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Gender and cooperative preferences*

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1. Introduction

While research on gender differences in cooperative and altruistic behavior is abundant, conclusions remain mixed and inconclusive (for surveys, see Eckel and Grossman, 2008; Croson and Gneezy, 2009). In their authoritative survey, Croson and Gneezy (2009) argue that women are more sensitive than men to social cues or subtle changes in the design or framing of a given interaction. Interestingly, recent research by Kuhn and Villeval (2015) shows that women are more likely to self-select into cooperative incentive schemes and that they are more inclined to demonstrate their cooperativeness in front of others (Charness and Rusticchini, 2011). We complement these findings in the present study by providing evidence on gender differences in cooperative preferences. Cooperative preferences and beliefs differ markedly in our study, which is based on data from a baseline experiment in Germany and robustness checks from six other countries around the world.

More specifically, we implement cooperation experiments based on the voluntary contribution mechanism for public goods provision (Ledyard, 1995; Zelmer, 2003; Chaudhuri, 2011). The voluntary contribution mechanism captures the important trade-off in all social dilemmas between individual rationality implying a Pareto-dominated outcome and collective rationality leading to a social optimum. Most importantly, our data is based on a design, introduced by Fischbacher et al. (2001) and validated by Fischbacher and Gächter (2010) and Fischbacher et al. (2012), that allows for the fully incentivized elicitation of a complete vector of conditional contributions to the public good, as well as of unconditional contributions and of beliefs about unconditional contributions. The method permits the construction of an individual reaction function, providing information on the preferred contribution level for each possible average contribution of other group members. Based on this reaction function, individuals can be assigned a contributor type according to a standard taxonomy of commonly submitted contribution patterns as introduced by Fischbacher et al. (2001). Predominant types are the familiar *free-riders*, who always contributes zero regardless of the (expected) contributions of other group members, and *conditional cooperators*, who increase their contributions with the (expected) increase of others' contributions.

A main advantage of the approach is that it allows us to disentangle differences in beliefs from differences in cooperative preferences, and differences in cooperative preferences from actual cooperation behavior. Both turn out to be important for understanding existing results concerning gender differences in the literature. In other words, by only eliciting cooperation behavior in social dilemmas, it is likely that relevant differences remain overlooked. Eliciting a full contribution schedule following the approach by Fischbacher et al. (2001) provides a much more detailed picture of potential differences in cooperative preferences between men and women than just unconditional contributions as it completely eliminates strategic uncertainty, which may otherwise trigger different responses across sexes, for instance as a consequence of different attitudes towards uncertainty.

As already mentioned, the results in the existing experimental literature regarding gender effects in cooperation are rather inconclusive. While some studies provide evidence that women are more cooperative in social dilemmas, others find the opposite, and still others report no significant effects at all. In public goods games, lower voluntary *unconditional* contributions of women are reported by Sell and Wilson (1991), Sell et al. (1993), and Brown-Kruse and Hummels (1993). Replicating the latter study, however, Cadsby and Maynes (1998) do not find any gender differences. Sell et al. (1993), Solow and Kirkwood (2002), Chermak and Krause (2002), and Andreoni and Petrie (2008) also find no significant differences in the contributions of men and women. Conflicting results are reported by Stockard et al. (1988), Nowell and Tinkler (1994), and Seguino et al. (1996), who show that women contribute more than men. Frank et al. (1993) find women to cooperate significantly more than men in a prisoner's dilemma game, while Dorrough and Glöckner (2019) find in a cross-national one-shot prisoner's dilemma game conducted online that men are significantly more cooperative than women. Ortmann and Tichy (1999) find women to cooperate significantly more than men, but only for the first round of interaction in a repeated public goods problem – a temporary effect also documented by Mason et al. (1991).[1]

There are several potential reasons for inconclusive gender effects in cooperation games. Obviously, contribution decisions blend several behavioral motivations such as altruism, (expected) reciprocity (or trust), (social) risk, and perhaps more. If we take it for granted that women tend to be more altruistic (an early paper is Eckel and Grossman, 1998, but many more studies have been conducted since then) and that women tend to be more risk averse[2] – both well-established in the literature – then the two effects might cancel out in some cooperation games. In particular, an explanation for the inconclusiveness might arise from different empirical protocols and different experimental designs in the studies at hand (see also Eckel and Grossman, 2008, for a discussion). However, an incentive-compatible mechanism – such as the one proposed by Fischbacher et al. (2001) – allows for a closer look at cooperative preferences *and* beliefs across gender and might add important insights to the existing literature. Our main experiment covers 144 German participants, of whom 89 are female. We have chosen the German data as a baseline since many public goods experiments, especially those using the design developed in Fischbacher et al. (2001), have been conducted in German-speaking countries. Since we implement a one-shot game, all observations are independent. In order to address the robustness of our findings, we contrast the results from this experiment with the results from previous experiments that some authors of this paper have conducted in various places on five continents; each of them following almost exactly the same experimental design. While the nature of an international sample entails small differences between the locations (such as in the language of instructions,

[1] For reviews of the literature on gender effects in social dilemmas, see Eckel and Grossman (2008) and Croson and Gneezy (2009). Croson and Gneezy (2009) provide references to the older psychological literature that uses the prisoners' dilemma game in order to study gender effects in cooperation.

[2] While this is certainly true and well-established for natural risks, there is less evidence for gender effects in situations that involve social risks (see, for instance, Bohnet et al., 2008). The difference is that natural risk is resolved by a natural device, and social risk is resolved by a decision of an interaction partner.

remuneration, and composition of the subject pool), we have much more control over the data than in a standard meta study, as all experiments have been conducted by the authors themselves (including their co-authors and potential helpers).

Our empirical results provide a clear picture: Women are significantly more often classified as conditionally cooperative than men, while men are more likely to be classified as free-riders. Once classified as conditionally cooperative, there is no difference at all between men and women. This means that the sensitivity of one's own contribution to the average contribution of other group members is the same for the two genders. The key to understanding the inconclusive results in the literature seems to be different beliefs.

For management and economic policy applications, it seems relevant to know more about the relative cooperativeness of women and men. Setting a good example in a work team or providing seed money in a charity drive could, for example, have a stronger impact on women than men, on average. For instance, women become less generous in fund-raising compared with men when it is easy to avoid the solicitor (DellaVigna et al., 2013). While we did not test the hypothesis experimentally, it seems that beliefs are more malleable or more sensitive to subtle (social) cues for women than for men. This is in line with the conclusion in Croson and Gneezy (2009). In other words, women and men have different underlying inclinations to cooperate, but how these underlying preferences play out in a given environment depends on beliefs and, ultimately, on the (social) context. A host of implications regarding the optimal organization of teams and introduction of leadership in team work follow from our results and should be tested in future studies in the laboratory and in the field.

The remainder of the paper is structured as follows: In Section 2 we describe the design of our experiments. In Section 3 we present and discuss our results. Section 4 includes the robustness checks with data from other countries. Finally, our conclusions follow in Section 5.

2. Experimental design

2.1 One-shot public goods game

To investigate both cooperative behavior and underlying preferences for cooperation, we use the design of the one-shot public goods experiment developed by Fischbacher et al. (2001) and, additionally, ask for beliefs about the cooperation of others. Hence, the design consists of three stages: (i) an *unconditional contribution,* (ii) the elicitation of a *contribution schedule,* and (iii) the elicitation of subjects' *beliefs* about others' average unconditional contributions.[3]

[3] See also Fischbacher and Gächter (2010) or Gächter and Renner (2010) for the elicitation of beliefs in such a setup.

All participants are randomly matched into groups of four. They receive an initial endowment of 20 experimental points each and then simultaneously have to decide how to allocate them.[4] The two options are to either keep the points for oneself or invest some or all of them in a public good. The invested amount, an integer that satisfies $0 \leq c_i \leq 20$, is henceforth referred to as the *unconditional contribution.* The sum of all contributions to the public good is multiplied by 1.6 and divided equally among all group members. This leads to the following payoff function for subject i, which is linear in the public good contributions

$$\pi_i = 20 - c_i + 0.4 \sum_{j=1}^{4} c_j \,, \qquad (1)$$

where c_i denotes the contribution of subject i and the sum of c_j denotes the contributions of all group members to the public good. The marginal per capita return (MPCR) from investing in the public good is 0.4. From an individual perspective, free-riding (i.e., $c_i = 0$) is a dominant strategy for every payoff-maximizing decision maker. Since the sum of marginal returns is larger than 1, however, contributing the entire endowment is the optimal choice from a collective perspective (i.e., maximizing efficiency). The decision is made only once and anonymously, thus there are no incentives to build a reputation.

In the second stage, without any feedback on stage 1 outcomes, all participants are asked to complete a contribution table. The contribution table includes all possible average contributions of the three other players in the group, rounded to integers and ranging from 0 to 20 points. For each of these 21 possible averages, participants indicate how much they would contribute to the public good if these were the average contributions to the public good (i.e., we use a variant of the strategy vector method). The contributions in the table are referred to as c*onditional contributions* as they state how much a participant is willing to contribute conditional on the average contribution of the three other members of her group.

Both the unconditional and the conditional contributions can determine final payoffs. Incentive compatibility is guaranteed by applying the following mechanism: In each group, one group member is randomly selected by the roll of a four-sided die.[5] For this group member the conditional contribution is payoff-relevant, whereas for the other three group members their unconditional contributions are. More specifically, the three unconditional contributions in a group and the corresponding conditional

[4] Each experimental point earned in stage 1 or 2 was later exchanged for 0.33 euro. The exchange rate was announced at the beginning of the experiment.

[5] At the beginning of the experiment, each group member is randomly assigned a number from one to four. After all decisions have been made, one of the participants in a session is randomly selected by the computer. The selected participant then rolls the die, monitored by the experimenter. This procedure ensures that the participants regard the mechanism that determines the group member for whom the conditional contribution is to become payoff-relevant as truly random.

contribution (for the specific average of the three unconditional contributions) determine the sum of points contributed to the public good. Individual earnings are then calculated according to equation (1).

In the third stage, again without any feedback on stage 2 outcomes, we elicit subjects' beliefs by asking for guesses on the average unconditional contribution of the other group members (rounded to integers). Note that this stage was not announced in the instructions to avoid any potential influence on the elicitation of the unconditional and conditional contributions and to avoid hedging. The question and the incentive mechanism were described on the computer screen. Like in Fischbacher and Gächter (2010) and Gächter and Renner (2010), we pay subjects for the accuracy of their guesses to create stronger incentives for truthful revelation. We implement the following payment schedule: If a subject's guess coincides with the (rounded) average unconditional contribution of her group members, she gets 9 additional points. If it differs by one point (two points), she receives 6 (3) points. Any deviation larger than two points from the true average contribution level leads to zero earnings from this stage.

2.2 Procedures

We conducted the computer-based experiment with the z-Tree software (Fischbacher, 2007) and the organizational software ORSEE (Greiner, 2015). A total of 144 undergraduate students (89 women and 55 men) from any discipline except economics participated in six sessions (24 subjects in each) at the University of Munich, Germany. Unlike a few of the previous studies, we did not impose a special gender composition of groups or sessions. There were two additional parts of the experiment, but these took place after the public goods game.[6] In order to avoid any effects from earnings in one part or stage on subsequent behavior, all decisions and results in the different stages and parts were only revealed at the end of the entire experiment. The sessions lasted up to 1½ hours and the average payoff was 16.98 euro, including a show-up payment of 4.00 euro. The average payoff from the public goods game used in the following analysis was 8.66 euro.

Subjects received written instructions at the beginning of each experimental part (see Appendix B). The instructions were read aloud, and we gave the opportunity to ask questions in private. To ensure that all subjects had understood correctly, they had to complete some computerized exercises requiring them to compute the payoffs for different contribution levels. We started the public goods game only after all exercises had been completed successfully. Directly before payment, subjects answered a post-experimental questionnaire including some questions related to socio-economic factors. Among those was a question about the subject's gender. Except for this question, gender was never mentioned or made salient in the experiment. In fact, the post-experimental questionnaires generally contain the question for gender in all experiments conducted at the laboratory. No subject could have guessed that

[6] For details see Kocher et al. (2015, 2017), who use parts of the data from the same experiment. The research questions of the current paper and the results presented here are novel.

the interest of the study was in gender differences in cooperation. Finally, subjects were paid in private and dismissed.

3. Results

3.1 Gender and unconditional cooperation

Starting with unconditional contributions, we find that our experimental participants contribute on average 6.75 points (33.8% of their endowment) to the public good and expect their group members to contribute on average 7.24 points (36.2%). The levels we find in Munich in Germany correspond well with previous findings in German-speaking countries (e.g., Fischbacher et al., 2001; Fischbacher and Gächter, 2010; Kocher et al., 2008).[7]

As shown in Table 1, we find differences between male and female participants. The unconditional contributions of women are significantly higher than those of men (two-sided Mann-Whitney U-test, $p = 0.02$, $N = 144$). On average, women contribute 7.60 points (38.0% of their endowment) to the public good, whereas men contribute only 5.38 points (26.9%). However, women, on average, also seem to believe in a higher contribution by others than men. The corresponding expected contributions are 7.73 (38.7%) and 6.45 (32.3%) points, respectively, and the difference slightly fails conventional levels of significance, according to a two-sided Mann-Whitney U-test ($p = 0.06$, $N = 144$). The self-serving bias, i.e., expecting others to contribute more than oneself, is consistent with findings in Fischbacher and Gächter (2010) and is caused to a large degree by free-riders (detailed analysis in Section 3.3).

Result 1. *Women's unconditional contributions are significantly higher than men's. However, women also tend to hold slightly more optimistic beliefs about their group members' contribution levels than men.*

Table 1: Descriptive statistics (N = 144)

	Unconditional contributions	Expected contributions
All subjects	6.75 (33.8%)	7.24 (36.2%)
Men	5.38 (26.9%)	6.45 (32.3%)
Women	7.60 (38.0%)	7.73 (38.7%)
H0: No difference between men and women (two-sided Mann-Whitney U-test (p-value))	0.02	0.06

[7] Results in Russia are provided by Herrmann and Thöni (2009). Volk et al. (2012) study the temporal stability of conditional cooperation.

To disentangle beliefs from the gender effect, we run a Tobit regression as shown in Table 2. In line with the results of previous studies, we observe beliefs to be positively and highly significantly associated with unconditional contributions. The more an individual expects others to contribute, the more s(he) contributes herself/himself. When controlling for beliefs, women still contribute more than men; however, only at the 10% level of significance, suggesting that differences in beliefs do not fully explain the observed gender gap in unconditional contributions. In Model 2 in Table 2, we also include an interaction term for gender and beliefs but find no evidence that a change in belief has a different impact on unconditional contributions for the two genders. Note, however, that the gender dummy and the interaction become insignificant in an OLS regression that we conducted as a sensitivity analysis, while the belief variable remains highly significant. Obviously, one has to take these results with a grain of salt. While we follow the standard in belief elicitation, beliefs have been elicited after contribution decisions and might, at least partly, be endogenous.

Result 2. *Subjects' unconditional contributions increase in the belief about others' contributions. Controlling for beliefs, women still contribute more than men, but the effect is not significant at conventional levels.*

Table 2: Explaining unconditional contributions

	Model 1			Model 2		
	Coef.	Std. Error	p-value	Coef.	Std. Error	p-value
Belief	1.41***	0.12	<0.01	1.58***	0.20	<0.01
Woman	1.57*	0.94	0.10	3.60*	2.04	0.08
Belief * Woman	-	-	-	-0.27	0.24	0.26
Constant	5.46***	1.16	<0.01	6.67***	1.63	<0.01
N	144			144		

Censored tobit regressions. *** Difference significant at 1% level, ** significant at 5% level, * significant at 10% level. Coef. = coefficient; Std. = standard.

3.2 Gender and cooperative preferences

Following Fischbacher et al. (2001), we categorize subjects into four contributor types based on their submitted conditional contribution schedule. A subject is classified as a *Conditional Cooperator* if either his/her conditional contribution increases weakly monotonically with the average contribution of the other group members or the relationship between his/her own and the others' average contributions is positive and significant at the 1% significance level using a Spearman rank correlation coefficient (based on the classifications used in Fischbacher et al., 2001; Fischbacher and Gächter, 2010). *Hump-shaped Contributors*, sometimes called triangle contributors, are subjects who show weakly monotonically increasing contributions (or increasing with a Spearman rank correlation coefficient at the 1% significance level) up to a given level of others' contributions (the inflection point); above that level, their conditional contributions decrease weakly monotonically (or according to a significant Spearman rank correlation coefficient at the 1% level). A *Free-rider* is a subject who exhibits a conditional contribution of zero for all levels of the other members' average contributions. Finally, those who cannot be categorized into any of the three classes above are referred to as *Other*.[8]

We find that overall, 18.8% of our participants can be classified as free-riders, 55.6% as conditional cooperators, 11.1% as hump-shaped, and 14.6% as others. This distribution is very similar to the distributions reported in other studies on conditional cooperation in German-speaking countries, e.g., Fischbacher et al. (2001) and Kocher et al. (2008). As can be seen in Figure 1, we find substantial differences between men and women. 61.8% of the women but only 45.5% of the men can be classified as conditional cooperators. On the other hand, 30.9% of men but only 11.2% of women are free-riders.[9] Men are also more likely to be classified as hump-shaped contributors (18.2% vs. 6.7%), whereas non-standard contribution patterns are shown more often by women (5.5% vs. 20.2%).[10] The distributions of types differ significantly between genders at the 1% significance level (Fisher's exact test; N = 144).

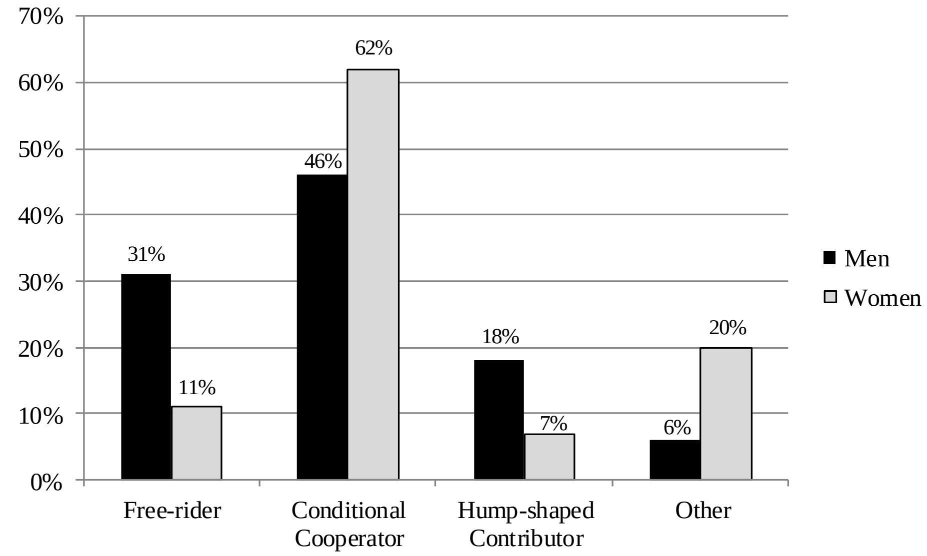
Result 3. *Women are classified as conditionally cooperative significantly more frequently than men, whereas men are more often classified as free-riders.*

[8] Thöni and Volk (2018) provide a meta study for the classification of cooperation types.

[9] A simple two-way table, restricting the type space two free riders and conditional cooperators, shows that the classification is significantly different for men and women (two-sided Fisher's exact test; N=107; $p < 0.01$). If one applies the same test to free riders versus the rest (conditional cooperators versus the rest), there is a significant difference between men and women (two-sided Fisher's exact tests; N=144; $p < 0.01$ and $p = 0.02$).

[10] If at all, women classified as "Others" seem to be more cooperative than men in this category.

Figure 1: Distribution of types by gender



Combining types and unconditional contributions, we do not find significant differences in contributions between men and women *within* any particular type (according to two-sided Mann-Whitney U-tests). The similarity in the unconditional contributions of men and women becomes particularly apparent when looking at conditional cooperators – the most common type for both genders – in Table 3 (average contributions of male and female conditional cooperators are 8.12 and 8.14 points, respectively). The same conclusion can be drawn regarding average beliefs within types, as there are no significant differences between men and women.

Table 3: Unconditional contributions and beliefs by gender and type

Type of subject	Number of subjects		Unconditional contributions			Beliefs		
	Men (n=55)	Women (n=89)	Men	Women		Men	Women	
All types	100%	100%	5.38	7.60	**	6.45	7.73	*
Free-rider	30.9%	11.2%	1.41	0.50		3.88	4.80	
Conditional cooperator	45.5%	61.8%	8.12	8.14		8.00	7.82	
Hump-shaped	18.2%	6.7%	4.90	8.83		6.80	9.17	
Other	5.5%	20.2%	6.67	9.44		7.00	8.61	

** Difference significant at 5% level, * significant at 10% level, (based on two-sided Mann-Whitney U-tests).

Result 4. *There are no significant differences in unconditional contributions or beliefs between men and women* within *each type category.*

Table 4 extends the regressions of Table 2 by introducing a dummy variable for subject type. We take *free-rider* as the base category and find, not surprisingly, that all other types contribute significantly higher amounts unconditionally. Moreover, the coefficient for the belief is again highly significant. Most importantly, however, our gender dummy variable becomes insignificant, indicating that we have explained the gender gap in the unconditional contribution. To be precise, the difference in unconditional contribution between men and women seems to be due to both differences in beliefs and differences in the distribution of cooperative types across gender.

Result 5. *The gender gap in the unconditional contribution seems to be related to both gender differences in beliefs and gender differences in the underlying distribution of cooperative preferences.*

In a last step of our analysis we take a closer look at the conditional contribution schedules. Table 5 investigates gender differences based on conditional contributions. It gives an indication of the sensitivity of the reaction function to others' average contributions, using a Tobit specification with robust standard errors because of the 21 observations at the individual level. If we consider all participants, we observe the expected conditional dependence and a significant gender effect, but Model 1 lumps together all contributor types. Model 2 restricts the sample to only those who have been classified as conditional cooperators. Even though the slope of the conditional cooperation function can be very different across different conditional cooperators (in other words, the self-serving bias of individuals can be different), there is no significant gender effect. Almost by definition, the sensitivity to others' average contributions is stronger among conditional cooperators (in Model 2) than in the entire sample (in Model 1). Once one is classified as a conditional cooperator, there are no further gender differences.

Result 6. *There is no gender gap in the conditional contributions of participants classified as conditional cooperators.*

Table 4: Explaining unconditional contributions

	Model 1			Model 2		
	Coef.	Std. Error	p-value	Coef.	Std. Error	p-value
Belief	1.25***	0.11	<0.01	1.33***	0.19	<0.01
Woman	1.34	0.92	0.89	1.14	2.00	0.57
Belief * Woman	-	-	-	-0.13	0.23	0.57
Type:						
Conditional cooperator	7.65***	1.50	<0.01	7.57***	1.51	<0.01
Hump-shaped	5.31***	1.83	<0.01	5.28***	1.84	<0.01
Other	8.29***	1.77	<0.01	8.25***	1.77	<0.01
Constant	-9.56***	1.57	<0.01	-10.27***	1.89	<0.01
N	144			144		

Censored tobit regressions. *** Difference significant at 1% level, ** significant at 5% level, * significant at 10% level. Type: Base category is free-rider. Coef. = coefficient; Std. = standard.

Table 5: Explaining conditional contributions

	Model 1 (all subjects)			Model 2 (only Conditional Cooperators)		
	Coef.	Std. Error	p-value	Coef.	Std. Error	p-value
Others' average contribution	0.62***	0.09	<0.01	0.98***	0.09	<0.01
Woman	5.10***	1.52	<0.01	1.79	1.13	
Others' average contrib. * Woman	-0.03	0.11		-0.12	0.10	
Constant	-4.92***	1.30	<0.01	-2.80***	1.09	0.01
N	3024		-	1680		-

Censored tobit regressions. *** Difference significant at 1% level, ** significant at 5% level, * significant at 10% level. Robust standard errors clustered at the individual level. Coef. = coefficient; Std. = standard.

4. Robustness analysis: data from five continents

In the light of inconclusive results in previous studies on gender and cooperation, it is natural to be very cautious regarding our results and their robustness. We have a quite homogenous subject pool of 144 mostly German undergraduate students, and it could be the case that our results are subject-pool specific or country-specific. As a robustness check, we take data sets of recent public goods experiments that subsets of the authors of the present paper conducted for other reasons than studying gender effects. The main finding of this robustness exercise is that our main result – women are relatively more often classified as conditional cooperators, whereas men are relatively more often classified as free-riders – is confirmed.

More precisely, in the following we look at gender effects in four different studies conducted in six different countries on five continents, namely Austria, Colombia, Ethiopia, Japan, USA, and Vietnam. Kocher et al. (2008) investigated conditional cooperation in Austria, Japan, and USA. The Colombian data are from Martinsson et al. (2009, 2015). Martinsson et al. (2016) conducted the experiments in Ethiopia, and the data for Vietnam are from Martinsson et al. (2013).[11] The studies differ in some small details, but they all use the same basic Fischbacher et al. (2001) design.

[11] We are grateful to all of our co-authors that were involved in the projects that we use in this robustness assessment, in particular Todd Cherry, Stephan Kroll, Haileselassie Medhin, Robert Netzer, Nam Pham-Khanh, Matthias Sutter, and Clara Villegas-Palacio.

Table 6: Number of observations by gender and country[12]

Country	Men	Women	All
Austria	23	12	35
Colombia	127	84	211
Ethiopia	55	28	83
Japan	30	6	36
USA	19	17	36
Vietnam	28	20	48
All	*282*	*167*	*449*

Table 6 provides an overview of the number of observations that the studies rely on, broken up by gender and country. As the number of participants is too small to draw robust conclusions regarding gender effects for each country separately and as it is not our aim to study culture- or country-specific effects, we pool the data. This gives us a large data set that allows assessing the geographical universality of our main results from Section 3. More detailed information about the data at country level is included in Appendix A.

Pooling all data from Table 6 we again find considerable differences in the conditional contribution patterns across men and women. Table 7 shows that 61% of women but only 52% of men can be classified as conditional cooperators, whereas 21% of men but only 8% of women are free-riders. Overall, the distribution of types differs significantly across the sexes (Kruskal-Wallis, $p = 0.02$; $N = 449$).

Result 7. *The presence of gender differences in type distribution – men being relatively more frequently classified as free-riders and women being relatively more frequently classified as conditional cooperators – is a robust finding.*

We briefly summarize results on unconditional contributions and beliefs from the studies shown in Table 6. Notice that beliefs are not elicited in Kocher et al. (2008). Martinsson et al. (2013), and Martinsson et al. (2009, 2015) use unconditional contributions that range from 0 to 60 points. If we compute average unconditional contributions over all studies (dividing contributions in the latter studies by three to make them comparable), we find that women contribute slightly more than men, but the difference fails to reach significance on conventional levels (means = 7.08 vs. 6.63; two-sided Mann-

[12] We have no information about the gender of one participant in each of the three countries Austria, Colombia, and Ethiopia. Thus, these three persons are excluded from the analysis. The study in Japan was conducted at the Technical University of Tokyo, which explains the very low number of female participants.

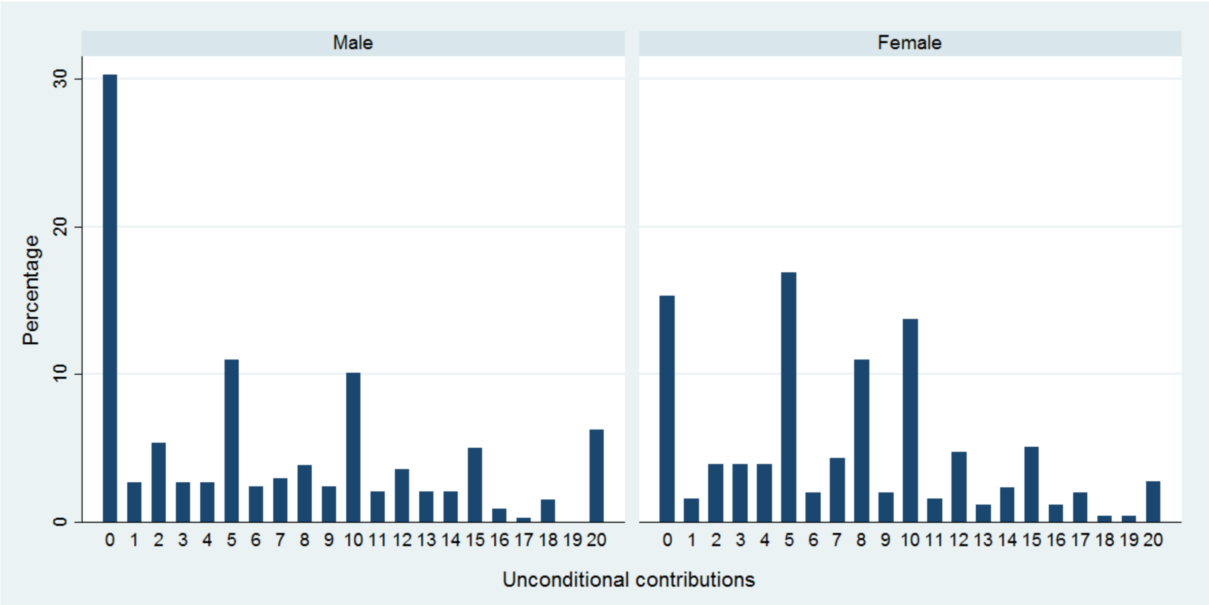
Whitney U-test, p = 0.12, N = 448). Similarly, average beliefs of women (mean = 7.16) are higher than those of men (mean = 6.20) overall, although the difference is not significant (two-sided Mann-Whitney U-test, p = 0.40, N = 259). This does not mean that there are no differences between the studies. In Vietnam and one of the studies in Colombia (Martinson et al, 2009), men hold more optimistic beliefs than women. While in Vietnam women still contribute more unconditionally than men, this is not the case for the study in Colombia. In this study, women contribute slightly less than men unconditionally (means = 7.42 vs. 8.00; two-sided Mann-Whitney U-test, p = 0.74, N = 94). Women are, however, still more often conditionally cooperative (67% vs. 56%) and less often classified as free-riders (4% vs. 19%). Hence, looking at the unconditional contributions alone and not accounting for beliefs or conditional contribution pattern might provide an incomplete and potentially misleading picture when assessing cooperation. While beliefs and unconditional contributions of men and women vary across studies (and might strongly depend on elicitation details), the distribution of contribution types and the resulting gender differences in cooperative preferences elicited from the contributions schedules seem very stable.

Table 7: Contribution type by gender in pooled data

Type of subject	Men	Women
Free-rider	21% (59)	8% (14)
Conditional cooperator	52% (147)	61% (102)
Hump-shaped	10% (27)	7% (11)
Other	18% (49)	24% (40)
All	100% (282)	100% (167)

A final result is noteworthy, since it confirms an important previous finding. Andreoni and Vesterlund (2001) find that the generosity of men and women depends on its "price." When cheap, men are more generous, whereas women are more generous when such behavior is more expensive. A second finding is less often noted. Andreoni and Vesterlund's experiments provide evidence that men are more likely to be either perfectly selfish or perfectly selfless, whereas women are more likely to be in-between. The public goods game is, of course, different from the dictator game, but we observe a related phenomenon in our data. Men more often unconditionally contribute zero than women (30.3% vs. 15.3%), but they are also slightly more likely to contribute their entire endowment (6% vs. 3%), when we look at the overall sample (including Germany). Figure 2 shows the distribution of unconditional contributions across all studies.

Figure 2: Distribution of unconditional contributions by gender



5. Conclusion

Experimental evidence of gender differences in cooperation has so far been mixed and inconclusive. We contribute to the ongoing debate by combining unconditional contributions, cooperative preferences (a contingent contribution schedule), and beliefs about the cooperation of others. One asset of our setup is that it allows for comparison of its results with a set of experiments conducted on five continents, and thus it is possible to check for universality and robustness of main findings.

Our results indicate a clear gender gap in cooperative preferences. Women are significantly more likely to be classified as conditional cooperators; i.e., if they know that others contribute (more), they are more likely to contribute as well. Men are more frequently classified as free-riders. There are no differences in the unconditional contribution behavior within each type category. Most importantly, conditional cooperators behave almost identically across the genders when it comes to unconditional contributions. This general pattern of preferences holds around the world. Our data shows that these underlying preferences may play out differently in studies that only examine unconditional contributions, which is the most common type of experimental study conducted. The reasons for these differences are different beliefs about others' contributions or differences in subject pool and details in the experimental setups.

With our main results in mind, we think that at least three aspects of gender differences in cooperation deserve more attention in the future. First, determinants of beliefs are not well understood, in general. However, differences in beliefs contribute to the gender gap in cooperative behavior, and thus more work is needed that analyzes the foundations and the malleability of beliefs (e.g., Dufwenberg et al., 2011). Second, country- or culture-specific effects as well as the context of the social dilemma (framing effects, etc.) might have a strong influence on the gender gap in cooperation through beliefs. If it is true that women are more sensitive to social cues than men, unconditional contributions alone will exhibit large variation. Small-scale experimental studies therefore bear the risk of yielding inconclusive or even misleading results. Moreover, the main alternative, i.e., large-scale studies, may not be much better, as they too could be affected by the specific context or social cues. Meta studies could be a viable alternative, or smaller-scale experimental studies with a systematic variation in context and cues. Third, our results have implications for the implementation of repeated public goods games. Future experiments can test whether the behavioral patterns across gender in repeated public goods games are well-predicted based on the connection of beliefs and underlying cooperative preferences, for instance along the lines of Fischbacher and Gächter (2010).

Methodologically, we want to emphasize the importance of looking at complete reaction functions and beliefs when studying gender differences. Unless this is done, empirical results provide a non-comprehensive picture. If women have a stronger intrinsic inclination to reciprocate cooperative behavior of others, implications for optimal team composition or introducing leadership in teamwork that induces conditional cooperation follow immediately. Given our results, it seems even mor important to initiate cooperation or signal the intention to cooperate when women are present. Interestingly, the existing literature on leading by example in social dilemmas (e.g., Gächter et al., 2012; Arbak and Villeval, 2013) mainly focuses on gender differences in leadership rather than gender differences in following contingent on the example given by the leader. Our results provide a directed hypothesis: Setting a good example in a work team or providing seed money in a charity drive should have a stronger impact on women than on men.

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Appendix

A. Further results

Table A.1: Distribution of types, unconditional contributions, and beliefs by gender and country

Type of subject	Austria		Colombia		Japan		USA		Vietnam		Ethiopia	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Free-rider	0.26	0.17	0.13	0.04	0.33	0.50	0.16	0.00	0.04	0.05	0.40	0.18
	(6)	(2)	(17)	(3)	(10)	(3)	(3)	(0)	(1)	(1)	(22)	(5)
Conditional	0.52	0.50	0.68	0.70	0.43	0.33	0.74	0.94	0.46	0.55	0.16	0.29
cooperator	(12)	(6)	(86)	(59)	(13)	(2)	(14)	(16)	(13)	(11)	(9)	(8)
Hump-shaped	0.13	0.08	0.06	0.04	0.13	0.00	0.00	0.00	0.11	0.05	0.16	0.21
	(3)	(1)	(8)	(3)	(4)	(0)	(0)	(0)	(3)	(1)	(9)	(6)
Other	0.09	0.25	0.13	0.23	0.17	0.17	0.11	0.06	0.39	0.35	0.27	0.32
	(2)	(3)	(16)	(19)	(3)	(1)	(2)	(1)	(11)	(7)	(15)	(9)
All	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
	(23)	*(12)*	*(127)*	*(84)*	*(30)*	*(6)*	*(19)*	*(17)*	*(28)*	*(20)*	*(55)*	*(28)*
Mean unconditional contribution	7.87	5.50	7.91	8.43	7.93	5.50	8.21	8.00	5.07	5.30	2.73	4.79
Mean belief	-	-	7.03	7.41	-	-	-	-	6.42	6.08	-	-

Table A.1 displays country-specific data on the distribution of types, unconditional contributions, and beliefs. In order to make the data directly comparable, we re-classify some individuals from the study of Kocher et al. (2008). In the original study, subjects were classified as conditional cooperators only if they submitted a contribution schedule that was weakly monotonically increasing with the average contribution of the other group members (with at least on strict increase in the contribution schedule). All other studies use a slightly different classification mechanism (based on Fischbacher et al., 2001), for which subjects are also classified as conditional cooperators if they have a highly significant (at the 1% level) positive Spearman rank correlation between their own and others' contributions. As a consequence, we re-classify one (male) individual from the USA and three individuals (two men, one woman) from Austria as conditional cooperators instead of "Others". Furthermore, notice that unconditional contributions and beliefs in Colombia and Vietnam are divided by three, as the contribution range in these experiments was 0–60 points.

B. Experimental instructions[1] [for online publication!]

Welcome to the experiment and thank you for participating!

Please stop talking to other participants from now on.

General

This is an experiment on economic decision making. You will earn “real” money that will be paid out to you in cash at the end of the experiment. During the experiment all participants will be asked to make decisions. Your decisions and the decisions of other participants determine your earnings from the experiment according to the following rules.

The experiment will last two hours. If you have any questions or if anything is unclear, please raise your hand, and one of the experimenters will come to you and answer your questions privately.
During the experiment a part of your earnings will be calculated in **points**. At the end of the experiment all points that you earn will be converted into euro at the exchange rate of

1 point = 0.33 euro (3 points = 1 euro).

In the interest of clarity, we will only use male terms in the instructions.

Anonymity

You will learn neither during nor after the experiment, with whom you interact(ed) in the experiment. The other participants will neither during nor after the experiment learn, how much you earn(ed). We never link names and data from experiments. At the end of the experiment you will be asked to sign a receipt regarding your earnings which serves only as a proof for our sponsor. The latter does not receive any other data from the experiment.

Means of help

You will find a pen at your table which you, please, leave behind on the table when the experiment is over. While you make your decisions, a clock will run down at the top of your computer screen. This clock will give you an orientation how long you should need to make your decisions. But you can nevertheless exceed this time. The input screens will not be dismissed once time is over. However, the pure output screens (here you do not have to make a decision) will be dismissed.

Experiment

The experiment consists of three parts[2]. You will receive instructions for a part after the previous part has ended. The parts of the experiment are completely independent; decisions in one part have no consequences for your earnings in later parts. The sum of earnings from the different parts will constitute your total earnings from the experiment.

[1] Translated from the original German version.

[2] Instructions for Parts 2 and 3 can be found in the Appendix to Kocher et al. (2017).

Part I

The decision situation

The basic decision situation will be explained to you in the following. Afterwards you will find control questions on the screen which should raise your familiarity with the decision situation.

You will be a member of a group consisting of **4 people**. Each group member has to decide on the allocation of 20 points. You can put these 20 points into your **private account** or you can put them **fully or partially** into a **group account**. Each point you do not put into the group account will automatically remain in your private account.

Your income from the private account:

You will earn one point for each point you put into your private account. For example, if you put 20 points into your private account (and therefore do not put anything into the group account) your income will amount to exactly 20 points out of your private account. If you put 6 points into your private account, your income from this account will be 6 points. No one except you earns something from your private account.

Your income from the group account:

Each group member will profit equally from the amount you put into the group account. On the other hand, you will also get a payoff from the other group members' in-payments into the group account. The income for each group member out of the group account will be determined as follows:

Income from group account =
Sum of all group members' contributions to the group account $\times$ 0.4

If, for example, the sum of all group members' contributions to the group account is 60 points, then you and the other members of your group each earn 60 x 0.4 = 24 points out of the group account. If the four group members contribute a total of 10 points to the group account, you and the other members of your group each earn 10 x 0.4 = 4 points out of the group account.

Total income:

Your total income is the sum of your income from your private account and that from the group account:

Income from your private account (= 20 – contribution to group account)
+ Income from group account (= 0,4 $\times$ sum of contributions to group account)
= Total income

Before we proceed, please try to solve the control questions on your screen. If you want to compute something, you can use the Windows calculator by clicking on the respective symbol on your screen.

Procedure of Part I

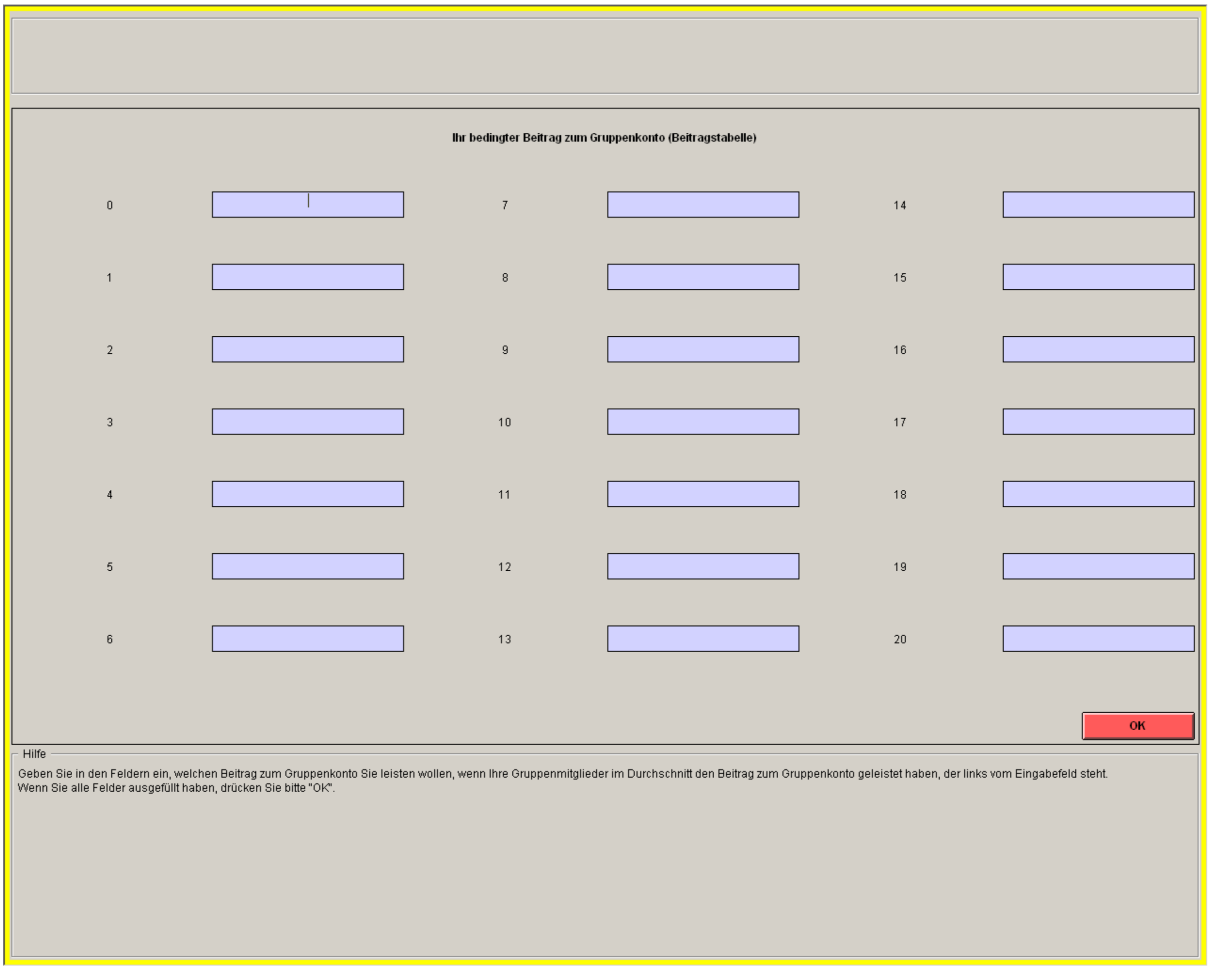
Part I includes the decision situation just described to you. The decisions in Part I will only be made **once**.

On the first screen you will be informed about your **group membership number**. This number will be of relevance later on. If you have taken note of the number, please click “next”.

Then you have to make your decisions. As you know, you will have 20 points at your disposal. You can put them into your private account or you can put them into the group account. Each group member has to make **two types** of contribution decisions which we will refer to below as the **unconditional contribution** and the **contribution table**.

- In the **unconditional contribution** case you decide how many of the 20 points you want to put into the group account. Please insert your unconditional contribution in the respective box on your screen. You can insert integer numbers only. Your contribution to the private account is determined automatically by the difference between 20 and your contribution to the group account. After you have chosen your unconditional contribution, please click “next”.

- On the next screen you are asked to fill in a **contribution table**. In the contribution table you indicate **how much <u>you</u> want to contribute to the group account for each possible average contribution of the <u>other</u> group members** (rounded to the next integer). Thus, you can condition your contribution on the other group members’ average contribution. The contribution table looks as follows:



The numbers in each of the left columns are the possible (rounded) average contributions of the **other** group members to the group account. This means, they represent the amount each of the other group members’ has put into the group account on average. You simply have to insert into the input boxes how many points you want to contribute to the group account – conditional on the indicated average contribution. **You have to make an entry into each input box**. For example, you will have to indicate how much you contribute to the group account if the others contribute 0 points to the group account on average, how much you contribute if the others contribute 1, 2, or 3 points on average, etc. You can insert any integer numbers from 0 to 20 in each input box. Once you have made an entry in each input box, please click “OK”.

After all participants of the experiment have made an unconditional contribution and have filled in their contribution table, a random mechanism will select a group member from every group. Only **the contribution table** will be the payoff-relevant decision for the **randomly determined subject**. Only the **unconditional contribution** will be the payoff-relevant decision for the **other three group members** not selected by the random mechanism. You obviously do not know whether the random mechanism will select you when you make your unconditional contribution and when you fill in the contribution table. You will therefore have to think carefully about both types of decisions because both can become relevant for you. Two examples should make this clear.

<u>Example 1:</u> Assume that **the random mechanism selects you. This implies that your relevant decision will be your contribution table**. The unconditional contribution is the relevant decision for the other three group members. Assume they made unconditional contributions of 0, 2, and 5 points. The average rounded contribution of these three group members, therefore, is 2 points ((0+2+5)/3 = 2.33).
If you indicated in your contribution table that you will contribute 1 point to the group account if the others contribute 2 points on average, then the total contribution to the group account is given by 0+2+5+1=8 points. All group members, therefore, earn 0.4×8=3.2 points out of the group account plus their respective income from the private account.

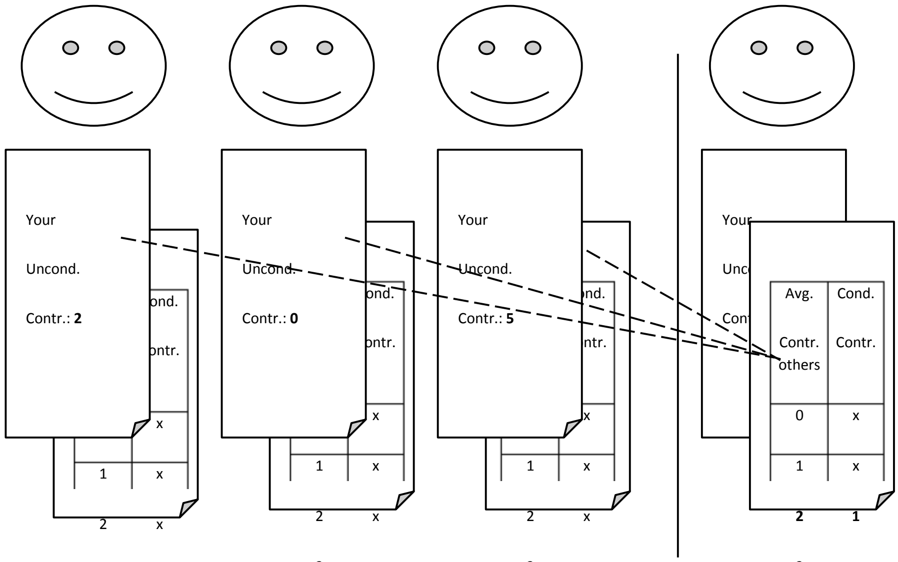
If, instead, you indicated in your contribution table that you would contribute 19 points if the others contribute two points on average, then the total contribution of the group to the group account is given by 0+2+5+19=26. All group members therefore earn 0.4×26=10.4 points out of the group account plus their respective income from the private account.

<u>Example 2:</u> Assume that **the random mechanism did not select you,** implying that **the unconditional contribution is taken as the payoff-relevant decision** for you and two other group members. Assume your unconditional contribution to the group account is 16 points and those of the other two group members are 18 and 20 points. The average unconditional contribution of you and the other two group members, therefore, is 18 points (= (16+18+20)/3).

If the group member whom the random mechanism selected indicates in her contribution table that she will contribute 1 point to the group account if the other three group members contribute on average 18 points, then the total contribution to the group account is given by 16+18+20+1=55 points. All group members will therefore earn 0.4×55=22 points out of the group account plus their respective income from the private account.
If, instead, the randomly selected group member indicates in her contribution table that she contributes 19 points to the group account if the others contribute on average 18 points, then the total contribution to the group account is given by 16+18+20+19=73 points. All group members will therefore earn 0.4×73=29.2 points out of the group account plus their respective income from the private account.

The random selection of the participants will be implemented as follows. A randomly selected participant will throw a 4-sided die **after** all participants have made their unconditional contribution and have filled in their contribution table. She enters the thrown number into the computer thereby being monitored by the experimenter who confirms the correctness of the entry by password. The thrown number will then be compared with the group membership number, which was shown to you on the first screen. If the thrown number equals your group membership number, then your contribution table is payoff-relevant for you and the unconditional contribution is payoff-relevant for the other three group members. Otherwise, your unconditional contribution is the relevant decision for you.

The following figure visualizes the situation in example 1. You are the person on the right side with group membership number 3. Number 3 was thrown and therefore your conditional contribution is payoff-relevant. For the other three group members the unconditional contribution is payoff-relevant.



You will make all your decisions only **once**. After the end of Part I you will get the instructions of Part II. How much you have earned in Part I will be revealed at the end of the experiment.

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Vienna, *12.08.2020*

Prof. Daniela Puzzello
Editor
Journal of Economic Behavior and Organization

Resubmission of JEBO-D-19-00390: "Gender and cooperative preferences " (with Nadja Furtner, Peter Martinsson, Dominik Matzat, and Conny Wollbrant)

Dear Prof. Puzzello,
dear Daniela,

Thank you very much for your message and for giving us the opportunity to revise the our paper. Let me first of all apologize for the unusually long turnaround time on our side. There was a very unfortunate misunderstanding among us authors, and I thought that we already had resubmitted. Somehow, we did not get a reminder, but it might have gone in the wrong folder. I am very, very sorry for this, and I hope for your understanding.

In the remainder of this letter, we explain how we addressed your comments. The relevant parts of your e-mail (including the referee reports) are inserted in italics.

We also tried to comply with the JEBO style guide throughout the paper.

We very much hope that you find this revision satisfactory, and we look forward to seeing the paper published in the Journal of Economic Behavior and Organization. Thanks again for your support.

Sincerely Yours,
Martin Kocher (on behalf of the authors)

Response to Reviewer 1:

JEBO-D-19-00390

"Gender and cooperative preferences "

Thank you for your positive evaluation of our paper and the very helpful comments!

In the following we respond to your suggestions and describe our changes. Quotes from your report are in italics.

Summary: This paper reports lab experiments that are designed to examine the mechanisms leading to differences in behavior of women and men in public goods games. The experiments are well-designed, and the results provide significant insight into the reasons for gender differences in behavior. The lab experiments are then bolstered using results of similar games in six different countries.

This is a solid paper, with a clear research question, appropriate methodology, and meaningful results. Overall I like it very much, and think it is well worth publishing. I only have a few suggestions for improvement, and these are really matters of taste rather than substance.

Thanks very much for the positive reading!

Suggestions:

1. I would quibble with the introductory paragraph. Gender is not a "treatment" but an individual difference. To me it is silly to bemoan our inability to assign gender randomly. This is a paper exploring mechanisms behind observed gender differences. Women and men can't be disassembled into "gender" and "other" factors. Gender is a package of things, culturally and biologically determined, inseparable. The question is interesting without this.

We agree. What we meant to say and what ended up as a much too short statement in the introductory paragraph was that effects of gender in decision making and the way we can control for cultural, biological and social backgrounds in empirical analyses might be related. Since we expected that not every reviewer would agree with your last sentence ("the question is interesting without this"), our statement become quick defensive. On a second read, we fully agree with your assessment. We have just dropped the following three sentences from the paper to follow your advise: "A main general problem in assessing gender effects is the obvious impossibility of inducing exogenous treatment variation on the variable of interest, namely gender. As a consequence, reported differences in the behavior of men and women from laboratory experiments may capture residuals of effects that are not controlled for by other background variables in the empirical model used by the researcher. However, there still is structure in the empirical results on gender differences:"

2. Another quibble: Many disagree with Croson and Gneezy's characterization of women as more sensitive than men to treatments. I wouldn't assert this as something they "conclude," as there is no real evidence for it, but rather that they "argue". You have an example in your conclusion, where you note that men are more sensitive than women to the price of giving. Someday you might find yourself in a strong conversation with Alessandra Cassar, who has a paper showing the context dependence of gender differences, or Muriel Niederle, who, in her Gender chapter, also provides examples where men are more sensitive than women to treatments. It depends on the treatment/context.

Thanks a lot! Changed to “argue”.

3. Please just don't use "seminal" in a gender paper. Some find it cringe-worthy. (You can look it up.)

Did look it up and got it. We have deleted the term.

4. P. 3, there are many social dilemma experiments in social psych and sociology showing gender differences going one way or the other. E&G in the survey that you cite argue that it is because the public goods game confounds altruism and risk aversion - if women are more altruistic (plenty of studies on this), and more risk averse, then behavior will depend on the details. You could mention the work showing women donate more, starting with E&G EJ 98 and moving forward. Greater giving by women turns up in the charitable giving literature as well.

Thanks a lot for the comment. We now say that the inconclusiveness for gender results in cooperation games might come from countervailing gender effects in altruism and in risk aversion. We refer to Eckel and Grossman (1998), and we then say that details of the design might matter a lot.

5. The first sentence of the second paragraph on p. 4 is (inadvertently) rather funny.

Agreed. Sounds very odd on a second read. We have changed the statement to: “For management and economic policy applications, it seems relevant to know more about the relative cooperativeness of women and men.”

6. P. 8. Do you worry at all that beliefs are endogenous?

We follow the literature in how we elicit and control for beliefs, but we of course agree that establishing exogeneity of beliefs is impossible in the specific design that we use. One would, for instance, need a comparison of belief elicitations before and after contribution decision (see Gächter and Renner, 2010), but even then, we do not know how belief formation and choice may be entangled. We added the following cautionary note: “Obviously, one has to take these results with a grain of salt. While we follow the standard in belief elicitation, beliefs have been elicited after contribution decisions and might, at least partly, be endogenous.”

7. Result 2, use of prepositions. I'd say belief "about" others' contributions, and not significant "at" conventional levels. There are a few other spots where things like this happen.

Thanks very much for the careful reading! We have carefully read the paper and changed the prepositions where necessary.

8. P. 9 - are the "others" just noisy, or do they include some full-contributors?

In Germany, we have two out of the 144 participants that contribute the full amount, regardless of the contribution of the other group members. Both of them are female. Since it is only two out of 21 decision makers in the category “Others”, we do not have enough evidence to take conclusion here. It happens rather rarely in other countries too, but also males show this pattern sometimes.

Response to Reviewer 2:

JEBO-D-19-00390

“Gender and cooperative preferences "

Thank you for your positive evaluation of our paper and the very helpful comments!

In the following we respond to your suggestions and describe our changes. Quotes from your report are in italics.

This study elicits unconditional contributions, contributions contingent on average contributions by the three other participants, and predicted average contributions of others in an incentive-compatible framework for a one-shot public goods game. It then divides people into types based on cooperative preferences derived from the contingent contributions. It is noteworthy that females are more likely to be classified as conditional cooperators than males, while males are more likely to be classified as free riders than females. The types and predictions are then used to explain the lower contributions of males relative to females. Once a person's type and beliefs about what others will contribute are added as explanatory variables, the gender dummy loses its significance as an explanatory variable for unconditional contributions. Moreover, there are no remaining gender differences within each category. I would describe this result by saying the gender effect on contributions is completely mediated by the combination of types and beliefs. As a robustness check, the authors move beyond their German subjects to find consistent results in six other countries in different parts of the world.

The study appears to be well designed and implemented. The statistical analysis is appropriate and persuasive. A formal mediation analysis would speak to a wider audience of social scientists and might be considered, but the existing presentation will be persuasive to most economists. I would interpret the important role played by cooperative-preference type as one of two mediating variables as an endorsement of the validity of this construct. It is clearly useful in explaining individual differences that are related to gender.

Thanks very much for the positive reading of our paper! Since the authors are all economists and do not regularly use mediation analyses, we have not added one to the paper. We think that it would need some more discussion on the role of preferences, types, gender, and behavior, and their interactions. While all of this is very interesting, it would require quite some additional space in the paper. We are happy to add the analysis to the paper if you want us, but we interpreted your remarks as suggestive, leaving the decision with us. If our interpretation is wrong, please let us know, and we of course add the analysis to the paper.

Aside from what I regard as an optional suggestion to undertake a formal mediation analysis, I have only two other minor remarks.

First, the subjects roll a four-sided die, not a four-sided dice. Dice is a plural form, referring to more than one die.

Changed. Thanks a lot for the careful reading!

Second, contingent contributions were elicited for different average-contributions levels by the three other members of one's group. This makes sense when one can only ultimately observe and react to the total level of contributions by others in a repeated game. However, sometimes in life we are given *information about individual contributions. If such information were available, I wonder if it would make a difference. For example, would one react differently to an average contribution of ten points when the average derives from all three players contributing ten points each compared to when one player contributes 20, another contributes 10, and the third contributes zero? This is however a question for another study.*

This is indeed a very interesting idea! We are not aware of any published study on this issue. As an aside, a former Ph.D. of one of the authors wrote a thesis chapter on the topic and implemented experiments almost exactly along the lines of the above suggestion. Even for the extreme cases (for instance, comparing a contribution vector of {20;0} of the two other group members to a contribution vector of {10;10} in three-person groups) there was no significant difference in reactions, i.e. in the conditional contribution. Given the null result, the study was never published unfortunately. Perhaps the vectors need to be made more salient to decision makers, but it seems that the variance in contributions plays a smaller role in conditional contributions than we expect.

Good luck with this interesting research!

Thanks very much!

Declaration of Interest statement

Declarations of interest: None.