Legitimacy and cooperation: A framed field experiment

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LEGITIMACY AND COOPERATION - A FRAMED FIELD EXPERIMENT

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Abstract

Decentralization of irrigation management to local communities is often claimed to improve performance. The argument is that decentralization enhances the perceived legitimacy of irrigation management, which in turn increases the willingness of water users to cooperate and contribute to irrigation management. To test this hypothesis, we collected information about water users' legitimacy perceptions in five villages alongside an irrigation channel in Maharashtra, India. In two of the villages, the irrigation department is in charge of irrigation management, while in the other three villages, this task has been decentralized to local water users associations (WUAs). To assess the impact of legitimacy perceptions on cooperation, we used survey-based indicators of perceived legitimacy to explain three outcomes, each of which partly reflects the willingness of water users to cooperate and contribute to irrigation management: (1) water users' self-reported charge payments, (2) WUA-reported charge payments, and (3) water users' behavior in a field experiment that was framed in terms of irrigation management. Our results show that legitimacy perceptions differ between the two types of villages as well as between WUA members and non-members, but these differences do not explain any of the three outcomes. Non-members contribute significantly *less* under the irrigation frame as compared to WUA members, but game behavior is not correlated with (self-reported or WUA-reported) charge payments. We conclude that decentralization of irrigation management may enhance legitimacy perceptions but this has no effect on the willingness of water users to contribute to irrigation management.

Keywords: Framed field experiment, public goods game, irrigation management, legitimacy, water users association

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1. Introduction

Decentralization of public services is claimed to improve performance for two reasons (Bardhan 2002). First, users have a direct stake in well-functioning public services and because they also have an informational advantage over government agencies they can design, target and manage these systems in a more effective way (Bardhan 2002, Mansuri and Rao 2004). Second, decentralization implies that users obtain partial authority to collect contributions, allocate services and make decisions regarding the maintenance of the public good. This obtained authority is claimed to improve the legitimacy of public good management as it increases users' willingness to cooperate and enhance performance of the public good (Tyler 2006, Tyler and Fagan 2008).

This paper considers the second argument, that decentralization improves legitimacy and thus enhances cooperation, in the context of irrigation management in India. Mollinga (2000) argues that reduced legitimacy of top-down irrigation management in India has been an explicit reason to decentralize irrigation management to water users associations (WUAs). The importance of legitimacy for improved irrigation management is confirmed by Gorton et al. (2009), who evaluate the decentralization of irrigation management in Macedonia. They conclude that the main factor explaining improved performance is increased trust in the authorities. Araral (2009) finds that decentralized irrigation management performs better than centralized management in the Philippines because WUAs control non-cooperative behavior more effectively than government agencies. More generally, Bó et al. (2010) find that democratic institutions increase cooperation, indicating that the willingness to cooperate is influenced by perceptions of institutional functioning.

We focus our analysis on five villages located alongside an irrigation channel in rural Maharashtra, India. In two of these villages, the irrigation department is in charge of irrigation management, while in the three remaining villages, this task has been decentralized to WUAs. Given that villages (and villagers) self-select into forming a WUA, we cannot determine the causal relationships between decentralization, WUA membership and legitimacy perceptions. We can, however, compare legitimacy perceptions between WUA members and non-members and we assess whether differences in legitimacy perceptions affect the willingness of water users to cooperate and contribute to irrigation management.

In order to understand why legitimacy perceptions may differ between water users it is important to understand the different considerations on which perceptions of legitimacy may be based. Weber (1968) distinguishes between legitimacy based upon deterrence to customs and values (shared values and norms), legitimacy based upon devotion to actions or character of an authority (shared vision), and legitimacy linked to the process of rule implementation and interpretation (procedural justice). Given that decentralization of irrigation management implies a change in rule implementation and interpretation, i.e. devolving decision-making power from the irrigation department to the WUA, we expect to see differences in perceived procedural justice between WUA and non-WUA villages. This expectation is supported by the work of Dayton-Johnson (2000) who finds that differences in perceived representation in decision-making and rule establishment influence cooperation in irrigation management. Alternatively, subjects may differ in their visions with regard to the desirability of decentralization. WUA members voted in favor of decentralization and may view the WUA as more legitimate than non-members. In the following we will use both definitions of legitimacy, i.e. based on perceived procedural justice and based on shared vision. We will not address legitimacy based on shared values and norms since we do not expect norms to change because of decentralization.

To assess the impact of legitimacy perceptions on cooperation we consider three outcomes, each of which partly reflects the willingness of water users to cooperate and contribute to irrigation management: (1) water users' self-reported charge payments, (2) WUA-reported charge payments, and (3) water users' behavior in a field experiment that was framed in terms of irrigation management. We expect contributions in the game to reflect water users' willingness to contribute to irrigation management because we frame the game: half of the respondents is told that the game is about irrigation management ('the irrigation treatment') and fills in a survey about the perceived legitimacy of irrigation management before playing the game, whereas the other half is told that the game is about contributions to the village festival (the 'festival treatment') and fills in the survey afterwards. Note that we apply *label framing* rather than *valence framing* where, apart from the wording, also the incentive structure of the game is changed (see Andreoni 1995). We analyze the impact of water users' legitimacy perceptions on (self)-reported and revealed contributions while controlling for factors that may directly influence contribution levels (Bardhan 2000), like landholding size, income status, and gender, as well as general trust and fairness perceptions. We assess

legitimacy based on perceived procedural justice with the legitimacy survey, and legitimacy based on shared vision by accounting for WUA membership.

Our results show that legitimacy perceptions differ, both between the two types of villages as well as between WUA members and non-members, but these differences do not explain game behavior nor respondents' self-reported or WUA-reported charge payments. Non-members do contribute significantly *less* under the irrigation frame as compared to WUA members. We show that this effect is not caused by differences in perceived procedural justice, but may be caused by differences in shared vision. Game behavior is not correlated with (self-reported or WUA-reported) charge payments however, which might raise questions about the external validity of our experimental results. Alternatively, and in line with Ruttan (2008), our indicators of cooperation could be measuring different aspects, e.g. game behavior measuring a 'willingness to collaborate' and charge payments a 'willingness to invest'. If so, our results would suggest that legitimacy perceptions generate a willingness to collaborate, but have no impact on the 'willingness to invest' as reflected in charge payment behavior.

The remainder of this paper is structured as follows. In the next section we introduce the decentralization of irrigation management in the Warana sub-basin in Maharashtra, India. In Section 3 we present our methodological approach and in Section 4 we present our main results. In Section 5 we discuss these results and conclude.

2. Background

We conducted our analysis in five villages located at the head of the Warana sub-basin in the Indian state of Maharashtra. In two villages (Sonavade and Nathavade), there is no WUA. In the other three villages (Panumbre, Mandur and Kalundre), WUAs were established about 10 years ago as part of the Cooperative Societies Act to support voluntary decentralization of irrigation management. In 1987 the Government of India issued guidelines for involving farmers in the management of irrigation systems and in 1988 the Government of Maharashtra issued guidelines to encourage the formation of WUAs. Under these last guidelines, which were also implemented in the Warana sub-basin, a WUA is established when a majority of landowners who own canal-irrigated land within the designated command area is in favor of doing so.

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Figure 1 illustrates the location of the five villages in the sub-basin and the proportion of land in the command area. Each village has a command area of canal-irrigated land ranging from 200-400 ha.
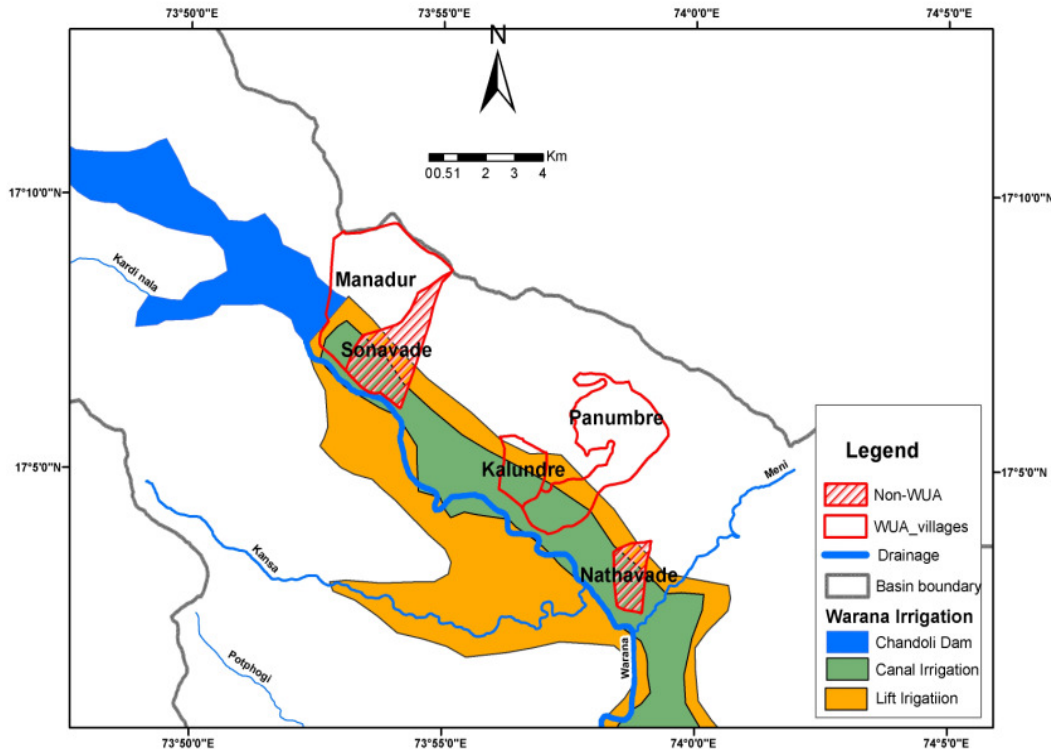
Figure 1: Location of the study villages

The five villages are similar in terms of population, livelihood strategies and access to canal-irrigation. Given that they are all located in the upper part of the basin, externalities in water extractions between villages do not arise. In terms of caste composition, all five villages are mostly populated by the Maratha dominant farming caste in the area and the proportion of households belonging to other castes is small. Most households do not receive assured livelihoods from agriculture and have members who have entered non-agricultural occupations or migrated to the cities in search of employment. The bulk of local agricultural laborers belong to the scheduled caste *dalits* among whom the incidence of landlessness is high. Given our focus on farmers with access to irrigated land, landless farmers are not included in our sample and our sample is rather homogeneous in terms of caste composition.

There are four benefits of establishing a WUA: (a) a discount of up to 20% on the water bill for abstracted water from the major canal; (b) a formal acknowledgement of water

entitlements from the Irrigation Department to the WUA; (c) a one-time system maintenance upgrade, and (d) formal freedom from prescribed cropping patterns by the irrigation department. In return, WUAs have to fulfill three main responsibilities: (a) development of the water distribution plan based on farmers' seasonal water demand forms; (b) maintenance of the minor canal; and (c) collection of water charges.

WUAs have an elected management committee consisting of rotating WUA members, which coordinates and monitors all its affairs. Non-members cannot be denied water service by the WUA, but they can get up to 30% surcharge on top of the annual irrigation charge because of their non-membership. Any household that owns land in the canal command can become a WUA member by paying a one-time small membership fee, called 'share capital'.

We asked the respondents in the WUA villages whether they had initially voted in favor of WUA establishment or not. A surprisingly low number of respondents indicated having voted in favor (55%). Initially we were surprised by this finding, but when inquiring further we found that a considerable part of the population does not believe farmers are capable of managing irrigation systems. This is in line with the earlier suggestion that WUA membership captures the shared vision dimension of legitimacy. Other explanations for the low number of initial WUA members are (a) that becoming member involves a substantial amount of paper work and documentation, whereas the costs of non-membership are relatively limited and (b) that political affiliations matter; when the initiative to establish a WUA is taken by one village faction then members of rival factions may not join the WUA. In interpreting the findings we will come back to these different explanations. In the next section we first present our methodological approach.

3. Methodology
To assess the impact of legitimacy perceptions on the willingness of water users to cooperate and contribute to irrigation management, we used survey-based legitimacy indicators to explain three outcomes: (1) water users' self-reported charge payments, (2) WUA-reported charge payment data, and (3) water users' behavior in a field experiment that was framed in terms of irrigation management. Data on reported charge payments was obtained from the survey (self-reported) and we subsequently consulted the WUA secretaries in the WUA villages for official charge payment data from their administration (WUA-reported). Water users' behavior in the field experiment is closely related to the survey data because the survey acted as a framing device. Before we elaborate on the survey

and experiment separately, we first address the connection between the two by introducing the concept of framed field experiments.

3.1 Framed field experiments

Framed field experiments are part of the larger family of economic experiments which were originally developed to systematically evaluate economic theories under laboratory conditions. They originated from the field of psychology but, different from psychological experiments, in economic experiments subjects play for real money to avoid hypothetical bias effects. Economic experiments have been heavily criticized for being too abstract to capture the real world characteristics that determine behavior, like market experience and reputation effects (List 2006), but also for neglecting subject heterogeneity in terms of moral and social values, norms and beliefs. In fact, Henrich et al. (2010) argue that the fact that most economic experiments are conducted with 'Western, educated, industrialized, rich and democratic' (WEIRD) subjects reduces the generalizability of most findings to non-western settings and seriously lowers the external validity of the results.

Levitt and List (2007) argue that there are five factors that influence the external validity of experimental methods; (a) the presence of moral and ethical considerations, (b) the extent to which one's actions are scrutinized by others and the nature of that scrutiny, (c) the context in which the decision is embedded, (d) the subject pool of respondents, and (e) the stakes of the game. In our experiment, we did not introduce moral considerations or reputation effects, but our subject pool did consist of the actual decision-makers, i.e. farmers with access to canal irrigation, and we introduced context by framing the game.

To trigger subjects' perceptions of irrigation management legitimacy we used the survey as a framing device (cf. Bouma and Ansink, 2013), in addition to frame-specific wording in the experimental instructions. Respondents in the irrigation treatment filled out the survey before playing the game, while respondents in the festival treatment filled out the same survey afterwards, the two groups not meeting each other in between. Based on the experiences of Bouma and Ansink (2013) we decided to frame both treatments, as we found that non-WEIRD subjects have difficulty understanding the abstract explanation of a public goods game when it is not framed in a concrete setting. Hence, we explained the non-framed treatment in terms of contributions to the village festival as this turned out to be the natural counterpart of village level cooperation in public good provisioning, without any connection to irrigation management.

With regard to the survey, we combined items from two existing legitimacy surveys, selecting those items that were most relevant for assessing perceptions of procedural justice relating to irrigation management. Specifically, we used Stern (2008) for items on rule awareness and rule influence and Tyler and Fagan (2008) for items on the representation of interests and trust in financial management. In addition, we added items from the World Values Survey relating to general trust and fairness perceptions to control for such differences in the analysis. Initially, we also used Weatherford (1992) and Gibson et al. (2005) for items on political legitimacy, but after pre-testing the survey we decided to drop these questions because they did not match the field context. For the full survey, please see Appendix A.

The experiments were conducted in December 2011 by a team from VU University Amsterdam, the Netherlands, and SOPPECOM[3], India. Subjects were invited using invitation letters that were distributed by local contact persons to a random selection of farmers with irrigation access. Subjects were told they were going to participate in a game in which they could earn money. We did not provide any further information about the game or the context of the research prior to the experiment. Upon arrival, subjects were registered and randomly assigned to one of two treatments, as discussed below. Because of possible illiteracy problems, game instructions (see Appendix B) were read out aloud by one of the authors in the local language, Marathi. Subjects' understanding of the game was tested by asking control questions to the group.

3.2 Experimental design

The game set-up is standard to public goods games. Subjects were anonymously grouped in groups of size 4, each group playing 5 rounds of the game with no history (i.e. no remaining tokens from the earlier round). We played multiple rounds in order to check subjects' comprehension of the game and possible learning effects. Group composition remained unchanged throughout the experiment. At the start of each round, individuals received 20 tokens in an individual account. Each token represents 1 Rs ($0.019). Subjects were given the option to contribute up to 20 token to a group account. Contribution decisions were made in private and simultaneously.

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[3] Society for Promoting Participative Ecosystem Management (SOPPECOM), based in Pune (Maharashtra, India), is a non-governmental organization working in the field of natural resource management, especially water, since 1991.

Based on the group's contribution decisions, the payoff π_i to subject i in a given round equals:

$$\pi_i = 20 - t_i + 0.4\left(\sum_{j=1}^{4} t_j\right)$$

This payoff function is equal to the standard payoff function in linear public goods games (Andreoni 1995, Park 2000), reflecting a social dilemma where extractions by others affect own pay-offs. The individually optimal decision is to contribute nothing while the socially optimal decision is to contribute all tokens (each subject earning 32 tokens). Parameter values that we used correspond to other studies with groups of size of 4, e.g. Fehr and Gächter (2000), Nikiforakis (2010), and Bougherara et al. (2011). In addition to the show-up fee of 50 Rs ($0.93), the maximum possible payoff to a subject equaled 220 Rs ($4.09). On average and including the show-up fee, subjects earned 189 Rs ($3.51), with a standard deviation of 21 Rs ($0.39), slightly less than twice the daily wage of an agricultural laborer.

Contribution decisions were made anonymously, using cards that were put into coded envelopes. In each round, envelopes were collected by one of the instructors and brought to a separate room where the lead author calculated total contributions and payoffs. This procedure assured double blind interaction, which is important to avoid experimenter bias effects (see Zizzo 2010). At the end of each round, subjects received feedback on individual extractions t_j of each group member j, the group account and their payoff π_i in this round.

In total, our sample consisted of 124 subjects, 88 from WUA villages and 36 from non-WUA villages.

To check the impact of framing we discussed with each group after the experiment what the experiment had reminded them of. In the irrigation treatment, most subjects immediately started talking about irrigation management, whereas in the festival treatment, this topic was not mentioned once. This last observation is important, because if subjects in the festival treatment would have also mentioned irrigation management we would have had little basis to compare results between treatments.

3.3 Data analysis

With regard to the analysis of the survey data we concentrated on the differences in legitimacy perceptions between WUA villages and non-WUA villages, and between WUA members and non-members. We used principal component analysis to construct indicators

of perceived procedural justice, based on the relevant survey items (i.e. items on rule awareness, perceived influence in decision-making, perceived consistency of rule enforcement, trust in the WUA/irrigation department to represent the respondent's interests and trust in the WUA/irrigation department with regard to financial matters, see Appendix C for the analysis). We did not include the question about the respondent's belief of equal treatment by the WUA/irrigation department in the principal component analysis because this question was, mistakenly, not asked in one of the villages concerned.

We estimated a Probit model to assess the impact of legitimacy perceptions on both self-reported and WUA-reported charge payments, assessing impacts in terms of marginal changes in the probability of charge payments. With regard to the analysis of the experimental data we focused on the differences between the two treatments, comparing game contributions (a) between the two types of villages, and (b) within WUA villages, between WUA members and non-members. We estimated two models, OLS and Tobit, the Tobit model taking account of the fact that observations are censored as subjects could not contribute less than 0 or more than 20.[4] In the analysis, we systematically included the different control variables (WUA membership, age, gender, income status, illiteracy, caste membership, landholding size, membership of a village organization, general trust and fairness perceptions, village fixed effects). In the paper we only present results for a limited number of control variables, given that the other control variables proved insignificant. To distinguish between treatment effects and respondent beliefs and perceptions we use interaction variables. For example, the interaction variable 'irrigation frame * WUA member' measures the contribution made by WUA members in the irrigation treatment of the game. The single variable 'WUA membership' now measures only the contribution decisions of WUA members in the festival treatment, and the single variable 'irrigation frame' measures the pure framing effect (i.e. not accounting for respondent heterogeneity in terms of WUA membership).

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[4] In addition, we estimated an interval regression model, but given the similarity of the findings we do not present these results here.

4. Results

We first present the survey results in Section 4.1, followed by the experimental results in Section 4.2. In section 4.3, we combine and compare game behavior with the WUA-reported charge payment data. In Ansink and Bouma (2013) we elaborate our methodological results.

4.1 Survey results

In Table 1 we present the summary statistics of respondent characteristics for the different respondent groups. We tested for statistically significant differences between the two types of villages as well as between WUA members and non-members, using Mann-Whitney test statistics. The p-values from these tests are presented in the tables below.

Table 1: Summary statistics

	WUA			WUA	Non-WUA	
	Member	*Non-member*	*p-value*	*All*	*All*	*p-value*
Average age (1)	47.8	52.3	0.28	49.7	44.3	0.13
Gender (female=1) (1)	6%	19%	0.06	11%	17%	0.43
Member of majority caste (Maratha)(1)	96%	84%	0.05	91%	69%	0.00
Poor (11) [5]	28%	19%	0.33	25%	19%	0.51
Average landholding (acres) (3)	2.22	1.62	0.12	1.97	2.68	0.23
Average irrigated land (acres) (3)	1.05	0.80	0.06	0.94	1.30	0.30
Member of village organization (8)	60%	38%	0.04	50%	42%	0.40
Off-farm income is important (10)	44%	57%	0.24	50%	67%	0.09
Illiterate (12)	20%	51%	0.00	33%	28%	0.57
# Observations	50	37		88	36	

The numbers between brackets refer to the numbers of the survey questions: see Appendix A. Since one respondent did not answer the WUA membership question, we have one missing observation.

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[5] Please note that these figures are based on self-reported income. Taking the upper limit of each category (for category 3 we took Rs 6000) divided by the total number of adult household members gave us a very rough estimate of the monthly income/capita. If this is below 740 Rs (the state's poverty line) we marked the household as poor. Outcomes are comparable to the official poverty figures for rural Maharashtra, i.e. with 29% of the population below the poverty line.

The sample is relatively homogeneous because of our focus on farmers with irrigation access. Still, in non-WUA villages 30% of the respondents do not belong to the majority caste group and in all villages around 20% are classified as poor.

Comparing the summary statistics of WUA and non-WUA villages shows that both types of villages are rather similar; only in terms of caste composition does a statistically significant difference arise. Comparing WUA members and non-members we find differences in terms of illiteracy, caste composition, and membership of a village organization, i.e. WUA members are more active in village organizations, more literate and more often belong to the majority caste. We will control for these differences in our empirical analysis.

It is important to note that 'WUA membership' reflects self-reported, current membership. This is strongly correlated with self-reported, initial WUA membership (Pearson correlation coefficient, 0.83), an indication that initial members continue being WUA members, but the correlation with WUA membership as reported by the WUA secretary is much less (0.30). Although we can only speculate about the reasons for this difference, it seems that in many cases illiterate households were 'assisted' to register as a WUA member, and that some of these households might not be aware that they became WUA member in the first place. For the analysis the important point is whether respondents consider themselves as WUA member, and share a vision of decentralized irrigation management. Hence, in the analysis we use self-reported current WUA membership as the explanatory variable, but we will assess the robustness of our findings for the other membership categories as well.

In Table 2 we present respondents' self-reported charge payments and (only for WUA villages) the charge payments as reported by the WUA secretaries. WUA-reported charge payments are lower than self-reported payments, but it is important to note that differences arise mostly because of one village (Kalundre) where 100% of the respondents reported paying their charges, but only 47% did. p-Values reflect Mann-Whitney test statistics.

Table 2: Irrigation charge payments

	WUA			WUA	Non-WUA	
	Member	*Non-member*	*p-value*	*All*	*All*	*p-value*
Pays water charges (always) (18) (self-reported)	96%	97%	0.77	96%	82%	0.01
Pays water charges (always) (WUA data)	79%	63%	0.13	72%		
Believes others pay water charges (19)	91%	88%	0.63	90%	70%	0.01

The numbers between brackets refer to the numbers of the survey questions: see Appendix A.

Water users from WUA villages are more likely to pay their water charges than water users from non-WUA villages and they also expect more often that others will pay. Between WUA members and non-members there are no differences in (self-) reported charge payments.

In contrast with the findings presented in Table 2, when considering the legitimacy related results of the survey the main differences are not between WUA villages and non-WUA villages but between WUA members and non-members in villages with decentralized irrigation management (see Table 3). WUA members feel more capable of influencing decision-making, are more aware of the rules regarding water charge payments and believe more often that the rules are consistently enforced. In addition, WUA members more often feel that their interests are well-represented and more often belief that people are treated equally. Between the two types of villages, differences arise in rule awareness and respondent trust in the authorities regarding financial contributions, water users from WUA villages more often being aware of the rules and trusting the authorities. In terms of general trust and fairness perceptions no differences arise between village types or WUA members and non-members. With regard to trust in community members and the irrigation department, however, water users in non-WUA villages trust significantly less. p-Values reflect Mann-Whitney test statistics.

Table 3 Survey results of legitimacy based on perceptions of procedural justice

	WUA			WUA	Non-WUA	
	Member	*Non-member*	*p-value*	*All*	*All*	*p-value*
Rule consistency (14)	82%	52%	0.01	71%	71%	1.00
Rule influence (15)	57%	24%	0.00	44%	42%	0.82
Rule awareness (13)	53%	30%	0.04	43%	23%	0.04
Interests well-represented (16)	79%	61%	0.09	73%	63%	0.30
Equal treatment (20)	83%	65%	0.05	76%	56%	0.11
Trust with finances (17)	89%	83%	0.45	87%	72%	0.05
People take advantage (21)	20%	19%	0.94	20%	31%	0.19
General trust (22)	40%	38%	0.84	40%	31%	0.34
I completely trust (23):						
People from this community	65%	70%	0.63	68%	51%	0.09
Irrigation department	61%	63%	0.91	62%	45%	0.10

The numbers between brackets refer to the numbers of the survey questions: see Appendix A.

The question is whether these differences in legitimacy perceptions have real impacts: When comparing the findings of Tables 2 and 3 it may seem apparent that water users from WUA villages pay their charges more often because they are better aware of the rules regarding charge payments and because they trust the authorities with their financial contributions. If we conduct a Probit analysis explaining (stated) charge payments on the basis of respondent characteristics and legitimacy perceptions (see Table 4) we find, however, that legitimacy perceptions do not play a significant role.

As explained in the methodology section, the legitimacy indicators are based on principal component analysis. The full analysis is presented in Appendix C, the analysis suggesting that the five legitimacy variables share two principal components: PCArule reflecting three rule-related items, and PCAtrust reflecting two trust-related items. Together, the two components explain 66% of the variation.

Table 4: Probit analysis of charge payment behavior- marginal effects

|	Self-reported (all villages)			WUA reported (WUA villages)		
	Without legitimacy	*With legitimacy*	*Only legitimacy*	*Without legitimacy*	*With legitimacy*	*Only legitimacy*
WUA village	0.11**	0.13 **				
WUA member				0.15	0.12	
Gender	-0.16 **	-0.15 *	-0.22 *	0.11	0.12	0.12
Landholding	-0.02 **	-0.03 **	-0.04 **	-0.03	-0.03	-0.04
Irrigated land	0.03	0.04	0.05	0.10	0.10	0.13
PCArule		0.01	0.01		0.01	0.03
PCAtrust		-0.00	-0.02		0.03	0.04
LR chi2	16.5	19.7	13.8	4.5	3.5	3.6
Pseudo R2	0.26	0.36	0.25	0.05	0.05	0.05
# Observations	119	92	92	78	62	63

*10%, ** 5%, * 1% significant

The probability that water users pay their charges is influenced by village type (WUA village), gender and landholding size. When we consider (WUA-reported) charge payments none of the factors explains charge payments, not even WUA membership. In both cases, legitimacy perceptions play no role. Note that this result also holds when we replace PCArule and PCAtrust by any selection of the five legitimacy variables they are based on. Respondents from WUA villages may be more likely to pay their water charges but this is not because of differences in perceived procedural justice: when we leave 'WUA village' or 'WUA membership' out of the analysis PCArule and PCAtrust still have no effect. Hence, we find no evidence that perceptions of procedural justice influence subject's willingness to contribute to irrigation management. Instead, self-reported charge payments are mostly explained by respondents' landholding size and irrigation access, which seems to indicate that contributions are incentive-driven. For the sub-sample of WUA villages the explanatory power of the model is very low. We included all other control variables in both models but given that the findings were insignificant we don't present these findings here.

4.2 Experimental results

The results presented in Figure 2 indicate that there are no differences in game behavior between treatments (all observations, framed=64, n-framed=60, Mann-Whitney p=0.51). Across rounds, contributions decrease, which is in line with the experimental literature on repeated linear public goods games, and reassures that respondents' did comprehend the game. (Chaudhuri 2011).
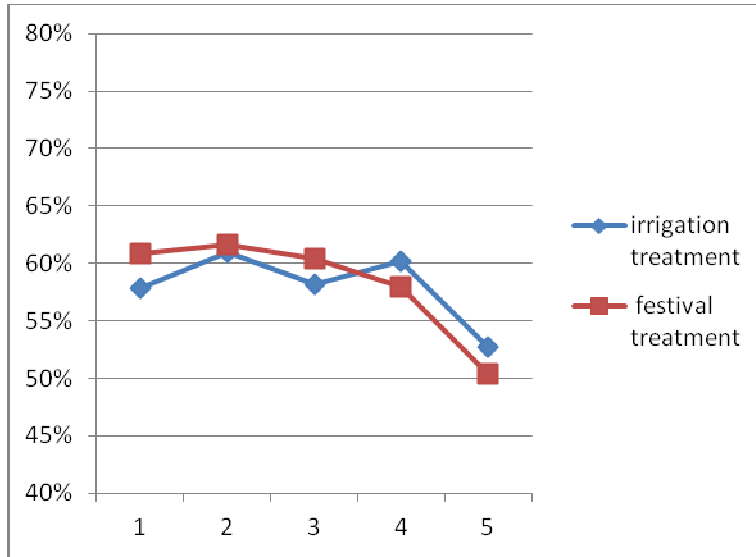
Figure 2: Contributions (as % of the maximum possible contribution) across the five rounds, separated by treatment

Analysis of subjects' first-round contributions (table 5) confirms that framing has no statistically significant effect.[6] Gender does play a role in explaining contributions, and subjects who feel that people tend to take advantage contribute less. Interestingly, subjects that trust their community members tend to contribute less in the festival treatment, which could be an indication that subjects free-ride when they expect that others will contribute.

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[6] In considering the impact of legitimacy perceptions on game behavior, we focus on results of the first round only, assuming that legitimacy perceptions play less of a role as the game evolves.

Table 5: First-round contributions (all villages)

	OLS		Tobit	
Gender	3.2 (1.7)*	4.9 (2.6)*	4.8 (2.2)**	7.8 (3.4)**
Framed (i.e. irrigation treatment)	-2.3 (2.4)	-3.0 (3.3)	-3.0 (3.0)	-4.4(4.0)
WUA village	0.5 (1.7)	-0.00 (2.3)	0.8 (2.2)	-0.2 (2.9)
Framed*WUA village	0.4 (2.4)	1.9 (3.2)	0.4 (3.1)	3.2 (4.0)
Trust community members	-3.0 (1.6)*	-3.2 (2.0)	-3.7 (2.0)*	-4.1 (2.5)*
Framed*trust community members	2.4 (2.2)	2.5 (3.1)	3.2 (2.9)	3.2 (3.9)
People take advantage of you	-2.3 (1.3)*	-2.9 (1.7)*	-3.1 (1.7)*	-4.1 (2.1)**
PCArule		0.2 (0.7)		0.4 (0.9)
PCAtrust		-0.2 (0.9)		-0.2 (1.1)
Framed*PCArule		-1.3 (1.0)		-2.0 (1.3)
Framed*PCAtrust		0.6 (1.2)		0.8 (1.5)
Constant	13.7 (1.6)***	14.0 (2.0)***	14.8 (2.1)***	15.5 (2.5)***
F/ LR chi2	1.3	1.1	9.9	14.6
Adjusted R2/Pseudo R2	0.02	0.01	0.01	0.03
# Observations	121	89	121	89

Standard errors between brackets. *10%, ** 5%, *** 1% significant

When we consider the sub-sample of WUA villages and include WUA membership as an explanatory variable, the picture changes drastically. Figure 3 presents game outcomes for WUA members and non-members across treatments, indicating that WUA members behave significantly different from non-members (Mann-Whitney test, p=0.08). When analyzing differences between subject types *and* treatments (i.e. four groups) we find that most of the difference is due to (i) non-members contributing more under the festival frame than WUA members; and (ii) non-members contributing less under the irrigation frame than under the festival frame. The other two pair-wise differences are statistically not significant, indicating that it is not WUA members who necessarily contribute more under the irrigation frame, but non-members who contribute less, as compared to the village festival frame (see also Ansink and Bouma 2013).
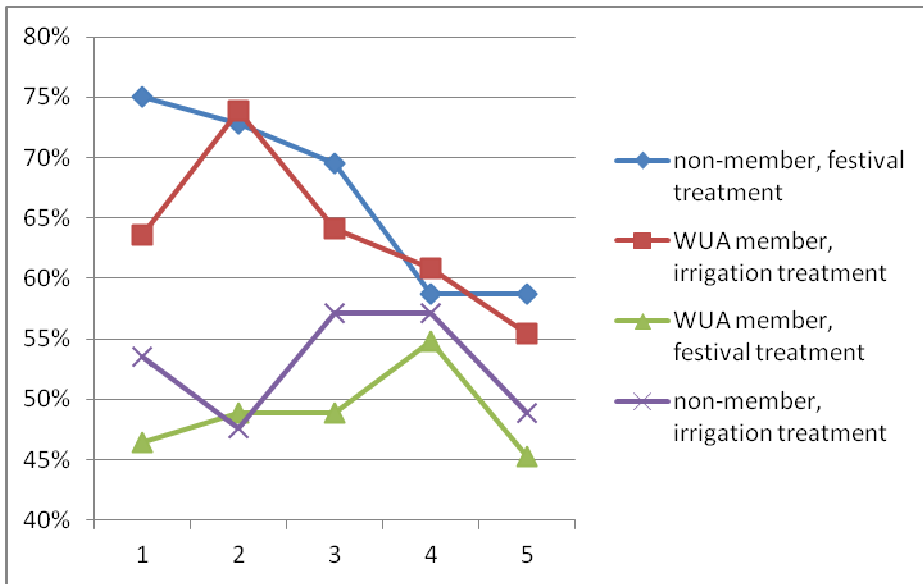
Figure 3: Contributions (as % of the maximum possible contribution) across the five rounds, separated by treatment and WUA membership

Econometric analysis of subjects' first-round contributions (see Table 6) confirms that WUA members behave significantly different from non-members under the different treatments. WUA board members (survey item 6, see Appendix A) always contribute more, regardless of the treatment they are in. Framing has a significant, negative impact, which implies that, on average, subjects contribute more when the game is framed in terms of the village festival as compared to irrigation management. Adding the procedural justice indicators PCArule and PCAtrust has no significant effect (although it does slightly increase the explanatory power of the model and it reduces the significance of the pure framing effect). Adding other variables does not change the findings: subject characteristics like illiteracy, membership of majority caste group, income status and landholding do not explain game behavior and general trust and fairness perceptions also play no role. Outcomes are robust to alternative model specifications.[7] The number of observations decreases across models because of missing observations for some of the legitimacy indicators used.

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[7] Findings are robust for inclusion of initial WUA membership in place of current WUA membership, but not when self-reported current membership is replaced by WUA-reported initial membership.

Table 6: First-round contributions (WUA villages only)

	OLS		Tobit	
Gender	-0.6 (2.4)	1.2 (3.1)	-0.6(3.1)	1.6 (3.9)
Framed	-5.3 (3.0)**	-5.4 (4.0)	-7.6 (3.9)**	-7.0 (5.0)
WUA member	-7.4 (1.9)***	-7.6 (2.5)**	-10.3 (2.6)***	-10.3 (3.2)***
Framed*WUA member	6.3 (2.8)***	6.5 (3.6)**	8.7 (3.6)***	8.8 (4.5)**
Trust community members	-1.5 (1.9)	-1.4 (2.4)	-2.2 (2.4)	-2.0 (3.0)
Framed*trust community members	2.4 (2.9)	2.9 (3.7)	3.5 (3.7)	3.7 (4.6)
WUA board member	4.0 (1.7)**	4.0 (2.1)**	5.9 (2.2)***	6.3 (2.6)**
PCArule		0.1 (0.9)		0.1 (1.0)
PCAtrust		-0.2 (1.0)		-0.3 (1.3)
Framed*PCArule		-1.4 (1.2)		-2.0 (1.5)
Framed*PCAtrust		0.5 (1.7)		0.5 (2.0)
Constant	16.9(2.0)***	16.9 (2.7)***	19.7 (2.7)***	19.3 (3.5)***
F/ LR chi2	2.5	1.5	18.6	18.1
Adjusted R2/Pseudo R2	0.12	0.08	0.04	0.05
# Observations	75	62	75	62

Standard errors between brackets. *10%, ** 5%, *** 1% significant

When we analyze contributions across rounds using a multi-level mixed effects model, we find that non WUA members still contribute significantly less in the irrigation treatment and more in the festival treatment of the game. Given that the other estimates are also similar, we refrain from presenting full results in this paper, the findings indicating that there are no major differences in first-round behavior as compared to the subsequent rounds.

4.3 Correlation of experimental results with charge payments

Charge payment behavior is hardly correlated with game behavior, even in the irrigation treatment of the game. For the full sample, the Pearson correlation coefficient between first-round contributions and self-reported charge payments is -0.02 (across treatments). For the sub-sample of WUA villages, the Pearson correlation coefficient is -0.08 when comparing WUA-reported charge payments with first-round contributions in the irrigation treatment, and it is 0.08 when comparing charge payments with behavior in the festival treatment of the game.

There are two possible explanations for the lack of correlation between charge payment behavior and behavior in the game. First, we might be measuring two different aspects of cooperation. Ruttan (2008) suggests that the willingness to cooperate consists of two parts: 'a willingness to collaborate' and a 'willingness to invest'. Although we assumed that we measure the same willingness to cooperate by considering (1) water users' self-reported charge payments, (2) WUA-reported charge payments, and (3) water users' behavior in a field experiment, we might in fact have been measuring a 'willingness to invest' with (1) and (2) and a 'willingness to collaborate' with (3). If so, our results would suggest that perceptions of irrigation management legitimacy generate a willingness to collaborate (at least; for part of the water users), but that this does not necessarily translate into higher charge payments as charge payment behavior depends on water users 'willingness to invest'. This 'willingness to invest', as the results presented in Table 4 indicate, is determined more by incentives, like landholding and irrigation access, which are usually not affected by the decentralization process.

Second, the external validity of the current field experiment may be limited, which would be in line with Voors et al. (2011) who conclude from a lack of correlation between field and game behavior that the external validity of field experiments is low. Given that the framing of our field experiment did trigger different behaviors from WUA members and non-members, in line with their collaboration patterns in irrigation management, we would however like to argue that the validity of field experiments may be limited when considering incentives for cooperation, but that when considering factors like shared vision, beliefs and collaboration preferences the outcomes of field experiments may be externally valid indeed.

5. Conclusions

The objective of this paper was to assess whether different perceptions of the legitimacy of irrigation management would have real impacts in terms of contributions to irrigation management. This is relevant because one of the objectives of decentralizing irrigation management to WUAs is to improve irrigation system performance through enhancement of the legitimacy of irrigation management.

Although we could not determine the causal relationships between decentralization, WUA membership and legitimacy perceptions, we compared differences in legitimacy perceptions between WUA and non-WUA villages, and between WUA members and non-members. We

assessed whether these differences explained (self-) reported charge payments and contributions in a framed field experiment. We focused on two aspects of legitimacy: based on perceived procedural justice and based on shared vision. We found that perceptions of procedural justice indeed differ between WUA and non-WUA villages, and between WUA members and non-members, but that they do not explain game behavior nor subjects' self-reported or WUA-reported charge payments. What did explain game behavior is WUA membership: non-members contributing significantly less in the irrigation treatment as compared to the festival treatment. We showed that these differences were not caused by differences in perceived procedural justice, or by social or economic subject characteristics, but seem to be caused by differences in shared vision.

With regard to the policy implications of our findings the analysis indicates that improving the legitimacy of irrigation management will not be sufficient to improve irrigation management itself. Perceptions of the legitimacy of irrigation management may generate a willingness to collaborate with the authorities for part of the water users (the WUA members), but this does not necessarily translate into e.g. increased charge payments. Further research is required to assess the causal linkages between decentralization, legitimacy perceptions and cooperation, and to test whether these findings hold in other contexts too.

Acknowledgements

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Appendix A: Legitimacy Survey (translated from Marathi)

Village/hamlet (name)	
Household number and respondent name	
Date of the interview	

1. What is your:

Age=	Gender= male/ female	Caste=

2. How many members in your household? NB Children=under 12 years old.

Total=	Adults=	Children=

3. How much land does the household own? How much of this land is irrigated? (in acres)

Of the irrigated land, how much is canal irrigated? How much is river irrigated? (in acres)

How much is well irrigated? How much of the land is waste land? (in acres)

Total land=		Total irrigated land=	
Waste land=	Canal irrigated=	River irrigated=	Well irrigated=

4. Are you a member of WUA? Yes/No

5. Were you a WUA member when the WUA was formed? Yes/No

6. Are you, or have you recently been, member of the WUA executive committee?
Yes/No

7. Is any of your family members or close relatives member of the WUA executive committee?
Yes/No

8. Do you actively participate in other village level organizations?
Yes/No

9. Apart from agriculture, what are other sources of income to your household?

Wage laborer 01	Commerce/small business 02	Public sector employment 03	Other (specify)

10. Does off-farm income constitute an important part of your livelihood? Yes/No

11.   What is approximately the average monthly income of your household? Please include all income from wages, sold products, remittances, pensions of all household members, excluding taxes.

	Household
Rs 1- Rs 1800	01
Rs 1801- Rs 3000	02
Rs 3000 and above	03
Uncertain/Don't know	00

12.   What is the highest educational level that you have attained? (illiterate=1, 2)

01= no formal education	02= incomplete primary school	03= primary school	04=incomplete secondary school
05= secondary school	06= incomplete college	07= college/university	

13.   (WUA only) Are you aware of the WUA rules regarding water charges and irrigation water?
Yes/No

(non-WUA only) Are you aware of the irrigation department rules regarding (idem)?
Yes/No

14.   Are the rules applied consistently to everyone?
Yes/No

15.   (WUA only) Do you feel that WUA members can influence these rules?
Yes/No

(Non-WUA only) Do you feel that farmers can influence irrigation decision-making?   Yes/No

16.   (WUA only) Do you trust the WUA to represent your interests?
(Non-WUA only) Do you trust the Irrigation Department to represent your interests?

01 = Trust completely	02 =Somewhat trust	03=Don't trust much	04 =Don't trust at all

17.   (WUA only) Do you trust the WUA with your financial contributions?
(Non-WUA only) Do you trust the Irrigation Department with your financial contributions?

01 = Trust completely	02 =Somewhat trust	03=Don't trust much	04 =Don't trust at all

18.   Do you regularly pay your water charges?

01= Always	02= Usually	03= Sometimes	04= Seldom	05= Never

19. Do you believe that others regularly pay their water charges?

01= Most people	02= the majority	03= neutral	04= a minority	05= few people

20. (WUA only) Does the WUA treat all farmers equally with respect to irrigation water provisioning?

(Non-WUA only) Does the Irrigation Department treat all farmers equally (idem)?   Yes/No

21. Do you think most people would try to take advantage of you if they got a chance, or try to be fair?

People would try to be fair			People would take advantage of you	
01	02	03	04	05

22. Generally speaking, would you say that people can be trusted or that you need to be careful?

People can almost always be trusted	01
People can usually be trusted	02
You usually can't be too careful in dealing with people	03
You almost always can't be too careful in dealing with people	04

23. I 'd like to ask you how much you trust people from various groups.

	Trust completely	Trust somewhat	Do not trust very much	Do not trust at all
Your family	01	02	03	04
This community	01	02	03	04
People from the irrigation dept	01	02	03	04
Local authorities	01	02	03	04
People of another caste group	01	02	03	04
People of another religion	01	02	03	04

Appendix B: Game Instructions (translated from Marathi)

In bold: irrigation treatment (between brackets: festival treatment)

Greetings and welcome to all of you. My name is ... and I work for SOPPECOM, Pune (introduce rest of the team). We collaborate with VU University, the Netherlands in a research project about ***participatory irrigation management (household participation in community cooperation)*** for which we would like to play a few games with you. Depending on the decisions made by you and others in these games you can earn some money. The payment that you receive for these games is not from my pocket/SOPPECOM but from a European university research fund.

Before playing the game we will give you instructions. It is very important that you listen to these instructions carefully. In case you do not understand the instructions please raise your hand and ask for clarification. You are not allowed to communicate during the game. If you violate this rule, you will be dismissed from the game and will not earn any money.

Now I will start explaining the game. At the start of the game we randomly divide you into groups of four. You will play the game with these four people. The groups will remain the same throughout the game. Except for me, nobody will know who is in which group. Neither before, nor after the game, will you learn with whom you played the game. Thus, your actions are anonymous, and nobody will come to know your identity.

We will play the game 5 times, each time with the same group. At the beginning of each game you will each receive 20 token. Your task is to decide how much of the token you want to contribute to a group account and how many token you want to keep for yourself. ***You can see the group account as a shared fund of resources, like for example the irrigation system: when you contribute to irrigation system maintenance this will benefit the whole group. (You can see the group account as a shared fund of resources, like the collective effort of organizing the village festival: when you contribute to the organization of the village festival this will benefit all***).

Each token has a value, i.e. 1 token=1 Rs. You can contribute 0, 5, 10, 15 or 20 token to the group account. Every 5 token that you contribute to the group account is multiplied by 1.6. For example, when you contribute 5 token we add 8 Rs to the group account, which will be evenly shared by the members of your group. ***Clearly, the pay-offs of contributing to irrigation system maintenance are non-monetary (i.e. more water), but the principle that collaborative investments in a collective resource generate higher returns is the same. (Clearly, the pay-offs of investing effort in organizing the village festival are non-monetary (i.e. community sharing), but the principle that investments in a collective resource generate higher returns is the same.***

Every 5 token that you keep for yourself raises your own earnings with 5 Rs. Thus, every token that you keep raises your own earning and every token that you contribute raises the earnings of your group members as well. Also, you get earnings for each token that is contributed by other members of your group to the shared group account.

In the envelope which you received you will find pieces of paper with the numbers of token that you can contribute to the group account (show envelop). Please, leave only the number of token that you would like to contribute in the envelope. For example, if you want to contribute 5 token, you leave the number 5 in the envelope. You then close the envelope and hand the envelope to my assistant. Don't show the remaining numbers to the rest of the players, remember that you may be disqualified for doing so and thus not receive any money at the end of the game. Once all the group members have decided how much they want to contribute to the group account you will be informed about the contributions of all group members and how much token there are in the group account with the following sheet (*show sheet*):

	You	Highest contribution	Middle contribution	Lowest contribution
Contributions to the group account				
Total amount in group account				
Your earnings in this round of the game				

Are there any questions? Then we will now show you some examples to help you gain understanding about the calculation of your earnings:

1. If all four group members decide to contribute nothing, there are no contributions to the group account and each member earns 20 token (20 Rs)

2. If all four group members decide to contribute all token to the group account there are 80 token in the group account. Total earnings are 80*1.6=128 token, which are equally divided so that each member receives 32 token (32 Rs)

3. If you contribute all 20 token to the group account, the second member contributes 10 token, the third member contributes 15 token and the fourth member does not contribute anything, there are 45 token in the group account. Total earnings from the group account are 45*1.6=72 token (or 18 token per member) and the different members earn different amounts:

> *You earn:*   *0+18= 18 token*
>
> *Member 2 earns:*   *10+18 = 28 token*
>
> *Member 3 earns:*   *5 + 18+ = 23 token*
>
> *Member 4 earns:*   *20 +18 = 38 token*

4. If the other three members contribute all 20 token to the group account but you do not contribute any token, there would be 60 token in the group account. Total earnings from the group account are 60*1.6= 96 token (or 24 token per member) and the different members earn different amounts:

> *You earn:*   *20 +24 = 44*
>
> *Member 2 earns:*   *0 + 24 = 24*
>
> *Member 3 earns:*   *0 + 24 = 24*
>
> *Member 4 earns:*   *0 + 24= 24*

Is this clear? Are there any questions?

For the next round of the game you again receive 20 token, and you play the game another time with the same group. After playing the game 5 times, the total amount of token that you earned will be converted and we will pay this amount to you in real money. So if you, for example, earn 10 token in each round of the game your earnings are 50 token and you are paid 50 Rs. You will only receive your money in the end, i.e. after the game is played 5 times. We will keep a record of your earnings to make sure you receive the correct amount.

If you have any remaining questions please raise your hand. Before we start the game we will test your understanding of the game individually by asking each of you a couple of questions.

Control Questions
1. There are 80 token in the group account. How much can you maximally extract? How much can you minimally extract? (Answer: 20, 0)
2. If you extract 10 token from the group account, what are your earnings from the first stage? (Answer: that depends on what the others do)

So, we will now start the game. Please be silent and don't communicate or exchange with others during the game. If you have any questions please raise your hand and we will come to you. Remember that you are not allowed to communicate during the game and that if you violate this rule you will be dismissed from the game and will not earn any money.

Exit part

We have now come to the end of the game. Please remain seated and do not communicate with others until you have left this room. (Please also don't talk with the group waiting outside: they will play a different game so you will confuse them if you tell them about the game you played. Outside we will ask you to fill in a short survey and wait until the next group finishes the game. After they have finished we will call you back inside)

We will call you one by one to go to the experimenter, hand in your identification tag, and learn about your total earnings. We will then ask you to sign a receipt for the payments and you will receive your earnings and the show up fee in a closed envelop. You are then free to go home. Don't tell others what you have earned in the game, this is private information and nobody needs to know how you played the game.

I would like to thank you for your participation in this game.

Appendix C: Principal Component Analysis

We conducted Principal Component Analysis to assess the common elements between five procedural justice variables addressed in the legitimacy survey (items 13—17, see Appendix A). The analysis led to the selection of two components (with Eigenvalue larger than one) that jointly explain 66% of variance. We applied varimax rotation (with Kaiser normalisation) to distribute the explained variance over the two components, in order to make the interpretation of the two components clearer.

Table C.1 Components of the principal component analysis

Variable	Component 1	Component 2	Unexplained
Rule awareness (13)	0.66	0.28	0.30
Rule consistency (14)	0.51	-0.21	0.35
Rule influence (15)	0.54	-0.07	0.43
Trust that interests are well-represented (16)	0.01	0.70	0.27
Trust with finances (17)	-0.08	0.62	0.34

The numbers between brackets refer to the numbers of the survey questions: see Appendix A.

Component 1 consists of 3 variables that relate to survey items on WUA rules. Component 2 consists of 2 variables that relate to survey items on trust. PCArule and PCAtrust are the component scores of respectively Component 1 and 2. They are estimated by taking the weighted sum, according to their component loadings, of the five variables, transformed into standardized variables (with mean 0 and variance 1). These scores are subsequently used in the regression analyses. The internal consistency of both components is acceptable. For Component 1, Cronbach's alpha = 0.68, for Component 2, Cronbach's alpha = 0.66.