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Abstract

This paper examines with an experiment a new way that inequality and competition may interact to affect productivity: through team public goods contributions. While inequality within a team diminishes team cooperation in the absence of competition, we find there is no effect of inequality when teams compete. Competition boosts cooperation and more so in unequal teams. Thus, a decline in competition accompanied by growing inequality has a doubly adverse effect on productivity. The difference in the effect of inequality is driven by the behaviour of the 'rich'. They disengage from their teams but recover their 'team spirit' under competition.

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1. Introduction

Many economic, social and political outcomes are determined through a competition between teams. Political parties contest elections, companies compete with each other in markets, research groups apply for competitive grants and the Dodgers may or may not win the World Series. In each case, a competition between groups of individuals organised into teams determines an important outcome. Success in these contests is likely to depend, in part at least, on the combined efforts of the individuals within a team. This paper is concerned with how inequality within teams that compete with each other affects the individual efforts of those within each team.[1] In particular, we focus on how inequality affects 'team spirit'. By this we mean, the inclination of individuals within a team to do things for the team that go beyond what selfishness dictates.

This is timely because growing inequality has been linked to the recent poor productivity performance in many OECD countries (see OECD 2015) and one, hitherto unexamined, way in which this might arise is through 'team spirit'. In particular, as inequality within teams increases, 'team spirit' may diminish with individuals within the team being more likely to free ride on the efforts of others in these team competitions to the detriment of productivity. The difficulty with addressing this possible explanation of the recent poor productivity performance in the US and elsewhere arises because there is evidence that competition, in markets at least, has become less intense at the same time as inequality has increased (see Council of Economic Advisers, 2016, and Barkai, 2016 for interesting new evidence of this). This creates a difficulty because there is also evidence that 'team spirit' weakens as competition wanes (see Bornstein *et al*., 1990). For this reason, we adopt an experimental approach. It enables us to disentangle the effects of increasing inequality from that of reduced competition on 'team spirit'. We thereby generate new insights with respect to the sources of the current 'productivity puzzle'. As a by-product, we also contribute to the understanding of (and a policy proposal for) another apparent feature of the contemporary world: the dis-connect of the rich from others in society.

Our experiment uses a public goods game. The public goods game captures well, given the difficulties with monitoring individual efforts, the free rider problem that can arise in any

[1] In this paper, we are particularly concerned with inequality in resource endowments. Other studies examine different sources of inequality such as group size (see discussion and references in Hargreaves Heap et al. 2015).

production team and which might be overcome through 'team spirit' to the benefit of efficiency. Two teams in the experiment make contributions to their respective public goods and we examine the effect of competition and inequality in a 2 × 2 design. Along the competition dimension, there is either competition between the teams for a prize, where the likelihood of winning the prize depends on the relative contributions of each team to their public good, or this competition is absent. On the inequality dimension, individuals in a team make contributions to the public good when they have equal or unequal endowments. There is experimental evidence on some of the cells in this 2 × 2 design (see Hargreaves Heap et al. 2015 and 2016). This evidence supplies some useful pointers as to what we might expect to find and it helps explain the specific hypotheses we test.

There is evidence that placing teams in competition with each other helps build 'team spirit' in our sense: team members contribute more to a team public good when their team is in competition for a prize with another team than when they are not (see Bornstein *et al.*, 1990, Nalbaltian and Schotter, 1997, Bowles and Gintis, 2011, Tan and Bolle, 2007, Ishida, 2006, Guntthorsdottir and Rapoport, 2006, and Marino and Zábojník, 2004). But, there is no evidence to our knowledge on whether this boost from competition still exists when there is inequality within a team. There are, however, reasons for supposing that it might not. For instance, in experiments when there is no competition between groups, inequality within a group reduces contributions to the public good (see Buckley and Croson, 2006, Reuben and Riedl, 2013, and Hargreaves Heap *et al*., 2016).

More generally, contributions to public goods are typically higher when individuals identify more strongly with the fellow members of their group (e.g., see Chen and Li, 2009, Corr *et al.*, 2015, on the in-group bias in contributions) and one might suspect that inequality between members of a team weakens this identification. The question, then, is does the malign effect of inequality on 'team spirit' when there is no competition carry over to when there is competition? This is the basis of H1.

> **H1:** Unequal teams respond less strongly to competition through the increase in their aggregate contribution to the public good than do equal teams.

The question is important because if we find support for H1, then this might be one, hitherto unexplored, mechanism through which increasing inequality affects productivity: it blunts the otherwise efficiency promoting effect of competition between teams. If this was the case,

then we also expect (H2) equal teams in competition to exhibit more 'team spirit' than unequal ones.

> **H2** Equal teams in competition contribute more to the public good than do unequal teams in competition.

There is a more specific underpinning to H1 that we examine in H3. It arises from the evidence on how inequality affects contributions to a 'pure' public good when there is no competition. This suggests that the aggregate fall in contributions with inequality is due to the way that the 'rich' (unlike other income groups) contribute proportionately less when there is inequality than they would if there was no inequality (see Hargreaves Heap *et al*. 2016). In other words, inequality in the absence of competition corrodes the 'team spirit' of the rich but not others. Thus, a specific question, consistent with H1, concerns whether the 'rich' remain reluctant to step up to the plate, so to speak, when their team is put in competition with another. There is also similar evidence of a disconnect by the rich in a different competitive setting (see Rapoport et al., 1989).[2] H3 follows.

> **H3:** The rich respond to competition by increasing their % contribution to the public good by less than the poor in their team.

This is an important hypothesis to test because it may offer a new insight into an increasingly observed social phenomenon: the dis-connect of the rich from others in society, as revealed by the greater attention they give to themselves. For example, those driving expensive cars are apparently less likely to stop for pedestrians attempting to cross the road at a crosswalk than those driving cheaper ones (see Piff *et al.*, 2012) and the richer you are, the less attention you seemingly pay to other people when walking down the road (see Dietze and Knowles, 2016). H3 tests whether this dis-connect is also revealed by the rich through their relatively small public goods contributions in team competitions when there is inequality.

These are the key hypotheses we wish to test regarding the effect of inequality within a team on the 'team spirit' that is promoted by competition. Inequality within a team may, however, have a further effect from the possible contrast with the other team. Social Identity Theory, for example, predicts that a team member's sense of identity from belonging to that team

[2] They examine an all pay contest between groups where individuals make a binary decision on whether to contribute their endowment to their group contest fund. Individuals have unequal endowments and they find the rich in each group are less likely to contribute their resources to the group contest than the poor and medium group members.

depends on the contrast with other groups (see Tajfel and Turner, 1979). As a result, we might expect the greatest boost from competition when equal teams compete with unequal ones because this creates a sharp contrast between groups. H4 tests for this effect.

> **H4:** The boost in contributions to the public good from competition is greatest for each type of team when an equal team competes with an unequal one.

H1 and H4 are based on the idea that group identification affects 'team spirit' and that such identification may depend respectively on the way groups are constituted through their internal relations of equality/inequality (H1) and external relations of contrast/similarity (H4). Another line of thinking on the relation between a sense of group identity and action focuses on the way that cognitive dissonance between identity and actions can produce a change in either or both (see Festinger, 1957). Thus, an equal team that competes with another equal team may experience some cognitive dissonance because the competition will create inequality (between the teams) where previously there was none. To avoid such dissonance, team members may adjust downwards their identification with equality and hence their team, with the result that they compete less vigorously than when there was no such (or less) dissonance associated with competing. In comparison, when an equal team competes with an unequal one, the dissonance for members of the equal team is likely to be milder because inequality already exists prior to the competition (and so we expect a stronger boost from competition in these circumstances). This is the same prediction as H4 for equal teams. Following the same dissonance line of argument, unequal teams will not experience dissonance when they compete with either unequal ones or equal ones and so there will be no difference in team identification: that is, H4 will not hold for unequal teams. Thus depending on whether H4 holds only for equal or both types team, we will favour either the cognitive dissonance account or the Social Identity one of how the contrast between teams affects team spirit.

Against these group-identification lines of argument (and H1, H4), it is possible that individuals simply value winning intrinsically (that is, independently of whatever the monetary value is of the prize) and this explains why they contribute more to the public good when there is a competition. Indeed, there is evidence of this effect from experiments on individual contests (see Sheremeta, 2010). If this is also the motive that is triggered in a group competition, then it is not obvious that inequality within the team will affect the level of individual contribution when there is competition. Indeed, in the model we set out in

section 3, inequality will not affect contributions to the public good under competition so long as endowments are sufficient to cover an individual's willingness to pay for this extra non-pecuniary buzz from winning.

We find that unequal teams respond more strongly to competition than equal ones (against H1). This is because the 'rich' step back up to the plate when there is competition as they now contribute a similar percentage of their endowment to the public good as other members of their team (against H3). As a result, the contributions of unequal teams that were lower than equal ones in the absence of a competition become similar when there is competition (against H2). In short, the effect of increasing inequality on 'team spirit' depends crucially on whether there is competition or it is absent. This, in turn, supplies a key insight into the possible contribution of dwindling 'team spirit' to the contemporary poor productivity performance. In effect, our experiment suggests that a reduction in competition when combined with an increase in inequality could have delivered a double-whammy to productivity. The removal of competition reduces 'team spirit' and, when there is no competition, an increase in inequality further diminishes 'team spirit', specifically of the 'rich'. Had there been no fall in competition, then increasing inequality would not have had this effect. It is the combination of dwindling competition and increasing inequality that is crucial. Or to re-focus these results on the dis-connect of the rich, it is not increasing inequality *per se* that is associated with this dis-connect because there is no such effect when there is competition. In other words, getting rid of the rich through the move to equality is one way of getting rid of the 'problem of the rich', but it is not the only one. An injection of competition will do just as well. We also find evidence in favour of H4 for equal teams but against H4 for unequal teams, favouring the cognitive dissonance over the social identity theory.

Section 2 presents a model of team competition in the absence of 'team spirit'; it provides the baseline predictions that enable us to determine whether subjects actually display some 'team spirit' in the form of greater contributions to the public good. Section 3 explains the design of the experiment in detail and Section 4 gives the results. We discuss them and conclude the paper in Section 5. The online Electronic Supplementary Material contains additional analysis (Appendix A) and the experimental instructions for the competition treatment with inequality within one group and for the VCM-Inequality treatment (Appendix B).

2. A model of team competition

We follow the Hargreaves Heap *et al.* (2015) version of the Guntthorsdottir and Rapoport (2006) model. It introduces inequality via differences in the individual endowments of team members and it has the virtue, when individuals are only concerned with material payoffs, of generating predictions of behaviour that are independent of the level of inequality within either team.

In the absence of a competition, each player i in group k composed of m players receives an endowment of $e_{ik} > 0$ and must decide how much to invest $0 \leq x_{ik} \leq e_{ik}$ in a public good. The remainder, $(e_{ik} - x_{ik})$, is invested in a private good. Each player's return from the private good is 1 and each player's return from the public good is equal to a fraction g ($0 < g < 1$ and $mg > 1$) of the total contribution to the public good in group k, denoted by $X_k = \sum_i x_{ik}$. Thus, g is the marginal per-capita return (MPCR) from the public good. The payoff to player i in group k is given by

$$V_{ik} = (e_{ik} - x_{ik}) + g X_k \qquad (1)$$

In the Nash equilibrium, each player contributes nothing to the public good while all players contribute their entire endowments in the social optimum. Both the equilibrium and optimum are the same under finite repetitions of the stage game.

When there is a competition between teams, the public goods decision just described is, in addition, connected to a team competition between two groups. Groups k and l ($k \neq l$) compete for a prize S. The total allocations to the public good in the two groups, X_k and X_l, determine the probability with which each group wins the prize according to the Tullock contest success function (Tullock, 1980) given by

$$Prob\ (Group\ k\ wins) = \begin{cases} X_k/(X_k + X_l) & \text{if } (X_k + X_l) \neq 0 \\ 1/2 & \text{otherwise} \end{cases}. \qquad (2)$$

The prize S is split equally amongst the m members of the winning group. Individual payoffs are given by

$$V_{ik} = (e_{ik} - x_{ik}) + g X_k + [X_k/(X_k + X_l)].(S/m). \qquad (3)$$

In an interior equilibrium, we now have (see Hargreaves Heap *et al.*, 2015)

$$X_k^* = X_l^* = \frac{s}{[4m\ (1-g)]} > 0. \quad (4)$$

The only requirement is that both groups have sufficient funds. Further, there are multiple equilibria – any combination of contribution decisions that sum to X_k^* in each group constitutes an equilibrium. Since the public goods element of the game still remains, the social optimum remains unchanged, i.e., full contribution by all individuals. Once again, both the equilibrium and optimum remain the same under finite repetition.

The key equilibrium predictions of the model are:

1. The competition for the prize raises contributions to the public good above levels observed in the absence of competition.

2. As long as both groups have sufficient funds, inequality in endowments among members of one's own group has no effect on contributions.

3. As long as both groups have sufficient funds, inequality in endowments among members of the competing group has no effect on contributions.

3. Experimental Design and Procedures

Our baseline is a linear VCM without competition. This has two variants: (i) equality of individual endowments (E) and (ii) inequality of individual endowments (I). The total value of the endowments is the same in both cases.

Our competition treatments append the Tullock contest and we consider 3 possible two-team competitions: (i) between teams with equal endowments (EE); (ii) between a team with equal endowments and one with unequal endowments (EI); and (iii) between teams where both have inequality in their individual endowments (II).

The precise details of the decisions and pay-offs in each part are as follows.

3.1 Linear VCM Treatments

The baselines are linear public goods games that use the Voluntary Contributions Mechanism (VCM). Each subject in a three-person group (m = 3) received an endowment of tokens that

he/she could allocate to a private account or contribute to a group account. Returns from the private account were one. Earnings from the group account were the same for each member of the group and were equal to half the total allocations to the group account by all members of the group, i.e., MPCR = g = 0.5.

In VCM-E, each member of the group received an endowment of 50 tokens. In VCM-I, one member of the group received an endowment of 20 tokens, one an endowment of 50 tokens, and the third an endowment of 80 tokens each period. Importantly, the total per-period endowment in a group was the same, 150 tokens, in both treatments.

At the end of a period, subjects were informed of the total contribution to the public good in their group in that period, and their individual earning from the private account and group accounts in that period. Subjects did not receive any information about the individual decisions of the others in their groups, or about decisions and outcomes in other groups, at any time.

3.2 Competition treatments

In treatments with competition, subjects were once again assigned to groups of three members but now participated in two stages in each period. In the first stage in every period, subjects made the above public good provision decision, i.e., how much of their endowment to allocate between their private accounts and the group account. Returns from both accounts were generated in the same way as in the VCM treatments. Each subject received the same information after the first stage as in the VCM treatments.

In an automatic second stage, each group was paired with another group of three members. The two groups were automatically entered into a competition for a prize that was worth $S = 120$ tokens for the group. Total group allocations by both groups influenced the probability with which each group wins the prize using a Tullock contest success function (2). Each member of the wining group received an equal share of the prize, i.e., 40 tokens. Given our parameters, group contribution to the public good in equilibrium is 20 tokens.

In the second stage, subjects were additionally informed of the total allocation to the group account in the competing group, the winning probabilities for each group and which group won the prize in the period.

We used the same endowment configurations as in the VCM treatments. Each member of an equal group received a per-period endowment of 50 tokens. In unequal groups, one member received an endowment of 20 tokens, another an endowment of 50 tokens and the third, an endowment of 80 tokens.

In the first treatment (Comp-EE), both competing groups were equal. In the second treatment (Comp-EI), the resource distribution was equal (E) in one group and unequal (I) in the other group. In the third treatment (Comp-II), both groups had the unequal distribution of endowments. In all treatments, subjects knew the distribution of endowments in their own group and in the competing group. However, they were never informed of who received each endowment.

Our chosen endowment levels guaranteed that each group could contribute at least the equilibrium amount of 20 tokens to the public good. Moreover, each individual in each group could single-handedly contribute the equilibrium amount. Thus, we preserved the equilibrium prediction in all competition treatments. Finally, the total amount of resources in each group was kept the same in all groups, regardless of the internal distribution of endowments.

Table 1 summarises our treatments and lists the number of observations in each treatment.

Table 1. Summary of Treatments

		Endowments within group			
Treatment	**Competition?**	**Group 1**	**Group 2**	**# groups**	**# pairs**
VCM-E	No	50-50-50	-	12	-
VCM-I	No	20-50-80	-	13	-
Comp-EE	Yes	50-50-50	50-50-50	22	11
Comp-EI	Yes	50-50-50	20-50-80	28	14
Comp-II	Yes	20-50-80	20-50-80	24	12
Total		**-**		**99**	**37**

Note: Data from treatments VCM-E and Comp-EE were used in Hargreaves Heap *et al*. (2015) – respectively, VCM50 and Comp50-50. Also, data from treatments VCM-E and VCM-I were used in Hargreaves Heap *et al*. (2016) – respectively, VCM50 and VCM20-50-80. In the latter, we examine the influence of inequality on public good contributions and in the former we consider how inequality between teams affects contributions.

3.3 Procedures

All experimental sessions were conducted using student subjects at the University of East Anglia (UEA). The 12 to 18 subjects in a session were anonymously and randomly assigned

to three-person groups that remained fixed during the session (partner matching). Additionally, in the competition treatments, each group was randomly matched with another group and this matching also remained fixed throughout the session.

Once instructions were read aloud by an experimenter, each subject had to correctly answer a quiz before the experiment began. The experiment was computerised using z-Tree (Fischbacher 2007). A total of 297 subjects participated in our experiment. No subject participated in more than one session (between-subject design).

In all treatments, the stage game was repeated for 20 periods. Earnings from a period could not be carried forward to future periods. In each period, each subject received a fresh endowment. Further, each subject received the same endowment each period. Subjects were paid their earnings from all 20 periods of the game. In the VCM treatments, accumulated token earnings were converted to cash at the rate of 150 tokens to £1. In the competition treatments, final token earnings were converted to cash at the rate of 200 tokens to £1. As in Hargreaves Heap *et al*. (2015), different exchange rates were used to keep earnings comparable between treatments with and without competition. A session lasted 45 minutes on average and each subject earned between £10 and £11 on average including a £2 show-up fee.

4. Results

Unless otherwise mentioned, we use nonparametric Wilcoxon rank sum tests to make pairwise comparisons of the team contributions across treatments. The p-values reported are for two-sided tests.

4.1 The effects of competition on team spirit in equal and in unequal teams

We begin by identifying whether competition in our experiment produces a boost to 'team spirit' in the form of increased contributions to the public good. First, for equal groups, we compare the contributions to the group account when there is equality and no competition (VCM-E) with the contributions by equal groups (E) when there is competition (i.e., COMP-EE and E-COMP-EI). This is done in Figure 1a for each period. In Figure 1b we do the same for unequal groups by comparing contributions when there is no competition (VCM-I) with

the contributions when there is competition (i.e., I-COMP-EI and COMP-II). Table 2 presents summary statistics of per-period (averaged over all 20 periods) group account contributions in equal and unequal groups. An observation is a group of three members, except in Comp-EE and in Comp-II, where an observation is the average group contribution in a competing *pair* of groups.

Figure 1. Average group contributions over time in equal and unequal groups

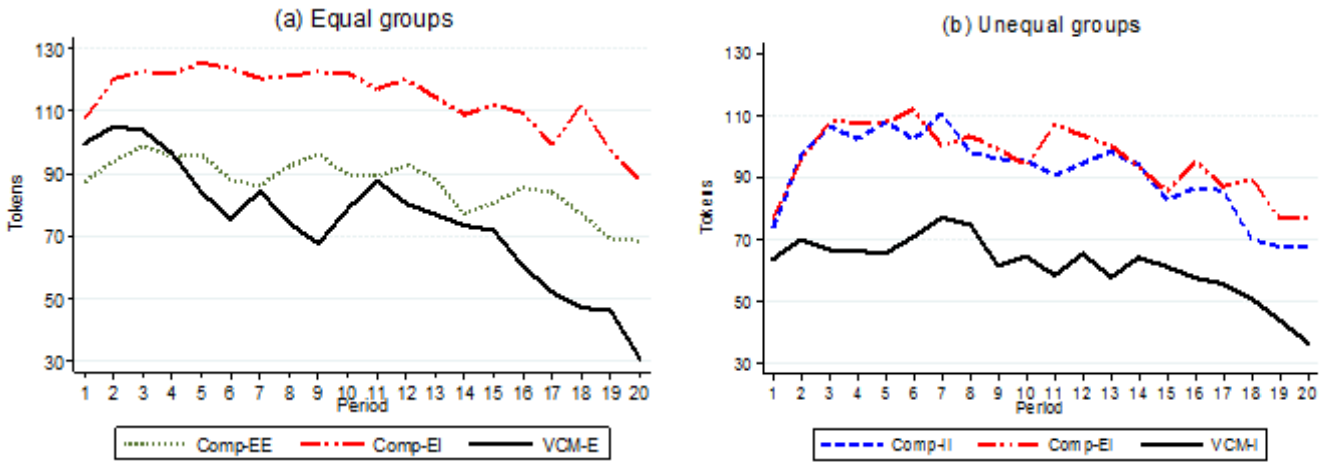


Table 2. Average group contributions

	Obs	Equal groups	Unequal groups
VCM-E	12	74.78 (45.99)	-
VCM-I	13	-	61.49 (45.07)
Comp-EE	11	86.78 (17.72)	-
Comp-EI	14	114.20 (30.24)	95.89 (28.50)
Comp-II	12	-	91.32 (17.69)

Figures in parentheses are standard deviations. In Comp-EE and Comp-II, an observation is a competing pair.

Figure 1 (a) shows the usual pattern of declining contributions in VCM-E (for instance, see Fehr and Gächter, 2000) and it suggests that while equal groups contribute more throughout in COMP-EI, it is only towards the end that equal groups contribute more in COMP-EE. Table 2 reinforces this impression. The contributions are only statistically significantly higher in Comp-EE than in VCM-E in the last 5 periods ($p = 0.0423$). However, the increase in the equal group in Comp-EI over VCM-E is significant when averaged over all rounds ($p = 0.0221$).

Result 1: *Competition raises average contributions to the public good in equal groups as compared with the contributions by equal groups in the VCM. This is apparent throughout when the equal group competes with an unequal one and, in the later stages, when the equal group competes with another equal group.*

Figure 1 (b) shows a similar decline over time in the contributions in unequal groups and a much clearer difference when there is competition. Averaged over all 20 rounds, mean group contributions are significantly higher for the unequal group in Comp-EI ($p = 0.0153$) and in Comp-II ($p = 0.0339$) than in VCM-I.

Result 2: *Competition raises average contributions to the public good in unequal groups throughout as compared with contributions in an unequal VCM.*

Results 1 and 2 are robust to group-level panel random effects regressions (separate for equal and unequal groups) where the dependent variable is group account contribution in a round and independent variables are one-period lagged group contribution, treatment dummies and period dummies. The regressions are presented in columns 2 and 4 in Table A1 in Appendix A in the Electronic Supplementary Material.

We turn now to our Hypotheses. For H1-H3, we consider only competitions between equal teams and competitions between unequal teams. This avoids any confounding effect from an external contrast in the equal/unequal contests. Measured by the difference between a competing group's average aggregate contribution across all rounds and a VCM group's mean aggregate contribution, the boost in equal teams when they compete with other equal

teams is significantly lower than the boost that comes for unequal teams when they compete with other unequal teams (11.99 vs. 29.83; p = 0.0423).[3]

Result 3 (against H1): *Unequal teams gain more from a competition between themselves than do equal teams from a competition with other equal teams, judged by the boost in contributions to the public good.*

Note that average contributions are lower in unequal teams than in equal teams in the absence of competition (Table 2 and Hargreaves Heap *et al*., 2016). However, the greater boost in unequal teams due to competition leads to higher average group contributions in Comp-II than in Comp-EE (see Table 2). While a test shows that this difference is not statistically significant at the 10% level, the group-level regression reported in column 5 of Table A1 in Appendix A shows the difference is significant at the 10% level (p = 0.075).

Result 4 (against H2): *Unequal teams contribute (weakly) more to the public good in competitions between themselves than do equal teams in competitions with other equal teams.*

We gain some insight into why unequal teams gain more from competition by examining the behaviour of the rich. Table 3 presents average (over all 20 rounds) individual percentage (of endowment) contribution for unequal teams by endowment level (20, 50 and 80) when there is no competition and when there is competition with other unequal teams.

Table 3. Mean contribution percentage in unequal groups

	Obs	End 20	End 50	End 80
VCM-I	13	49.00	50.49	33.05
		(33.48)	(35.44)	(29.46)
Comp-II	12	67.44	66.72	55.59
		(18.37)	(10.60)	(17.45)

Figures in parentheses are standard deviations.

The disengagement of the rich is apparent in the VCM when there is no competition: the contribution of the rich is significantly smaller than those with the poor and middle endowment levels (p = 0.0131 and 0.0159, respectively). The boost from competition is apparent for each endowment level, but it is greatest for the rich (endowment 80). Further,

[3] This result is supported in group-level regressions reported in columns 1 and 3 of Table A1 in Appendix A in the Electronic Supplementary Material – the boost from competition (over all 20 rounds) is statistically significant only for unequal groups.

comparing the contribution with and without competition by each endowment level, the only boost that is statistically significant is that for the rich ($p = 0.0123$; $p > 0.10$ for the other endowment levels).

Result 5 (against H3): *The rich respond to competition by increasing their % contribution to the public good by more than others in their team.*

4.2 The effect of contrast in competition on team spirit when equal and unequal teams compete

We turn now to H4 and the effect on team spirit of contrast between teams in competition.

Figure 1a suggests that equal teams contribute more when they compete with unequal ones than equal ones and the difference in Table 2 averaged over all rounds is significant (114.20 vs. 86.78; $p = 0.0285$). A post-regression Wald test on regression (2) reported in Table A1 confirms that group contributions in equal groups are higher in Comp-EI than in Comp-EE ($p = 0.0297$).

Result 6 (consistent with H4 for equal groups): *In the presence of competition, equal groups contribute more on average to the public good when they face an unequal group than when they face another equal group.*

There is no such apparent difference for unequal teams in Figure 1 (b). Table 2 shows that average per-round contributions by Unequal groups are higher in Comp-EI than in Comp-II (95.89 vs. 91.32), but this is not statistically significant (even at the 10% level). A Wald test after regression (4) reported in Table A1 confirms that group contributions in unequal groups in Comp-EI and Comp-II are not significantly different ($p > 0.10$).

Result 7 (against H4 for unequal groups): *In the presence of competition, average contributions to the public good in unequal groups are not significantly affected by whether the competing group is equal or unequal.*

In other words, combining Results 6 and 7, it seems that equal groups do not simply recover their competitive instinct when competing with unequal teams, they actually compete more

vigorously than do the unequal ones. We interpret this as equal teams becoming, as it were, 'evangelical'.[4]

To explore the differences in behaviour that those in equal teams display when competing with an equal as compared with an unequal team, we develop what is known from the individual contest and public goods literature when there is no competition: that individual contributions in contests depend on the lagged contribution of their opponent (for instance, see Dechenaux *et al.*, 2015) and that individual contributions to public goods depend on the lagged contributions of other group members (for instance, see Sefton *et al.*, 2007).

We estimate two individual panel random-effect regressions of public good contributions by those in equal groups in Comp-EE and in Comp-EI. In the first regression, the independent variables are the individual's one-period lagged contribution, the lagged deviation of his/her contribution from the average of others in the group, an indicator for whether his/her group won the prize in the previous period, the competing group's total contribution in the previous period, a dummy for the Comp-EI treatment (excluded category = Comp-EE), and period dummies. In the second regression, we additionally include interactions between the treatment dummy and the lagged win dummy and the lagged opponent's contribution. In both regressions, we estimate robust standard errors clustered on competing pairs of groups. The regression estimates are presented in Table 4.[5]

[4] Figure A1 and Table A2 in Appendix A compare contributions in the equal and unequal groups when facing one another, i.e., in Comp-EI. In a competition between an equal group and an unequal group, controlling for past behaviour, average contributions to the public good are (weakly) higher in equal groups than in unequal groups.

[5] They generate the usual significant effect of own lagged contribution and deviation from contribution of others as has been found in the public goods literature.

Table 4. Determinants of individual contributions in equal competing groups

Lagged own contribution	0.662***	0.651***
	(0.043)	(0.046)
Lagged deviation from contribution of others in own group	-0.128***	-0.123***
	(0.025)	(0.025)
Lagged indicator for win	-0.605	-0.590
	(0.941)	(1.425)
Lagged group contribution in competing group	-0.006	-0.024
	(0.012)	(0.015)
Comp-EI	2.030**	-2.063
	(0.917)	(2.344)
Lagged win × Comp-EI	-	-0.119
		(1.802)
Lagged competitor's group contribution × Comp-EI	-	0.046**
		(0.022)
Constant	9.319***	11.57***
	(2.341)	(3.042)
Observations	2034	2034

Dependent variable = individual contribution in a period. Only includes data for individuals in equal groups that face competition. Standard errors clustered on pairs in parentheses. Includes period dummies (not reported). In both regressions, the excluded category is Comp-EE. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first regression confirms at the individual level the earlier finding that contributions are higher in equal groups that compete against unequal groups. The second regression shows that this increase is driven by a difference in the reaction to the contribution by the competing group. While the lagged contribution of the competitor is not significant in both regressions, the interaction of this variable with the Comp-EI dummy is positive and significant in the second regression. This suggests that individuals in equal groups react more strongly, in the sense of increasing their own contributions, to an increase in contributions by an *unequal* competing group than by an equal competing group.[6]

[6] We have conducted similar analysis for unequal groups, using % contributions to adjust for the differences in endowment and we find that there is not a similar difference in how unequal group members respond to the contribution of their opponent between different types (see Table A3 in Appendix A in the Electronic Supplementary Material).

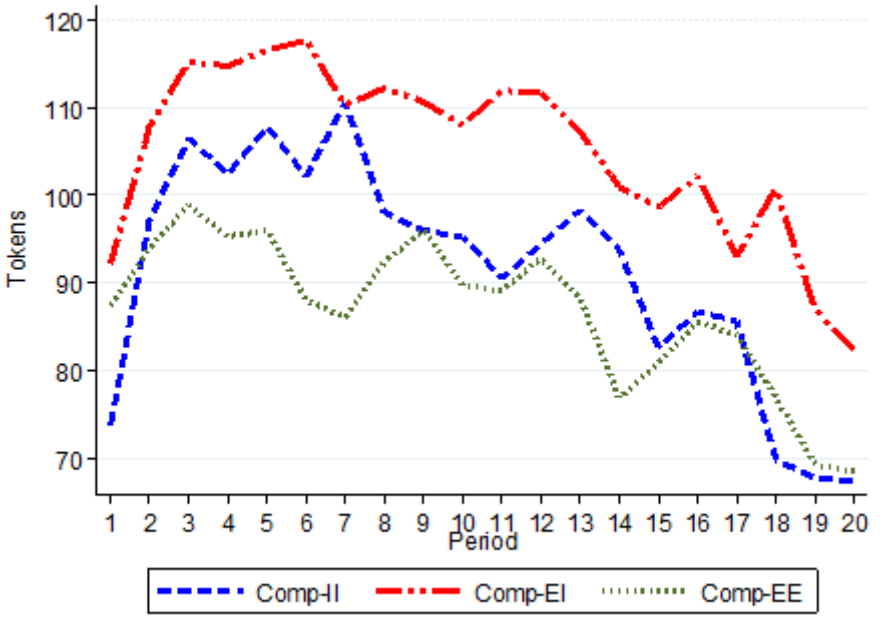
Result 8: *Individuals in equal groups raise contributions by a greater amount in response to an increase in contributions by unequal competing groups than by equal competing groups.*

Since this responsiveness to the contribution of the other team can be taken as another indicator of a team's competitiveness, this reinforces the conclusion from the evidence on aggregate contributions that equal teams are less inclined to compete with each other.

4.3 The welfare effects of inequality under competition

To complete the analysis of the effects of inequality, we consider whether the combined average contributions of both teams in the competition depends on level of inequality. For this purpose, we measure inequality by the number of teams with unequal internal distributions. So, we compare equality (where both teams are equal), with part inequality (where one team is equal and the other is unequal) and finally with full inequality (where both teams are unequal). Figure 2 presents average group contributions in a pair over time.

Figure 2. Average group contributions over time in competing pairs of groups



Comp-EI stands out as one might expect, given Results 4, 6, and 7. The average group contribution is marginally significantly higher in Comp-EI than Comp-EE ($p = 0.0798$), and the other differences are not significant.

As above, we estimate a group-level panel random effects regression of group account contributions in the competition treatments on lagged group contributions, treatment dummies (the excluded treatment is Comp-EE), and period dummies. In addition, since we only include data from the competition treatments, we also included controls for past competitive outcomes – an indicator for winning the prize in the previous period, and the competing group's lagged group account contribution. The second regression also includes a dummy for unequal groups in Comp-EI. The regression estimates are presented in Table 5. We report robust standard errors clustered on independent competing pairs of groups.

Table 5. Comparing competition treatments – group level regressions

Lagged group account contribution	0.731***	0.725***
	(0.000)	(0.038)
Lagged indicator for win	-1.959	-1.934
	(1.706)	(1.716)
Lagged group account contribution in competing group	-0.002	0.003
	(0.034)	(0.034)
Comp-EI	5.417**	7.678**
	(2.45)	(3.092)
Comp-II	1.766	1.757
	(2.176)	(2.176)
Unequal group in Comp-EI	----	-4.548
		(3.125)
Constant	36.62***	36.62***
	(4.574)	(4.580)
Observations		1398

Standard errors clustered on pairs in parentheses. Includes period dummies (not reported). The excluded treatment is Comp-EE. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first regression confirms the finding from the aggregate tests that group contributions in Comp-EI are significantly higher than in Comp-EE ($p = 0.027$) and that contributions in Comp-II are not significantly different from those in Comp-EE ($p > 0.10$). The second regression highlights that equal groups in Comp-EI have higher contributions than equal

groups in Comp-EE, as the Comp-EI dummy is significant ($p = 0.013$).[7]

Result 9: *In the presence of competition, total contributions are highest when there is one unequal group in a competing pair. Thus, it appears the effect of unequal groups on total contributions in group competitions is non-monotonic.*

5. Discussion and Conclusion

Competition in markets has, of course, been well known, at least since Adam Smith, to promote efficiency through the allocation of resources. The possible beneficial influence of competition on efficiency through its generation of 'team spirit' is, in comparison, relatively new. It is nonetheless important because, like the earlier insight, it has policy implications. For example, policy makers have an additional reason to care about the effective absence of competition in markets and managers may want to create competitions between different work groups. However, members of teams in markets or within firms are rarely equally endowed. Indeed, this may itself be a policy choice. What is not well known is whether the boost to 'team spirit' from introducing a team competition is robust to the existence of inequality within a team. There are reasons for doubting that it is because the experimental evidence suggests that inequality erodes 'team spirit' when there is no competition.

We find, however, that the boost to 'team spirit' from competition is actually bigger in unequal teams than equal ones. The extra boost is largely explained by the rich under inequality regaining the 'team spirit' when there is competition which they otherwise lose when there is inequality. In this sense, the new insight regarding team competition and the promotion of efficiency is robust to the existence of within team inequality.

The importance of this result is perhaps best appreciated by considering what it means for our understanding of the recent productivity puzzle in many OECD countries and the observation that the rich seem increasingly to be living in a world of their own. There has been a growth in inequality and on many accounts a fall in competition. It is this combination that, our results suggest, has particularly adverse effects on productivity through the influence of the behaviour of the rich. The absence of competition diminishes 'team spirit' generally and so

[7] A post-regression Wald test after the second regression rejects the hypothesis that Comp-EI = Comp-II ($p = 0.0520$). This suggests that equal groups in Comp-EI contribute more than groups in Comp-II.

undermines productivity, but this is especially so in unequal teams because the rich seem to respond to inequality by becoming notably more selfish than others when there is no competition. Or to put this point in terms of the dis-connect of the rich, our experiment suggests that it is not inequality per se that leads to the rich showing less interest in the public good because this is not apparent when there is competition. Instead, it is the absence of competition when combined with inequality that produces the dis-connect. In short, it is possible to tackle the problem of the rich's disconnect from society without, as it were, abolishing them through a move to equality because policies that promote competition will have the same effect.

It is tempting to draw a similar conclusion in relation to productivity policy. The promotion of competition may again seem the key since the gain to efficiency from greater equality within a team, that is present when there is no competition, seems to disappear once there is competition. However, this is not quite right. We also find that competition between an unequal team and an equal team notably boosts 'team spirit' in the equal team as compared with the unequal one. This result favours cognitive dissonance theory over social identity theory as an explanation of how such contrasts contribute to 'team spirit'.[8] However, it is perhaps more important because it reinforces the general thought that inequality is only good up to some point and thereafter it has adverse effects on efficiency (see OECD, 2015). This is so in our experiment even when there is competition. In our case, efficiency through competition is served better by having one unequal team rather than two equal ones, but it is also ill-served by having two unequal teams.

[8] That the size of the boost is affected by inequality in these ways suggests that individuals are not simply responding to competition because they get some extra buzz from competing. Instead it seems that 'team spirit' is in play and is affected by inequality.

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ONLINE ONLY

Electronic Supplementary Material for

The productivity puzzle and the problem with the rich: an experiment on competition, inequality and ‘team spirit’

Shaun P. Hargreaves Heap, Abhijit Ramalingam, Brock V. Stoddard

Appendix A. Supporting Analysis

Table A1. The effect of competition - group level regressions

Panel random effect regressions

Unit of analysis = group of three players

Dependent variable = total contribution to the group account in a round

Robust standard errors clustered on independent competing pairs of groups

	(1) Equal: VCM vs. Comp-EE	(2) All Equal groups	(3) Unequal: VCM vs. Comp-II	(4) All Unequal groups	(5) Comp: Equal vs. Unequal
Lagged group account contribution	0.825*** (0.045)	0.826*** (0.037)	0.747*** (0.000)	0.729*** (0.046)	0.761*** (0.000)
Comp-EE	4.485 (2.880)	4.468 (2.791)	-	-	-
Comp-EI	-	9.259*** (3.505)	-	10.651** (4.715)	-
Comp-II	-	-	8.619* (4.681)	9.146** (4.609)	6.980* (3.919)
Constant	19.389*** (6.452)	20.134*** (5.037)	29.644*** (4.561)	29.996*** (4.248)	32.479 (5.841)
Observations	646	912	703	969	684

Standard errors clustered on pairs in parentheses. Includes period dummies (not reported). In regressions (1)-(4), the corresponding VCM treatment is the excluded treatment. In regression (5), Comp-EE is the excluded treatment. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Post regression Wald tests:

Equal groups – regression (2): H_0: Comp-EE = Comp-EI: z = 4.73; p = 0.0297

Unequal groups – regression (4): H_0: Comp-EI = Comp-II: z = 0.31; p = 0.5791

Figure A1. Average group contributions over time in Comp-EI

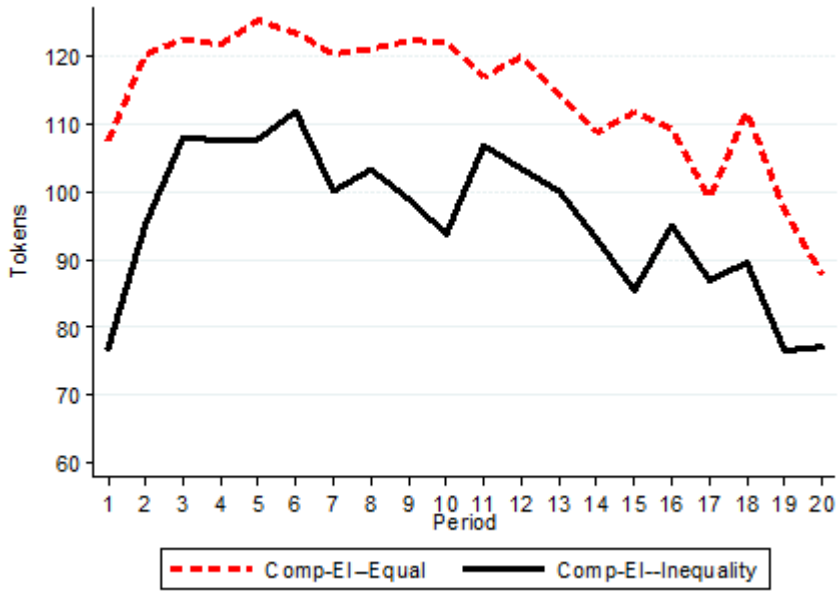

Table A2. Comparing groups in Comp-EI – group level regression

Lagged group account contribution	0.750***
	(0.044)
Lagged indicator for win	-2.302
	(2.81)
Lagged group account contribution in competing group	0.076
	(0.05)
Unequal	-5.30*
	(3.092)
Constant	36.62***
	(4.580)
Observations	1398

Standard errors clustered on pairs in parentheses. Includes period dummies (not reported). The excluded category is the equal group in Comp-EI. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A3. Determinants of individual percent contributions in unequal competing groups

Lagged own percent contribution	0.713***	0.712***
	(0.048)	(0.048)
Lagged deviation from percent contribution of others in own group	-0.171***	-0.170***
	(0.047)	(0.047)
Lagged indicator for win	-1.875	-2.259**
	(0.961)	(1.030)
Lagged percent group contribution in competing group	0.0351	0.025
	(0.032)	(0.039)
Comp-EI	1.263	-1.226
	(1.744)	(4.023)
Lagged win × Comp-EI		1.081
		(1.848)
Lagged percent group contribution of competitor × Comp-EI		0.028
		(0.061)
Constant	28.68***	29.45***
	(2.904)	(3.346)
Observations	2160	2160

Dependent variable = individual percent contribution in a period. Only includes data for individuals in unequal groups that face competition. Standard errors clustered on pairs in parentheses. Includes period dummies (not reported). In both regressions, the excluded category is Comp-II. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B. Experimental Instructions

B1. Instructions for Comp-EI

Thank you for coming. This is an experiment about decision-making. You will be paid £2 for your participation PLUS whatever you earn in the experiment.

During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

The experiment consists of twenty (20) consecutive decision rounds. Your total earnings will be the sum of your earnings from all these rounds.

At the beginning of the experiment, participants will be randomly divided into groups of three (3) individuals. The composition of the groups will remain the same in each round. This means you will interact with the same people in your group throughout the experiment. However, you will never know the identities of the others in your group.

Your group will also be matched with another group of three people in the lab. In each round, your group will be matched with the same group. You will not know the identities of the members of the other group.

The experiment is structured so that the other participants will never be informed about your personal decisions or earnings from the experiment. You will record your decisions privately at your computer terminal.

During the experiment, all decisions and transfers are made in tokens (more details below). Your total earnings will also be calculated in tokens. At the end of the experiment, your earnings will be converted to Pounds at the following rate:

200 tokens = £1

You will be paid individually and privately in cash at the end of the experiment.

Task

Stage 1

At the beginning of each round, each member of each group receives an endowment of tokens. The endowment can be either 20 tokens, 50 tokens or 80 tokens. There are two possible scenarios for each group.

Endowment Scenario 1: Every member of your group receives an endowment of 50 tokens, i.e., the endowment is the same for each member of your group.

Endowment Scenario 2: One member of your group receives an endowment of 20 tokens, one member receives an endowment of 50 tokens and one member receives an endowment of 80 tokens.

Either Scenario 1 or Scenario 2 will apply to your group. However, the distribution of endowments in your group and the distribution of endowments in the group that your group is matched with WILL be different. If members of your group are endowed with 50 tokens each, then one member of the other group (the one your group is matched with) will be endowed with 20 tokens, another with 50 tokens and the third with 80 tokens. If one member of your group is endowed with 20 tokens, another with 50 tokens and the third with 80 tokens, then the members of the other group (the one your group is matched with) will be endowed with 50 tokens each.

You will be told the Scenario which applies to your group and your endowment within the Scenario at the beginning of the experiment.

The distribution of endowments within your group and your endowment will be the same in each round.

Your task is to allocate your endowment of tokens between your private account and a group account. Each token not allocated to the group account will automatically remain in your private account. Your total earnings include earnings both from your private account and the group account.

Earnings from your private account in each round: You will earn one (1) token for each token allocated to your private account. No one else will earn from your private account.

Earnings from the group account in each round: For each token you allocate to the group account, you will earn 0.5 tokens. Each of the other two members of your group will also earn 0.5 tokens for each token you allocate to the group account. Thus, the allocation of 1 token to the group account yields a total of 1.5 tokens for your group. Your earnings from the group account are based on the total number of tokens allocated to the group account by all members in your group. Each member will profit equally from the tokens allocated to the group account – for each token allocated to the group account, each member of your group will earn 0.5 tokens regardless of who made the allocation. This means you will receive earnings from your own allocation to the group account as well as from the allocations to the group account of your two group members.

<u>Your earnings in Stage 1 in each round</u> =

Earnings from your private account + Earnings from the group account

The following examples are for illustrative purposes only.

Example 1. Suppose Endowment Scenario 2 applies in your group. Assume that your endowment is 20 tokens. The endowments of the other two members of your group are 50 tokens and 80 tokens. Suppose you allocate 0 tokens to the group account. Suppose each of your other group members also allocates 0 tokens to the group account. The total number of tokens in the group account would be 0. Your earnings from Stage 1 in this round would be 20 tokens (= 20 tokens from your private account and 0 tokens from the group account). The earnings of the other members of your group would be 50 tokens for the member with an endowment of 50; and 80 tokens for the member with an endowment of 80.

Example 2. Suppose Endowment Scenario 2 applies in your group. Assume that your endowment is 80 tokens. The endowments of the other two members of your group are 20 tokens and 50 tokens. Suppose you allocate 40 tokens to the group account. Suppose each of your other group members allocates 0 tokens to the group account. The total number of tokens in the group account would be 40. Your earnings from Stage 1 in this round would be 60 tokens (= 40 tokens from your private account + 0.5*40 = 20 tokens from the group account). The earnings of the other members of your group would be 40 tokens for the member with endowment of 20 (= 20 tokens from his/her private account + 0.5*40 = 20 tokens from the group account); and 70 tokens for the member with an endowment of 50 (= 50 tokens from his/her private account + 0.5*40 = 20 tokens from the group account).

Example 3. Suppose Endowment Scenario 1 applies in your group. Your endowment is 50 tokens. It is the same (50 tokens) for each member of your group. Suppose that you allocate 50 tokens to the group account. Suppose that each of the other group members also allocates 50 tokens to the group account. The total number of tokens in the group account would be 150. Your earnings from Stage 1 in this round would be 75 tokens (= 0 tokens from your private account + 0.5*150 = 75 tokens from the group account). The earnings of the other members of your group would also be 75 tokens each.

After all individuals have made their decisions in the first stage you will be informed of the total allocation to the group account by your group and your earnings in tokens from the first stage of the round.

<u>Stage 2</u>

Your group will be matched with another group. In Stage 2, either your group or the other group will receive a prize of **120** tokens (40 tokens per group member). In each period, only one of the two groups can obtain the prize. By contributing to your group account you increase the **chance** of receiving the prize for your group. If the total number of tokens in your group account exceeds the total number of tokens in the other group's account, your group has a **higher chance** of receiving the prize.

The probability that your group receives the prize is calculated according to the following formula:

$$\frac{\text{Tokens in } \textbf{your group's} \text{ group account}}{\text{Tokens in } \textbf{your group's} \text{ group account} + \text{Tokens in the } \textbf{other group's} \text{ group account}}$$

The computer will assign the prize either to your group or to the other group, **via a random draw** that depends on the total allocation in the group accounts of the two groups as in the above formula. Below is a hypothetical example used to illustrate how the computer makes a random draw to decide which group wins the prize.

Note: The following example is for illustrative purposes only.

Example 4. Random Draw

Think of the random draw in terms of the computer randomly choosing a ball from a box of different coloured balls. For **each** token in your group's account the computer puts **1 red ball** into a box and for each token in the other group's account the computer puts **1 black ball** into the box. Then the computer randomly draws one ball out of the box. If the ball drawn is red then your group receives the prize, if the ball drawn is black then the other group receives the prize. Suppose **members of your g**roup allocate a total of **65** tokens to your group account while members of the other group allocate **35** tokens to their group account. Thus, the computer will place **65 red balls** and **35 black balls** into the box (**100 balls in total**). Then the computer will randomly draw one ball out of the box. You can see that since your group has contributed more it has a **higher chance** of receiving the reward. Your group will receive the prize - **65 out of 100** times. The other group has a lower chance of receiving the prize - **35 out of 100** times.

A group can never guarantee itself the prize. However, by increasing your contribution to the group account, you can increase your group's chance of receiving the prize. If your group receives the prize, 120 tokens will be divided equally among the members of your group, i.e., you and the other 2 members of your group will receive 40 tokens each.

The other group your group will be matched with will remain the same in all 20 rounds. You will not know the identities of the members of the other group.

You will be informed of the total allocation to the group account in your group and the total allocation to the group account by the other group. You will also be informed of the probability of winning the prize for your group. Finally, you will be informed which group won the prize - your group or the other group.

NOTE: You will **NEVER** be informed of the individual allocations of the other members of your group or the members of the other group.

<u>Your earnings in Stage 2 in each round</u> = 40 tokens if your group wins the prize

<u>OR</u> 0 tokens if the other group wins the prize

<u>Your TOTAL earnings in each round</u> = Earnings from Stage 1 + Earnings from Stage 2

At the end of each round, you will be informed of your earnings from the first stage, whether your group won the prize, your earnings from the second stage and your total earnings from the round.

Your earnings from earlier rounds cannot be used in the following rounds. You will receive a new endowment in each round. The same process will be repeated for a total of 20 rounds.

<u>Questions to help you understand the decision task</u>

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you understand the instructions. Please answer these questions on your computer terminal. Once everyone has answered all questions correctly, we will begin the experiment.

B2. Instructions for VCM-I

Thank you for coming. This is an experiment about decision-making. You will be paid £2 for your participation PLUS whatever you earn in the experiment.

During the experiment you are not allowed to communicate with any of the other participants or with anyone outside the laboratory. Please switch off your mobile phone now. If you have any questions at any time during the course of this experiment, please raise your hand. An experimenter will assist you privately.

The experiment consists of twenty (20) consecutive decision rounds. Your total earnings will be the sum of your earnings from all these rounds.

At the beginning of the experiment, participants will randomly be divided into groups of three (3) individuals. The composition of the groups will remain the same in each round. This means that you will interact with the same people in your group throughout the experiment. However, you will never know the identities of the others in your group.

The experiment is structured so that the other participants will never be informed about your personal decisions or earnings from the experiment. You will record your decisions privately at your computer terminal.

During the experiment, all decisions and transfers are made in tokens (more details below). Your total earnings will also be calculated in tokens. At the end of the experiment, your earnings will be converted to Pounds at the following rate:

150 tokens = £1

You will be paid individually and privately in cash at the end of the experiment.

Task

At the beginning of each round, each member of each group receives an endowment of tokens. The endowment can be either 20 tokens, 50 tokens or 80 tokens. One member of your group receives an endowment of 20 tokens, one member receives an endowment of 50 tokens and one member receives an endowment of 80 tokens.

You will be told your endowment at the beginning of the experiment.

Your endowment will be the same in each round.

Your task is to allocate your endowment of tokens between your private account and the group account. Each token not allocated to the group account will automatically remain in your private account. Your total earnings include earnings both from your private account and the group account.

Earnings from your private account in each round: You will earn one (1) token for each token allocated to your private account. No one else will earn from your private account.

Earnings from the group account in each round: For each token you allocate to the group account, you will earn 0.5 tokens. Each of the other two members of your group will also earn 0.5 tokens for each token you allocate to the group account. Thus the allocation of 1 token to the group account yields a total of 1.5 tokens for your group. Your earnings from the group account are based on the total number of tokens allocated to the group account by all members in your group. Each member will profit equally from the tokens allocated to the group account – for each token allocated to the group account, each member of your group will earn 0.5 tokens regardless of who made the allocation. This means that you will earn from your own allocation to the group account as well as from the allocations to the group account of your two group members.

Your earnings in each round =

Earnings from your private account + Earnings from the group account

The following examples are for illustrative purposes only.

Example 1. Assume that your endowment is 20 tokens. The endowments of the other two members of your group are 50 tokens and 80 tokens. Suppose you allocate 0 tokens to the group account. Suppose each of your other group members also allocates 0 tokens to the group account. The total number of tokens in the group account would be 0. Your earnings from this round would be 20 tokens (= 20 tokens from your private account and 0 tokens from the group account). The earnings of the other members of your group would be 50 tokens for the member with an endowment of 50; and 80 tokens for the member with an endowment of 80.

Example 2. Assume that your endowment is 80 tokens. The endowments of the other two members of your group are 20 tokens and 50 tokens. Suppose you allocate 40 tokens to the group account. Suppose each of your other group members allocates 0 tokens to the group account. The total number of tokens in the group account would be 40. Your earnings from this round would be 60 tokens (= 40 tokens from your private account + 0.5*40 = 20 tokens from the group account). The earnings of the other members of your group would be 40 tokens for the member with endowment of 20 (= 20 tokens from his/her private account + 0.5*40 = 20 tokens from the group account); and 70 tokens for the member with an endowment of 50 (= 50 tokens from his/her private account + 0.5*40 = 20 tokens from the group account).

Example 3. Assume that your endowment is 50 tokens. The endowments of the other two members of your group are 20 tokens and 80 tokens. Suppose that you allocate 50 tokens to the group account. Suppose the group member with the endowment of 20 allocates 20 tokens to the group account and the group member with the endowment of 80 allocates 80 tokens to the group account. The total number of tokens in the group account would be 150. Your

earnings from this round would be 75 tokens (= 0 tokens from your private account + 0.5*150 = 75 tokens from the group account). The earnings of the other members of your group would also be 75 tokens each.

After all individuals have made their decisions you will be informed of the total allocation to the group account in your group and your earnings in tokens from the round.

Your earnings from earlier rounds cannot be used in the following rounds. You will receive a new endowment in each round. The same process will be repeated for a total of 20 rounds.

Questions to help you understand the decision task

When everyone has finished reading the instructions, we will ask you a few questions regarding the decisions you will make in the experiment. These questions will help you understand the calculation of your earnings and ensure that you have understood the instructions. Please answer these questions on your computer terminal. Once everyone has answered all questions correctly we will begin the experiment.