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Voluntary Partnerships For Equally Sharing Contribution Costs - Theoretical Aspects and Experimental Evidence -

Irene Maria Buso, Daniela Di Cagno, Werner Gueth, Lorenzo Spadoni

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- Theoretical Aspects and Experimental Evidence -

Buso, Irene Maria
ibuso@luiss.it

Di Cagno, Daniela
ddicagno@luiss.it

Gueth, Werner
gueth@coll.mpg.de

Spadoni, Lorenzo
lspadoni@luiss.it

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Abstract

Contributors to public goods with individual commitment power decide before voluntarily contributing, whether and when to join the (sub)group whose partners equally share the cost of their contributions. We analyse the voluntary formation of the cost sharing partnership, when it is internally (no partner wants to opt out) and externally (no outsider wants to opt in) stable, and how (un)stable partnerships affect contribution behaviour. All contributors decide between joining and not joining for all possible conditions before learning in which random sequence individual contributors successively enter or not the partnership. After being informed about whether there is no partnership and, when there is one, how many belong to it, and whether one is partner or outsider, all group members independently contribute. So participants can freeride not only by abstaining from voluntary contributions, but also by not joining the partnership. Theoretically participants would form a stable cost sharing partnership whose partners (outsiders) contribute maximally (minimally); experimental evidece shows that hardly any such benchmark behavior exists. Instead we confirm a strong inclination to join the partnership to avoid or at least weaken freeridng incentives.

JEL Codes: C92, H41, D85
Keywords: Endogenous Public Good, Group Formation, Group Size

1 Introduction

Voluntarily forming a partnership for equally sharing contribution costs assumes self-commitment power and allows to overcome the freeriding problem. First contributors voluntarily determine when they would or would not join the partnership. Then after learning whether there is no partnership and, if there is one, how many belong to it and whether one is partner or outsider, all group members independently decide how much to contribute. So one can freeride by not contributing and/or not joining the partnership. We investigate theoretically and experimentally such partnership formation and its effect on contribution behavior.

Although not joining the partnership may render outsiders better off, this does not exclude opportunistically joining it. In case of a stable partnership (Selten and Güth, 1982) no partner would be better off by unilaterally opting out (internal stability) and no outsider would gain by unilaterally opting in (external stability). Our design excludes multiple (stable) partnerships via imposing a sequential random order in which contributors do (not) join, aware of how many of those deciding earlier in the sequence have already joined.

Paradigmatic field examples of cost sharing partnerships are trade unions, financed by the fees of their members to negotiate with employers about work conditions and wages. When successful collective negotiations achieve wage increases and other improvements, like shorter work time, at least in Continental Europe with national trade unions, employers generally grant the higher wages and better work conditions not only to union members but to all employees. By this, employers cleverly provide outsider incentives for employees resulting in partly very low shares of unionized employees. In the USA, unions have reacted to this social dilemma by enforcing closed-shop agreements which exclude non-unionized employees from enjoying union-negotiated improvements[1]. Our setup resembles collective wage bargaining without the closed-shop restriction where sequentially forming the partnership captures the continuous exit of old and entry of new union members.In case of partnerships with few members like in micro-lending or in alliance formation of countries, sequential formation seems typical.

An even more obvious example is endogenous cartel formation for price leadership on homogenous oligopoly markets. Assuming symmetry, similar to our setup, all sellers on the market with a linear demand function could have the same strictly quadratic and convex cost functions. Cartel outsiders would face a constant price, which the price leading cartel guarantees by clearing the market at its price. So outsiders sell quantities according to their supply functions whereas all cartel members equally share the residual demand at the price chosen by them. So like partners of contribution cost sharing partnerships all cartel members earn the same what allows to let a random cartel member determine the price. In such a

[1] In case of closed-shop collective wage negotiations usually all permanent employees become union members (see Booth, 1985 or Naylor and Cripps, 1993).

market setup obviously cartel outsiders never face worse than cartel members (outsiders can optimally react to the price whereas cartel members have to sell their equal share of the residual demand). Like in our setup one can derive (internally and externally) stable cartel size m^*, however, without the obvious simplicity of our setup, based on linear public good provision, which renders it more suitable for an experimental analysis.

According to our experimental protocol, participants decide whether to join the partnership or not before the computer selects the random sequence: participants sequentially join or not the partnership via (not) entering as the first, second,..., being aware of how many of those deciding earlier have already joined. These complete plans, to which we refer as (participation) profiles, allow to distinguish quite clearly participant types like unconditional cooperators (freeriders), who would always (never) join and maximally (minimally) contribute, but also clever opportunists who join only when otherwise no stable partnership would result (see Fischbacher et al., 2001, Kocher et al., 2008, for related categorization attempts). But are the individual plans when to join or not stable across repetitions or path dependent due to receiving feedback information?

From an institutional policy perspective we analyse whether partnerships are formed at all and, if so, whether they are predominantly stable and how this affects contributions. Will outsiders and partners contribute as predicted by opportunism (own payoff maximization) and how do (un)stable partnerships affect efficiency, compared to no partnership formation?

One finding is nearly no support for consistent opportunistic behavior. However, considerable shares of participants would never (always) opt for becoming a partner and would nearly always (never) freeride in contributing. On average, there is a higher than predicted willingness to join and contributions by partners are much larger than by outsiders. Moreover, average contributions are larger and more stable than those reported for standard public goods experiments.

This paper develops as follows: Section 2 presents the game form and the research hypotheses; Section 3 describes the experimental protocol; Section 4 informs about our results and Section 5 concludes.

2 Game form and experimental design

Let $n(\geq 3)$ denote the group size, i.e., the number of contributors. When the partnership is formed with at least $m(\geq 2)$ partner(s), we refer by i to partners and, when $m < n$, by j to outsider(s). The payoff of an outsider j is:

$$e - c_j + \alpha C \quad with \quad 0 < \alpha < 1 < n\alpha$$

and $C = c_1 + \ldots + c_n$ as the total contribution, $e = 25$ is the individual endowment, and integer c_j with $5 \leq c_j \leq 20$ denotes j's contribution. For at least $m(\geq 2)$ partners i what matters, too, is:

$$C(m) = \sum_{i=1}^{m} c_i,$$

i.e., how much all partners contribute in total. All partners i earn the same, namely:

$$e - \tfrac{C(m)}{m} + \alpha C.$$

When deciding whether or not to join the partnership, contributors must anticipate that, in case of common and anticipated opportunism, outsiders j freeride:

$$c_j^*(m) = 0.$$

Instead for partners i the optimal contribution is m-dependent via:

$$c_i^*(m) = \begin{cases} e & if \quad m\alpha > 1 \\ 0 & if \quad m\alpha < 1 \end{cases} .$$

The partnership is formed sequentially, i.e., one decides to join or not, aware of how many of those preceding oneself in the sequence have joined before. So, each contributor $k = 1, \ldots, n$ has to make five binary choices $\delta_k(.) \in \{0, 1\}$ in case of $n = 3$ and nine binary choices in case of $n = 4$. Here $\delta_k \in \{0, 1\}$ means that: [2]

$$\delta_k = \begin{cases} 1 & k\, joins\, the\, partnership \\ 0 & k\, does\, not\, join\, the\, partnership \end{cases} .$$

We refer to the list of these five, respectively nine, binary decisions δ_k of contributor k as $k's$ (partnership) profile. After eliciting δ_k for all $n(\geq 3)$ contributors $k = 1, ..., n$ a random sequence is randomly drawn in an unbiased way and determines, based on all n profiles, whether there is no partnership at all, i.e., $\sum_k \delta_k \leq 1$, denoted by $m = \emptyset$, or, in case of $m \neq \emptyset$, the size $m(\geqslant 2)$ of the partnership, and who is partner and, for $m < n$, who is outsider.

As long as $m\alpha < 1$ an opportunistic partner i will freeride whereas i would maximally contribute when $m\alpha > 1$. Instead outsider(s) j would freeride. So one will opportunistically join the partnership only if one's joining increases m from $m\alpha < 1$ to $(m + 1)\alpha > 1$. This improves the equal payoffs of partners i and even more those of outsiders j. So, partnerships of size m^* with $(m^* - 1)\alpha < 1 < \alpha m^*$ are externally stable (no outsiders want to opt in) and, since m with $(m - 1)\alpha > 1$ allows at least one partner to gain by unilaterally opting out, also internally stable. Stable partnerships render each partner pivotal (similar to strict equilibria in threshold public goods games): if one partner would opt out, the partnership would not anymore trigger maximal contributions of its remaining partners and, in case of $m > m^*$, at least one partner would opt out.

Our experimental design distinguishes two conditions:

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[2] When being last in the sequence and reacting to "0" having joined before, both decisions $\delta_k = \{0, 1\}$ would imply $m \leq 1$, i.e., $m = \emptyset$ (in Table 1 such cases are excluded by "X").

$$m^* = m^*(\alpha) = \begin{cases} 3 & for\ \alpha = .4\ and\ n = 4 \\ 2 & for\ \alpha = .6\ and\ n = 3 \end{cases} .$$

Both conditions theoretically imply $m \neq \emptyset$ and $m^* = n - 1$, i.e., the coexistence of m^* partners and one outsider. Table 1 presents the optimal δ^*-profiles predicting stable partnerships of size m^* with 0-contributions by its outsiders and full contributions by its partners. The first in the sequence never joins, the second one only when the first one has not joined before, etc., in line with backward induction.

Table 1: The sequentially rational profiles $\delta^* \in \{0, 1\}$ with "X" excluding a choice when both, $\delta = 0$ and $\delta = 1$, imply $m = \emptyset$.

n=3				n=4				
how many have joined before you	your position in the sequence			how many have joined before you	your position in the sequence			
	3rd	2nd	1st		4th	3rd	2nd	1st
0	X	1	0	0	X	0	1	0
1	1	0		1	0	1	0	
2	0			2	1	0		
				3	0			

Universal $\delta_k = 0$ behaviour for all positions in the sequence by all n contributors is also an equilibrium outcome since its common expectation renders each choice $\delta_k \in \{0, 1\}$ ineffective. This equilibrium, however, fails to be perfect (Selten, 1975): in a slightly perturbed game all choices in Table 1 have small positive probabilities of being decisive so that optimally reacting as in Table 1 is the unique optimal profile.

3 Experimental protocol and research focus

We collected data of 96 participants in 4 sessions employing the experimental methodology, described in Buso et al. (2020), i.e., via lab-like online sessions. The two conditions with different group size (n) and marginal propensity to contribute (α) are run between subject. Participants played 12 rounds, aware of not interacting in the same group in two consecutive rounds. The re-matching group size (of which participants were unaware) is 6 in $n = 3$ & $\alpha = .6$ and 8 in $n = 4$ & $\alpha = .4$. Only one randomly selected round was paid (in addition to the show-up fee of 6 euro).

Participants were paid at the end of the experiment via Prolific (Palan and Schitter, 2018). Sessions lasted on average 90 minutes. The experiment was programmed in oTree (Chen et al., 2016) and carried out with student participants of Luiss Cesare Lab, recruited via Orsée (Greiner, 2015) among students of Economics, Law and Political Science. None participated in more than one session.

Rounds proceed as follows: each participant first makes the 5 binary decisions to join or not in case of $n = 3$ and 9 in case of $n = 4$ for all possible positions in the sequence. Then a random sequence is drawn, and the computer works out whether and which partnership is formed. Each participant is alerted to $m = \emptyset$ or the partnership size $m(\geq 2)$ and whether (s)he is a partner or outsider. Based on this information, participants finally decide independently how much to contribute.

Each participant is endowed with 25 ECU (experimental currency unit) and can contribute any integer amount between and including 5 and 20 ECU. This guarantees that, irrespective of their interaction outcomes, participants earn a proper sum of what they kept for themselves and what they gain from public good provision. Each token is converted in euro at the exchange rate, 1 ECU=0.50 euro.

After simultaneously contributing each group member is asked for beliefs concerning others' contributions without this being incentivized.[3] After each round participants periodically receive feedback information, their own payoff, whether $m = \emptyset$ or, in case of $m \neq \emptyset$, the size (m) of the partnership, whether they are partner or outsider, their own and the total contribution, and, if they are partners, the total contribution of all partners. After feedback information participants play another round till reaching the last one. In addition to test behavioral hypotheses like benchmark behavior, derived in Section 2, we seem to offer and test a new method how to account for the usually substantial heterogeneity in individual choice behavior by partnership profiles and their correlation with contribution choices. The data are rich due to:

- asking each participant in the first stage for 5, respectively 9 binary "join" ($\delta = 1$) or "not" ($\delta = 0$) choices to which we refer as individual partnership profiles,
- observing how individual contributions condition on $m \neq \emptyset$, on partnership size m and whether one is partner or outsider,
- eliciting (without additionally incentivizing this) beliefs about others' contribution choices after contributing, and
- running 12 successive rounds to assess whether profiles and contribution behavior are

[3]Since beliefs depend on m and, in case of $m \geq 2$, whether one is partner or outsider, it has been asked:
- if $m = \emptyset$: how much did you expect a typical other to contribute?
- if $m = n$: how much did you expect a typical partner to contribute?
- if $2 \leq m < n$: if a partner, how much did you expect
  - the (a typical for $m > 2$) partner to contribute?
  - the (a typical for $n = 4$ and $m = 2$) outsider to contribute?
- if outsider, how much did you expect
  - a typical partner to contribute?
  - (only if $n = 4$ and $m = 2$) the other outsider to contribute?

stable or strongly path dependent due to periodic feedback information.

Trying to account for heterogeneity in individual behavior is closely related to Fischbacher et al. (2001), who ask their participants for strategy vector choices in linear public good games with "leaders" (independent contributors) and "followers" (conditioning contributors) and categorize mainly by reaction profiles of followers. This categorization has been extensively used (e.g., Kocher et al., 2008) to explore intercultural heterogeneity what could also be done by our two-stage setup for "$n = 3$ & $\alpha = .6$" which is simpler.

Both methods (Fischbacher et al., 2001 and ours) presuppose individual commitment power. In future work we plan to extend the categorization via participation profiles also to contribution behavior (see our Conclusions for details).

4 Results

We begin with describing the whole choices in the first stage of each round. As these are our main novel aspect, we provide extensive descriptive statistics and related regression analyses. The findings on contribution behaviour are reported thereafter.

4.1 Partnership formation

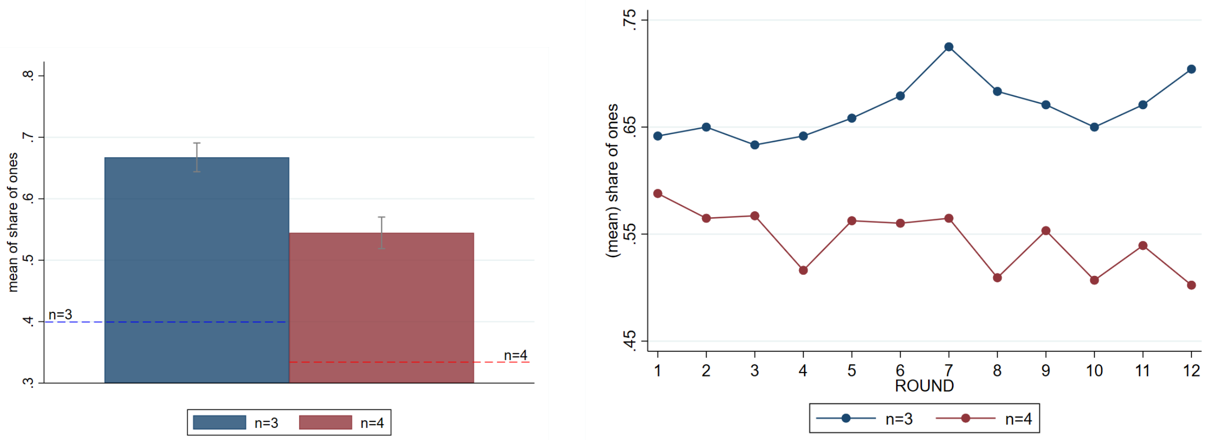
We first use the profiles to explore the general *Willingness to Join* via an aggregate measure, the relative frequency of $\delta = 1$-choices, henceforth *share of ones*.[4] We further analyse how the 12 successive individual profiles vary across the 12 rounds to identify *individual patterns in joining profiles*. Whether the *Willingness to Join* leads to actual partnership may depend on the random sequence drawn. The systematic way of eliciting the *Willingness to Join* allows to simulate all possible sequences of sequential partnership formation and to compare the actual and simulated frequencies of partnership with varying m size.

Willingness to Join

The average *share of ones* and its dynamics are illustrated in Figure 1 and Table 2. The left panel of Figure 1 shows that the average *share of ones* for $n = 3$ & $\alpha = .6$ significantly dominates the one for $n = 4$ & $\alpha = .4$ (Mann-Whitney test, $z = 7.716$, $p = 0.000$). Furthermore, this difference widens across rounds, even if the overall pattern remains quite stable in both conditions (see right panel of Figure 1).

[4]The *share of ones* is the average number of $\delta = 1$-choices divided by the number of all δ-choices, 5 in $n = 3$ and 9 in $n = 4$. We will later use this *Willingness to Join*, in all δ-regression analyses.

Figure 1: The left panel reports the *shares of ones* with confidence intervals at 95%; dashed lines represent the theoretical prediction for each condition; the dynamics across rounds are illustrated in the right panel.



The average *shares of ones* is always greater than theoretically predicted (left panel of Figure 1): 65% in $n = 3$ & $\alpha = .6$ (theoretically 40%) and 54% in $n = 4$ & $\alpha = .4$ (theoretically around 33%). Table 2 reveals a strong willingness to join even when not optimal, although the relative frequency of joining when optimal is far below 1 in both conditions. So there is quite some tendency to opt for the partnership which, however, is hardly in line with benchmark predictions, based on common (and anticipated) opportunism.

Table 2: *Share of Ones* per choice cell

$n = 3$ & $\alpha = .6$				$n = 4$ & $\alpha = .4$				
how many have joined before you	m*=2			how many have joined before you	m*=3			
	your position in the sequence				your position in the sequence			
	3rd	2nd	1st		4th	3rd	2nd	1st
0	X	0.44*	0.75	0	X	0.32	0.42*	0.62
1	0.70*	0.74		1	0.42	0.54*	0.59	
2	0.68			2	0.64*	0.66		
				3	0.65			

This Table displays the relative frequency of $\delta = 1$ for each choice cell in stage 1. The cells where $\delta = 1$ is optimal are identified by *.

For the dynamics of the shares of ones Table 3 provides regression results with the individual *share of ones* in each round as dependent variable. The regressions support path dependence in joining behaviour for both conditions: there is a positive and significant relation between the *share of ones* in successive rounds in regressions (1) and (3). Another path dependence is shown by regressions (2) and (4): there is a negative relation between not being a member in $t - 1$ and the *share of ones* in t and a significantly positive relation between being a member in $t - 1$ and the *share of ones* in t. Regressions (5) and (6) on the whole sample further confirm path dependence in joining behavior with stronger effects for $n = 3$ & $\alpha = .6$ than for $n = 4$ & $\alpha = .4$.

Table 3

	Depvar: individual share of ones at round t					
	(1)	(2)	(3)	(4)	(5)	(6)
	$n = 3$ & $\alpha = .6$	$n = 3$ & $\alpha = .6$	$n = 4$ & $\alpha = .4$	$n = 4$ & $\alpha = .4$	$n = 3$ & $\alpha = .6$ *and* $n = 4$ & $\alpha = .4$	$n = 3$ & $\alpha = .6$ *and* $n = 4$ & $\alpha = .4$
No Partnership $t-1$ (baseline)						
m=2 & member $t-1$		0.02		-0.01		
		(0.02)		(0.03)		
m=2 & no member $t-1$		0.04		-0.05*		
		(0.03)		(0.03)		
m=3 & member $t-1$		0.05**		0.01		
		(0.02)		(0.03)		
m=3 & no member $t-1$				-0.01**		
				(0.04)		
m=4				0.06**		
				(0.03)		
member $t-1$						0.04**
						(0.01)
Share of ones $t-1$	0.37***		0.45***		0.42***	
	(0.04)		(0.04)		(0.02)	
N=4					-0.10***	-0.16***
					(0.03)	(0.04)
Dummy Final Round	0.04	0.5	-0.04	-0.03	-0.0001	-0.004
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
Demographics	✓	✓	✓	✓	✓	✓
Round dummies	✓	✓	✓	✓	✓	✓
Session Number	✓	✓	✓	✓	✓	✓
Observations	528	528	528	528	1056	1056
Number of individuals	48	48	48	48	96	96
Number of groups	8	8	6	6	14	14

The model used is a multilevel one, with two nested levels: individual and matching group. Demographic controls include gender and age of the participant, field of study, geographic region, number of past experiment, self reported easiness of experiment.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

There are too many possible profiles and even the same *share of ones* can allow for multiple *individual joining profiles*. We therefore focus on profiles with a percentage share of at least 5% of all $48x12 = 576$ profiles in each condition. Table 4 for $n = 3$ & $\alpha = .6$ and Table 5 for $n = 4$ & $\alpha = .4$ distinguish 5 different profiles for either condition (in addition to the optimal one although its share is close to nil).

For either condition Profile 1, "always joining", seems to capture unconditional cooperation and can be rationalized by strong efficiency concerns. Instead Profile 2, "never joining", could be due to not wanting to voluntarily engage in collective action, even when profitable. Profile 4 for $n = 3$ & $\alpha = .6$ can be described as "always joining", but not as the first one. Except for Profile 4 for $n = 3$ & $\alpha = .6$, all other profiles (Profile 3 and 5 for $n = 3$ & $\alpha = .6$ and Profile

3, 4, 5 for $n = 4$ & $\alpha = .4$) seem to aim at $m = n$ whenever the grand partnership ($m = n$) is still possible. The tendency to form the grand partnership is contrasted by a tendency of not joining when $m = n$ is not anymore possible.

Table 6 summarizes the percentages of the five more frequent joining profiles (as well as for optimal joining in the top row). Altogether the five frequent profiles account for 68.9% of the $n = 3$ & $\alpha = .6$ and 46.75% of the $n = 4$ & $\alpha = .4$ profiles in the data set. Both conditions yield significant shares of "always joining" (24.8% and 14.5%, respectively) and "never joining" (8% and 13%, respectively) profiles, and these shares increase in last rounds (from 7 to 12), as shown in Table 6. Optimal joining profiles are negligible (3% in $n = 3$ & $\alpha = .6$ and 0% in $n = 4$ & $\alpha = .4$).

Table 6 also reports the percentage of subjects adopting a certain profile in at least 6 of their 12 profile choices: overall 49% of the subjects in $n = 3$ & $\alpha = .6$ and 30% in $n = 4$ & $\alpha = .4$ reveal rather stable *individual joining habit* (see Table 14 in the appendix for more details). This finding suggests inertia in the share of ones even at the individual level (Table 3).

Table 4: Types of Joining Profiles when $n = 3$ and $\alpha = .6$

$n = 3$ & $\alpha = .6$							
Joining Profile 1				Joining Profile 2			
How many have joined before you	Your position in the random sequence			How many have joined before you	Your position in the random sequence		
	3rd	2nd	1st		3rd	2nd	1st
0	X	1	1	0	X	0	0
1	1	1		1	0	0	
2	1			2	0		
Joining Profile 3				Joining Profile 4			
How many have joined before you	Your position in the random sequence			How many have joined before you	Your position in the random sequence		
	3rd	2nd	1st		3rd	2nd	1st
0	X	0	1	0	X	0	0
1	1	1		1	1	1	
2	1			2	1		
Joining Profile 5				Optimal Profile according to theory			
How many have joined before you	Your position in the random sequence			How many have joined before you	Your position in the random sequence		
	3rd	2nd	1st		3rd	2nd	1st
0	X	0	1	0	X	1	0
1	0	1		1	1	0	
2	1			2	0		

This Table displays the joining profiles with at least 5% of the overall choices (576).

Table 5: Types of Joining Profiles when $n = 4$ & $\alpha = .4$

$n = 4$ and $\alpha = .4$

Joining Profile 1				
How many have joined before you	Your position in the random sequence			
	4th	3rd	2nd	1st
0	X	1	1	1
1	1	1	1	
2	1	1		
3	1			

Joining Profile 2				
How many have joined before you	Your position in the random sequence			
	4th	3rd	2nd	1st
0	X	0	0	0
1	0	0	0	
2	0	0		
3	0			

Joining Profile 3				
How many have joined before you	Your position in the random sequence			
	4th	3rd	2nd	1st
0	X	0	0	1
1	0	0	1	
2	1	1		
3	1			

Joining Profile 4				
How many have joined before you	Your position in the random sequence			
	4th	3rd	2nd	1st
0	X	0	0	1
1	0	1	1	
2	1	1		
3	1			

Joining Profile 5				
How many have joined before you	Your position in the random sequence			
	4th	3rd	2nd	1st
0	X	0	1	1
1	0	1	1	
2	1	1		
3	1			

Optimal Profile according to theory				
How many have joined before you	Your position in the random sequence			
	4th	3rd	2nd	1st
0	X	0	1	0
1	0	1	0	
2	1	0		
3	0			

This Table displays the joining profiles with at least 5% of the overall choices (576).

Table 6: Frequency of Joining Profiles

type of choices	$n = 3$ & $\alpha = .6$			$n = 4$ & $\alpha = .4$		
	% choices		% subjects	% choices		% subjects
	All rounds	Rounds 7-12		All Rounds	Rounds 7-12	
According to theory	3	2	0	0	0	0
Profile 1 (always join)	24.8	32.3	25	14.5	17	14.5
Profile 2 (never join)	8	10	6	13	17	12.5
Profile 3	17.9	17	10	5	4.2	0
Profile 4	5.7	2.7	2	6.25	3.1	2.1
Profile 5	9.5	8.7	6	8	11.1	6.25
total	68.9	72.7	49	46.75	52.4	30

For each joining profile in Table 4 and Table 5, we report its percentage of choices and the percentage of subjects using it in at least 6 out of 12 rounds.

Comparison of Actual and Simulated m-frequencies

In spite of the significantly larger *Willingness to Join* for $n = 3$ & $\alpha = .6$, the relative partnership frequency partnership does not differ between the two conditions, a trend which persists across time (74% for $n = 3$ & $\alpha = .6$ respectively 75% for $n = 4$ & $\alpha = .4$; t-test on actual frequencies, $t = 1.5308$, $p = 0.06$), as shown in Figure 2 and Table 7. However, this result is not confirmed when simulating all possible sequences of partnership formation (see Table 7)[5]. The simulated partnership percentages [6] show that there is a significant higher number of partnerships formed in $n = 3$ & $\alpha = .6$ than in $n = 4$ & $\alpha = .4$ (78% for $n = 3$ & $\alpha = .6$ respectively 72% for $n = 4$ & $\alpha = .4$; t-test, $t = -25.1549$, $p = 0.0000$)[7]. Overall, partnership formation, $m \neq \emptyset$, dominates in both conditions and this trend is stable (see the right panel in Figure 2).

[5]Considering simulated partnerships, we have 3456 observations for $n = 3$ & $\alpha = .6$ and 13824 observations for $n = 4$ & $\alpha = .4$. The 3456 data are derived from 576 choices which can be combined according to 6 possible sequences. The 13824 data are derived from 576 individual profile choices which can be applied to 24 possible sequences.

[6]The actual frequencies are included in the simulated ones as a subgroup.

[7]The t-test is run considering the averages at subject level. The result is confirmed also using the Mann-Whitney test.

Figure 2: Shares of actually formed partnerships with confidence intervals at 95% for each *condition* in left panel and their dynamics across rounds in right panel.

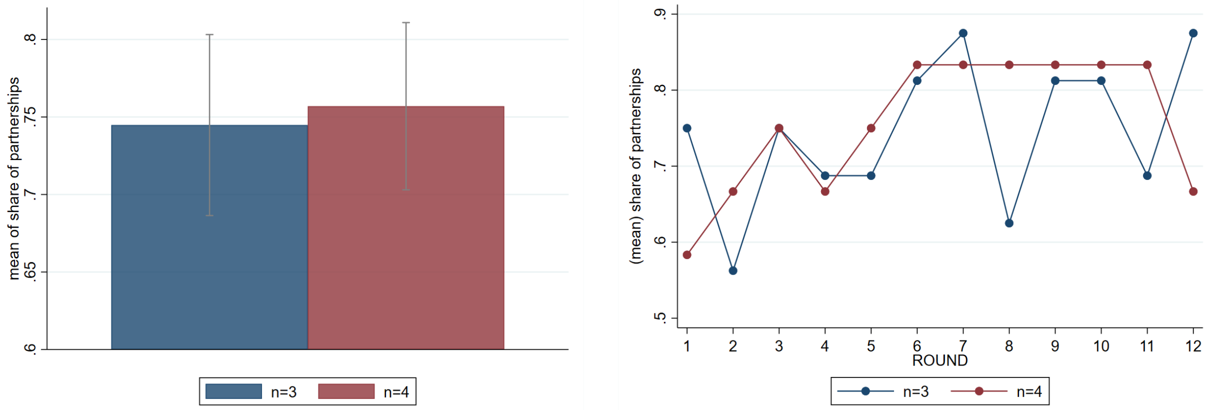


Table 7: m-frequencies for actual and simulated data

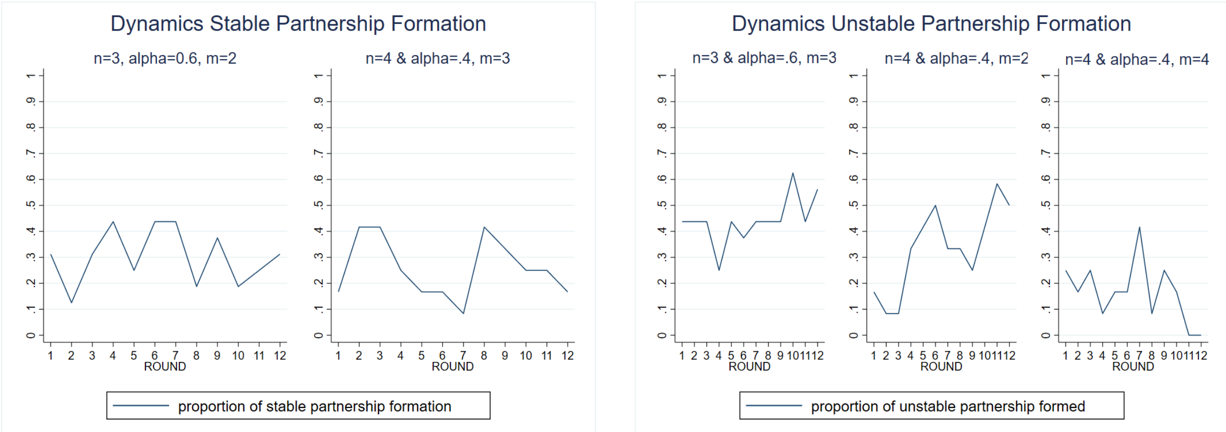
	$n = 3$ & $\alpha = .6$			$n = 4$ & $\alpha = .4$			
	overall	m=2	m=3	overall	m=2	m=3	m=4
actual	0.74	0.30	0.44	0.75	0.33	0.25	0.17
simulated	0.78	0.34	0.44	0.72	0.26	0.33	0.13

This Table displays the proportion of actually formed and simulated partnerships, separately for partnership size (m) and condition.

There is a difference in *Willingness to Join* and forming the grand partnership between the two conditions: although unstable the grand partnership $m = n$ dominates in case of $n = 3$ & $\alpha = .6$ for both, actual and simulated, data. Instead, for $n = 4$ & $\alpha = .4$ smaller partnerships with $m < n$ dominate.

Figure 3 illustrates the dynamics of stable and unstable partnerships. While the stable partnerships are more cyclic but on average rather constant across rounds in case of $n = 3$ & $\alpha = .6$, unstable partnerships show more erratic patterns. The frequency of grand partnerships, $m = n$, increases across rounds for $n = 3$ & $\alpha = .6$, but decreases for $n = 4$ & $\alpha = .4$.

Figure 3: Proportions of stable partnerships in left and of unstable ones in right panel for both conditions.

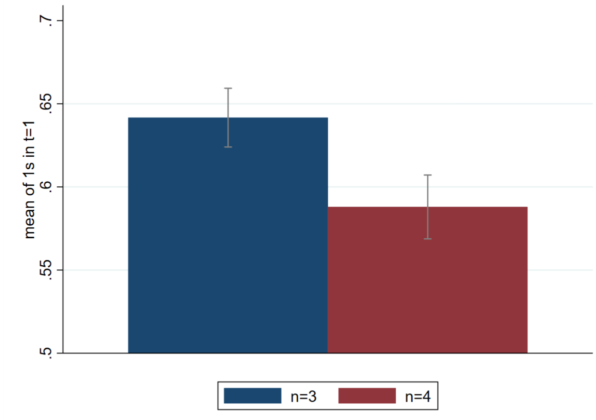


***Finding 1**: Voluntarily forming partnerships, $m \neq \emptyset$, clearly dominates and can be accounted by the willingness to join.*
At the individual level profiles like "always joining" and "never joining" stick out.
Individual joining behaviour is characterized by inertia and results in an overall stable pattern of partnership formation across rounds.

The tendency to join is stronger for $n = 3$ & $\alpha = .6$ than for $n = 4$ & $\alpha = .4$ (see the illustration in Figure 4 via the relative shares of "1"). The latter finding may be due to the larger freeriding incentive, $1 - .4 = .6 > 1 - .6 = .4$, but also to cognitive burden of having to choose in 9 rather than only 5 cases of sequential partnership formation (see Table 1). In future research one may vary only α with and without changing the stable group size m^* or vary only the group size but maintain α. The latter seems more problematic since the efficiency of contributing, $n\alpha - 1$, increases with n when α is costant.[8]

[8] Our setup only guarantees the same efficiency $2 \times .6 = 1.2 = 3 \times .4$ for the stable group sizes across the two conditions.

Figure 4: Tendency to join measured as share of ones in t=1.



4.2 Contribution behavior

Figure 5 shows contribution behavior after partnership formation: average contributions and their dynamics for both condition. The left panel illustrates via 95%-confidence intervals that $n = 3$ & $\alpha = .6$ triggers a significantly larger average contribution. According to the regressions, presented in Table 8, heterogeneity in contributions in both conditions are explained by *Willingness to Join* and by being partner which both have a positive and significant impact.

Figure 5: The contribution confidence intervals at 95% in left panel (dashed lines represent the theoretical predictions) and their dynamics across rounds in right panel.

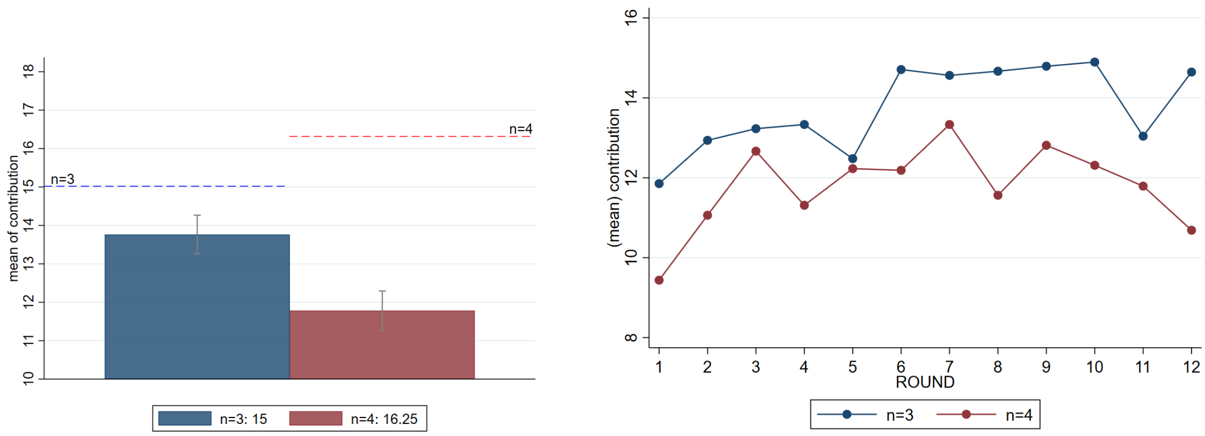


Table 8

	Depvar: Contribution at round *t*	
	(1)	(2)
	$n = 3$ & $\alpha = .6$ *and* $n = 4$ & $\alpha = .4$	$n = 3$ & $\alpha = .6$ *and* $n = 4$ & $\alpha = .4$
Rel. share of ones	7.33***	
	(0.66)	
Member		5.51***
		(0.28)
n=4	-1.28	-1.66**
	(0.79)	(0.74)
Final round	2.10***	1.91***
	(0.66)	(0.60)
Demographics	✓	✓
Round dummies	✓	✓
Session Number	✓	✓
Observations	1056	1056
Number of individuals	96	96

Dependent variable is the individual's contribution in a given round of play; the model used is a multilevel one, with two nested levels: individual and matching group. Demographic controls include gender and age of the participant, field of study, geographic region, number of past experiment, self reported easiness of experiment.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Overall establishing a partnership, i.e., $m \geq 2$, boosts aggregate contributions. Tables 9 and 10 report contribution shares of 55% for $n = 3$ & $\alpha = .6$ and 47% for $n = 4$ & $\alpha = .4$, mainly due to partners who contribute on average 60% of their endowment when $n = 3$ & $\alpha = .6$ and 52% when $n = 4$ & $\alpha = .4$. These percentages seem large compared to the meta-analysis for linear public good games (Zelmer, 2003).

According to Tables 9 and 10 contributions of partners always exceed those of outsiders: the average percentage of free-riders (contribution=5) is higher among outsiders whereas maximally contributing (contribution=20) is more frequent for partners. Without partnerships, i.e., $m = \emptyset$, free-riding is more frequent (42% when $n = 3$ & and $\alpha = .6$, 56% in $n = 4$ & $\alpha = .4$) than when a partnership exists (14% when $n = 3$ & $\alpha = .6$ and 27% when $n = 4$ & $\alpha = .4$), while the opposite holds for fully contributing.

Table 9

	outsiders		partners		Overall	
	m				with p.ship	general
	∅	2	2	3		
Mean	10.02	12.29	13.72	16.28	15.04	13.76
Std. Err.	0.48	0.89	0.53	0.32	0.28	0.26
n. of cases	147	58	116	255	429	576
# contr.=5	62 (42%)	17 (29%)	16 (14%)	26 (10%)	59 (14%)	121 (21%)
# contr.=20	29 (20%)	21 (36%)	39 (34%)	133 (52%)	193 (45%)	222 (39%)

Contribution Levels for $n = 3$ & $\alpha = .6$
.

Table 10

	outsiders			partners			Overall	
	m						with p.ship	general
	∅	2	3	2	3	4		
Mean	8.1	7.80	6.54	14.85	15.98	15.13	12.97	11.78
Std. Err.	0.39	0.45	0.62	0.61	0.44	0.58	0.30	0.26
n. of cases	140	96	37	96	111	96	436	576
# contr.=5	79 (56%)	54 (56%)	30 (81%)	16 (17%)	3 (3%)	14 (15%)	117 (27%)	196 (34%)
# contr.=20	9 (6%)	5 (5%)	2 (5%)	45 (47%)	52 (47%)	44 (46%)	148 (34%)	157 (27%)

Contribution Levels for $n = 4$ & $\alpha = .4$
.

It is interesting to explore how individual contribution choices in the 12 successive periods depend on the individual profiles chosen in the first stage by individual i in the same period t. To analyze this one can use the *share of ones* as explanatory variable or distinguish whether period t has resulted in $m = \emptyset$, i.e., all contributors qualify as outsiders, or in $m \geq 2$, whether one is partner or, in case of $m < n$, outsider.

Table 11, which analyzes both conditions separately, explains contribution choices by the *Willingness to Join* in models (1) and (3) for either condition and in models (2) and (4) by the size m of the partnership and whether one is a partner or not.[9] From models (1) and (3) we see that *Willingness to Join* has significant and positive effects on contributions. Models (2) and (4) confirm that partners contribute significantly more, irrespective of the partnership size m. Surprisingly, we find a positive endgame effect.

Altogether we can state:

[9]Viewing $m = \emptyset$ as the baseline, we use $m = 2$, $m = 3$ ($m = 4$ only for condition $n = 4$ & $\alpha = .4$) as dummy variables and the partner dummy with value 1, when i is a partner in period t.

Finding 2: *Allowing for voluntary formation of the cost sharing partnerships triggers significantly often partnerships which, in turn, lead to significantly higher contribution levels. This latter effect, however, is significantly weaker for $n = 3$ & $\alpha = .6$ than for $n = 4$ & $\alpha = .4$ due to the latter's much lower outsider contribution level.*

Table 11

Depvar: Contribution at round *t*				
	(1)	(2)	(3)	(4)
	$n = 3$ & $\alpha = .6$	$n = 3$ & $\alpha = .6$	$n = 4$ & $\alpha = .4$	$n = 4$ & $\alpha = .4$
Share of ones	5.34***		9.53***	
	(0.93)		(0.86)	
No partnership (baseline):				
- non-partner & m=2		0.76		-0.20
		(0.66)		(0.60)
- partner & m=2		3.50***		5.41***
		(0.53)		(0.60)
- non-partner & m=3				-1.12
				(0.84)
- partner & m=3		5.42***		7.14***
		(0.49)		(0.57)
- partner & m=4				6.67***
				(0.59)
final round	2.46***	2.11***	2.07**	2.05**
	(0.88)	(0.81)	(0.99)	(0.87)
Demographics	✓	✓	✓	✓
Round dummies	✓	✓	✓	✓
Session dummies	✓	✓	✓	✓
Observations	576	576	576	576
Number of individuals	48	48	48	48

Dependent variable is the individual's contribution in a given round of play; the model used is a multilevel one, with two nested levels: individual and matching group. Demographic controls include gender and age of the participant, field of study, geographic region, number of past experiment, self reported easiness of experiment.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Figure 6 for $n = 3$ & $\alpha = .6$ and Figure 7 for $n = 4$ & $\alpha = .4$ present actual average and theoretical contributions (theoretical ones are indicated by horizontal lines, separately for partners and outsiders for all possible m). Overall, outsiders contribute, on average, more than the minimum and partners do not always contribute maximally. The higher willingness of partners to contribute, compared to outsiders, seems not to be guided by their contribution incentives. Figure 7, for instance, shows a positive and sustained contribution for the unstable $m = 2$ partnership. So the willingness to contribute seems more due to being a partner than to monetary freeriding incentives. Although contribution behaviour is not optimal; average payoffs are close to their benchmark level, especially for $n = 3$ & $\alpha = .6$ (see Figure 8).

Beliefs by partners about other partners' contribution when a partnership exists may explain actual contributions. Table 12 shows that beliefs by partners about other partners' contribution have a positive and significant effect on their contributions.

Figure 6: Average (and optimal) contribution dynamics depending on the partnership outcome for $n = 3$ & $\alpha = .6$.

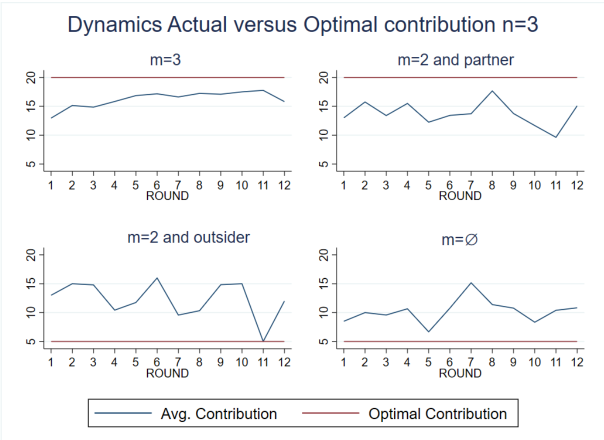


Figure 7: Average (and optimal) contribution dynamics depending on the partnership outcome for $n = 4$ & $\alpha = .4$.

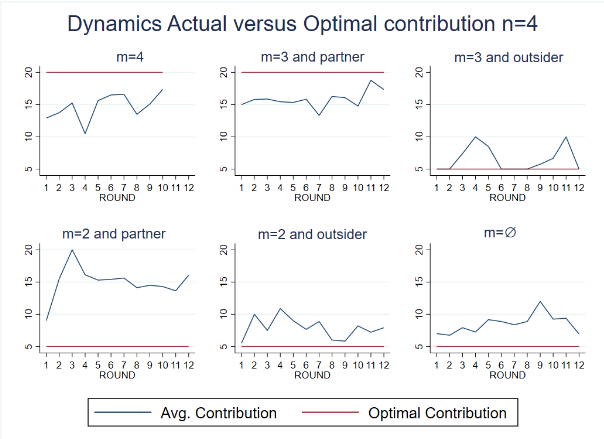


Figure 8: Average and predicted payoff for both conditions and their dynamics.

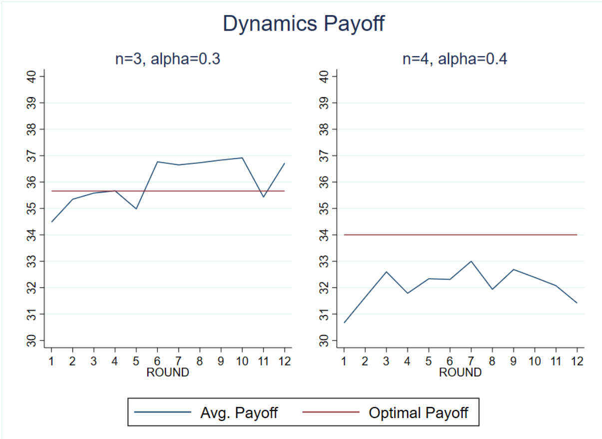


Table 12

	Depvar: Contribution at round t				
	(1)	(2)	(3)	(4)	(5)
	$n = 3$ & $\alpha = .6$	$n = 3$ & $\alpha = .6$	$n = 4$ & $\alpha = .4$	$n = 4$ & $\alpha = .4$	$n = 4$ & $\alpha = .4$
	$m = 2$	$m = 3$	$m = 2$	$m = 3$	$m = 4$
belief on partner(s)	0.67***	0.39***	0.94***	0.80***	0.82***
	(0.09)	(0.06)	(0.09)	(0.09)	(0.08)
belief on outsider(s)	0.16**		0.06	0.06	
	(0.08)		(0.09)	(0.07)	
final round	0.75	1.81**	1.23	0.84	
	(1.55)	(0.83)	(2.15)	(1.72)	
Demographics	✓	✓	✓	✓	✓
Round dummies	✓	✓	✓	✓	✓
Session number	✓	✓	✓	✓	✓
Observations	116	255	96	111	96

Dependent variable is the individual's contribution in a given round of play; the model used is a multilevel one, with two nested levels: individual and matching group. Belief partner(s) contribution is how much a partner believes other partner(s) to contribute; belief outsiders is how much an insider believes outsider(s) to contribute. Demographic controls include gender and age of the participant, field of study, geographic region, number of past experiment, self reported easiness of experiment.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5 Conclusions

Before contributing in linear public good provision participants with self-commitment power can voluntarily form a partnership, whose members equally share their total contribution costs. It has been shown that this distinguishes notorious freeriding [10] from surprisingly rare clever freeriding in the opportunistic sense. There is substantial abstaining from joining the partnership, but also considerable willingness to always join. Furthermore, partners contribute, on average, much more than outsiders.

One might speculate whether notorious freeriding via never joining profiles and essentially abstaining from contributing indicates an inclination to avoid any voluntary involvement in collective action. We are reluctant to accept such interpretation since modern life with its sophisticated forms of labor division relies on frequent voluntary engagements in trade and beyond. If at all, one might justify notorious freeriders by competitive preferences since minimally contributing outsiders never fare worse than partners. We confirm substantial notorious freeriding but question its cleverness: clever opportunists would join the partnership whenever they would be pivotal.

Unlike unconditional freeriding, always joining and maximally contributing as a partner, when $m \neq \emptyset$, can be justified by strong efficiency concerns although partners do not contribute maximally even when $m \geq m^*$. Cristal-clear types are rare, also in later rounds: "always joining" and "never joining" profiles increase their share from the first to the second 6 rounds.

Endogenously forming the cost sharing partnership seems an interesting and promising mechanism but, due to imposing sequentiality in joining the partnership, more suitable for small groups. It may be practical for price leaders cartels or oligopoly markets but may not resolve the social dilemma problem of large groups, e.g. national trade unions to which we refer in the Introduction. Sequential formation of partnerships in large groups may capture the changing size of partnership due to continue exit of old and entry of new partners. Here it has been mainly assumed to avoid multiple stable partnerships.

Voluntary partnership formation offers new ways to categorize types like unconditional cooperators, notorious freeriders and other contributor types what helps to account for the considerable heterogeneity in individual contributions and, in case of repeatedly interacting participants, in individual contribution dynamics. We are reluctant to suggest crucial contributor types, based only on our own data, although "never-joining" and "always-joining" will be

[10] Notorious freeriding in the sense of never joining and freeriding in contributing.

likely confirmed even when more data have become available. Accordingly, we have abstained from categorizing additional types, for instance, based on the profiles with at least 5%-shares of all 12×48 profiles, which mostly lose importance in the later rounds. [11] Due to this we obviously do not account for most of behavioral heterogeneity but only begin with such an analysis.

Capturing the individual tendency to join the cost sharing partnership by individual shares of "ones" is a crude way of distinguishing individuals, except for the border cases 0, i.e., never-joining, and 1, i.e., always joining. Accounting for heterogeneity in contribution behavior by (non)existence of partnership, its size m (≥ 2) and whether one is partner or outsider seems more suitable. We confirm significantly positive shares of cost sharing partnerships which enhance the prospects of voluntary cooperation: voluntary partnerships decisively improve the prospects of voluntary public goods provision.

Our categorization attempt may seem cognitively more demanding than that of Fischbacher et al. (2001). Whereas they distinguish leader or unconditional and follower or conditional contributions but maintain the freeriding incentives[12], our setup renders these incentives endogenous and even allows to avoid them by $m \geq m^*$. On the other hand, to understand that $(m^* - 1)\alpha < 1 < m^*\alpha$ renders one pivotal is easy and let one wonder why opportunistic participants have not learned during 12 rounds when they would be pivotal.

Due to assuming exogenously given groups of contributors our research is less related to the literature exploring how endogenously generated contributor groups differ in contributions [13]. Other studies focus on endogenous timing what, in view of the two stages in our setup, renders them more related.[14] The sequentiality in our design is two-fold: partnership formation

[11] The only exception is Profile 5 of $n = 4$ & $\alpha = .4$ (see Table 6).

[12] Letting followers react to others' contributions could be seen as asking for "leading by example" (see Güth et al., 2007)

[13] Ahn et al. (2008) examine endogenously formed contributor groups reporting that restricting entry allows for highly cooperative mid-size groups, while restricted entry/exit render groups larger, but less cooperative. In a similar setting (Ahn et al., 2009) the same authors vary entry and exit and find than entry restrictions increase earnings and contributions, render congestion less problematic and yield group sizes closer to the optimal ones. Charness and Yang (2014) allow participants to exit their groups, to exclude other members, and to merge with already existing groups and find a positive effect on average contribution rates. My and Chalvignac (2010) and Nosenzo and Tufano (2017) show that endogenous sorting via the option to play or not, or the ability to exit promotes cooperation among those who opt in. In a setting where participants choose both the group size and its composition, Ehrhart et al. (1999) find that even when efficiency requires the grand coalition this is seldom achieved: higher returns with increasing group size let groups with higher contributions grow in size but enhance freeriding. In Brekke et al. (2011) subjects can join a group according to their prosocial disposition: contributions are initially higher and stay high in more prosocial groups.

[14] Nosenzo and Tufano (2017) let participants choose the timing of their contributions. Although in line with theory, sequential moves exacerbate freeriding: subjects tend to avoid early contributing. Potters et al. (2005) study a public good game with only some donors being informed about the value of the good and

precedes contributing and is also sequential.

The two conditions, $n = 3$ & $\alpha = .6$ as well as $n = 4$ & $\alpha = .4$, both imply $m^* = n - 1$, i.e., a partnership and one outsider j and the same efficiency incentives $2 \times .6 = 1.2 = 3 \times .4$ in case of $m^* = n - 1$-stable partnerships. However, the two conditions differ considerably in their cognitive challenge: on Stage 1 one has to make 9 or only 5 $\delta_t \in \{0, 1\}$-choices and has to anticipate on Stage 2 a richer variety of partnership outcomes. Our main reason for both conditions has been to learn whether both confirm the same behavioral types like never or always wanting to join or in contributing. Although we confirm similar qualitative results for both conditions, we are reluctant to apply the $n = 4$ & $\alpha = .4$ condition also in future research.

In future research we actually want to extend conditional choice elicitation to both stages which obviously offers even better prospects for categorizing participant types not only on the (not) joining profiles, but also by the unconditioning in contributing.

contributions being simultaneous or sequential and find that sequentiality boosts contribution levels.

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Appendix

Table 13: Relative frequency of Join per round

$n = 3$ & $\alpha = .6$														
Round	1	2	3	4	5	6	7	8	9	10	11	12	total	theory prediction
Frequency of Join	0.64	0.64	0.64	0.64	0.66	0.68	0.72	0.68	0.66	0.64	0.66	0.7	0.66	0.4
$n = 4$ & $\alpha = .4$														
Round	1	2	3	4	5	6	7	8	9	10	11	12	total	theory prediction
Frequency of Join	0.58	0.56	0.56	0.51	0.56	0.55	0.56	0.51	0.55	0.51	0.54	0.5	0.54	0.33

This table displays the proportion of *join* choices, $\delta = 1$ in each round where the optimal percentage would be 0.4 for $n = 3$ & $\alpha = .6$ and 0.33 for $n = 4$ & $\alpha = .4$.

Table 14

$n = 3$ & $\alpha = .6$												
	≥ 1	≥ 2	≥ 3	≥ 4	≥ 5	≥ 6	≥ 7	≥ 8	≥ 9	≥ 10	≥ 11	≥ 12
Profile 1	50	41	35	29	25	25	22.9	22	14.6	10.4	10.4	2.1
Profile 2	22.9	18.75	14.6	6.25	6.25	6.25	4.2	4.2	4.2	2.1	2.1	2.1
Profile 3	45.8	31.2	27.1	25	14.5	14.5	10.4	10.4	10.4	8.3	8.3	2.1
Profile 4	22.9	14.6	12.5	8.3	4.1	4.1	0	0	0	0		0
Profile 5	27.1	16.7	10.4	8.3	8.3	8.3	6.25	6.25	6.25	6.25	6.25	4.1
$n = 4$ & $\alpha = .4$												
	≥ 1	≥ 2	≥ 3	≥ 4	≥ 5	≥ 6	≥ 7	≥ 8	≥ 9	≥ 10	≥ 11	≥ 12
Profile 1	48	21	16.7	14.5	14.5	14.5	10.4	10.4	8.3	4.1	4.1	4.1
Profile 2	37.5	25	18.75	16.7	12.5	12.5	8.3	8.3	6.25	2.1	2.1	2.1
Profile 3	18.75	14.6	10.4	6.25	6.25	0	0	0	0	0	0	0
Profile 4	25	12.5	10.4	8.3	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Profile 5	20.1	16.7	14.6	8.3	6.25	6.25	6.25	6.25	4.1	2.1	2.1	0

This table shows for each profile in Tables 4 and 5 the percentage of subjects using it at least 1,2,3,4,5,6,7,8,9,10,11 12 rounds.

Table 14 shows that no profile is chosen always by more than 5% of the participants in either condition and that the most frequently constantly employed profiles with 4.1% of participants each differ across conditions (Profile 5 for $n = 3$ & $\alpha = .6$ and Profile 1 for $n = 4$ & $\alpha = .4$).

Instructions

These are the instruction for the treatment where $n = 4$ & $\alpha = .4$ [$n = 3$ & $\alpha = .6$]. English translation follows.

ISTRUZIONI

Descrizione generale dell'esperimento

Benvenuti a questo esperimento!

Nel corso di questo esperimento, completamente informatizzato, voi e gli altri partecipanti dovrete prendere alcune decisioni. Le vostre decisioni e quelle degli altri partecipanti determineranno il vostro guadagno per l'esperimento che verrà calcolato come spiegato di seguito.

In aggiunta al vostro guadagno per l'esperimento riceverete 6 euro per la vostra partecipazione e per la compilazione di un breve questionario alla fine dell'esperimento.

L'esperimento si compone di 12 round.

In ciascun round avrete l'opportunità di guadagnare gettoni sperimentali (ECU) che verranno convertiti alla fine dell'esperimento in euro al tasso di 1 ECU= 0,5 euro.

Alla fine dell'esperimento il computer selezionerà casualmente un solo round per il pagamento che verrà effettuato tramite Prolific. I dati dell'esperimento (le vostre decisioni) rimarranno anonimi nel senso che gli sperimentatori non saranno mai in grado di collegare il vostro nome alle vostre scelte.

All'inizio dell'esperimento il computer ti raggrupperà in modo casuale con altri 3[2] partecipanti tra quelli presenti in questa sessione dell'esperimento. Tu e gli altri soggetti selezionati formerete quindi un gruppo di 4[3] in ogni round.

Nota bene: Alla fine di ogni round la composizione del gruppo di cui fai parte verrà modificata in modo tale che almeno un membro del gruppo sia diverso rispetto al round precedente. In ogni caso non verrete mai a conoscere l'identità degli altri partecipanti al vostro gruppo né durante la sessione né in seguito.

In ogni round dell'esperimento dovrete prendere due tipi di decisione: la prima riguarda la decisione di partecipare o meno ad una "Iniziativa" relativa a un "Progetto" comune a tutti i membri del vostro gruppo; la seconda riguarda quanto contribuire al "Progetto".

Dopo avere effettuato tali scelte dovrete rispondere in ogni round ad alcune domande la cui risposta non influenza in alcun modo i vostri guadagni.

Alla fine di ciascun round il computer vi comunicherà quale è il vostro guadagno in ECU per quel round. Alla fine dell'esperimento il computer selezionerà casualmente uno dei round per il pagamento e ve lo comunicherà, ricordandovi il guadagno che avete realizzato in tale round e che costituisce il vostro guadagno per l'esperimento. Prima del pagamento vi verrà chiesto di rispondere ad un breve questionario anonimo e non incentivato.

E' importante che leggiate con attenzione le istruzioni e capiate il modo in cui i vostri guadagni sono collegati alle vostre decisioni e a quelle degli altri. Per essere sicuri di ciò, all'inizio dell'esperimento, vi verranno proposte alcune domande di controllo per verificare se avete capito come il computer calcolerà i vostri guadagni.

Per qualsiasi dubbio rivolgetevi agli sperimentatori via chat o attraverso il microfono e qualcuno vi risponderà subito privatamente.

La decisione di aderire all' "Iniziativa" relativa al Progetto

In ogni round tu e gli altri membri del tuo gruppo dovrete scegliere uno dopo l'altro se volete partecipare o meno all'"Iniziativa" comune.

NB.: L'ordine in cui ciascuno di voi prenderà effettivamente tale decisione è stabilito casualmente dal computer.

Prima che il computer ti comunichi in che ordine prenderai effettivamente la tua decisione (cioè se sarai il primo, il secondo, il terzo o il quarto [primo, il secondo o il terzo] del tuo gruppo) dovrai dichiarare se intendi partecipare o non partecipare **per ogni possibile ordine che ti venga assegnato e sulla base di quanti membri del tuo gruppo hanno deciso di partecipare all' "Iniziativa" prima di te.**

Una volta dichiarate le tue scelte per ogni situazione possibile, il computer selezionerà l'ordine di decisione effettivo e eseguirà ciò che avevi dichiarato di volere fare nello scenario corrispondente a quello verificatosi.

Il computer ti informerà se si è realizzata o meno l'"Iniziativa" tra i partecipanti del tuo gruppo, quanti di voi partecipano ad essa e se tu ne fai parte o no.

Ricordate che la partecipazione all' "Iniziativa" è volontaria per ciascuno di voi. Di conseguenza, potrebbe avvenire che meno di due partecipanti al vostro gruppo vogliano partecipare all'"Iniziativa", in tal caso l'"Iniziativa" non verrà intrapresa.

La decisione di quanto contribuire al "Progetto"

All'inizio di ogni round ciascuno di voi riceverà una dotazione di 25 ECU che dovrete decidere, indipendentemente e simultaneamente agli altri partecipanti, se e in che misura utilizzare per contribuire ad un "Progetto" comune. *NB: dovete scegliere un ammontare di contribuzione al "Progetto" compresa tra 5 e 20 ECU.*

Il vostro guadagno dal "Progetto" è calcolato in ogni round come segue:

(a) se avete deciso di partecipare all'"Iniziativa", ed essa viene intrapresa, il vostro guadagno è dato da:

la vostra dotazione – [(la vostra contribuzione + la contribuzione degli altri partecipanti all'iniziativa) il numero dei partecipanti all'iniziativa)] + α (la vostra contribuzione + la contribuzione degli altri membri del gruppo).

Fate attenzione quindi che in questo caso la vostra contribuzione effettiva sarà diversa da quella dichiarata e pari alla media delle contribuzioni con cui tu e gli altri partecipanti all'iniziativa avete deciso in modo indipendente di contribuire al "Progetto".

(b) se avete deciso di non partecipare all'Iniziativa, o essa non è stata intrapresa, il vostro guadagno è dato da:

la vostra dotazione – la vostra contribuzione + α (la vostra contribuzione + la contribuzione dei membri del vostro gruppo).

In tutti i round il valore di α sarà pari a 0,4[0,6].

Buon lavoro.

ENGLISH VERSION

INSTRUCTIONS General Description of the Experiment

Welcome to this experiment!

In this experiment, completely computerized, you and the other participants will make choices. Your choices and those of the other participants will determine your earnings for the experiment according the rules that will be explained in these instructions.

In addition to the earnings for the experiment, you will receive 6 euros for showing up and answering a short questionnaire at the end of the experiment.

The experiment consists of 12 rounds.

You have the opportunity to earn points (ECU) in each round that will be converted into Euro at an exchange rate of 1 point= € 0.5.

At the end of the experiment, one round is randomly selected for payment. The payment will be implemented using Prolific. The data of the experiment (your choices) are anonymous: the experimenter will not be able to connect your name to your choices.

At the beginning of the experiment you will be randomly matched by the computer with other 3[2] participants. You and the other selected participants will form a group of 4[3] in each round.

Note that after each round the composition of the group will change such that you will always interact with a group different from the group of the previous round for at least one participant. Note that you will not learn who the other members of your group are, neither during nor after today's session.

In each round you will make two types of choices. First, you will decide to join or not an "Initiative" related to a "Project" common to all the group members; the second choice will concern how much to contribute to the "Project".

After these choices, in each round you will be asked to answer few questions whose answers will not have any relevance for your earnings.

After each round you will learn the number of points (ECU) earned in that round. At the end of the experiment it will be shown on the screen which round has been drawn for payment and you will be recalled about the points earned in that round which will be your earnings for the experiment. Before the payment, you will be asked to answer few questions not relevant for the payment and that will preserve your anonymity. It is very important that you completely understand the instructions and the way your earnings are related to your decisions. In order to check your understanding, at the beginning of the experiment we will ask you to answer some questions about payoff calculation. If at any point during the experiment you have a question, please contact the experimenters using the chat or the microphone, and you will be answered privately.

The decision to join the "Initiative" related to the "Project"

In each round you and the other group members will choose sequentially whether to join or not the "Initiative".

Note that the position in the sequence for you and the other group members will be chosen randomly by the computer.

Before you are let aware of your actual position in the sequence (i.e., if you are the first, the second, the third or the fourth [the first, the second or the third], you will be asked whether you want to join or not the "Initiative" for every possible position in this sequence and **for every possible number of participants that have already joined the group before you.**

Once you have chosen whether to join or not in every possible scenario, the actual position in the sequence for each of you will be randomly drawn, and choices in the corresponding scenario will be implemented.

The computer will inform you about the existence of the "Initiative" in your group, how many group members are part of it, and if you are in.

Remember that participating to the "Initiative" is voluntary. Hence, it may happen that less than two members of your group choose to join; in this case, the "Initiative" will not exist.

The decision of how much to contribute to the "Project"

Each of you will be endowed with 25 points at the beginning of each round. You will choose simultaneously and independently whether and how much to contribute to a "Project" with your endowment: each of you have to choose an integer amount between and including 5 and 20 to devote to the "Project".

Your earnings from the "Project" in each round will be calculated as follows:

(a) If you chose to join the "Initiative" and this exists, your earnings are equal to:

Your Endowment– [(your contribution + the contribution of the other member(s) of the "Initiative") / the member of the "Initiative" including you)] + α (your contribution + the contribution of the other group members).

Note that in this case your actual contribution may be different from the amount you stated and it will be equal to the average contribution of the members of the "Initiative".

(b) If you chose to not join the "Initiative" or if this does not exist, your earnings are equal to:

$$\text{Your Endowment} - \text{your contribution} + \alpha\,(\text{your contribution} + \text{the contribution of the other group members}).$$

In every round the value of alpha will be equal to 0.4[0.6].