Public Trust in Organizations

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1 Experimental Design

We propose to implement the indefinitely-repeated binary trust-game in four treatments in a between-subject design. In all treatments, the public interacts with the organization repeatedly. For all supergames, the continuation probability after every round δ is 5/6.[1] The expected length of every supergame is thus 6. We implement indefinite repetition through random termination. To keep the length of the supergames constant across treatments, we generated three sequences beforehand and use them to determine the length of each supergame. There are 9, 5 and 9 supergames with 41, 40 and 39 rounds in total for the three sequences respectively and all three sequences will be implemented for one third of the subjects of each treatment.[2] The treatments vary in the organizational structure of the organization.

[1] A 'supergame' is one indefinitely repeated game, including all rounds until its random termination.

[2] We used Stata to generate 3 sequences of uniformly distributed random numbers between 0 and 1 with seeds 7, 8 and 9. We used seeds 1 to 6 in our previous research projects, therefore we start from 7. Denote the 3 sequences as $\{r_n\}_i = \{r_1, r_2, ...\}_i$, where $i = 7, 8, 9$ indicates the seed underlying the sequence and $n \in \mathbb{N}$. The first supergame has n_1 rounds if $r_{n_1} \leq 1/6$ and for all $n < n_1$, $r_n > 1/6$. The second supergame has $n_2 - n_1$ rounds if $r_{n_2} \leq 1/6$ and for all $n_1 < n < n_2$, $r_n > 1/6$. Repeat the procedure to find the lengths of all supergames. The resulting length sequences are SQ1 $(3, 2, 1, 17, 1, 1, 7, 7, 2)$, SQ2 $(16, 10, 2, 11, 1)$ and SQ3 $(6, 2, 2, 15, 2, 1, 5, 3, 3)$.

- **I** (Treatment with an individualistic organizational structure.) One individual decision-maker interacts repeatedly for 3 periods with the public. At the end of the third period, the current decision-maker is replaced by a new decision-maker.
- **C** (Treatment with a collectivist organizational structure and overlapping terms.) The committee consists of three decision-makers of overlapping generations. At the end of every period, the subject representing the oldest generation exits the committee. At the beginning of every period, a subject enters the committee as the young member.
- **CST** (Treatment with a collectivist organizational structure and synchronized terms.) Three decision-makers interact repeatedly for 3 periods with the public. At the end of the third period, all members retire an are replaced by three new members.
- **CA** (Treatment with a collectivist organizational structure, overlapping terms and mission announcement.) The treatment differs from C with an additional mission statement stage. Before each supergame, the committee votes on one of the two announcements: "We will always play 'send'." and "We will always play 'not send'." The committee announcement is chosen by majority rule and remains displayed on the screens of all subjects in the same group for the entire supergame.

In all treatments, the public consists of a single subject who stays in position until the supergame ends. In each period, we let subjects play the normal-form binary trust-game, that is public and decision-makers decide on actions simultaneously rather than sequentially. In the treatments C, CST and CA, the decision of the organization (that we call committee in the instructions) is made by simple majority rule.

At the end of each round in all treatments, the public is informed of the single decision-maker's decision or committee decision if and only if the public chose *Send*. Individual votes of committee members in C, CA and CST remain secret to the public. The single decision-maker always receives feedback on the decision of the public. Committee members receive feedback on individual votes, committee decision and the public's choice.

Matching Groups For treatment I, there are 27 subjects per session. Each session consists of 3 matching groups. Each matching group is further divided into 3 groups. Each group consists of one subject in the role of the public, an individual decision-maker and a waiting subject. Sessions start by randomly assigning subjects into the 3 matching groups. Within each matching group, we assign them then randomly into 3 groups and into the role of public, decision-maker or into the waiting pool.[3] Subjects assigned to the role of the public keep this role throughout the whole session. Before the start of each supergame, we randomly rematch subjects within their matching group. The subjects that are not in the role of the public are again randomly assigned to a role. For all sessions, every matching group is assigned a different sequence. Hence the lengths and numbers of supergames differ between the 3 matching groups.

In the theoretical model a decision-maker serves for a finite number of terms. Afterwards, the decision-maker retires. Implementing this set-up one-to-one in the laboratory would be difficult because it would require (indefinitely) many subjects. To get around this problem, we have to allow for re-entry while keeping the chance of re-entry into the same group sufficiently low to avoid repeated game effects also in the last term of a decision-maker. We chose the following implementation: The individual decision-maker interacts repeatedly with the public in the same group for 3 periods. Afterwards, she is replaced by the waiting subject of that group. She then waits in the next group for 3 periods before she becomes a decision-maker there. A decision-maker who retires from group 1, for example, continues by waiting in group 2 for 3 periods before becoming a decision-maker there. Similarly, the next step for a decision-maker who retires from group 3 is to wait in group 1 for 3 periods before becoming a decision-maker in that group. Hence, it takes 13 periods for a retired decision-maker to re-enter her initial group (and at first in the waiting pool), and 16 periods to become a decision-maker again in her initial group. With our continuation probability $\delta = 5/6$, the chance of the latter is only around 5%, which is low enough to not affect our theoretical predictions.

For treatments C, CST and CA, each session consists of one matching group. Each matching group again consists of 3 groups, and each group consists of one subject in the role of the public, 3 decision-makers in the committee of either overlapping or synchronized terms and a waiting pool of 3 subjects.

Analogous to treatment I, subjects can re-enter but the chance is equally small. All retired decision-makers move into the next group, and spend three periods waiting there before entering

[3]The role of the waiting pool will be explained in detail below.

that group's committee. Hence it again takes 13 periods for a retired decision-maker to re-enter her initial group, and 16 periods to become a decision-maker again in that group. This design makes sure, first, that the lab implementation is close to theoretical scenario and, second, that the treatments are identical with respect to the low re-entry probability.

In all treatments, the choice history of both the decision-makers and the public is visible to all waiting subjects in the same group.

Payment A potential concern regarding the individualistic set-up I could be that the public's choice only influences the payment of one decision-maker whereas it affects three players in the other treatments. Therefore, we design the payment in treatment I in such a way that the choice of the public also influences three players. To do so, we randomly draw two subjects from another matching group as "passive members" of the organization. They are paid the same amount as the decision-maker, but they do not engage in the decision-making. Subjects are not aware whether they are chosen as passive members or not until the end of the session.

In all sessions, subjects are payed a show-up fee of EUR 5 in CST and a show-up fee of EUR 4 in I, C and CA. In addition, they are payed their accumulated earnings over all rounds. The points they earn are exchanged to euros at an exchange rate of 7 cents per point. As subjects that are not in the role of the public are in the waiting pool in half of the rounds (in expectation) they would earn substantially less than the subjects in the role of the public in the C, CST and CA treatments. In the I treatment, they earn enough extra points from being picked as passive assistants. To raise the average earnings of the subjects which are not in the role of the public in C, CST and CA, we pay waiting subjects a fix wage of 5 points per round that they have to wait. With this payoff structure, we expect average payoffs between EUR 20 and EUR 25 per session.

Experimental Parameters Figure 1 shows the stage-game payoffs for all treatments. The public is the row player, the decision-makers are the column players. Players are endowed with $E = 5$. If the public does not make a transfer, players end up with their endowments. If the public transfers $T_1 = 4$, the (three) committee members receive $R_1 = 6$,; i.e., the transfered is multiplied by a factor of (3*)1.5. When a transfer is received, the decision-maker(s) can send back $T_2 = 2$, which reduces her payoff to 9. The public receives $R_2 = 8$; i.e., the back transfer (from all three committee members) T_2 is multiplied by a factor of 4 (over 3).

We choose these parameters for the following reasons. First, they ensure that in collectivist organization with overlapping terms, co-operation between the public and decision-makers can be sustained with $\delta = 5/6$. Second, the public is indifferent with regard to 'Send' and 'Not Send' (in the absence of repeated game effects) if it considers decision-makers to be trustworthy with a probability of 50%. Third, both parties receive the same payoffs if 'Send' is chosen by both and if 'Not Send' is chosen by the public. Finally, the co-operation payoff 9 is efficient.[4]

Figure 1: Stage Game Parameters

	$Send_2$	$Not\ Send_2$
$Send_1$	$9, 9$	$1, 11$
$Not\ Send_1$	$5, 5$	$5, 5$

All treatments are programmed in z-Tree (Fischbacher, 2007). Subjects are recruited via hroot (Bock et al., 2014). We intend to run 20 sessions in total (3 * 6 sessions with one matching groups of 21 subjects each for the C, the CA and CST treatments, and 2 sessions with 3 matching groups of 9 subjects each for the I treatment) with a total of 432 subjects.[5] We will conduct half of the sessions of each treatment in LakeLab of the University of Konstanz, and the other half in the WiSo-Experimentallabor of the University of Hamburg.

Pilot We piloted versions of the C and the I treatment with a different stage game in December 2019. The pilot demonstrated that the planned number of supergames can be played in less than two hours and that subjects are able to understand the matching protocol. However, they also showed us that the stage game that we let them play was too complicated. In the game, the subjects in the role of the public had to guess the (inflation) choice of the organization, and correct guesses were incentivized with a quadratic loss function. This set-up was motivated by the inflation-expectation literature. While we did observe lower inflation in the C treatment (as expected), we also noted via the quiz answers that many subjects had a hard time understanding their pay-off functions. After reconsidering the exact focus of the project, we decided to go for the broader question of trust in organizations and the much simpler binary trust-game as our stage game.

[4] Reciprocating transfers induces a loss of 2 for the decision-maker in individualistic treatment, and an aggregate loss of 6 in collectivist treatments. The public gains 8. Hence, co-operation increases efficiency.

[5] These numbers stem from our power calculations. See next section for details on these calculations. Note, that in case we do not implement treatment CA, the total number of subjects would come down to 306.

2 Hypotheses, Tests, and Further Analyzes

Hypotheses and Tests For the theoretical reasons outlined in the previous sections and judging by results from previous studies comparing finite and indefinite repetitions of a stage game, we expect higher co-operation in the C treatment than in the CST and I treatments. Moreover, we expect that an announcement of an organizational mission leads to higher trust in the CA treatment than in the C treatment. As usual in the analysis of experiments with indefinitely repeated games, we will give subjects time to learn and focus our attention on the last five supergames to test our hypotheses.

Based on these observations we formulate our hypotheses, which directly follow from the theoretical predictions in Section 3.

H1s: *Co-operation rates will be higher in the C treatment than in each of the CST and I treatments in the last five supergames. Co-operation rates will also be higher in the CA treatment than in the C treatment in the last five supergames.*

We will test the three corresponding H0s by comparing the co-operation rates within the pairs of treatments C–I, C–CST, and CA–C. We will run (one-sided) $t-$tests on the equality of the co-operation rates, averaging the co-operation rates within each matching group first and then taking these averages as our independent observations. In other words, we will treat each matching group as one independent observation, which is a very conservative way of dealing with potential dependencies within matching groups. We will further run a two-sided $t-$test of the Null-hypothesis that there is no difference in the trust rate between I and CST, which we predict to be the case.[6]

[6]For this test, we will again first average the co-operation rates within each matching group and then take these averages as our independent observations.

Simulations In the simulations, we iterated the following process 20,000 times for various effect sizes:

1. Create a data set of 5 (supergames) * 3 (number of matching groups per treatment) * 3 (number of groups per matching groups) * 2 (treatments) observations and an indicator variable for treatment 2.
2. Draw random numbers from the Bernoulli distribution with success probability 0.4 for treatment 1.
3. Draw random numbers from the Bernoulli distribution with success probability 0.4 + (effect size) for treatment 2.
4. Average the random draws within each group. These are the simulated average co-operation rates.
5. Regress the average co-operation rates on the indicator variable to get the difference and the cluster-adjusted standard error (clustering on the matching group). Use these for a one-sided $t-$test. Return the $p-$value.

Finally, we computed the share of the $p-$values smaller than 0.05, which gave us the statistical power.

Our simulations suggest that we will have enough power ($> 87\%$) to detect effect sizes of 15 percentage points at the 5% level with a one-sided $t-$test and 6 matching groups per treatment. We checked for the accuracy of the method by running a simulation with an effect size of 0 (again with 20,000 iterations of the process described above). The relative frequency of $p-$values smaller 0.05 was 0.051, which is very close to the 0.05 that we would expect in this case.

Further Analyses In addition to testing our hypotheses, we will explore subjects' behavior in depth to better understand the aggregate findings. These analyzes will be explorative in nature and we, therefore, refrain from specifying further concrete hypotheses. This part will include analyzes of the voting behavior of the members of the organization, the evolution of co-operation over the rounds within supergames and over supergames, as well as strategy estimations.

Strategy choices have been studied extensively for the repeated Prisoner's Dilemma (for an overview of the findings, see e.g., Dal Bó and Fréchette, 2018) but with few exceptions (Engle-Warnick and Slonim, 2004, 2006) not for the repeated trust-game, and certainly not for our particular version of it. To fill this gap, we will build on the strategy frequency estimation method (SFEM) introduced by Dal Bó and Fréchette (2011), and use the R package stratEst, which was developed by Dvorak (2019) and first used in Dvorak and Fehrler (2019). The SFEM is frequently used to obtain maximum-likelihood estimates of the shares of a candidate set of strategies in experimental data. Simply generating a candidate set of several strategies for our set-up has the clear disadvantage that the results of the SFEM are specific to this set and it is hard to know ex ante which strategies should be included because of the small number of previous studies on the indefinitely-repeated trust-game. To circumvent this problem, we will compute Maximum Likelihood estimates for an endogenously determined number of strategies where the structure of each strategy is the result of a model selection process. Thus we will infer the strategies from the data rather than imposing a predefined set of strategies. The process will always start with a large number of such generic strategies, which will then be reduced step-by-step using the integrated classification likelihood criterion (IC-BIC, Biernacki et al. (2000)). The ICL-BIC is an entropy-based selection criterion for mixture-models which has been used to estimate the dimensionality of the strategy space in other settings before (Breitmoser, 2015).

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