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Sharing and cooperation in an experiment with heterogeneous groups☆

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ABSTRACT

We investigate the impact of inequality on sharing and cooperation using a dictator game and a linear public good game where some participants work for their endowment ("workers") while others do not ("non-workers"). Moreover, we differentiate between two types of inequality, namely in source and in level. In contrast to most studies, participants are fully informed about the endowment of the other players. The key finding of our paper is that both sharing and cooperation critically depend on the source of the endowment. In particular, workers are more likely to share with other workers than with non-workers and more inclined to contribute to the public good when grouped with other workers rather than when grouped with non-workers. Considering also the choices made by non-workers, we argue that the worker premium in sharing and cooperation is based on fairness considerations rather than an in-group bias. Adding inequality in the level of endowment reduces the importance of the source of endowment as driver of behavior. This also suggests that reducing one layer of inequality may not improve cooperative behavior in society significantly, implying that a big-push policy tackling many dimensions of inequality at the same time may be required.

1. Introduction

Inequality is on the rise and there is a fear that this will lead to a society with less sharing and less cooperation (Piketty, 2014; Piketty and Zucman, 2014; Putnam, 2000). We take this concern to the lab and experimentally introduce inequality in source of endowment as well as in the level of endowment. In particular, some participants receive their endowment as compensation for work ("workers") while others receive their endowment without any work requirement ("non-workers"), and the endowment may be low, medium, or high. Subsequently, we let the participants play a dictator game to measure sharing and a linear public good game to measure cooperation in both homogeneous group and heterogeneous group contexts.

The key finding of our paper is that workers are more willing to share and cooperate with other workers than with non-workers. This finding is robust to the inclusion of additional dimensions of inequality, notably in the *level* of the endowment. Moreover, we find that the co-worker premium in sharing and cooperation is strongest in a setting without additional inequalities, notably in the level of endowment, which we argue is likely to be due to the reduced salience of work status as source of inequality in a more complex environment. This also suggests that reducing one dimension of inequality may not be very effective in terms of stimulating sharing and cooperation, as it may simply increase the salience of the remaining dimensions, a finding which may have important policy implications.

We add to the experimental literature on group composition and cooperative behavior by considering both sharing and

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cooperation, by disentangling source and level of inequality, and by conducting the experiments in a setting of full information.[1] Indeed, most contributions in this literature analyze cooperation in a setting where participants are not informed about the other group members' source of endowment (Cherry et al., 2005; Muehlbacher and Kirchler, 2009; Buckley and Croson, 2006; Eisenkopf et al., 2013). One exception is Oxoby and Spraggon (2012) who show that, in a full-information setting, the presence of minorities in a group is bad for cooperation. That paper, however, does not disentangle source and level inequality, and does not consider sharing in a situation without minorities, such as the dictator game. Similarly, Cherry and Shogren (2008) study sharing in a dictator game with full information, focusing on whether the dictator's endowment is earned or windfall, and on the *opportunity* of the recipient (that is, whether or not the recipient had an opportunity to earn money). They find that both the source and the opportunity matter for decisions in a dictator game. They do not, however, consider public good games or the question of how cooperation or sharing is affected by homogeneity or heterogeneity in group composition.[2]

Yet another innovation in our experiment is the fact that earnings from work are derived from a manual and tedious exercise rather than from a cognitive task, where the latter is the typical approach in the literature. We believe this is important, as cognitive tasks could activate unintended psychological processes that confound the causal effect of effort. Furthermore, participants in most experiments are students, who may well have a 'taste' for cognitive activities, implying that such efforts can be seen as rewarding rather than the opposite.

The remainder of the paper is organized as follows. Section 2 describes the experiment and the participants. Section 3 provides the results of the analysis and discusses mechanisms, and Section 4 concludes.

2. The experiment and the sample

The experiment involved 240 students at the University of Bari, Italy, who took part in nine separate sessions (including a pilot) during two consecutive days.[3] There was a gender balance among the participants and the average age was around 22 years. The experiment was designed to test the effect of heterogeneity in the source of endowment, as well as in level of endowment, on contributions in a public good game and dictator game. For this purpose, a two-stage procedure was used. In the first stage, participants were randomly allocated to either a working session or a no-working session: in either case, the invitation to participate in the experiment was identical.[4] The working sessions consisted of a 30-minute repetitive manual task (cutting strips of paper) during which the participants were not allowed to interact with each other but could observe that they all had to do exactly the same kind of task. The workers received a lump sum payment for their work, while the non-workers simply received a windfall endowment.

In the second stage, the participants played a linear public good game with three members in each group and with a multiplier of 50 percent, and a dictator game. As is well known, the most efficient solution in the public good game is to contribute everything to the common fund, but the Nash equilibrium, in the absence of other-regarding preferences, is to contribute nothing. We ensured that the participants understood the workings of the game by numerical examples and explanations before they made their choices. Similarly, transfers in dictator game are normally ascribed to altruism.

The participants were placed in a situation where the group members had the same source of income (homogeneous case) and in a situation where they had different sources of income (heterogeneous case). After the public good game, workers played a dictator game where they made contribution decisions both with another worker and with a non-worker. In both games we randomly assigned the order in which the participants were exposed to the homogeneous group and heterogeneous group situations.

We randomly assigned participants to different endowment levels in the public good game: low (9 euros), medium (15 euros), and high (18 euros). For the workers, these endowments were framed as compensation for their work, while no such framing was given to the non-workers. In all groups, the sum of the endowment was kept constant at 45 euros. For the dictator game, all participants received a five euro "bonus" and asked to make a transfer decision to another participant, identified by both source and level of initial endowment.

We did not reveal the outcomes of the games during the workshop, and that payments were made individually and in sealed envelopes at the end, based on earnings from one randomly selection situation (homogeneous case or heterogeneous case) in each game.

3. Results

3.1. Empirical approach

The main empirical question is how workers respond to changes in the group environment. Accordingly, the analysis focuses on the behavior of workers. However, we also present evidence on non-workers in order to better uncover the key mechanisms behind our findings.

There are 180 workers in our sample. They made decisions both in the homogeneous group case and in the heterogeneous group case. Using a within-subject design, this means that for public good game we have 360 observations. For the dictator game, the low and high endowment participants made contribution choices in four situations: when the recipient was low (nine euros) or high (18 euros) endowment worker, and low or high endowment non-worker. The medium-endowment workers (15 euros) only played against a similarly endowed worker and non-worker. Hence, with information for one participant missing, we have 598 observations in the dictator game. Our main regression results are based on the following empirical specification:

$$Y_i = \alpha + \beta_1 W + \beta_2 Controls + \varepsilon_i. \quad (1)$$

Here, Y_i refers to either contributions in the dictator game or contributions to the public fund in the public good game, while W is a dummy which takes the value one if the worker is grouped with other workers (homogeneous group) and zero if grouped with non-workers (heterogeneous group). We run regressions both without and with controls. Moreover, we run separate regressions

[1] Information about the endowment of the other group members may be important, as shown by for instance Anderson et al. (2008) who find that inequality (in the level of income) reduces public goods contributions, but only when endowments are known to all participants. Chan et al. (1999) also emphasize the importance of information and communication for public goods contributions.

[2] Our paper also relates to a literature on group identity and cooperation (Eckel and Grossman, 2005; Charness et al., 2007; Chen and Chen, 2011). Typically, this literature finds that only the strongest treatments, including communication and interaction, has an impact on team performance.

[3] The experiments were conducted in Italian; see the online appendix B for a translated version of the experimental protocol.

[4] Table A.1 in Appendix A gives sample size according to treatment, while Table A.2 shows that workers and non-workers are balanced on background variables.

Table 1
Sharing, cooperation and group composition.

	Dictator game				Public good game			
	All (1)	All (2)	Equal (3)	Unequal (4)	All (5)	All (6)	Equal (7)	Unequal (8)
Co-worker	17.11*** (1.95)	17.39*** (1.91)	24.33*** (4.41)	15.42*** (2.16)	5.94** (2.78)	5.94** (2.69)	8.56* (4.44)	4.63 (3.45)
Constant	11.24*** (1.41)	31.10*** (10.85)	11.33*** (3.12)	11.21*** (1.58)	32.32*** (1.96)	23.36 (15.36)	24.83*** (4.45)	36.07*** (2.44)
Controls	No	Yes	No	No	No	Yes	No	No
Observations	598	598	120	478	360	360	120	240

Note: Estimation results from OLS-regressions on as transfers in the dictator game (in percent of endowment) and contributions in the public good game, defined as contributions to the public fund (in percent of endowment), for the full sample ("All"), the equal endowment sample ("Equal") and the unequal endowment sample ("Unequal"). *Co-worker* is a dummy that takes the value one if the other group members are workers, and zero otherwise. Controls are Low endowment, High endowment, the order in which the games are played, the gender and age of the respondent, their grades from high school, and whether or not they lived at the university campus. Standard errors in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

Table 2
Cooperation, expectations and free riding, by endowment source and group composition.

	Workers			Non-workers		
	Homogeneous	Heterogeneous	Difference	Homogeneous	Heterogeneous	Difference
Public good game	33.38 (23.78)	24.83 (24.90)	48.56* (0.057)	22.89 (21.68)	26.56 (24.14)	−3.67 (0.538)
Expected contributions	42.11 (24.70)	47.72 (24.49)	−5.61 (0.214)	35.39 (23.82)	26.56 (18.93)	8.83 (0.117)
Free riding	8.72 (28.42)	22.89 (30.31)	−14.17*** (0.009)	12.50 (26.87)	0.00 (19.89)	12.5** (0.045)

Note: The table shows contributions in the public good game, average expected contributions by the other group members, and free riding, measured as *Expected contributions* minus *public good game* contributions, in an equal-endowment setting. The first three columns show choices and expectations for workers, when grouped with other workers (Homogeneous), when grouped with non-workers (Heterogeneous), and the difference between the two, from a t-test. Similarly, the three last columns show choices and expectations for non-workers, when grouped with other non-workers (Homogeneous) and when the group also includes workers (Heterogeneous), and the difference between the two, estimated by a t-test. Standard deviations in parenthesis, expect for the estimated *Difference*, where the parenthesis show p-values.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

for the equal endowment sample and the unequal endowment sample in order to investigate whether the co-worker dummy is larger or smaller in a setting with additional inequalities.[5]

There are 60 non-workers in our experiment. They played the public good game both in the homogeneous group case and in the heterogeneous group case, and hence we have a total of 120 observations for the non-workers. We use this information mainly to shed light on mechanisms, comparing average contributions to the public good for both workers and non-workers in different group contexts, and also brining in expectations, as will become clear in Section 3.3.[6]

3.2. Regression results

Table 1 shows the regression results on contributions by workers in the dictator game and the public good game, as a share of the endowment, without and with controls. Regressions (1) and (2) are for the dictator game using the full sample, while regression (3) is for the equal endowment sample, and (4) for the unequal endowment sample. Similarly, regressions (5) and (6) are for the public good game using the full sample, (7) the equal endowment sample, and (8) the unequal endowment sample.

Overall, the results in Table 1 show that contributions are higher when workers are grouped with other workers than with non-workers, as indicated by the positive and statistically significant coefficient on the *Co-worker* dummy (at the one-percent level in the dictator game and at the five-percent level in the public good game), which we refer to as a *co-worker premium*. The differences are quantitatively significant and robust to the inclusion of controls, as evidenced by regressions (2) and (6). Finally, we observe that the co-worker premium is larger in a setting without additional inequalities. This is evident from the fact that the co-worker premium is larger in the Equal endowment sample than in the Unequal endowment sample. We interpret this as work status reducing its salience as source of inequality when adding new layers of inequality.

[5] Table A.3 in Appendix A shows the full regressions including a complete set of controls, as well as an interaction effect between the homogeneous group dummy and indicators for low and high endowment. Given the panel dimension of the data, we also present regressions using individual-level fixed effects, which does not change the key results.

[6] In Appendix A we also report results from regressions on non-workers' cooperation using model (1), see Table A.4.

3.3. Mechanisms: fairness or group identity?

Our hypothesis is that the greater sharing and cooperation by workers when facing other workers, compared to when facing non-workers, is based on *fairness considerations*: effort should be rewarded, be it as transfers in the dictator game or contributions in the public good game.

The main alternative hypothesis is that cooperation is driven by *group identity*. We do not, however, believe that this is the case, for two reasons. First, in the design of the experiment particular attention was devoted to minimizing participant interaction. Second, and more importantly, we do not find evidence of such an in-group bias among *non-workers*. We have information about the choices and expectations of non-workers in the public good game. If cooperation was all about group identity, then we would expect non-workers to contribute more to other non-workers, or, to the extent that windfall gains do not create any group feeling, at least not *more* to members of the other group, namely the workers.

However, this is exactly what we observe, as summarized in Table 2. It shows contributions by workers and non-workers in an equal endowment setting, comparing choices and expectations in both a homogeneous group situation and a heterogeneous group situation. For workers, the homogeneous group means grouped with other workers, while heterogeneous means grouped with non-workers. For non-workers, homogeneous means grouped with other non-workers, while the heterogeneous case also involves workers.[7] The table also shows expected contributions by the other group members in the various settings, and introduces the concept of *free riding*, here defined as what the decision maker expects the other group members to contribute minus his or her own actual contribution.

Confirming what was already shown in Table 1, we observe that workers contribute more in the homogeneous than in the heterogeneous group setting. Moreover, we observe that they do so despite the fact that they believe that non-workers will contribute more. These two observations taken together imply that there is more free riding in the heterogeneous group case, the difference being significant at the one-percent level.

For non-workers, however, we do not observe any own-type premium. On the contrary: non-workers contribute less in the homogeneous group case than in the heterogeneous group case although the absolute difference in mean values is not statistically significant. Interestingly, non-workers contribute on average less when matched with fellow non-workers despite the fact that they expect that these will contribute more, implying a significantly *larger* degree of free riding when non-workers are matched with their own type, with the difference being significant at the five-percent level. In sum, these results indicate that cooperation is not primarily driven by an in-group bias, thus lending support to what we consider to be the leading alternative explanation, namely fairness considerations.

[7] Non-workers were either grouped with two non-workers or with one non-worker and one worker; the latter in order to be able to calculate aggregate contributions in a situation with one worker and two non-workers.

4. Conclusion

We measure sharing and cooperation using a dictator game and a linear public good game, randomly assigning some individuals to endowment derived from work (“workers”) and some to endowment without any effort (“non-workers”). Moreover, we experimentally introduce differences in endowment levels. We find that workers are significantly more cooperative and sharing when grouped with other workers than when grouped with non-workers. Adding inequality in level of the endowment reduces the co-worker premium of sharing and cooperation, a fact we ascribe to the reduced salience of work status as source of inequality in a more complex environment.

In terms of mechanisms, we argue that the larger degree of cooperation between workers is driven by fairness consideration. Studying the behavior of non-workers, we find that they, too, cooperate more, and free ride less, in a setting which also involves workers than in a non-worker-only setting, suggesting that our results are not driven by an in-group bias.

Our study analyzes individual behavior, but from a societal perspective it is perhaps more important to understand the impact of group composition on total public good contributions. Based on the average contributions in the different settings, we find that even though non-workers contribute more when grouped with workers, this does not compensate for the loss in contributions by the workers themselves when moving from an all-worker group to a mixed group. In sum, therefore, our study lends support to the concern that greater inequality in society may be a threat to sharing and cooperation, but also that there are not necessarily complementarities between the different dimensions of inequality: adding one dimension, reduces the importance of the other. A corollary of this finding is that if the goal of policymakers is to boost cooperative behaviors, removing one layer of inequality might not be sufficient: a big (equality) push might be necessary.

Appendix A

Table A.1
Sample size according to type.

Source of endowment	Level of endowment	Number of participants
Workers		180
	9 euros	60
	15 euros	60
	18 euros	60
Non-workers		60
	15 euros	30
	18 euros	30
Total		240

Table A.2
Balance workers and non-workers.

	Full sample	Workers	Non-workers	Difference
Male	0.529	0.517	0.567	−0.05
	(0.5)	*(0.5)*	*(0.499)*	*(0.504)*
Age	21.74	21.72	21.83	−0.11
	(2.68)	*(2.83)*	*(2.20)*	*(0.77)*
Grade	82.5	82.97	80.95	2.02
	(11.87)	*(11.31)*	*(13.41)*	*(0.254)*
University campus	36.2	35.0	40.0	−5
	(0.48)	*(0.48)*	*(0.49)*	*(0.48)*
Observations	240	180	60	

Note: Male is a dummy taking the value one if the participant is male and zero if female; *Age* is the participant's age in years; *Grade* refers to the grades at high school (0–100); *University campus* refers to whether the participant is a resident of one of the student campuses. Standard deviations in parenthesis, except for Difference, where parenthesis shows standard errors.

Table A.3
Sharing, cooperation and group composition, full specification.

	Dictator game			Public good game		
	(1)	(2)	(3) Fixed Effects	(4)	(5)	(6) Fixed Effects
Co-worker	17.39***	21.31***	17.76***	5.94**	8.56*	5.94***
	(1.91)	(4.35)	(1.72)	(2.69)	(4.66)	(1.74)
Co-worker and High endowment		−5.56			−5.59	
		(5.29)			(6.59)	
Co-worker and Low endowment		−4.22			−2.26	
		(5.39)			(6.59)	
High endowment	−0.83	3.41		2.49	5.217	
	(2.79)	(3.73)		(3.28)	(4.70)	
Low endowment	−3.92	−1.98		13.52***	14.65	
	(2.81)	(3.81)		(3.36)	(4.71)	
Male	−7.121***	−7.21***		−0.00	−0.00	
	(1.95)	(1.95)		(2.74)	(2.74)	
Age	0.12	0.12		0.49	0.49	
	(0.37)	(0.37)		(0.48)	(0.48)	
Grade	−0.13	−0.13		−0.08	−0.08	
	(0.09)	(0.09)		(0.12)	(0.12)	
University campus	0.75	0.75		7.92***	7.92***	
	(2.06)	(2.06)		(2.93)	(2.94)	
Order	−3.22***	−3.02***		−1.86	−1.86	
	(0.93)	(0.96)		(2.69)	(2.69)	
Constant	31.10***	28.83***	10.89***	23.36	22.05	32.32***
	(10.85)	(11.11)	(1.24)	(15.36)	(15.51)	(1.23)
Observations	598	598	598	360	360	360

Note: Estimation results from OLS-regressions (columns 1, 2, 4, 5) and Individual Fixed Effects regressions (columns 3 and 6) on transfers in the dictator game (in percent of endowment) and contributions in the public good game, defined as contributions to the public fund (in percent of endowment). *Co-worker* is a dummy that takes the value one if the other group members are workers, and zero otherwise; *High endowment* is a dummy that takes the value one if the participant has received the high endowment, and zero otherwise; Low endowment is a dummy that takes the value one if the participant has received the low endowment, and zero otherwise; *Co-worker and High endowment* is the interaction between *Co-worker* and *High endowment*; *Co-worker and Low endowment* is the interaction between *Co-worker* and *Low endowment*; *Male* takes the value one if the participant is male, and zero if female; *Age* is the participant's age in years; *Grade* refers to the grades at high school (0-100); *University campus* refers to whether the participant is a resident of one of the student campuses; *Order* is a numerical variable which indicates the order of the games played. Standard errors in parentheses.

***$p < 0.01$.

**$p < 0.05$.

*$p < 0.1$.

Table A.4
Cooperation and group composition, non-workers.

	(1)	(2) Fixed Effects	(3)	(4)
Worker	1.56	1.56	1.55	3.67
	(4.71)	(1.94)	(4.14)	(5.88)
Worker and High endowment				−4.22
				(8.31)
High endowment			10.46**	12.57**
			(4.29)	(5.99)
Male			−9.31**	−9.31**
			(4.52)	(4.53)
Age			−3.54***	−3.54***
			(1.00)	(1.00)
Grade			−0.67***	−0.67***
			(0.16)	(0.16)
University campus			7.93*	7.93*
			(4.44)	(4.45)
Order			−0.056	0.056
			(4.14)	(4.16)
Constant	28.25	28.25	162.95***	161.89***
	(3.34)	(1.37)	(25.50)	(25.67)
Observations	120	120	120	120

Note: Estimation results from OLS-regressions (columns 1, 3, 4) and an Individual Fixed Effects regression (column 2). The dependent variable is contributions in the public good game, defined as contributions to the public fund (in percent of endowment). The covariates are the same as in Table A3 and defined there. Standard errors in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

Appendix B. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2020.109619.

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