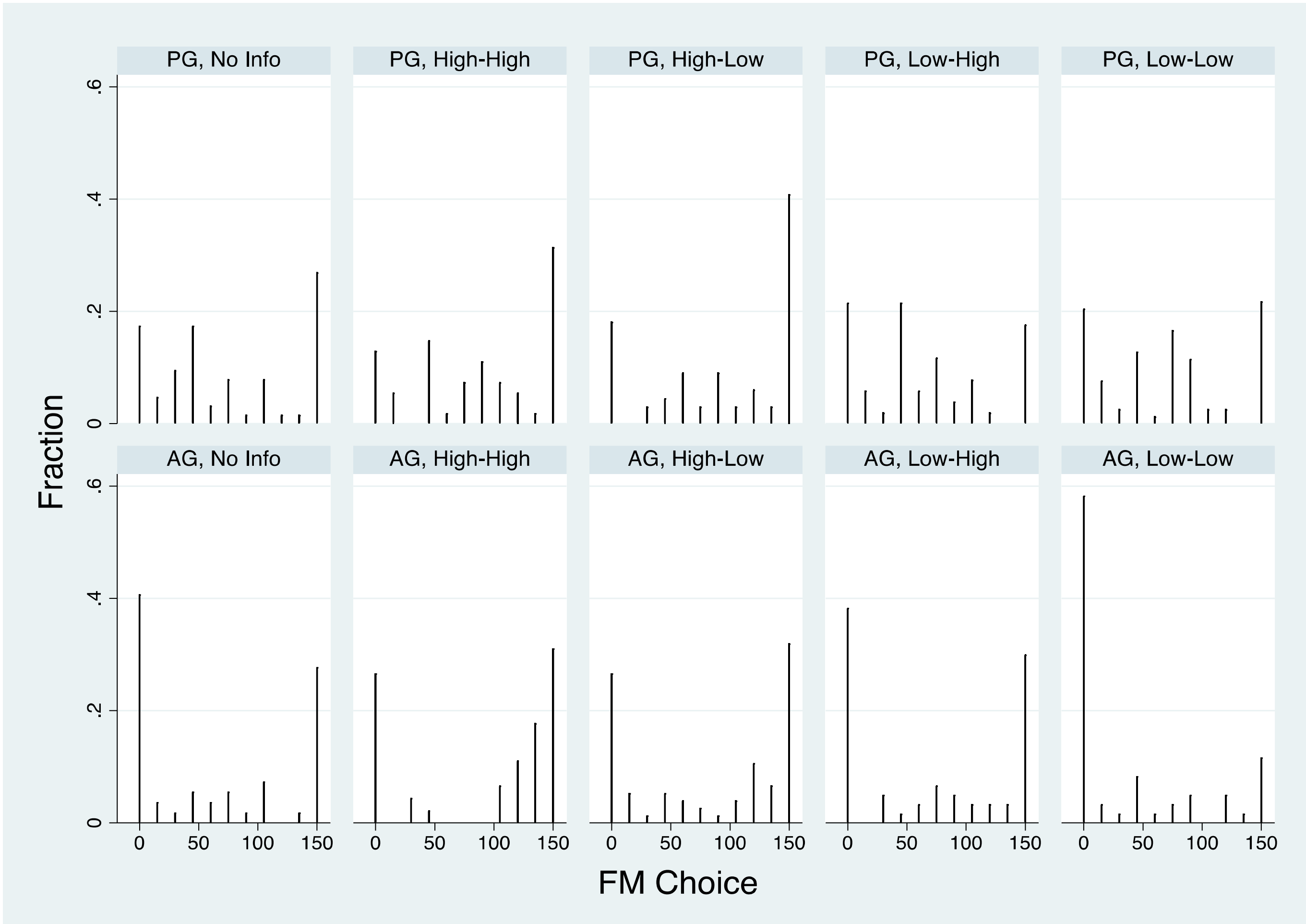
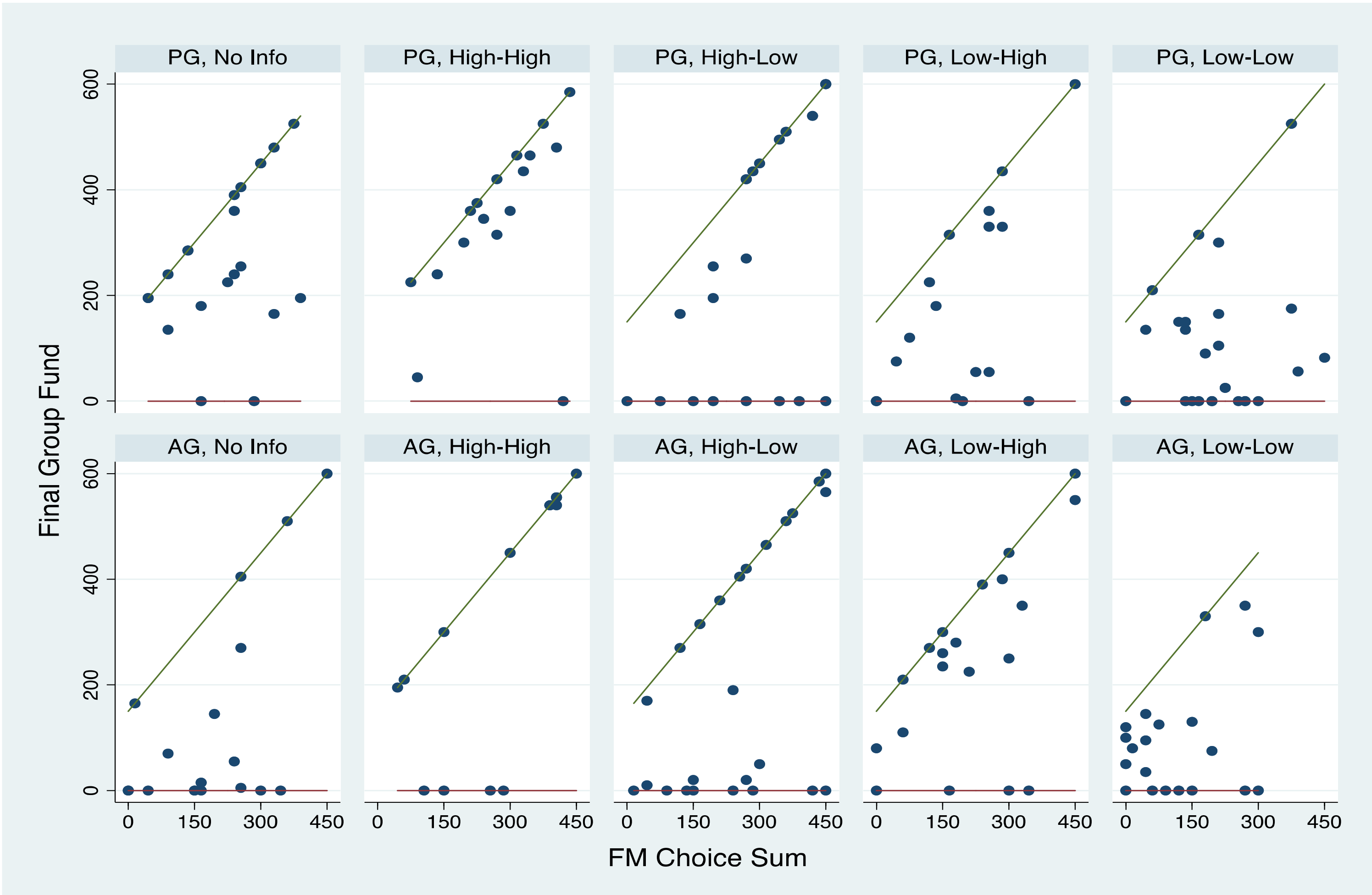


FIGURE 3
Second Mover Choices of Final Group Fund across Caste and Game Form Treatments



APPENDIX I. DERIVATION OF THEORETICAL RESULTS

We will use bold letters for vectors, *s* to index the second mover and capital letters for summations. The initial Individual Fund endowment of each player in the provision game is *e* and the initial Group Fund endowment is 0. In the appropriation game, the initial Individual Fund endowment of each player is 0 and the initial Group Fund endowment is *ne* (and the value is *mne)*. Let *m* denote the (constant) marginal multiplier on any player's allocation to the Group Fund.

Proof of Proposition 1.1

Let $v_i(\cdot)$ represent agent *i*'s convex and monotonic preferences over final payoffs. Let $\boldsymbol{u_i(P, y_i)}$ denote the utility from public good consumption, *P* and private good consumption, y_i constructed as a composition of $v_i(\cdot)$ and the payoff function $\boldsymbol{\pi}$. That is,

$$u_i(P, y_i) = v_i(\pi_i, \boldsymbol{\pi}_{-i}),\ where\ \pi_j = y_j + (m/n)P, \forall j = 1 \ldots n$$

It follows from concavity and monotonicity of $\boldsymbol{v_i(.)}$ that u_i is concave and increasing in public good level, P and private good level, $\boldsymbol{y_i = e - p_i}$.[33]

We use Varian's (1994) approach and look at the second mover's decision in terms of determining the final provision level, *P*. Adding the aggregate FMs' allocations, P_{-s} to the Group Fund in the second mover's budget constraint, we write the second mover's decision problem as

$$\max_{P, y_s} \boldsymbol{u_s(P, y_s)} \quad s.t. \quad \boldsymbol{y_s + P = e + P_{-s}, y_s \geq 0, P \geq 0}$$

As private and public good are normal goods the second mover's demand for *P* (as well as for y_s) increases with income, $e + P_{-s}$. That is, (*) $P = D_s(e + P_{-s})$ is increasing in $\boldsymbol{P_{-s}}$: the more the first movers allocate to Group Fund the larger the final level.[34]

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[33]Concavity of $u_i(P, y_i) = v_i(\pi_1(P, y_1), \cdots, \pi_i(P, y_i), \cdots, \pi_n(P, y_n))$ follows from other regarding preferences, v_i being concave and increasing in $\boldsymbol{\pi} = (\pi_1, \cdots, \pi_n)$ and the (weak) concavity of $\boldsymbol{\pi_j}$, for all $\boldsymbol{j = 1, \ldots, n}$.

[34] Note that this is not saying that the second mover's allocation, $\boldsymbol{br_s(P_{-s})}$ in the Group Fund increases in P_{-s}; that may or may not be true. It says that $\boldsymbol{P_{-s} + br_s(P_{-s})}$ increases in $\boldsymbol{P_{-s}}$. It is

Part a. As unconditional preferences are defined over final payoffs, it suffices to show that our provision and appropriation games are payoff equivalent.

Note that player *i*'s payoff in the provision game when the vector of contributions is **p**, equals player *i*'s payoff in the appropriation game when the vector of appropriations is, $\boldsymbol{z} = \boldsymbol{e} - \boldsymbol{p}$, verified as follows

$$p_i^{ag}(z) = z_i + \frac{1}{n}(m(ne - \sum_{j=1..n} z_j)) = e - p_i + \frac{m}{n}(ne - \sum_{j=1..n}(e - p_j)) = e - p_i + \frac{m}{n}\sum_{j=1..n} p_j$$
$$= p_i^{pg}(p)$$

Next, the payoff equivalence implies that $\boldsymbol{p} = (\boldsymbol{p}_{-s}, \boldsymbol{br}^{pg}(\sum_{j\neq s} \boldsymbol{p}_j))$ is a SPE in the provision game iff $z = (\boldsymbol{e} - \boldsymbol{p}_{-s}, e - br^{pg}(\sum_{j\neq s}(e - p_j))$ is a SPE in the appropriation game. It follows that, in equilibrium, efficiency of play is the same between games.

Part b. Let $\boldsymbol{p}^* = (\boldsymbol{p}^*_{-s}, \boldsymbol{br}^{pg}(\sum_{j\neq s} \boldsymbol{p}_j))$ be the most efficient SPE in the provision game and let P^* denote the provision level, that is, $P^* = \sum_{j\neq s} \boldsymbol{p}_j^* + \boldsymbol{br}_s^{pg}(\sum_{j\neq s} \boldsymbol{p}_j^*)$. The optimal (interior) allocations satisfy f.o.c.,[35]

$$\frac{\partial u_i(P^*, e - p_i^*)}{\partial P}(1 + \frac{\partial br_s^{pg}(P_{-s}^*)}{\partial P_{-s}}) - \frac{\partial u_i(P^*, e - p_i^*)}{\partial y_i} = 0, \forall i \qquad \text{(A.1)}$$

At any given income $Y = e + P_{-s}$ (varying with the first movers' choices, P_{-s}) by Axioms S and R (see Cox et al. 2013), $br_s^{pg}(Y) - br_s^{ag}(Y) = h_i(Y)$ for some positive increasing function $h_i(.)$. Using the last expression and statement (A.1) at P^* we have

$$\frac{\partial u_i(P^*, e - p_i^*)}{\partial P}(1 + \frac{\partial br_s^{ag}(P_{-s}^*)}{\partial P_{-s}}) - \frac{\partial u_i(P^*, e - p_i^*)}{\partial y_i} = -\frac{\partial u_i(P^*, e - p_i^*)}{\partial P} h_i'(e + P_{-s}^*) < 0$$

---

straightforward to show that the condition is satisfied (i.e., public good is a normal good) for convex altruistic preferences, $v_s(.)$ such that $\partial^2 v_s(.)/\partial s \partial i \geq 0, \forall i$.

[35] Note that both the first term and the second term are positive so interior optimal p_i are possible.

The last inequality requires, in appropriation game, first mover i allocate less in the Group Fund, i.e., $p_i^{ag} < p_i^*$ which together with ($*$) imply that efficiency of play in the appropriation game is smaller than in the payoff equivalent provision game.

Proof of Proposition 1.2

Let the sequential game be given and consider a group of individuals playing it. Let $\boldsymbol{p}^* = (\boldsymbol{p}_{-s}^*, br_s(\boldsymbol{p}_{-s}))$ be the most efficient SPE for this group of individuals in the game. Let, P^* denote the provision level, i.e., $P^* = \sum_{j \neq s} p_j^* + br_s(\sum_{j \neq s} p_j^*)$. The optimal (interior) allocations satisfy f.o.c.,

$$\frac{\partial u_i(P^*, e - p_i^*)}{\partial P}(1 + \frac{\partial br_s(P_{-s}^*)}{\partial P_{-s}}) - \frac{\partial u_i(P^*, e - p_i^*)}{\partial y_i} = 0, \forall i \tag{A.2}$$

Part a-c. Consider another group (call it 2) whose individuals are *sufficiently*[36] more altruistic than individuals in the previous group; call it group 1. Let E_{ij} denote the efficiency of the best SPE when all first movers are from group i (=1,2) and the second mover is from group j (=1,2). We show that $E_{11} < E_{12} < E_{22}$.[37]

Let the FMs total allocation, P_{-s} to the Group Fund be given. It follows from group 2 individuals being sufficiently more altruistic than group 1 individuals that $D_{s_2}(e + P_{-s}) = D_{s_1}(e + P_{-s}) + \varphi(P_{-s})$ for some positive increasing function $\varphi(\cdot)$. Substituting $D(e + P_{-s}) = P_{-s} + br(P_{-s})$ and differentiating with respect to P_{-s} we have

$$\frac{\partial br_{s_2}}{\partial P_{-s}}(P_{-s}) = \frac{\partial br_{s_1}}{\partial P_{-s}}(P_{-s}) + \varphi'(P_{-s})$$

Using the last equality and statement (A.2), we show that a first mover i from group 1 when the second mover is from group 2 would allocate more than p_i^* in the Group Fund because at P^*

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[36] Let's call individuals in group i, type i. We say that type 2 is *sufficiently* more altruistic than type 1 if the difference between the demands for the public good of the two types increases in income, Y.

[37] The proof for $E_{11} < E_{21} < E_{22}$ is similar.

$$\frac{\partial u_i(P^*,e-p_i^*)}{\partial P}(1+\frac{\partial br_{s_2}(P_{-s}^*)}{\partial P_{-s}})-\frac{\partial u_i(P^*,e-p_i^*)}{\partial y_i}$$
$$=\frac{\partial u_i(P^*,e-p_i^*)}{\partial P}(1+\frac{\partial br_{s_1}(P_{-s}^*)}{\partial P_{-s}}+\varphi'(P_{-s}^*))-\frac{\partial u_i(P^*,e-p_i^*)}{\partial y_i}$$
$$=\frac{\partial u_i(P^*,e-p_i^*)}{\partial P}\varphi'(P_{-s}^*)$$
$$>0$$

This together with the second mover's demand for public good increasing in FMs total allocations imply that $E_{11} < E_{12}$.

Next, we show that $E_{12} < E_{22}$. Let $p^{**} = (p_{-s}^{**}, br_{s_2}(p_{-s}))$ be the most efficient SPE when first movers are from group 1 and the second mover is from group 2. Let, P^{**} denote the provision level (i.e., $P^{**} = \sum_{j=1}^{n-1} p_j^{**} + br_{s_2}(\sum_{j=1}^{n-1} p_j^{**})$). Optimal (interior) allocations, by f.o.c. satisfy

$$\frac{\partial u_{i_1}(P^{**},e-p_i^{**})}{\partial P}(1+\frac{\partial br_{s_2}(P_{-s_2}^{**})}{\partial P_{-s_2}})-\frac{\partial u_{i_1}(P^{**},e-p_i^{**})}{\partial y_i}=0, \forall i$$

which can be equivalently written as

$$\frac{\frac{\partial u_{i_1}(P^{**},e-p_i^{**})}{\partial P}}{\frac{\partial u_{i_1}(P^{**},e-p_i^{**})}{\partial y_i}}(1+\frac{\partial br_{s_2}(P_{-s_2}^{**})}{\partial P_{-s_2}})=1 \quad \text{(A.3)}$$

The first ratio is the marginal rate of substitution, *wtp*(.) of private for public good. It follows from group 2 individuals being more altruistic that, at (P^{**}, y_i^{**})

$$\frac{\partial u_{i_2}(P^{**},e-p_i^{**})/\partial P}{\partial u_{i_2}(P^{**},e-p_i^{**})/\partial y_i}=wtp_{i_2}(.)>wtp_{i_1}(.)=\frac{\partial u_{i_1}(P^{**},e-p_i^{**})/\partial P}{\partial u_{i_1}(P^{**},e-p_i^{**})/\partial y_i}$$

which together with equality (A.3) imply that for a first mover *i* from group 2 we have

$$\frac{\partial u_{i_2}(P^{**},e-p_i^{**})}{\partial P}(1+\frac{\partial br_{s_2}(P_{-s_2}^{**})}{\partial P_{-s_2}})-\frac{\partial u_{i_2}(P^{**},e-p_i^{**})}{\partial y_i}>0$$

Thus, a first mover i from group 2 wants to increase her own allocation in Group Fund above $p_{i_1|s_2}^{**}$ and therefore in equilibrium, efficiency of play is higher in homogenous group 2, then in the mixed group with first movers form group 1 and the second mover from group 2.

Proof of Proposition 2

Let group-contingent preferences be represented by some concave function $f_i(\pi)$ increasing in own and insiders' payoffs, but decreasing in outsiders' payoffs.

The proof of *part 1* is identical to the proof of *part a* of Proposition 1.1 because group-contingent preferences are defined over final payoffs, and therefore for payoff-equivalent games are game invariant.

To show *part 2*, note that the composition of our mixed groups consist of all first movers being from one cast and the second mover being from another cast. It follows from the marginal per capita return, $m/n<1$ and from second mover's preferences decreasing in outsiders' payoffs (i.e., first movers in the mixed groups) that it is optimal for the second mover to appropriate the entire amount in the Group Fund. That is, $br_s(P_{-s})=-P_{-s}, \forall P_{-s}$ as

$$f_s(0,\cdots,0,e+P_{-s})\geq f_s(e-p_1+\frac{m}{n}P,\cdots,e-p_{n-1}+\frac{m}{n}P,e-z+\frac{m}{n}P),\ \forall z\in[-P_{-s},e]$$

where $P=P_{-s}+z$. Given second mover's strategy, it is dominant for any first mover i to allocate 0 in the Group Fund as for any positive allocations, $\boldsymbol{p}_{-i}$ of other first movers, we have

$$f_i(e-p_i,\boldsymbol{e}-\boldsymbol{p}_{-i},e+P_{-i}+p_i)\leq f_i(e,\boldsymbol{e}-\boldsymbol{p}_{-i},e+P_{-i}),\forall p_i\in[0,e]$$

The inequality follows from identity preferences, f_i increasing in own and other first movers' payoffs (who are from the same group as i) and decreasing in the second mover's payoff who is not from i's group.

APPENDIX II. ADDITIONAL DETAILS ON PROCEDURES FOR THE EXPERIMENT

The groups were formed based on the caste categories to which each subject belonged. Each subject was invited to come to a separate room to make her individual decision in private. After each subject came in and took his or her seat in the private room, the experimenter briefly explained the procedure and rules once again. Thereafter, the subject was handed a decision sheet based on his or her role as first mover or second mover. Across all ten treatments, the second mover subject was also informed about the amount of money contributed (PG) to or extracted (AG) from the Group Fund by each of the three first movers. The subject was asked to carefully consider all the information and thereafter make his or her decision in private. In the caste-informed treatments, each subject in a four-person group was informed about the caste composition of the other members of the group. No information about the caste of the other group members was provided to the subjects in the no-caste-information treatments.

We had to overcome difficulties in recruiting lower caste subjects. In order to be able to recruit a heterogeneous subject sample, we went to villages with relatively large presence of lower caste individuals. In other locations, we found subjects typically arriving at the experiment site in groups with their friends or neighbors. To ensure that subjects did not play strategically believing that their friends would be in the same group, we applied the following procedure. The name and village of residence of the subjects had been taken down one after the other in the order of arrival at the experiment site. Each subject was called by name one after the other to come to the private room. However consecutive people being called to the private room were placed in different groups. For example, subject numbers 1, 2 and 3 may have come from the same village and be called one after the other, but we placed them in different groups –for example subject #1 may be the first mover person 1 in Group 1, subject #2 could be the first mover person 1 in Group 2 and subject #3 could be the second mover person 1 in Group 3. At the time of explaining the instructions of the game, the subjects were clearly informed that they would be in groups different from their friends. When a subject came to the private room to make the decision, he or she was once again reminded that friends were not in the same group. Subjects may have made an assumption of a person's caste or characteristics when they saw the last person leaving the room. To minimize any effects from such observations, subjects were specifically informed that the previous person leaving the room would not be in their group.

Difficulties with collecting information on income. During February 2012, a series of questions about household income was asked after all decisions had been made. However, we will not use these income figures in this analysis. Several subjects mentioned that their answers may be incorrect since they were themselves unaware of how much they consume out of their own produce and how much they sell. This proportion varies across the year – depending on the seasonality of the plant. In such occasions, the experimenter asked for the most recent month and how much they earned during that time, but again, this may not reflect the correct figure as some plants grow well during winter months and poorly during warmer months. Muslim female subjects in some no-caste information groups informed the experimenter that their husbands do not inform them of how much they earn. Several Hindu women mentioned that they live in a joint family with the families of their brothers-in-law or uncles and are hence unaware of what the total family income is. Hence it is possible that the information provided by these subjects is incorrect. In many cases, subjects became defensive at the question of income. The subjects would ask why this income question was being asked and why such information would be necessary. Some subjects admitted that they would not provide their correct income information. In some other occasions, the subject would provide a broad range and left the experimenter the task of guessing an accurate figure. In other cases, the subject would admit that they did not have any source of income and they depended on loans from family members or neighbors for sustenance.

APPENDIX III. ADDITIONAL FIGURES

FIGURE A.1
Average Extensive Margins for First and Second Movers

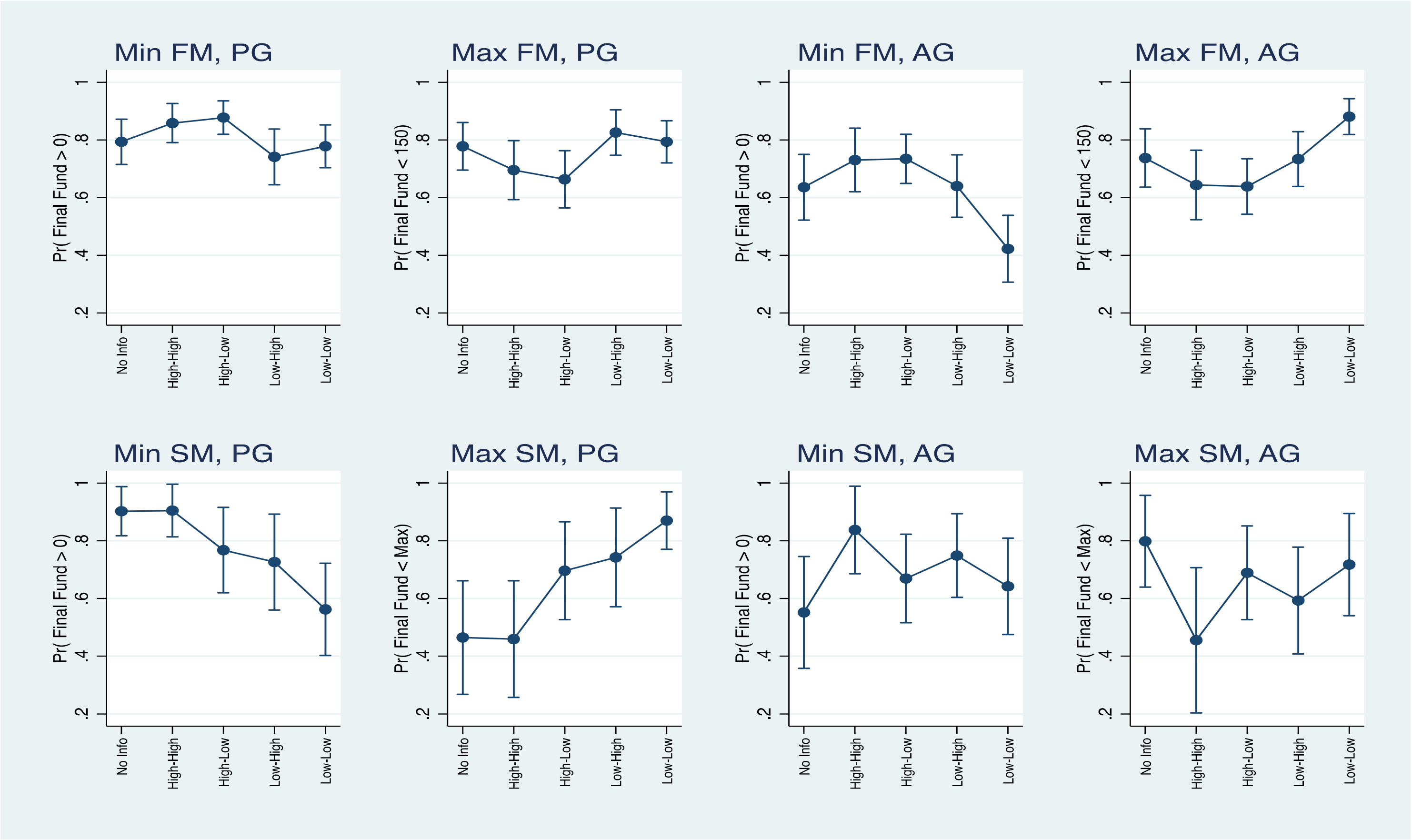

FIGURE A.2
Average Margins for Second Movers