Does Competition Resolve the Free-Rider Problem in the Voluntary Provision of Impure Public Goods? Experimental Evidence

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Abstract

In this paper we assume that a public project creates different payoffs to different contributors. Within this environment we study two institutions: *Rank Order Voluntary Contribution Mechanism* (Rank-Order-VCM) and *Random Order Voluntary Contribution Mechanism* (Random-Order-VCM). In Rank-Order-VCM individuals compete with their observable contributions towards a public project for a larger share of the payoff that the project generates while in Random-Order-VCM the shares are assigned randomly. We observe that competition outweighs incentives to free-ride and find that Random-Rank-VCM elicits median contributions equal to the full endowment throughout the whole experiment, including the last period. In Random-Rank-VCM the contributions are significantly lower and decline over time.

Keywords: Competition, public goods, experiment, voluntary contribution mechanism.

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1. Introduction

A (pure) public good is characterized by two features: non-rivalry and non-excludability (e.g., Varian, 1992). However, in reality many publicly provided goods are rivalrous in terms of consumption (and thus would be classified as 'impure' public goods). While people may have the same rights to access them, spatial or timely distances make access easier for some people than for others. For instance, the location of a hospital, fire brigade headquarters or generally public infrastructure determine to some extent the benefit one derives from the usufruct of such local public goods. If exclusion of free-riders from the consumption of a public good is impossible, the allocation decision gives some people, in particular those who live in the neighborhood, preferred access to local public goods. If these goods are financed by voluntary contributions, incentives to free-ride do exist.[1] However, through the allocation decision the planner can implement a rewarding system in which free-riding incentives are counteracted by making it more difficult for low contributors to enjoy the public good, for example by situating it further away from them than from high contributors.

In this paper we assume that a public project creates different payoffs to different contributors. Within this environment we study two institutions: *Rank Order Voluntary Contribution Mechanism* (hereafter Rank-Order-VCM) and *Random Order Voluntary Contribution Mechanism* (hereafter Random-Order-VCM). In Rank-Order-VCM individuals compete with their observable contributions towards a public project for a larger share of the payoff that the project generates. Rank-Order-VCM ensures that people who contributed more (and thus earned a larger share of the payoff) are less likely to feel taken advantage of as it has often been reported by subjects in a voluntary contribution mechanism experiments.[2] To test whether Rank-Order-VCM overcomes the free-rider problem we design a laboratory experiment studying the impact of competition

[1] Another specific example is financing a cultural event (e.g., a theater play) through voluntary contributions with the person who contributed more receiving higher quality seats. In the same fashion, a person who exerts more effort, spends more time on the project or invests more money into it would earn a larger share of the profit in a team production scenario, or airlines with higher contributions towards the airport would get their preferred time slots (instead of participating in an auction).

[2] The idea of focusing on preferences for cooperation in a VCM setting has been suggested by Andreoni (1995). For details on conditional cooperation see Keser and van Winden (2000), Fischbacher *et al*. (2001), Burlando and Guala (2005), Kurzban and Houser (2005), Chaudhuri and Paichayontvijit (2006), Chaudhuri (2007), Gunnthorsdottir *et al.* (2007) or Neugebauer *et al.* (2009).

on voluntary contributions and compare it to Random-Order-VCM -- an institution that allocates the shares from the public project randomly.

Many papers, both theoretical and experimental, have identified the free-rider problem in organizational and societal settings (see Ledyard, 1995 for a review). A small but growing research stream recognizes institutions that mitigate or completely eliminate this problem (Kosfeld and Riedl, 2004 review the literature). Other papers test these institutions experimentally. It is this literature to which we wish to contribute.

One type of institution that has been proposed to alleviate free-riding involves experimenter-imposed sanctions and rewards (e.g., Dickinson and Isaac, 1998; Falkinger *et al*., 2000; Dickinson, 2001; Orrison *et al*., 2004; Harbring and Irlenbusch, 2005; Croson *et al*., 2006), leading to a competition among contributors. However, the competition is not the main focus of these studies and therefore they cannot provide a direct answer whether it is capable of increasing contributions on its own: Dickinson (2001) investigates an institution in which all members of the group but the most cooperative one have to incur a fixed fine and the most cooperative member receives a reward in form of a fixed bonus payment. Orrison *et al*. (2004) and Harbring and Irlenbusch (2005) use a tournament incentive structure involving rewards for winners and sanctions for losers. These studies find that the additional incentives provide a large initial boost to cooperation, which diminishes over time. In Falkinger *et al*. (2000), subjects pay a tax if they contribute below the average contribution and receive a subsidy if they contribute above it. The authors find not only a significant initial effect on contributions but also increasing cooperation over time.

A considerable body of research has followed a related study by Fehr and Gächter (2000) on participant-imposed punishment where the main result hinges on the existence of a social norm rather then on competition. Nevertheless, their design is too distant from the above mentioned papers to permit an across-study conclusion about the effects of competition. In Fehr and Gächter's experiment, group members observe the individual contributions and are able to inflict a pecuniary sanction on other members by incurring a cost. Initially the effect on cooperation is small, but contributions increase to high levels as time progresses. Subsequent experiments show that similar impacts on contributions may be obtained even with non-pecuniary sanctions (e.g., Masclet *et al*., 2003; Noussair and Tucker, 2005). However, with non-pecuniary sanctions, contributions do not increase over time.

More recent work uses endogenous or exogenous group formation to mitigate the free-rider problem. Cinyabuguma *et al*. (2005) and Maier-Rigaud *et al*. (2005) allow participants to expel group members based on a majority vote. Their results show high levels of contribution among non-expelled members. In experiments related to local public goods (see Scotchmer, 2002 for a survey of theoretical results), individuals decide in which group to participate (e.g., Erhard and Keser 1999; Ahn *et al*. 2008). In majority of these studies the effect on cooperation due to this voluntary group selection is negligible, as free-riders infiltrate groups with high contributions. In our design, more specifically in Rank-Order-VCM it is impossible for free-riders to take advantage of cooperators to the same degree because they are automatically getting a smaller share of the profit.[3]

In experiments on exogenous group formation, individuals are re-sorted by the experimenter into homogeneous groups of high contributors and low contributors, either with or without their ex-ante explicit knowledge (Page *et al*., 2005; Gächter and Thöni, 2005; Caberera *et al*., 2006; Gunnthorsdottir *et al*., 2007, 2009). In most of these studies, high levels of contribution can be sustained in the cooperative groups, but not in the non-cooperative groups. Hence, average contributions usually decline over time.[4]

In a related study to ours in terms of competition effects, Gunnthordottir and Raporport (2006) show that combining voluntary contribution mechanism with intergroup competition for an exogenous and commonly known prize reduces free-riding. Gunnthordottir and Raporport implement two different profit sharing rules (egalitarian and proportional) under which the prize is distributed to members of the winning group and find that the proportional sharing rule does better than the egalitarian one. However, from their design it is not obvious to what degree the proportional sharing rule contributes to the reduction of free-riding as it is coupled with intergroup competition. In our experiment we avoid using different groups or a fixed prize and focus solely on the situation where a larger share of the public good goes to a higher contributor.

[3] Our design also contrasts with the model by van Dijk and van Winden (1997), tested by van Dijk *et al*. (2002) where contributions toward a local public good create social ties.

[4] In Gunnthorsdottir *et al.* (2009) average contributions stay high throughout the entire experiment, following the near-efficient equilibrium.

Next we present the model, experimental setup and our results, followed by a short discussion. Instructions can be found in the appendix.

2. Experimental Design and Procedures

2.1 Rank Order Voluntary Contribution Mechanism

In Rank-Order-VCM, each subject from a group of four faces the following decision problem: How much of the initial endowment (50 New Zealand cents) to contribute to a project (c_i) and how much of it to keep ($50 - c_i$). Each cent kept generates payoff only to the given subject, each cent contributed towards a project generates payoff to all the members of the group. The final payoff to player *i* is then given by:

$$\pi_i = 50 - c_i + m_i \sum_{j}^{n=4} c_j$$

The individual multiplier (m_i) is determined by the amount allocated to the project by the given subject and the amount allocated by the other participants in his or her group. Given the allocation of the others in the group, the higher the allocation of the subject to the project the higher are his or her chances for a larger multiplier. In the experiment we have implemented the following parameterization:

- If the subject's allocation is the highest in the group, his or her multiplier (= marginal return) $m_i = 0.65$.
- If the subject's allocation is the second highest in the group, $m_i = 0.55$.
- If the subject's allocation is the third highest in the group, $m_i = 0.45$.
- If the subject's allocation is the lowest in the group, $m_i = 0.35$.[5]

In case of a tie, i.e., if two or more participants allocate the same amount to the project, the corresponding multipliers are averaged. For instance, if the highest allocation is equal to the second highest, the multiplier for the two participants is 0.6 [= (0.65 + 0.55)/2]. If

[5] Note that our general setup also includes the standard symmetric VCM ($m_i = m_j$ for all *i*) and the proportional rule ($m_i = \frac{c_i}{\sum_{j=1}^{n} c_j}$) studied in Gunnthorsdottir and Raporport (2006) as special cases.

all four subjects contribute, the multiplier for each one of them is equal to 0.5. Hence, participants who allocate the same amount to the project get the same payoff and the average marginal per capita return from the project is 0.5.[6]

In Rank-Order-VCM, individuals are rewarded based on their contribution towards a group project. Given our parameterization, the unique Nash equilibrium is the situation where everyone free-rides, but it is not a dominant strategy equilibrium as in the standard VCM. From the perspective of neoclassical game theory this is the most crucial change to the game structure. However, there is a more subtle change; conditional cooperators are not being exploited as in VCM because higher cooperation is rewarded by a larger share for which the group members compete.

If we were to observe a different behavior in Rank-Order-VCM than in VCM it would not obvious whether it is due to competition or not. In particular, Rank-Order-VCM and the standard VCM differ in two additional aspects: the payoff structure and the fact that subjects learn about their marginal returns *after* the decision has been made as opposed to knowing what the marginal per capita return *before* the decision is made as in the case of VCM. Therefore, one needs to design a more appropriate baseline with identical payoff structure to Rank-Order-VCM to allow for such conclusion.

2.2 Random Rank Voluntary Contribution Mechanism

Random-Rank-VCM corresponds to a random allocation decision from our introductory example and serves as a control treatment as it implements an identical payoff structure as Rank-Order-VCM by randomly assigning ranks (with replacement) to all members of the group. Just as before, the individual marginal returns from a project are 0.65, 0.55, 0.45, or 0.35, based on this random rank. In case of a tie, the marginal returns get averaged. Subjects learn their marginal returns after the decisions are made.

Although the free-riding equilibrium is unique, we expect that the involved competition in Rank-Order-VCM induces an upward shift towards the efficient allocation. In some (non-equilibrium) instances more cooperative individuals may earn more than the less cooperative ones. Thus, we expect a significantly higher contribution levels in Rank-Order-VCM than Random-Rank-VCM.

[6] Although we did not run a standard VCM with the marginal per capita return = 0.5, this choice of design makes our results comparable to previous studies implementing such setup (e.g., Herrmann *et al*. 2008).

2.3 Procedures

The experiment consisted of two treatments implemented in an across subjects design. All sessions were conducted in May 2007 in the New Zealand Experimental Economics Laboratory (NZEEL) at the University of Canterbury. A total of 64 undergraduate subjects were recruited for the experiment. Most of the subjects had not previously participated in economics experiments (and none had participated in a social dilemma experiment). Each subject only participated in a single session of the study. We ran 4 sessions with exactly 16 subjects in each session. On average, a session lasted 75 minutes including initial instructional period and payment of subjects. Subjects earned on average 23.51 NZD.[7] We did not pay a show up fee. All earnings were calculated in New Zealand cents. All sessions were computerized and run under single blind social distance protocol. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007).

The assignment of subjects into groups was done according to the following process. Upon entering the laboratory subjects drew a number from an envelope. The number indicated their computer terminal for the experiment. The terminals were randomly matched into anonymous groups of four by the server. The composition of each group remained the same throughout the experiment. All this was known to the subjects and so was the fact that all members of the group faced the same decision problem.

Each participant was provided a hard copy of instructions that were identical across subjects. The instructions for both treatments were neutrally framed. The experimenter read the instructions aloud with subjects following the text in their own hard copy. After finishing reading the instructions and answering the questions we administered a computerized test to check for understanding of the decision making environment. The subjects were asked to individually select four numbers (with two numbers being equal) that would represent four contributions. After choosing the four numbers the test software asked them to calculate the multipliers and profits for all group members. It did not allow them to proceed until they got all the correct answers.

The decision making part of the experiment followed. Each session consisted of 2x15 rounds to check for a restart effect. After restart the subjects remained in the same

[7] The adult minimum wage in New Zealand at the time of the experiment was 10.25 NZD per hour.

group as before (partners design). In every round of the play the subjects were endowed with 50 NZ cents and had to decide how much of this endowment to allocate to a project and how much to keep for themselves.

The individual round payoffs were computed as the money the subjects kept plus the sum allocated to the project by all four members of the group where the latter was multiplied by their own personal multiplier. In Rank-Order-VCM treatment the personal multiplier was determined depending on the amount the subject contributed towards the project and on the rank order of this amount relative to the contributions of the other members of the group. In Random-Rank-VCM treatment the multiplier was randomly determined by the computer. The software would draw a number 1, 2, 3, or 4 for each participant. The number was drawn with replacement; therefore it was possible for the computer to draw the same number for more than one person in the group. The subject's individual multiplier was determined according to the rank of his or her random number. In particular, if the subject's number was the highest in the group, the multiplier was 0.65; 0.55 if it was the second highest; 0.45 if it was the third; and finally, 0.35 if the number was the lowest.

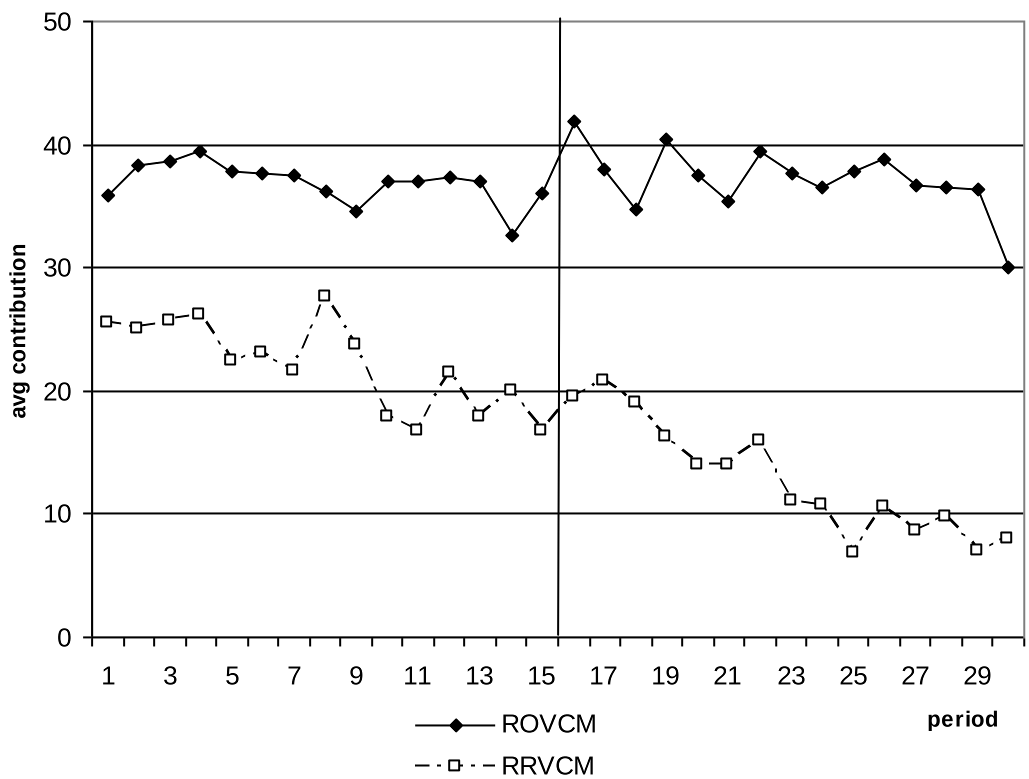
After each round the subjects received feedback information on the amount they and their group allocated to the project. They received information on the individual allocation ordered from highest to lowest, but were not be able to trace the amount to the person who allocated it. They also received information about their personal multiplier, the resulting payoff from the project, the amount of money kept and their round payoff. This information was recorded in a table on the subjects' screen and was available for all past rounds. At restart, the information for the first 15 rounds was cleared.

At the end of the experiment subjects were asked to fill out a questionnaire on demographics and strategies used when making the decisions. Finally, they were privately paid their earnings for the session.

3. Results

Figure 1 presents the comparison of average contributions in the 2 x 15 periods of the Rank-Order-VCM and Random-Rank-VCM treatments. While the average contribution in Rank-Order-VCM starts at 35.9 and oscillates between 30.1 and 41.8, the average contribution in Random-Rank-VCM starts at 25.4 and steadily declines throughout the whole experiment to reach its minimum of 6.8 in period 25. In the last period, the average contribution is equal to 7.9. The median contribution shows even a sharper contrast: In Rank-Order-VCM, the median contribution is equal to the endowment in all but period 9, while in Random-Rank-VCM the median contribution starts at 24 and drops down to 0 by the end of the experiment (see Figure 2).

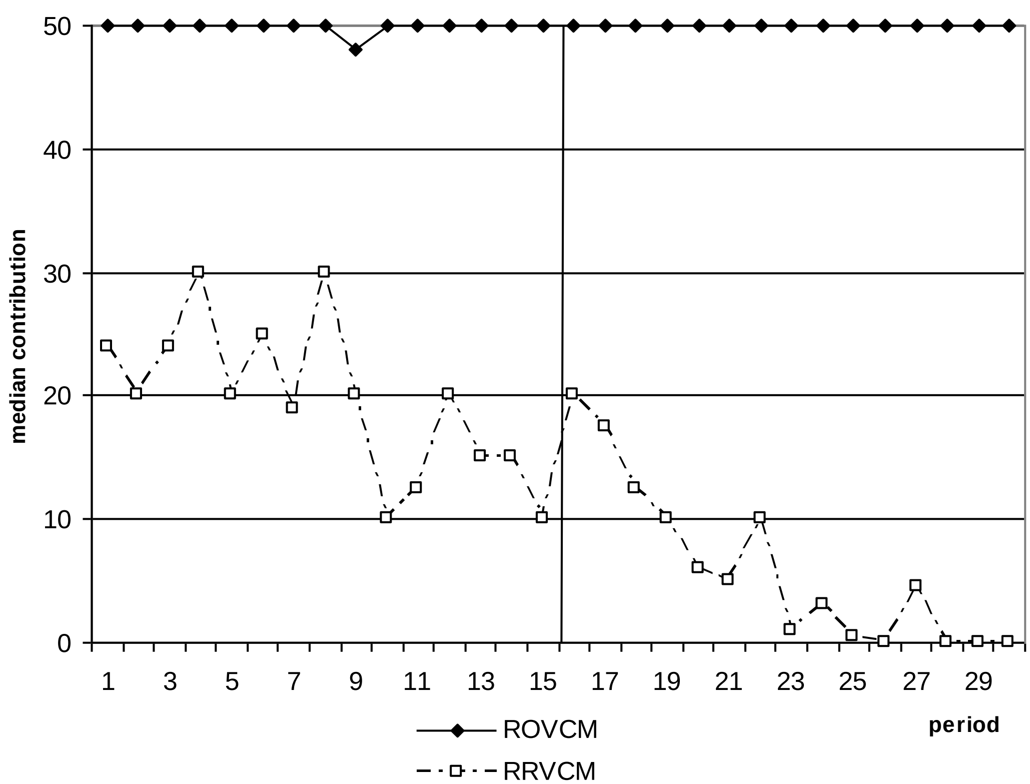
Figure 1. Average contributions in Rank-Order-VCM and Random-Rank-VCM



3.1 Treatment effect

The exact two-tailed Wilcoxon test for independent samples reveals that the group contributions in Rank-Order-VCM and Random-Rank-VCM are significantly different at 5% level for both the first 15 periods (p-value = 0.038) and for the second 15 periods (p-value = 0.005). Each treatment involved eight independent groups. The average contribution per group member was 38.5 (13.8) in Rank-Order-VCM and 16.4 (11.5) in Random-Rank-VCM (standard deviation in parentheses). This difference is also statistically significant (p-value = 0.005). The sample of individual first contributions which involves 32 observations per treatment suggests that the differences in contributions are significant right from the beginning; the p-value of the two-tailed Wilcoxon test is 0.037. Hence, we can conclude that Rank-Order-VCM leads to significantly higher contributions than Random-Rank-VCM.

Figure 2. Median contributions in Rank-Order-VCM and Random-Rank-VCM



3.2 Repetition effect

Our results from Random-Rank-VCM are in line with the stylized facts on the symmetric voluntary contribution mechanism reported by Ledyard (1995): The initial contributions are almost exactly half of the endowment and their decline is significant as shown by the random effects regression of the average group contribution on the time trend. The details are presented in Table 1, column (1). The regression involves a dummy variable for the restart of the game interacted on the time trend. The decline is significant in the original and in the restart game. The difference in contributions between the original and the restart game is evident: Each group contributes less in the restart game than in the original game. The probability that such an extreme outcome occurs due to chance is 0.008.

For Rank-Order-VCM, the average contribution increases from 37.3 to 39.6 between the original and the restart game. However, this difference is not significant as three groups increase and three groups decrease their contributions while two groups always contribute their full endowment. No significant time trend can be detected by the random effects dummy regression in the original or in the restart game for Rank-Order-VCM. The regression results are recorded in Table 1, column (2). Finally, based on the group data we observe that average contributions decline significantly more in Random-Rank-VCM than in Rank-Order-VCM (column (3)).

In summary, we observe no repetition effect in Rank-Order-VCM and there is a significant contribution decline in Random-Rank-VCM.

Table 1. Random-effects dummy regression: average contribution/group on time trend

(column ID)	(1) Random-Rank-VCM	(2) Rank-Order-VCM	(3) Both treatments
Number of observations	240	240	480
Number of independent observations	8	8	16
Independent variables			
Intercept	27.847* (4.415) [.000]	39.999* (5.195) [.000]	37.708* (4.619) [.000]
DummyRestart	1.467 (2.372) [.536]	4.759 (2.468) [.054]	
Period	-.708* (.217) [.001]	-.334 (.221) [.131]	.049 (.069) [.478]
DummyRestart $\times$ *(period – 15)*	-.310 (.275) [.259]	.279 (.286) [.330]	
DummyRandom-Rank-VCM			-8.929 (6.532) [.172]
DummyRandom-Rank-VCM $\times$ *(period)*			-.847* (.098) [.000]

Note: estimated coefficient (standard errors in parenthesis); [p-values in brackets]; *significant at 5%.

3.3 Absence of restart effect

Andreoni and Croson (2008) provide evidence that following a surprise restart in the symmetric VCM contributions jump back almost to their initial level after having declined in the original game. In our experiment, the restart was pre-announced and so the subjects anticipated the restart game. In the absence of surprise, we do not find a significant restart effect. From period 15 to period 16 of Random-Rank-VCM (Rank-Order-VCM), three (four) groups increased, three (one) groups decreased and two (four) groups maintained their contributions on the same level. The two-tailed Wilcoxon matched-sample test reveals that these changes are not statistically significantly different from those that occur between period 14 and 15 (the p-values are 0.208 and 0.600 for Random-Rank-VCM and Rank-Order-VCM, respectively).

3.4 Conditional cooperative behavior

In the symmetric VCM subjects' contributions are positively correlated to the lagged average contribution of others (e.g., Gunnthorsdottir *et al*., 2007; Neugebauer *et al*., 2009). We observe the same effect for Random-Rank-VCM and find that it is even more pronounced in Random-Rank-VCM. Table 2 records the corresponding dummy regression results in columns (4) and (5), which are based on the individual data. The data show that contributions are positively correlated to lagged average contributions of the other group members in both treatments. The differences between treatments with respect to this evidence of conditional cooperation are not significant as indicated by the binary variable for Rank-Order-VCM interacted on lagged contributions of others (see Table 2 column (6)).

Table 2. Random-effects dummy regression: contribution on lagged others' average contribution

(column ID)	(4) Random-Rank-VCM	(5) Rank-Order-VCM	(6) Both treatments
Number of observations	928	928	1856
Number of individual observations	32	32	64
Independent variables			
Intercept	17.882* (2.441) [.000]	16.759* (4.450) [.000]	9.753* (2.031) [.000]
Lagged others' average contribution	.176* (.063) [.005]	.470* (.061) [.000]	.417* (.046) [.000]
DummyRestart	-8.980* (1.568) [.000]	-2.861 (2.354) [.224]	
DummyRestart × lagged others' average contribution	.115 (.068) [.093]	-.078 (.059) [.185]	
DummyRank-Order-VCM			11.447* (3.389) [.001]
DummyRank-Order-VCM × lagged others' average contribution			.009 (.070) [.895]

Note: estimated coefficient (standard errors in parenthesis); [p-values in brackets]; *significant at 5%.

4. Discussion

In this paper we introduce an institution that counters the incentives to free-ride through competition within the VCM framework. The institution is based on a simple assumption that the implemented allocation gives preferred access to the local public to certain individuals and thus generates heterogeneous payoffs. That is, a person who lives closer to the (publicly funded) park derives a higher utility from it than a person who lives farther away. To model such situation we propose Rank-Order-VCM in which an individual who contributes more to a group project earns a greater reward resulting from the project than an individual who contributes less. This is accomplished by ranking the observable contributions and assigning a higher marginal return from the project to a higher contributor.

In the experiment we test a conjecture that competition created by such assignment of shares outweighs incentives to free-ride. We find that Random-Rank-VCM not only elicits higher contribution levels than Random-Rank-VCM where the rewards are allocated randomly, but also sustains median contribution to be 100% of the endowment throughout the entire experiment, including the last period. Our results thus emphasize the power of competition also in collective action scenarios involving a tension between the self interest and the interest of the group. However, one has to remember that in such environment the free-riding is not a dominant strategy. Therefore, a call for future research exploring the effects of competition without changing the underlying incentive structure (as in a standard VCM) seems warranted.

Another natural extension of our design would be a situation where history of contributions decides ties. On the other hand, competition can be a double-edged sword as high-power incentives in certain tournaments schemes are known to decrease contributions and can even lead to dysfunctional behavioral responses such as collusion of workers (e.g. Malcomson, 1984) or sabotage (e.g., Lazear, 1989, 2000; Falk and Fehr, 2001; Falk *et al*., 2008; Harbring and Irlenbusch, 2008).

The stylized nature of our experimental design makes the obtained results applicable not only to public goods that are heterogeneous in consumption but also extend to labor markets and collective action scenarios involving voluntary and observable contribution of time, money or effort. On the other hand, the behavior detected in our experiment obviously depends on the implemented parameters and it is possible that it might break down under smaller marginal incentives.

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Appendix
A.1. Instructions Rank-Order-VCM

The purpose of the experiment is to study how people make decisions. From now until the end of the experiment, unauthorized communication of any kind between participants is prohibited. If you want to ask any question, please raise your hand first. Please turn off your cell-phone and do not use the computer for any other purpose than your participation in the experiment requires. If you break these rules, we will have to exclude you from the experiment and from all payments.

In the experiment you will earn money according to your decisions and the decisions taken by the other participants. At the end of the experiment you will be privately paid the sum of your payoffs during the experiment.

<u>With whom do you interact?</u>

1. At the beginning of the experiment, all participants are randomly assigned to groups of four. The composition of each group remains the same throughout the experiment, but the identity of the participants in the group will not be revealed to you at any time.
2. The experiment consists of thirty rounds. After the first fifteen rounds, there will be a restart of another fifteen rounds.

<u>What do you have to do?</u>

3. In every round you are endowed with 50 Cents. You have to decide how to use this endowment; what amount you allocate to a Project and how much you keep for yourself. The other three participants in your group face the same decision problem.
4. The money you allocate to the Project generates payoff to you and to every other participant in your group. The money you keep generates payoff only to you.

<u>What will you earn?</u>

5. In every round, your payoff will be computed as follows.

Your round payoff

=

the money you keep for yourself

+

the sum allocated to the Project <u>by the four participants in your group</u>

×

your multiplier

6. Your multiplier is determined by the amount you allocate to the Project and the amount allocated by the other participants in your group. Given the allocation of the others in your group, the higher your allocation to the Project, the higher are your chances for a larger multiplier in that round. In particular:
    - If your allocation is the highest in the group, your multiplier is 0.65.
    - If your allocation is the second highest, your multiplier is 0.55.
    - If your allocation is the third highest, your multiplier is 0.45.
    - If your allocation is the lowest, your multiplier is 0.35.

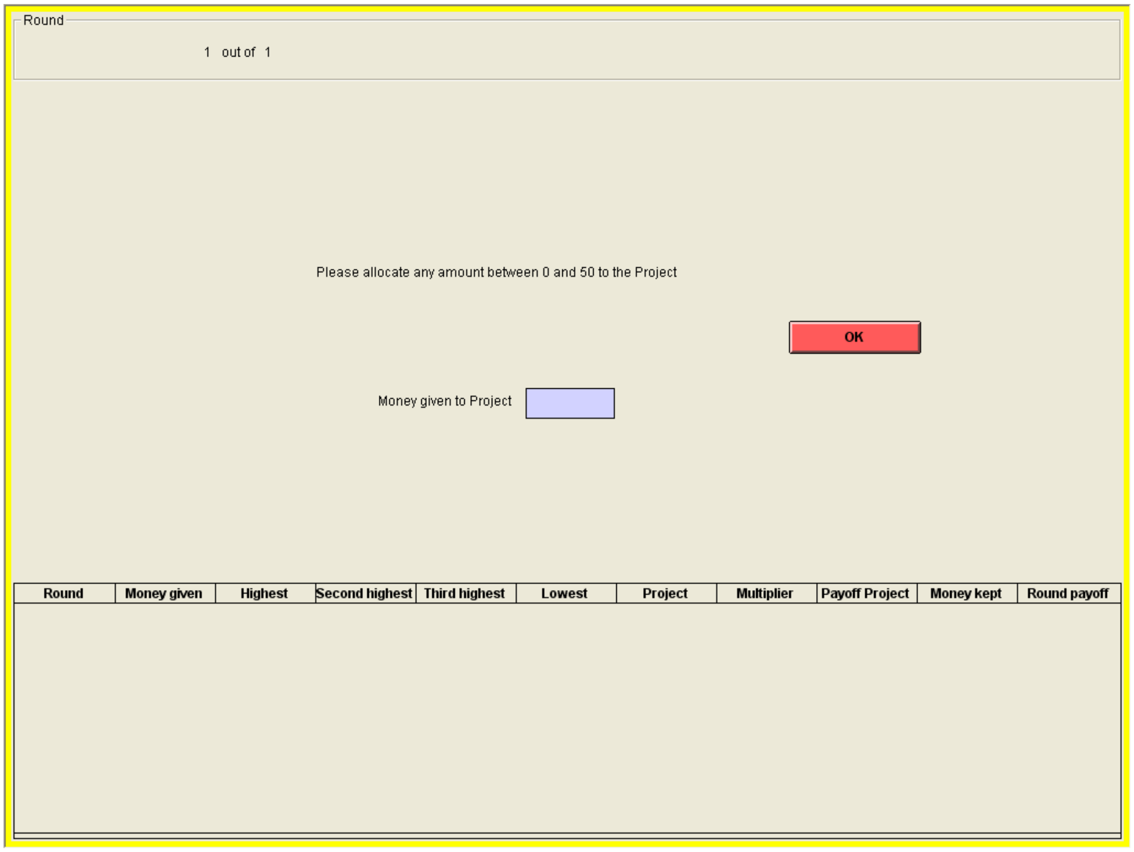
7. In case of a tie, i.e., if two or more participants allocate the same amount to the Project, the corresponding multipliers are averaged. For instance, if the second highest allocation is equal to the third highest, the multiplier for the two participants is 0.5 [= (0.55 + 0.45)/2]. Hence, participants who allocate the same amount to the Project get the same payoff.

How do you make your decisions?

8. In each round, you make your decision on the computer by entering an amount into the input field on the screen (you can select the input field with the mouse). Next you press the OK button (with the mouse) to confirm your decision. Note: After you have confirmed your decision you can not revise it anymore.

What information will you receive?

9. After each round you receive feedback information on the amount you and your group allocated to the Project. You receive information on the individual allocation ordered from highest to lowest, but you will not be able to trace the amount to the person who allocated it. You also receive information about your multiplier, the resulting payoff from the Project, the Money kept, and your round payoff.
10. This information is recorded in a table on your screen and will be available to you for all past rounds. At restart, the information for the first 15 rounds is cleared.


Round
1 out of 1
Please allocate any amount between 0 and 50 to the Project
OK
Money given to Project
Round
Money given
Highest
Second highest
Third highest
Lowest
Project
Multiplier
Payoff Project
Money kept
Round payoff

A.2. Instructions Random-Rank-VCM

The purpose of the experiment is to study how people make decisions. From now until the end of the experiment, unauthorized communication of any kind between participants is prohibited. If you want to ask any question, please raise your hand first. Please turn off your cell-phone and do not use the computer for any other purpose than your participation in the experiment requires. If you break these rules, we will have to exclude you from the experiment and from all payments.

In the experiment you will earn money according to your decisions and the decisions taken by the other participants. At the end of the experiment you will be privately paid the sum of your payoffs during the experiment.

<u>With whom do you interact?</u>

1. At the beginning of the experiment, all participants are randomly assigned to groups of four. The composition of each group remains the same throughout the experiment, but the identity of the participants in the group will not be revealed to you at any time.
2. The experiment consists of thirty rounds. After the first fifteen rounds, there will be a restart of another fifteen rounds.

<u>What do you have to do?</u>

3. In every round you are endowed with 50 Cents. You have to decide how to use this endowment; what amount you allocate to a Project and how much you keep for yourself. The other three participants in your group face the same decision problem.
4. The money you allocate to the Project generates payoff to you and to every other participant in your group. The money you keep generates payoff only to you.

<u>What will you earn?</u>

5. In every round, your payoff will be computed as follows.

Your round payoff

=

the money you keep for yourself

+

the sum allocated to the Project <u>by the four participants in your group</u>

×

your multiplier

6. In each round your multiplier is randomly determined by the computer; the

computer draws a number 1, 2, 3, or 4 for each participant. The number is drawn with replacement; therefore it is possible for the computer to draw the same number for more than one person in your group. Your multiplier is determined according to the rank of your random number. In particular:

a. If your random number is the highest in the group, your multiplier is 0.65.
b. If your random number is the second highest, your multiplier is 0.55.
c. If your random number is the third highest, your multiplier is 0.45.
d. If your random number is the lowest, your multiplier is 0.35.

7. In case of a draw, i.e., if two or more participants' random number is the same, the corresponding multipliers are averaged. For instance, if the second highest random number is equal to the third highest, the multiplier for the two participants is 0.5 [(= 0.55 + 0.45)/2]. You are informed about your multiplier only at the end of the period. Hence, you make your decision about your allocation without knowing the exact value of your multiplier.

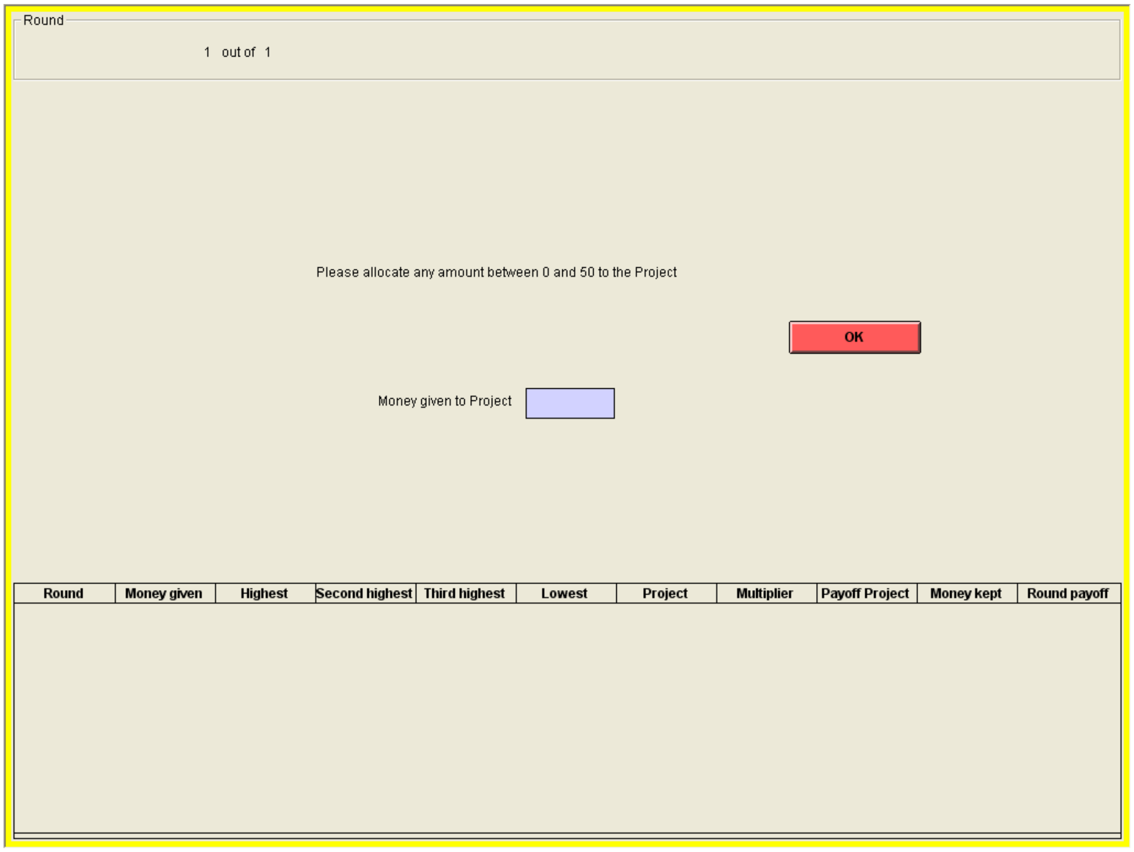
8. In case of a tie, i.e., if two or more participants allocate the same amount to the Project, the corresponding multipliers are averaged. For instance, if the second highest allocation is equal to the third highest, the multiplier for the two participants is 0.5 [= (0.55 + 0.45)/2]. Hence, participants who allocate the same amount to the Project get the same payoff.

How do you make your decisions?

9. In each round, you make your decision on the computer by entering an amount into the input field on the screen (you can select the input field with the mouse). Next you press the OK button (with the mouse) to confirm your decision. Note: After you have confirmed your decision you can not revise it anymore.

What information will you receive?

10. After each round you receive feedback information on the amount you and your group allocated to the Project. You receive information on the individual allocation ordered from highest to lowest, but you will not be able to trace the amount to the person who allocated it. You also receive information about your multiplier, the resulting payoff from the Project, the Money kept, and your round payoff.
11. This information is recorded in a table on your screen and will be available to you for all past rounds. At restart, the information for the first 15 rounds is cleared.


Round
1 out of 1
Please allocate any amount between 0 and 50 to the Project
OK
Money given to Project
Round
Money given
Highest
Second highest
Third highest
Lowest
Project
Multiplier
Payoff Project
Money kept
Round payoff