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Endowment inequality in public goods games: A re-examination☆

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HIGHLIGHTS

- Presents a clean test of the effects of endowment inequality in public goods games.
- Control for possible wealth or endowment effects at the individual.
- Inequality has an adverse effect since rich lower contributions in the face of inequality.
- The rich always contribute less than do the poor.
- The effect is robust to different endowments at the group level.

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ABSTRACT

We present a clean test of whether inequality in endowments affects contributions to a public good. It is a clean test because, to our knowledge, it is the first to control for possible endowment effects. We find that the key adverse effect of inequality arises because the rich reduce their contributions when there is inequality.

1. Introduction

The effect of inequality in endowments on contributions to a public good has typically been studied by comparing behavior in a public goods game when endowments are equal with a game where endowments are unequal (e.g., Isaac and Walker, 1988, Cherry et al., 2005, Buckley and Croson, 2006, Anderson et al., 2008, and Keser et al., 2011). The evidence is mixed, but on balance inequality of endowment lowers contributions (Zelmer, 2003). This is potentially important because it suggests a micro underpinning for the macro-level observation connecting increasing inequality with worse economic performance (e.g. OECD, 2015, and Ostrey et al., 2014).

The difficulty, however, with this experimental evidence and the inference is that two things change when equality of endowment is compared with inequality: individual endowments and the degree of inequality. If people's behavior responds to existence of inequality and to their endowment, then the comparison does not isolate the effect of inequality alone. To our knowledge, ours is the first paper to control for the possible individual endowment effect and so isolate cleanly the influence of inequality.

We study voluntary contributions to a public good (VCM) in 3 person groups under two conditions. The equality condition gives everyone the same endowment. This common endowment varies:

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in one case it is 20 = VCM-20, one 50 = VCM-50 and another 80 = VCM-80. The second condition has inequality: one person has 20, another 50 and the third has 80 = VCM-20-50-80. To test for the effect of inequality, controlling for individual endowment, we compare the contributions of subjects with the same endowment in the equality and inequality conditions (e.g., people in VCM-20 with the person who has 20 in VCM-20-50-80, etc.).[1]

We find that the poor and middle (defined by their endowment) individuals contribute the same in their equal VCMs as they do in the unequal VCM. The rich, however, contribute less in the unequal VCM than in their equal VCM. We test whether this effect of inequality is sensitive to the total endowment by running two further inequality conditions. They preserve the inequality relativities above but change the total endowment to match the total in VCM-20 and VCM-80: i.e., VCM-8-20-32, and VCM-32-80-128. The fall in the contribution of the rich relative to the poor is a robust pattern under inequality and this difference in behavior drives a fall in overall contributions under inequality.

This result is important for two reasons. First, it is a clean test of the influence of inequality *per se* in endowment on contributions to public goods. Second, as the lower contribution is due to the behavior of the rich, this kind of inequality poses a practical difficulty. To tackle inequality through the tax system requires increasing taxes on the rich and lowering them on the poor. However, since, in effect, the contribution to the public good in the experiment is a decision about how much to tax oneself, the experiment shows that these are exactly the circumstances when the rich are less inclined to tax themselves (at least for public goods) even as highly as others, let alone more highly.

2. Experimental design and procedures

Subjects played a repeated linear public goods game (VCM) in groups of three. Each subject received an endowment of tokens to allocate between a private and a group account. Return from the private account was 1. For each token allocated to the group account, each member of the group earned 0.5 tokens, i.e., MPCR = 0.5. Each round, each subject was informed of his/her group's total contribution and his/her individual earning from the round.

We ran six treatments. In three, all subjects of the group received the same per-period endowment: 20 in VCM-20; 50 in VCM-50 and 80 in VCM-80. In the remaining three, there is inequality. In VCM-8-20-32, one subject has an endowment of 8, the second 20, and the third 32. The total endowment is the same as VCM-20. Endowments were similarly unequal in the other two inequality treatments: VCM-20-50-80 and VCM-32-80-128 and their total endowments are the same as, respectively, VCM-50 and VCM-80.

Table 1 summarizes the treatments.[2] In all, the Nash equilibrium of the stage game is zero contribution while the social optimum is full contribution. Both remain unchanged under finite repetition.

Twelve to eighteen students from UEA were recruited for each session, totaling 210 students. In all treatments, the game was repeated for 20 periods. Subjects were anonymously and randomly assigned to fixed three-person groups (partner-matching). Subjects received printed instructions which were read aloud by an experimenter and they had to correctly answer a quiz before the experiment could start. The experiment was programmed in z-Tree (Fischbacher, 2007). A session lasted approximately 45 min. Token earnings were converted to cash at the rate of 150 tokens to £1 and a subject earned between £10 and £11 on average including a £2 show-up fee.

Table 1
Treatments.

Treatment	Endowments	# groups
VCM-20	20-20-20	11
VCM-50	50-50-50	12
VCM-80	80-80-80	11
VCM-8-20-32	8-20-32	11
VCM-20-50-80	20-50-80	13
VCM-32-80-128	32-80-128	12
Total	–	**70**

Table 2
Average percentage contributions by endowment level.

	End20	End50	End80
Equality VCM	44.04 (26.60)	49.86 (30.66)	51.27 (28.75)
VCM 20-50-80	49.00 (33.48)	50.49 (35.44)	33.05 (29.46)
p-values	0.664	0.957	0.164

Standard deviations in parentheses. *p*-values for Ranksum tests. # observations equal # groups in the treatment.

3. Results

Figs. 1 and 2 provide a summary of the results focusing on % contributions.[3]

Three things stand out.

1. Contributions in VCM-20 and VCM-50 are indistinguishable from, respectively, that of those endowed with 20 and those with 50 in VCM-20-50-80 (Fig. 1).
2. Contributions in VCM-80 are higher than that of those endowed with 80 in VCM-20-50-80 (Fig. 1).
3. The rich contribute less than the poor for every total endowment level, and this pulls down overall contributions under inequality cf. equality (Fig. 2).

The tables below present statistical tests of these patterns. Table 2 compares the average (over 20 periods) individual percent contribution for each individual endowment level under equality and inequality (Table B1 in Appendix B presents the comparisons for various sub-periods). There is no significant difference between equality and inequality for those with the 20 and 50 endowments in any sub-period or overall. The average contribution is, however, always higher for those with an endowment of 80 under equality than inequality and this is statistically significant in the first five periods (62.88 vs. 32.31; $p = 0.024$).

Table 3 examines whether the aggregate difference between the rich under equality and inequality is supported at the individual level using panel random effects regressions on individual % contributions. The first equation has controls for the inequality treatment interacted with endowment levels to test for differences under inequality for each endowment level. The only interaction that is significant is the endowment of 80 and the coefficient

[1] The 4:1 ratio between the rich and the poor in our 3 person interaction is close to what is found in OECD countries for the ratio between the average incomes of the top 1/3 to the bottom 1/3.

[2] Data from the equality treatments were also used in Hargreaves Heap et al. (2015).

[3] The % contributions control for endowment effects across subjects with different endowment levels. The average (over 20 periods) % contribution across treatments with equality are not different: VCM-20 vs. VCM-50 ($p = 0.712$); VCM-20 vs. VCM-80 ($p = 0.533$); VCM-50 vs. VCM-80 ($p = 0.902$). There are also no differences in any sub-period.