Public Goods, Reciprocity, and the Causal Effect of Expected Cooperation in Representative Samples*

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Abstract

Voluntary cooperation in public goods problems crucially affects the functioning and long-term fate of economic and political systems. Previous research emphasizes that cooperation in public goods games correlates with expectations about cooperation by others among students and other selected demographic subgroups. However, determining if this reciprocity effect is causal and a general feature of individual behavior requires the use of randomized experiments in combination with large-scale samples that are representative of the population. We fielded large-scale representative surveys (N=8,500) in France, Germany, the United Kingdom, and the United States that included a public goods game in combination with a novel randomized experiment and a survey instrument eliciting individual's conditional contribution schedules. We find a positive causal effect of higher expected cooperation on individual contributions that is most pronounced among positive reciprocity types which account for about 50% of all individuals. We also show that positive reciprocity is unevenly distributed: It is more widespread among richer, younger and more educated respondents. Therefore, socio-demographic characteristics matter for understanding behavior in social dilemmas because of their association with conditionally cooperative strategies.

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When and why do individuals and groups succeed in cooperating in the face of social dilemmas? A large set of literatures in various academic disciplines have addressed this question theoretically and empirically (Hume 2003 [1740]; Olson 1965; Axelrod and Hamilton 1981; Taylor 1987; Boyd and Richerson 1988; Ostrom 1990; Gintis 2000). Central to this body of research has been the cumulative empirical insights of lab and lab-in-the-field experimental studies investigating why groups succeed or fail in solving various types of social dilemmas. These studies have provided numerous fundamental insights about how individuals actually behave when faced with a social dilemma. In particular, theories highlighting the importance of social norms such as altruism, inequality aversion, and reciprocity have gained strong empirical credibility through the findings of these studies.[1] Lab-experimental research has also begun to identify different types of conditionally cooperative individuals to explain variation in public goods provision over time (Fischbacher, Gächter and Fehr 2001; Fischbacher and Gächter 2010).

Although much has been learned from this research program, a widely shared concern about these results has been that they are largely based on student populations. Might more diverse and representative samples of subjects behave differently in social dilemmas? Previous empirical studies have addressed this concern primarily by moving labs to the field and examining behavior in ultimatum and trust games in more diverse, non-student samples (Henrich 2000; Henrich, Boyd, Bowles, Camerer, Fehr, Gintis and McElreath 2001; Gächter, Herrmann and Thöni 2004; Bellemare and Kröger 2007; Holm and Danielson 2005; Henrich, Heine and Norenzayan 2010). While these studies have generated valuable knowledge about cooperative behavior in more heterogeneous settings, the subject pools are still, with a few exceptions (Fehr, Fischbacher, von Rosenbladt, Schupp and Wagner 2002; Thöni, Tyran and Wengström 2012) based on selected samples that are not nationally representative. This leaves open a large number of questions that are important for our understanding of cooperation in social dilemmas within and across countries: How important is conditional

[1] Henrich, Fehr and Gintis (2004) and Fehr and Schmidt (2006) provide overviews of the large theoretical and empirical literature on cooperation and social norms.

cooperation when examining representative samples? Do different types of individuals behave differently when facing social dilemmas? Is the importance of altruism and reciprocity as significant in representative samples as in student and other selected populations? Do the magnitudes of existing empirical descriptions of different cooperation types and behaviors based on non-representative samples generalize to more general populations?

In this paper, we start to answer these questions by studying behavior in public goods problems with a focus on the role of reciprocity in explaining cooperation. Previous lab-experimental studies strongly suggest that reciprocity, or the willingness to cooperate if one expects others to do so, constitutes a particularly influential determinant of actors' cooperative behavior in public goods games when examining students (Fischbacher and Gächter 2010; Engelmann and Strobel 2010; Charness and Haruvy 2002; Ostrom 2000) and other selected demographic subgroups (Fehr and Fischbacher 2002; Gächter et al. 2004; Henrich et al. 2001). Yet, we still lack evidence on the extent and distribution of cooperative behavior in the general population and an empirical estimate of the causal effect of expectations about the cooperation of others on own behavior that is based on nationally representative, large-scale samples. Our study provides new evidence on these and other quantities central to understanding cooperation in social dilemmas.

We fielded large-scale representative surveys (N=8,500) in France, Germany, the United Kingdom, and the United States that included a two-player, simultaneous, anonymous prisoner's dilemma game with continuous action sets and real monetary payoffs. We embedded a novel randomized experiment in the game instructions to respondents and added an instrument that elicited the individual's conditional contribution schedules (Rauhut and Winter 2010; Fischbacher et al. 2001; Selten 1967). The experiment randomized the example with which the instructions illustrated how the ultimate pay-off depends on both players' actions. Thus, our encouragement design manipulated whether respondents believed they were acting in a more or less cooperative environment. It did not involve deception. After the game we elicited how individuals mapped other contributions into own contributions to

classify their reciprocal strategy types.

We find that, while socio-demographics are at most weakly correlated with individuals' cooperative behavior, expectations about contributions by the other player are strong predictors of cooperation. Based on our randomized experiment we provide the first causal estimate of the effect of expected cooperation on own contributions in representative samples. We find that a one €/£/$ increase in the contribution an individual expects from the other respondent causes 1.4 €/£/$ higher own contributions on average. While this effect size suggests that individuals over-reciprocate, we find that a 95% confidence interval for this estimate contains 1. This result significantly strengthens the empirical literature on reciprocity. The effect of expected cooperation on contribution behavior is substantively large, clearly evident in a representative set of subjects, and can be given a causal interpretation.

In addition to studying the average effects of reciprocity, we investigate the distribution of reciprocal strategies in our representative samples and how these condition the causal effect of expected cooperation. We classify our $8,500$ respondents into different groups of conditional cooperators (Fischbacher et al. 2001; Thöni et al. 2012), distinguishing between Positive Reciprocity (44%), Positive Nonconditional (13%), Freerider (11%), Inverse U-shaped Reciprocity (5%), and Other (27%). Although the distribution of these types is quite similar across our four countries, we find that the distribution of these types is not evenly spread throughout the populations. Specifically, we find that positive reciprocity is significantly more widespread among female, younger, wealthier, and highly educated individuals. Further, we find that even among positive reciprocity types, younger, wealthier, and highly educated individuals respond more strongly to their expectations of the contributions of others to the public good. Finally, we re-estimate the causal effect of cooperative expectations for different reciprocity types using the encouragement design described above. We find that the effects of expectations about the contributions of others is strongest among positive reciprocity types and generally insignificant for most of the other strategy types.

Taken together these results indicate significant heterogeneity across general populations

in the importance of reciprocity in the context of public goods provision. Although on average reciprocity is evident in our representative sample, the effect is driven by the plurality subsample of individuals employing positively reciprocal strategies and these individuals are disproportionately younger, wealthier, and more educated. We discuss the implications of these findings for our understanding of cooperation in social dilemmas, the role of policy interventions and institutions for equilibrium selection in collective action problems, and subsequent research on reciprocity and cooperation.

Survey, Sample, and Experimental Design

Our survey was conducted on representative samples of the adult population in France ($N = 2,000$), Germany ($N = 2,000$), the United Kingdom ($N = 2,000$), and the United States ($N = 2,500$). The surveys were carried out online by YouGov in summer 2012. YouGov employs matched sampling to approximate a random sample of the adult population (Rivers 2011). The Appendix provides details about the survey design including distributions of socio-demographics in the sample and the populations. The survey had two parts. The first part was anonymous prisoner's dilemma game with continuous action sets that was embedded in a randomized other contribution experiment. The second part used the strategy method to elicit respondents' contribution schedules. The experiment did not involve deception.

Prisoner's Dilemma Game and Other Contribution Experiment

Our survey informed all respondents that they could win one of two Amazon gift cards and that the amount of the gift card would depend (i) on their decision about whether to give some amount of the gift card to the other winner and (ii) the analogous decision made by that winning respondent. Any amount given to the other respondent would be subtracted from the individual's base winnings of 100 €/£/$ and doubled before it was distributed to the other winner. Thus, the public good in this case is the amount of money that the

group takes from the experimenter. Formally, the payoff function for an individual i is: $\Pi_i = 100 - c_i + 2c_j$, where c_i is one's own contribution and c_j is the contribution by the other individual. Standard economic theory predicts that individuals should contribute nothing which implies that the payout to the two winners is the minimum aggregate payoff of 200 €/£/\$. However, the highest possible aggregate payoff is 400 €/£/\$. The exact instructions that followed the description of the lotteries were:

> "The ultimate value of the voucher depends on your decision on the following: If you win a voucher, you can decide to increase the value of the second voucher that another person has won. You can give any amount between 0 and 100 €/£/\$ by which the value of your voucher will be decreased. Each dollar that you decide to give to the other individual will be doubled. This means that if you decide to give, say, *[10, 30, 60, 90]€/£/\$*, the other person will receive *(20, 60, 120, 180) €/£/\$* and you will receive *(90, 70, 40, 10)€/£/\$*. Likewise, if the other person decides to give, say, *[10, 30, 60, 90]€/£/\$*, you will receive *(20, 60, 120, 180)€/£/\$* and they will receive *(90, 70, 40, 10)€/£/\$*."

We randomized the value in square brackets and computed the corresponding values stated in parentheses. As an example, one possible realization of the randomized part of the instructions was: "This means that if you decide to give, say, \$10, the other person will receive \$20 and you will receive \$90. Likewise, if the other person decides to give, say, \$60, you will receive \$120 and they will receive \$40." Thereby, we varied whether respondents were acting in a more or less cooperative environment. We subsequently asked respondents how much they would like to contribute and how much they expect the other winner to contribute (the order in which we asked these questions was randomized). After completion of the field work the winners were drawn and their contribution decisions determined the payoffs.

Measuring Reciprocity Types

The second part of the survey asked respondents about their conditional contribution schedules. To determine individuals' reciprocity types, immediately after our survey respondents played the payoff-relevant public goods game, we asked them to indicate how their

own contribution potentially depends on the other individual's contribution (Rauhut and Winter 2010; Fischbacher et al. 2001; Selten 1967).

The exact question wording was:

"Now suppose you knew how much the other winner of the voucher was going to contribute. Please indicate how much you would like to give if the other winner of the voucher gives the following amount? Remember that any amount that you decide to give to the other winner is doubled."

The respondent then chose a value they would give if they knew the other winner contributed 0, 25, 50, 75, 100 \$/£/€.

Figure A-1 in the Appendix shows the 8,500 individual contribution mappings by country. This part of the survey was not explicitly incentivized. To probe whether this part of the survey generated differences in individuals' level of conditional cooperation, we used an individual's expectation about the other contribution and his/her strategy (which maps from other to own contribution) to generate the contribution we would expect him/her to make based on his/her answers in the strategy method part of the survey. The Appendix provides more details about this additional analysis and the results. We find a very strong positive correlation between individual's contribution choices in the payoff-relevant part of the survey and the strategy method part (see Table A-6 in the Appendix). This suggests that the answers in these two parts of the survey are consistent.

To explore the distribution of reciprocity types we code respondents depending on the functional form that relates their own contribution and the contribution by the other individual (the Appendix provides detailed coding rules). We use a slightly more fine-grained classification than previous work (Fischbacher et al. 2001; Thöni et al. 2012) and distinguish five types: Freerider, Positive Nonconditional, Positive Reciprocity, Inverse U-shaped Reciprocity, and Other. Respondents are coded as Freeriders if they always contribute less than 5 \$/£/€. We code an individual as Positive Nonconditional if she/he gives a constant positive contribution that does not vary across the different known values of the other winner's

contribution (graph is a horizontal line placed above 0). The horizontal line need not be perfectly flat but cannot vary across all values by more than 5 \$/£/€. Positive reciprocity types are individuals whose contributions increase monotonically and the total increase is greater than 5 \$/£/€. We also identify inverse U-shaped reciprocity types (sometimes called "triangle contributors", see Fischbacher and Gächter (2010)) whose contribution function is convex and the difference between the maximum and minimum contribution is greater than 5 \$/£/€. Types that do not fit any of the definitions above are coded as Other. We also reestimated all results using 10 \$/£/€ as the threshold. Our findings remain virtually identical.

Figure 1 shows the distributions of reciprocity types by country. Across all four countries we find largely similar distributions of individuals' strategy types. About 10% percent of the populations are Freeriders and roughly the same share can be classified as Positive Nonconditional. Between 40 and 50 % of the societies consists of positive reciprocators. About one third of our representative sample uses some other functional form to map from their other contributions to their own contribution level.

Results

Own Contribution Behavior and Expected Contributions

Figure 2 shows the distribution of individual contributions to the public good in the pooled data ($N = 8,500$). Only about 12% of the individuals in France, Germany, the United Kingdom, and the United States make zero contributions. The vast majority contributes substantively to the public good. The modal contribution is 50 €/£/\$, which is suggestive of an equity norm. Overall, contributions cluster at 0, 10, 20, 25, 50, and 100 €/£/\$ and the average contribution is 29.4 €/£/\$. The high percentage of respondents that contribute to the public good resonates with the main claim of the lab-experimental literature that cooperative behavior in public goods games is substantially more prevalent than predicted by

standard economic theory. Moreover, the average contribution implies a 29.4% of endowment contribution which is broadly similar to average values reported in laboratory studies for one shot static public goods games like ours.[2]

Figure 2 reveals substantial variation in the distribution of public goods contributions in a representative population. We first explore the socio-demographic distribution of cooperation. To this end, we constructed the variable *Own Contribution* equal to each respondent's stated contribution to the linear public goods game. Figure 3 reports the ordinary least squares coefficient estimates—with 95% confidence intervals based on heteroskedasticity-robust standard errors—for the regression of *Own Contribution* on indicator variables for sex, age, income, and education. The results are striking. In general, socio-demographic characteristics are uncorrelated with observed contribution behavior. The estimates reported in Figure 3 are small and statistically insignificant for age, income and education. The one exception to this pattern is that on average, women tend to contribute about 2 €/£/$ less than men. This general pattern is further confirmed by investigating other socio-demographic characteristics of respondents. We also found no significant differences in our pooled analyses by marital status, employment status, and ideology.[3] There is essentially little evidence in our data to suggest that certain types of socio-demographic groups are more likely to contribute in public goods games and thus that groups or places with a higher incidence of a given type are advantaged in providing public goods.[4]

Our primary interest is in determining the importance of conditional cooperation in

[2]For example, Fischbacher et al. (2001) report that the total average 'unconditional contribution' for a static one-shot public goods game is 33.5% of the initial endowment in their study.

[3]See Table A-2 in the Appendix for additional results including tobit estimations that accounting for the censoring of contributions at 0 and 100. In country-specific analyses, we also examined whether there were differences by partisan identification. In France, individuals identifying with the National Front on average contributed 5 € less than those not identifying with a party. In Germany, individuals identifying with the CDU on average contributed 4 € more than those not identifying with a party. We observed no significant partisan differences in the UK and the US though in the UK right ideology was modestly correlated with lower contributions.

[4]This evidence is informative for thinking about a number of potential explanations for variation in public goods contributions. For example, it is inconsistent with the idea that higher income individuals feel better able to afford contributions and thus cooperation is facilitated among higher income individuals. These results are also inconsistent with explanations based on the idea that higher educated individuals are better able to see the advantages of everyone contributing and thus cooperate more easily.

explaining contribution behavior in our large-scale, representative sample. We converted the continuous expected contribution measure into three indicator variables based on the 25th and the 75th percentile of the observed distribution and added them to the regression model. Figure 3 also reports these estimates. Compared to those with a low expected contribution (between 0 and below 3 €/£/$), respondents that expect a medium contribution (3 to below 50 €/£/$) decide to contribute about 24 €/£/$ more on average. Respondents that expect the other winner to make a high contribution (50 or more €/£/$) contribute about 50 €/£/$ more on average. We find that, when compared to coefficients on the socio-demographic variables, an individual's expectation about how much the other individual will contribute is, by far, the strongest predictor.

In an additional analysis reported in Table A-2 (Model 2) in the Appendix we add a large set of covariates including a variable that captures individuals' level of altruism using a quasi-behavioral measure of altruistic inclination. This measure is based on the following survey instrument: We informed respondents that we will raffle another 100 €/£/$ among all respondents that completed the survey and that the winner can decide to donate parts of the voucher to a charity. We then asked respondents whether they would like to donate in case they won a voucher. If respondents indicated that they wanted to donate, we offered a large list of charities from which individuals could choose and asked them about the amount they would like to give. We coded respondents as exhibiting a relatively high level of altruism if, within the group of those willing to donate, they donated a nonzero amount (which also was the median donation). Consistent with previous laboratory results, we find that more altruistic individuals contribute significantly more in the public good game, but we also find that the point estimates for the expected cooperation indicators remain largely unchanged even when accounting for altruism and other potential confounds. On average, compared to those with a low expected contribution, individuals that expect the other player to make a medium contribution to the public good (3 to below 50 €/£/$) decide to contribute about 22 €/£/$ more on average. Those who expect the other player to make a relatively high

contribution (50 or more €/£/$) contribute about 50 €/£/$ more on average.

We also reestimated the model separately for those randomly selected 50% of respondents that were first asked to indicate their own contribution and for the remaining 50% of respondents that were first asked to indicate their expectations about how much the other winner contributes. The results for these two subgroups are virtually identical (see Models 3 and 4 in Table A-2 in the Appendix). Overall, the findings from our representative sample are consistent with the view that reciprocity is an important norm that guides individual contribution behavior.

The Causal Effect of Expectations

The partial correlation between expectations about the cooperative behavior of others and an individual's own contribution may or may not reflect a causal relationship. It is quite possible that individuals with particular unobserved characteristics tend to be both more likely to think others will contribute generously and contribute more themselves making the reciprocity account of the observed correlation spurious. To estimate the causal effect of expected contribution behavior in representative samples we exploit the randomized experiment embedded in the instructions for the public goods game. We regress an individual's own contribution decision on the treatment indicator *Other Contribution Treatment: High* which equals 1 if the respondent received instructions in which the other winner's contribution was 30, 60, or 90 €/£/$ and is zero otherwise. The results are identical when we create indicator variables for all treatment conditions (see Table A-5. Model 1 in Table 1 shows the reduced form results. We find that individuals in the high other contribution treatment contribute 2.4€/£/$ more than respondents in the low other contribution treatment and that this estimate is almost identical when we add a full set of socio-demographic covariates, country fixed effects, and controls for the own contribution treatment frame.

To estimate the causal effect of expectations about the other winner's contribution on own contributions, we use *Other Contribution Treatment: High* as an instrument for *Expected*

Contribution. This instrumental variable estimation assumes that (a) the randomly assigned treatment *Other Contribution Treatment: High* encourages respondents to have higher expectations about the other winner's contribution and (b) that there is no other direct effect of this treatment on own contributions. Models 3 and 4 in Table 1 report results from a regression of *Expected Contribution* on *Other Contribution Treatment: High* that support the first assumption. We find that individuals in the high other contribution treatment expect about 1.7€/£/$ higher contributions from the other winner than respondents in the control group. Although the second assumption (the exclusion restriction) cannot be tested, it appears plausible since the treatment is a randomly assigned specific suggestion about the other winner's contribution.

Models 5 and 6 in Table 1 report the instrumental variable estimates of the causal effect of *Expected Contribution* on *Own Contribution*. A one €/£/$ increase in the contribution that an individual expects from the other winner increases own contributions by about 1.4 €/£/$. This estimate suggests that individuals over-reciprocate. However, when we construct a 95% confidence interval for this estimate, we find that the estimate is not significantly greater than 1 (the interval is $(0.65, 2.11)$). This effect size is close to what previous lab-experimental work has reported (Fischbacher and Gächter 2010) and even closer to results based on a heterogeneous sample of adults in Denmark (Thöni et al. 2012).

A natural interpretation of these findings is that not only do reciprocity norms play an important causal role in explaining cooperative behavior but also the socio-demographic characteristics of individuals are not particularly important in understanding such behavior. This would seem to imply that evidence based on non-representative samples readily generalizes to the population. A potential problem with this interpretation is that we do not know how precisely individuals condition on their expectations about the contributions of others in representative samples, what the distribution of reciprocity types is across socio-demographic groups, and whether these reciprocity types moderate the causal effect of beliefs.

The Socio-Demographics of Reciprocity Type

As discussed above, we determined each individual's reciprocity type using the strategy method and classified respondents as Freerider, Positive Nonconditional, Positive Reciprocity, Inverse U-shaped Reciprocity, and Other types. To examine socio-demographic variation in the use of reciprocal strategies, Figure 4 shows the estimated change in the probability of observing a given strategy type for a given demographic change holding all other variables at their means (the multinomial logit coefficients used for these simulations are reported in Table A-7 in the Appendix). The interesting pattern revealed in the figure is that female, younger, wealthier, and highly educated respondents are all more likely to use positive reciprocity strategies. For example, the probability of Positive Reciprocity is 11 percentage points higher among high education respondents compared to the lower educated reference group. Overall, these results suggest that a group's socio-demographic composition matters for which reciprocity types are more prevalent. Variation in the socio-demographic composition of strategy types leaves open the possibility that some demographic groups may find it easier to cooperate than others. More specifically, groups for which positive reciprocity strategies are more prevalent may be more likely to respond to policy and institutional interventions that seek to raise expectations about the cooperative behavior others.

To explore these socio-demographic differences further, we investigate whether among the plurality of individuals who employ positive reciprocal strategies, there is variation in the responsiveness of cooperative behavior to changes in expectations. Although positive reciprocity generally facilitates cooperative behavior, the long-term evolution of cooperation depends on the elasticity of conditional cooperation. The higher the elasticity of conditional cooperation, the better the prospects for lasting cooperation (Fischbacher and Gächter 2010).[5].

[5]Cooperation failure can result from imperfectly conditional cooperation when for any additional unit contributed by the other, an individual contributes less than one unit. If these actors play against each other repeatedly, contributions will converge to zero over time, a prediction supported by previous lab-experimental results (Fischbacher and Gächter 2010)

To estimate the socio-demographic distribution of contribution elasticity, we first estimated an auxiliary regression for each respondent in which we regressed her/his contribution on a variable that indicated the amount given by the other person (0, 25, 50, 75, and 100 €/£/$). We then model an individual's contribution elasticity as a function of a full set of income, age, gender, and education indicator variables. Model 1 in Table 2 shows the results. We find significant differences in the distribution of contribution elasticity across socio-demographic groups. On average, female individuals have lower elasticities than male respondents. We also find, in line with our results on the socio-demographic distribution of strategy types, that older individuals exhibit less strongly reciprocal contribution schedules. Finally, those with higher levels of income and the more educated have significantly larger contribution elasticities. These findings remain virtually identical when adding additional covariates and when re-estimating the results using a tobit model. Overall, even when focusing on those parts of society that generally employ conditionally cooperative strategies, we find that some socio-demographic groups – male, younger, richer, and more educated individuals – appear to be significantly more conditionally cooperative than others.

The Causal Effect of Expectations by Reciprocity Type

We now explore whether reciprocity type conditions the cooperation-enhancing effect of expectations about the contribution behavior of others. Specifically, we expect that the causal effect of these expectations should be most evident for Positive Reciprocity types. To evaluate this prediction we reestimate the instrumental variable models presented in Table 1 by strategy type. The results reported in Table 3 support our conjecture. The causal effect of expected contribution is strongest among positive reciprocity types with a highly significant IV estimate of 1.3. In contrast, the estimates for Freerider, Inverse U-shaped Reciprocity, and Other are all statistically insignificant. The IV estimate for this group is 1.26 with a standard error of 0.503. The estimates for Freerider, Inverse U-Shaped Reciprocity, and Other strategy types are all statistically insignificant. For the remaining category of Positive

Nonconditional types, the IV coefficient is smaller (0.89) and only marginally significant. This finding may be explained by guilt aversion (Battigalli and Dufwenberg 2007), although we lack the information about respondents' higher order beliefs that would be necessary to explore the empirical validity of this argument in detail.[6]

Discussion

Societies in which individuals succeed in solving cooperation problems that allow for profitable exchanges have better prospects to grow and develop. The available lab-experimental studies investigating why groups succeed or fail in solving social dilemmas emphasize that individuals cooperate more than predicted by standard economic theory and that the willingness to cooperate is sensitive to expectations about the willingness of others to cooperate—reciprocity is an important feature of human behavior (Fehr and Fischbacher 2002; Fehr and Schmidt 2006; Ostrom 2000). These conclusions and many others in this literature are largely based on the behavior of students and other selected populations in a laboratory setting. Although a great deal has been learned from this research, an obvious concern—one shared by many of the contributors to this literature—is that representative populations might behave differently. A number of previous empirical studies have begun to try to address this issue by studying behavior in social dilemmas in diverse and even relatively large groups of subjects (see, for example, Baldassari and Grossman (2013) and Habyarimana, Humphreys, Posner and Weinstein (2009)). With just a few exceptions, however, these existing studies are still based on selected and not nationally representative samples.

Extending our knowledge of how individuals behave in social dilemmas to representative samples has the potential to answer several fundamental questions. For example, are some

[6]We also evaluated the importance of strategy type for explaining the effect of expectations of other contributions by reestimating by strategy type our baseline OLS regressions of *Own Contribution* on expected contributions and socio-demographic characteristics presented in Figure 3. Table A-3 in the Appendix reports these results which indicate larger coefficient estimates on our expected contribution measures for positive reciprocity types, providing further support for the idea that reciprocity type conditions the cooperation-enhancing effects of expectations about the contribution behavior of others.

demographic groups more likely to cooperate and if so why? Is the effect of social norms such as reciprocity or altruism causal? And do students and the general population differ in how much they react to the behavior of others? We need answers to these and other related questions to determine a baseline level of cooperative behavior among humans and how difficult it will be for different communities to solve social dilemmas. The answers also matter for understanding the potential effectiveness of different policy or institutional interventions to increase cooperation.

In this study, we start to contribute to this agenda by focusing on behavior in a public goods problem and specifically on the role of reciprocity in explaining cooperation. Our study, based on representative samples in France, Germany, the United Kingdom, and the United States, provides strong evidence that many important insights about behavior in public goods games observed among students and other selected populations are also evident in representative samples. We find that average contributions as a proportion of initial endowment are quite similar to those reported in studies with student subjects. Most importantly, we find that expectations about the contributions of others are strongly correlated with own contributions—reciprocity is central for understanding public good contributions. Moreover, we implement a new research design for establishing that this relationship is causal. Our causal estimate based on representatives samples further underscores the importance of reciprocity as promoting cooperation in industrialized countries.

In addition, we provide several results that are either in tension with findings in studies on students and selected samples or not previously explored. When coding the distribution of reciprocal types we find generally similar patterns across our four countries with Positive Reciprocity types constituting a plurality of respondents (generally between 40 and 50 percent) and with Freeriders making up about 10 percent of the distribution. We also find that nearly 30 percent of our respondents do not employ a conventional mapping strategy between the contributions of others and their own contributions. Most importantly, we document that the causal effect of expectations about the contributions of others is only

clearly evident among respondents coded as positive reciprocity types. This finding carries important policy implications: Policy and institutional interventions that seek to increase cooperation by changing expectations about the behavior of others are likely to only be effective in groups with a relatively high number of positive reciprocity types. Crucially, our results also indicate that these types are not equally distributed in the population with younger, richer, and more educated individuals more likely to employ positive reciprocity types and thus be more likely to respond to treatments that manipulate expectations about others cooperative behavior. We even find that within the group of positive reciprocity types these same demographic groups tend to respond more strongly to differences in expectations.

An important implication of these results is that specific socio-demographic groups within societies and the regions or countries in which they concentrate may enjoy an advantage in solving public goods problems. This is because cooperative behavior by these individuals reacts positively to institutions that stabilize expectations about the cooperative behavior of others. Thus, institutions will be most effective among socio-demographic groups in which positive reciprocity is more widespread. In contrast, societies that tend not to employ positively reciprocal strategies, institutions that increase expectations about other individuals' contributions will have relatively small or even no effects. If, for example, individuals do not play conditionally cooperative strategies, institutions that increase expectations about other individuals' contributions will have at best small effects. In contrast, such institutions will have positive effects in populations that indeed use positively reciprocal strategies. Consequently, policymakers and scientists engaging in the design of institutions to facilitate solving cooperation problems can improve the effectiveness of policy interventions by taking into account which types of strategies individuals in the target population employ and how these are distributed.

Our results also have noteworthy consequences for future research on behavior in social dilemmas. We have focused on static public goods problems and reciprocity in four advanced industrial democracies. Although some results based on lab-experiments seem to generalize

to overall populations, we find significant heterogeneity in the use of conditionally cooperative strategies across socio-demographic parts of societies. Thus, our findings demonstrate that representative surveys may be a necessary complement to the use of non-representative samples in lab and lab-in-the field experiments to gain a more complete picture of behavior in social dilemmas. For example, future research could explore different social dilemmas or the effects of different social norms such as altruism and inequality aversion. Extending our line of research to games in repeated settings would also be productive. Further research could also focus on studying representative samples in countries that vary in salient features such as levels of development and political institutions.

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Tables

	(1)	(2)	(3)	(4)	(5)	(6)
	Reduced Form		IV First Stage		IV	
Outcome Variable	Own Contribution		Expected Contribution		Own Contribution	
Expected Contribution (IV)					1.38***	1.45***
					(0.372)	(0.389)
Other Contribution Treatment: High	2.38***	2.45***	1.73***	1.70***		
	(0.658)	(0.657)	(0.649)	(0.646)		
Female		-2.73***		-2.02***		0.19
		(0.581)		(0.567)		(0.987)
Age: 30-49		1.52*		0.49		0.81
		(0.905)		(0.905)		(0.950)
Age: 50-69		1.34		0.45		0.70
		(0.876)		(0.872)		(0.923)
Age: 70+		-0.12		-0.47		0.56
		(1.340)		(1.311)		(1.305)
Income: Middle		0.63		0.04		0.60
		(0.794)		(0.792)		(0.831)
Income: High		1.15		0.71		0.16
		(0.886)		(0.882)		(0.949)
Education: High		0.23		-1.37**		2.21***
		(0.619)		(0.610)		(0.823)
Country Fixed Effects	No	Yes	No	Yes	No	Yes
Own Contribution Treatment	No	Yes	No	Yes	No	Yes
Root MSE	26.21	26.12	25.59	25.44		
F Test of Excluded Instrument			7.05	6.90		
Observations	8,498	8,497	8,498	8,497	8,496	8,495

Table 1: *The Causal Effects of Cooperative Environment on Own Contributions.* This table reports coefficients, robust standard errors (in parentheses) and p-values from several regression analyses (*** $p < .01$, ** $p < .05$, *$p < .10$). Columns 1 and 2 report reduced form OLS regression results of *Own Contribution* on the *Other Contribution Treatment: High* which is equal to 1 if the randomized example of the other lottery winner's contribution is equal to 30, 60, or 90 and equal to zero if it is 10. Columns 3 and 4 report the first stage regression of *Expected Contribution* on *Other Contribution Treatment: High*. Columns 5 and 6 report the instrumental variable estimates of *Own Contribution* on *Expected Contribution* using *Other Contribution Treatment: High* to instrument for *Expected Contribution*.

	(1) Basic	(2) Extended	(3) Tobit
Female	-0.051***	-0.049***	-0.049***
	(0.010)	(0.010)	(0.010)
Age: 30-49	-0.023*	-0.019	-0.019
	(0.013)	(0.014)	(0.014)
Age: 50-69	-0.103***	-0.096***	-0.096***
	(0.014)	(0.015)	(0.015)
Age: 70+	-0.124***	-0.108***	-0.108***
	(0.027)	(0.029)	(0.029)
Income: Middle	0.015	0.014	0.014
	(0.014)	(0.015)	(0.015)
Income: High	0.032**	0.031*	0.031*
	(0.015)	(0.016)	(0.016)
Education: High	0.042***	0.040***	0.040***
	(0.011)	(0.011)	(0.011)
Altruism: High		-0.020	-0.020
		(0.019)	(0.019)
Married		-0.001	-0.001
		(0.002)	(0.002)
Separated		-0.021**	-0.021**
		(0.011)	(0.011)
Divorced		-0.013	-0.013
		(0.014)	(0.014)
Widowed		-0.041	-0.041
		(0.037)	(0.037)
Domestic Partnership		-0.023	-0.023
		(0.020)	(0.020)
Unemployed		-0.055*	-0.055*
		(0.033)	(0.033)
Ideology		-0.022	-0.022
		(0.017)	(0.017)
Germany	0.007	0.002	0.002
	(0.014)	(0.014)	(0.014)
United Kingdom	0.049***	0.048***	0.048***
	(0.014)	(0.014)	(0.014)
United States	0.032**	0.032**	0.032**
	(0.014)	(0.014)	(0.014)
Constant	0.675***	0.700***	0.700***
	(0.018)	(0.022)	(0.022)
Observations	3,672	3,672	3,672
R-squared	0.051	0.053	

Table 2: *The Socio-demographic Correlates of Contribution Elasticity.* This table reports coefficients, robust standard errors (in parentheses) and p-values from several regressions of contribution elasticity on socio-demographic variables (*** $p < .01$, ** $p < .05$, *$p < .10$). Columns 1 and 2 report OLS regressions. Column 3 reports tobit estimates.

	Freerider	Positive Nonconditional	Positive Reciprocity	Inverse U-shaped Reciprocity	Other
Expected Contribution (IV)	-1.73	0.89*	1.26**	0.46	-3.80
	(4.097)	(0.469)	(0.502)	(4.836)	(14.944)
Female	-1.77	-1.70	-0.52	-0.18	-19.76
	(2.826)	(2.423)	(1.239)	(10.697)	(63.476)
Age: 30-49	16.36	5.16	0.20	6.03	22.58
	(25.043)	(5.176)	(1.939)	(10.783)	(64.415)
Age: 50-69	3.65	7.90*	1.75	2.60	-0.52
	(7.978)	(4.446)	(1.882)	(22.548)	(13.467)
Age: 70	-3.87	-0.56	-1.23	-2.16	-13.40
	(8.374)	(3.361)	(1.211)	(7.085)	(44.900)
Income: Middle	1.64	-0.69	1.26	1.51	5.62
	(3.048)	(2.186)	(1.161)	(21.094)	(16.833)
Income: High	-1.76	-0.72	0.18	-0.88	3.65
	(4.748)	(3.045)	(1.098)	(56.044)	(11.279)
Education: High	-0.88	4.45***	1.96**	1.83	2.22
	(2.090)	(1.694)	(0.889)	(22.492)	(7.933)
County Fixed Effects	yes	yes	yes	yes	yes
Own Contribution Treatment	yes	yes	yes	yes	yes
Observations	927	1,130	3,727	409	1,908

Table 3: *The Causal Effects of Cooperative Environment on Own Contributions by Strategy Type.* This table reports instrumental variable estimates of *Own Contribution* on *Expected Contribution* using *Other Contribution Treatment: High* to instrument for *Expected Contribution.* Robust standard errors are shown in parentheses (*** $p < .01$, ** $p < .05$, *$p < .10$).

Figures

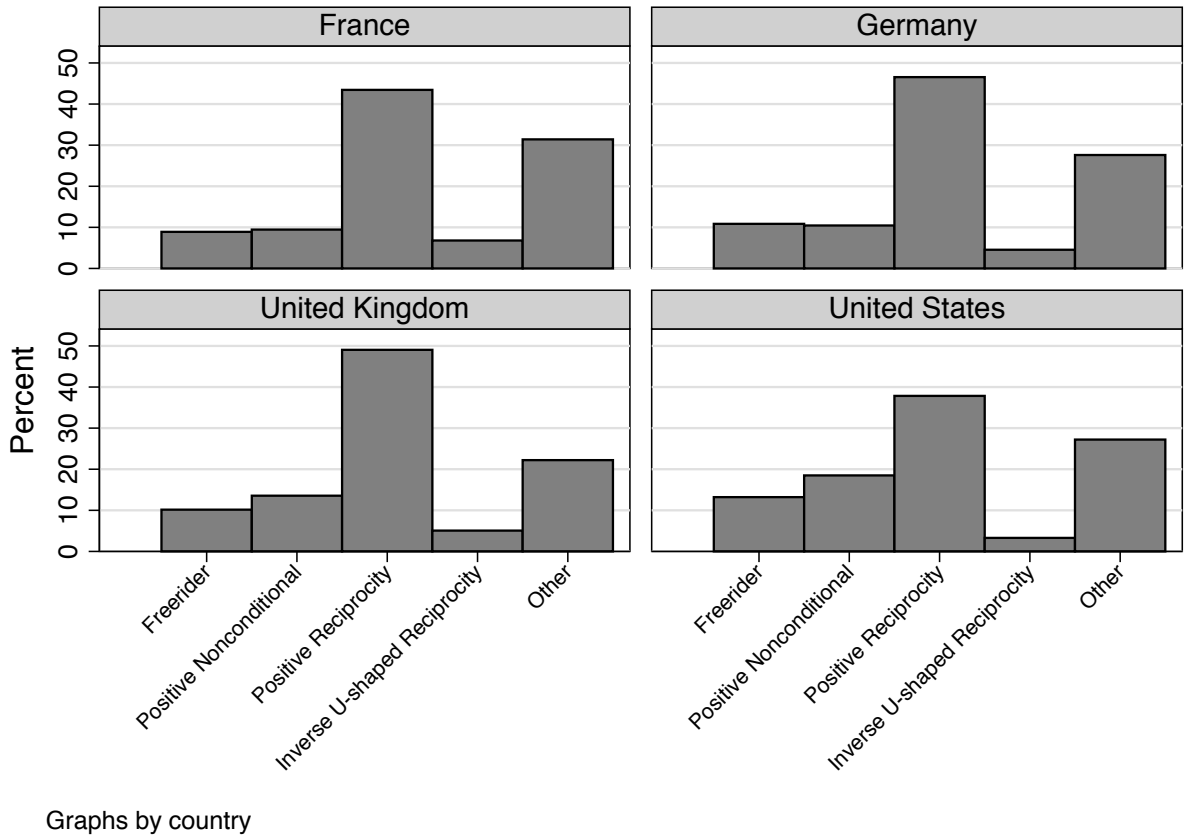

Figure 1: *Distributions of Strategy Types by Country.* This plot shows the distribution of individuals' strategy types. Strategies are elicited using the Strategy method (see section on "Coding of Strategies" for details).

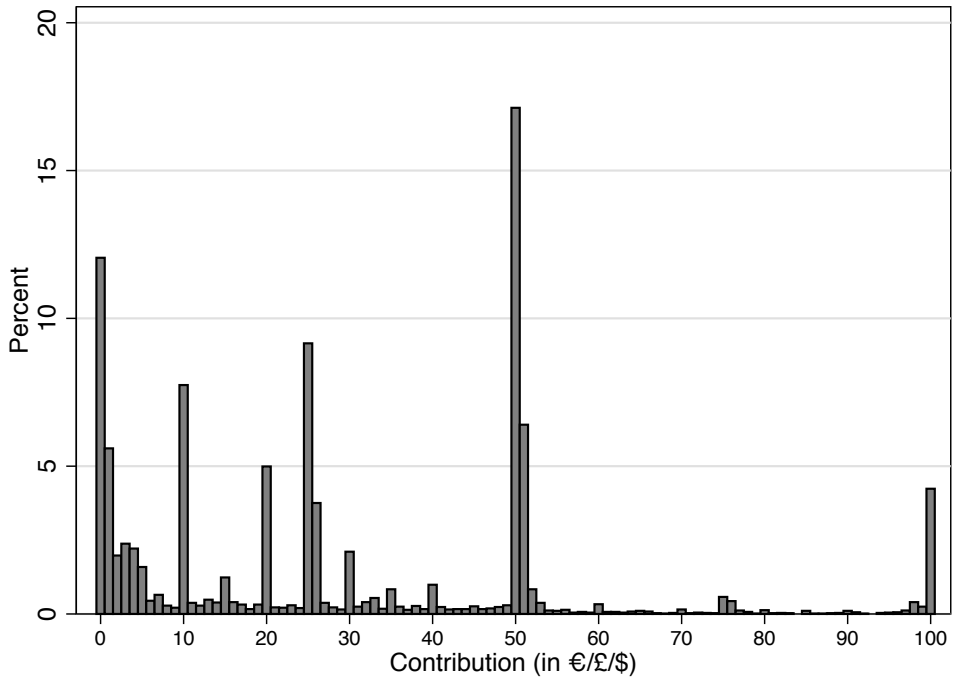

Figure 2: *Distribution of Own Contributions to the Public Good in Representative Samples.* The plot shows the distribution of contributions to the public good (pooled data, $N = 8,500$). Countries included are France ($N = 2,000$), Germany ($N = 2,000$), the United Kingdom ($N = 2,000$), and the United States ($N = 2,500$).

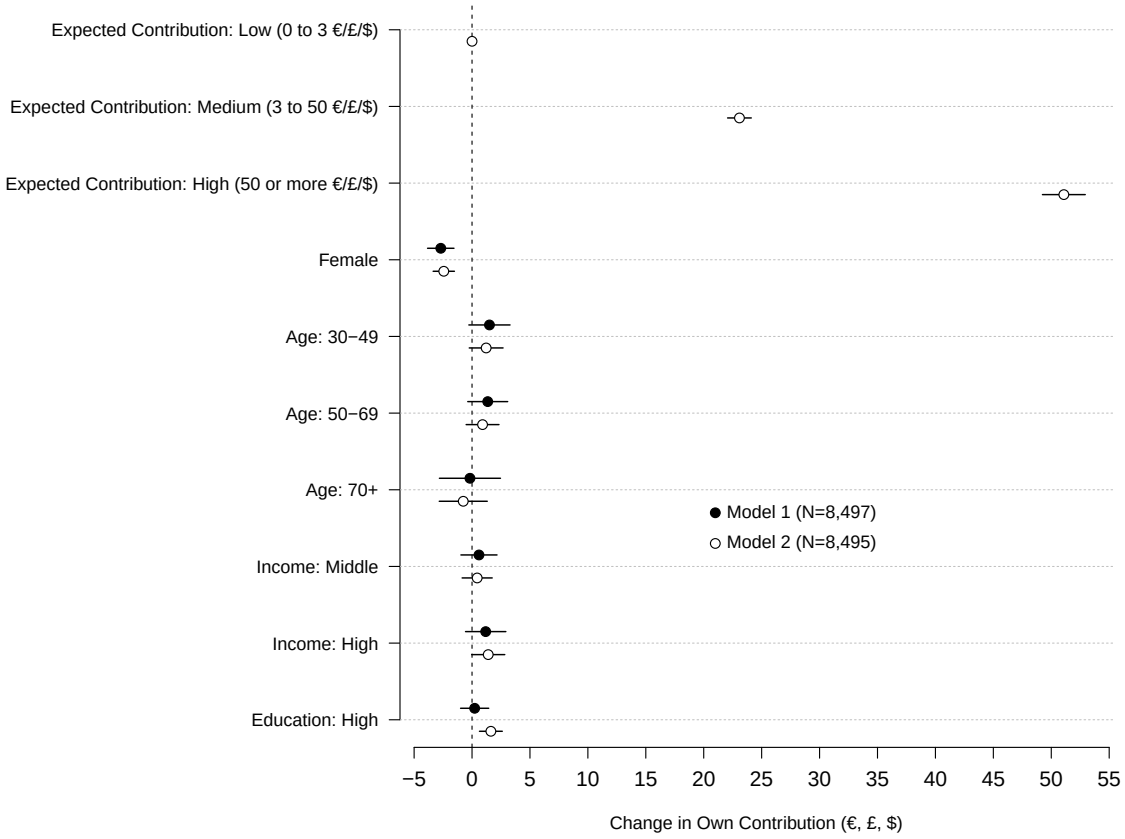

Figure 3: *Correlates of Cooperative Behavior in France, Germany, the United Kingdom, and the United States (pooled data).* This plot shows OLS coefficients (dots) and 95% confidence intervals computed from heteroskedasticity-robust standard errors (Model 1 $N = 8,497$, Model 2 $N = 8,495$). Expected contribution is measured using the following question: "How much do you think the other winner will contribute?" Answers were coded using three categories based on the distribution of responses. Expected contributions are coded as low if the respondent expects the other winner to contribute below 3€/£/$ (25th percentile). Expected contributions are coded as medium if the expected contribution is between 3€/£/$ and below or equal to 50€/£/$ (75th percentile), and high if the expected contribution is greater than 50€/£/$. The coefficient without a confidence interval indicates the reference group (Expected Contribution: Low). All models include country fixed effects.

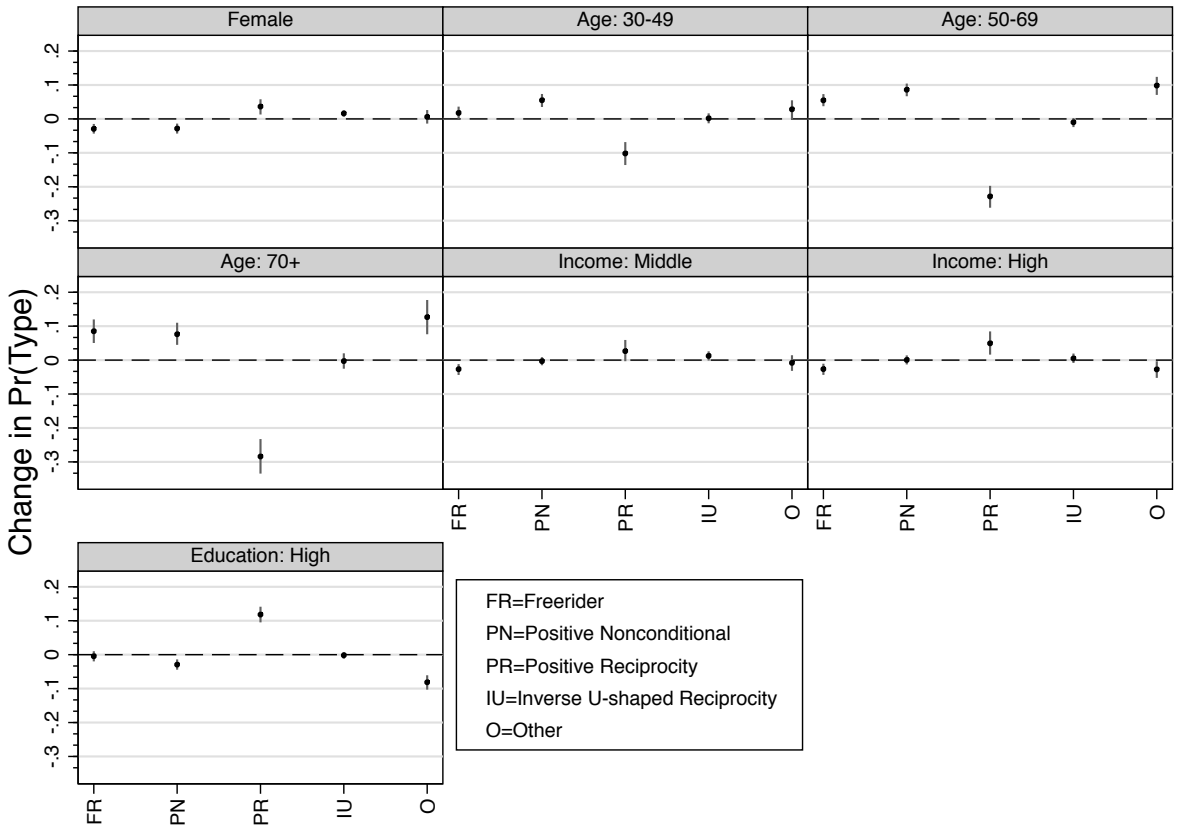

Figure 4: **The Socio-demographics of Strategy Types in France, Germany, the United Kingdom, and the United States (pooled data)**. This plot shows how the probability of a specific strategy type responds to a change in socio-demographic variables together with 95% confidence intervals computed from heteroskedasticity-robust standard errors. The simulations are based on results from a multinomial logistic regression (see Table A-7) and were implemented using Clarify (King et al. 2000). For *Female* the simulated change is from male to female respondents. For all age variables the reference group is *Age:* < 30. For all income variables the reference groups is *Income: Low*. For *Education: High* the reference group is *Education: Low*.

A Survey Sample

The online survey was carried out by YouGov. YouGov employs a carefully executed opt-in panel together with matched sampling to approximate a random sample of the adult population (Rivers 2011). Matched sampling involves taking a stratified random sample of the target population and then matching available internet respondents to the target sample. Previous work (Ansolabehere and Rivers 2013; Ansolabehere and Schaffner 2013) shows that matched sampling produces accurate population estimates and replicates the correlational structure of random samples using telephones and residential addresses.

The sampling procedure looked as follows. First, a target frame was constructed using official statistics on the distribution of socio-demographic in the national population. Within each strata respondents from YouGouvs online panel were chosen by weighted sampling with replacement based on a proximity matching method. The matching method measured how close a member of the panel was to a member of the target sample on a range of variables. Survey respondents were selected based on the proximity of the overall distance as measured by the weighted sum of the individual distance functions on each attribute. The matching variables were:

- France (2,000): Age, gender, education.
- Germany (N=2,000): Age, gender, education.
- United Kingdom (N=2,000): Age, gender, education, region.
- United States (N=2,500): Gender, age, race, education, party identification, ideology, and political interest.

Since matching is approximate, survey weights were computed based on official information about the distribution of socio-demographic characteristics to eliminate remaining imbalances. Table A-1 shows the distributions of socio-demographic variables in the population, the weighted sample, and the raw sample.

B Eliciting and Coding Individuals' Conditional Contribution Schedules

The second part of the survey asked respondents about their conditional contribution schedules. To determine individuals' reciprocity types, immediately after our survey respondents played the payoff-relevant public goods game, we asked them to indicate how their own contribution potentially depends on the other individual's contribution (Rauhut and Winter 2010; Fischbacher et al. 2001; Selten 1967). The exact question wording was:

"Now suppose you knew how much the other winner of the voucher was going to contribute. Please indicate how much you would like to give if the other winner of the voucher gives the following amount? Remember that any amount that you decide to give to the other winner is doubled."

The respondent then chose a value they would give if they knew the other winner contributed 0, 25, 50, 75, 100 $/£/€.

Using the information respondents provided about their conditional contribution schedules we plotted these schedules for all 8,500 respondents. We then coded each respondent in one of the following categories:

1. Free-riders: The respondent always contributes less than 5
2. Positive nonconditional: The respondent gives a constant positive contribution. The contribution does not vary across the different known values of the other winner's contribution (graph is a horizontal line placed above 0). The horizontal line need not be perfectly flat but cannot vary across all values by more than 5
3. Positive reciprocity: Contributions increase monotonically and the total increase is greater than 5
4. U-shaped reciprocity: The contribution function is convex and the difference between max and min contribution is greater than 5
5. Other: All cases that do not fit the six definitions above.

C Payoff-relevant Contributions and Contributions in the Strategy Method

The survey had two parts. The first part was the payoff-relevant public good game. The pay-off relevance of the contribution choice was made explicit. The second part used the strategy method to elicit respondents contribution schedules. This part of the survey was not explicitly incentivized. However, individuals responses in these two parts of the survey remain very consistent (see below). The exact question wording was:
"Now suppose you knew how much the other winner of the voucher was going to contribute. Please indicate how much you would like to give if the other winner of the voucher gives the following amount? Remember that any amount that you decide to give to the other winner is doubled."
The respondent then chose a value they would give if they knew the other winner contributed 0, 25, 50, 75, 100 $/£/€.

To explore whether the two parts generated differences in individuals level of conditional cooperation, we use an individuals expectation about the other contribution and his/her strategy (which maps from other to own contribution) to generate the contribution we would expect him/her to make based on his/her answers in the strategy method part of the survey. Since we have values from 0 to 100 (in steps of 25), we used the following bins to map from beliefs to predicted contributions:

- If the stated expectation in the payoff-relevant public goods game is below 12.5, an individuals predicted contribution is the contribution that she/he said she/he would make if the other gave 0 in the strategy method part

- If the stated expectation in the payoff-relevant public goods game is between 12.5 and 37.5, an individuals predicted contribution is the contribution that she/he said she/he would make if the other gave 25 in the strategy method part
- If stated expectation in the payoff-relevant public goods game is between 37.5 and 62.5, an individuals predicted contribution is the contribution that she/he said she/he would make if the other gave 50 in the strategy method part
- If stated expectation in the payoff-relevant public goods game is between 62.5 and 87.5, an individuals predicted contribution is the contribution that she/he said she/he would make if the other gave 75 in the strategy method part
- If stated expectation in the payoff-relevant public goods game is between 87.5 and 100, an individuals predicted contribution is the contribution that she/he said she/he would make if the other gave 100 in the strategy method part.

  We also used an alternative coding with 10 as the critical threshold instead of 5. The results remain very similar.

Clearly, this introduces some measurement error since we do not have a continuous contribution function, but since expectations measured in the payoff-relevant public goods game already cluster around these values, the measurement error likely is smaller than one would expect. Also, the measurement error would bias the results against our conjecture that there is a very strong positive correlation between individual's contribution choices in the payoff-relevant part of the survey and the strategy method part.

We find that there is a strong positive and significant correlation between an individual's own contribution in the payoff-relevant public goods game and the contribution one would predict based on his/her answers in the strategy method part (the correlation is .76 with p¡.001). Table A-6 shows the results from several regression models in which we explore whether the results based on the payoff relevant part of the survey differ from those measured in the strategy method part that was not explicitly incentivized. Specifically, we estimated three regressions that are reported in Table A-6.

- Model 1: Regression of own contribution on socio-demographics
- Model 2: Regression of predicted own contribution on socio-demographics
- Model 3: Regression of the difference between own contribution and predicted own contribution on socio-demographics. This model provides us with the difference in the two coefficients from the first two models. A negative sign means that this socio-demographic group should give less according to its strategy and a positive sign means that the group should contribute more on average given their contribution schedules as measured in the strategy method part of the survey.

We find that the results for predicted own contribution based on the strategy method (which was not explicitly payoff-relevant) are very similar to those for observed own observed contribution in the payoff-relevant public good game. There are only minor significant socio-demographic differences: Older respondents (over 70) and those between 50 and 59 should

give slightly more according to their strategy while highly educated should give somewhat less (about 1.2 $/£/€ on average). All other socio-demographic and political variables are not significant (and their coefficients in models 1 and 2 not significantly different from each other).

D Appendix Tables

	Population (%)	Weighted Sample (%)	Raw Sample (%)
France (N=2,000)			
Age: 18-39	31.6	31.6	30.6
Age: 40-54	28.5	25.9	26.8
Age 55+	39.9	42.6	42.7
Gender: Male	47.6	47.6	47.7
Gender: Female	52.4	52.4	52.4
Education: CAP/BEP or less	59.8	59.8	59.1
Education: Bac to Bac+2	27.5	27.5	28.2
Education: Bac+3 or more	12.7	12.7	12.8
Germany (N=2,000)			
Age: 18-39	23.1	23.1	24.8
Age: 40-54	36.6	36.6	32.3
Age 55+	40.3	40.3	42.9
Gender: Male	49	49	49
Gender: Female	51	51	51.1
Education: 16 or fewer	43.4	43.6	42.5
Education: 17 to 19 yrs	33	33.3	34.8
Education: 20 yrs or more	23.6	23.1	22.8
United Kingdom (N=2,000)			
Age: 18-34	23.4	23.4	25.4
Age: 35-54	33.7	33.7	44.6
Age 55+	42.9	43	30
Gender: Male	47.3	47.3	47.3
Gender: Female	52.7	52.7	52.7
Education: 16 or fewer	55.3	53.5	50.4
Education: 17 to 19 yrs	21.2	23	24.7
Education: 20 yrs or more	23.5	23.6	25
United States (N=2,500)			
Age: 18-34	29.5	27.1	19.4
Age: 35-54	38.5	34	32.4
Age 55+	32.1	39	48.1
Gender: Male	48.2	48.3	47.6
Gender: Female	51.8	51.2	52.4
Education: HS or less	45	44.9	39.7
Education: Some college	30	22.2	23.4
Education: College graduate	16.3	24	27.5

Table A-1: *Distributions of Socio-demographics in the Survey Sample and the Population.* The table shows the distributions of socio-demographics in the population, the weighted sample, and the raw sample. The population socio-demographics are taken from the following sources: France: French Statistical Office, 2009 Population Census. Germany: Sept-Oct 2011 Eurobarometer. France: Aug-Sept 2010 Eurobarometer. United States: 2007 American Community Survey, 2008 Current Population survey, 2007 Pew Religious Landscape Survey.

	(1) Socio-demographics	(2) Socio-demographics and Expectations	(3) Own Contribution Asked First	(4) Expectation Other Asked First	(5) Tobit
Expected Contribution: Medium (3-50$/£/€)		22.20***	23.09***	23.27***	31.11***
		-0.54	-0.751	-0.721	-0.693
Expected Contribution: High (¿50$/£/€)		50.37***	51.71***	50.78***	61.08***
		-0.944	-1.383	-1.285	-1.147
Female	-2.58***	-2.31***	-2.39***	-2.41***	-2.30***
	-0.582	-0.471	-0.674	-0.65	-0.548
Age: 30-49	2.02**	1.55**	1.97*	0.42	1.59*
	-0.948	-0.781	-1.064	-1.041	-0.882
Age: 50-69	1.64*	1.07	2.02*	-0.27	1.38
	-0.991	-0.819	-1.033	-1.009	-0.855
Age: 70+	-0.68	-1.05	-0.31	-1.27	-0.27
	-1.455	-1.166	-1.5	-1.49	-1.235
Income: Middle	0.13	0.15	0.09	0.91	0.68
	-0.83	-0.689	-0.963	-0.91	-0.772
Income: High	0.52	0.94	1.43	1.42	1.54*
	-0.963	-0.794	-1.051	-1.007	-0.856
Education: High	-0.04	1.48***	1.58**	1.70**	1.72***
	-0.619	-0.506	-0.729	-0.691	-0.586
Altruism: High	9.29***	5.71***			
	-0.678	-0.602			
Married	-0.28	-0.16			
	-0.883	-0.736			
Separated	-3.14*	-2.59*			
	-1.774	-1.461			
Divorced	-1.22	-0.97			
	-1.141	-0.933			
Widowed	-0.75	-1.11			
	-1.639	-1.377			
Domestic Partnership	-0.63	-1.22			
	-1.06	-0.869			
Unemployed	-0.86	-0.35			
	-1.159	-0.952			
Ideology	0.02	0.04			
	-0.121	-0.099			
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	8,495	8,493	4,238	4,257	8,495
R-squared	0.029	0.362	0.346	0.364	

Table A-2: *The Socio-demographic Correlates of Contributions.* This table reports results from regressions of individuals' own contribution behavior on socio-demographic variables and expected contributions by the other player. Own contribution is measured by individuals contribution behavior in the payoff-relevant public good game. Models 1 to 4 are OLS estimates. Model 3 reports results from those randomly chosen respondents that were first asked to indicate their own contribution. Model 4 reports results from those randomly chosen respondents that were first asked to indicated the contribution they expected from the other player. Model 5 reports Tobit estimates. Constant included but not reported. Robust standard errors reported in parentheses (*** $p < .01$, ** $p < .05$, *$p < .10$).

	(1) Freerider	(2) Positive Nonconditional	(3) Positive Reciprocity	(4) Inverse U-shaped Reciprocity	(5) Other
Expected Contribution: Medium	4.84***	3.74	21.85***	18.67***	18.88***
	(1.413)	(3.198)	(0.678)	(2.478)	(1.641)
Expected Contribution: High	9.19	36.22***	54.95***	43.13***	43.01***
	(5.679)	(3.829)	(1.731)	(3.728)	(1.864)
Female	-0.65	-3.99***	-2.62***	-1.16	-1.56*
	(0.792)	(1.516)	(0.639)	(2.064)	(0.908)
Age: 30-49	-0.17	-5.61*	1.47	2.16	0.06
	(1.838)	(3.112)	(0.907)	(3.338)	(1.651)
Age: 50-69	-2.35	-5.33*	1.09	-0.08	-0.32
	(1.667)	(3.024)	(0.913)	(3.254)	(1.533)
Age: 70	-2.25	-6.78*	-0.06	-0.20	-2.31
	(1.807)	(3.964)	(1.466)	(4.698)	(1.987)
Income: Middle	1.67	0.53	0.68	-0.40	-0.31
	(1.265)	(2.151)	(0.953)	(2.906)	(1.205)
Income: High	0.10	3.60	0.91	-2.64	1.28
	(1.040)	(2.370)	(1.026)	(3.429)	(1.364)
Education: High	-0.78	5.07***	1.75**	2.80	1.33
	(0.752)	(1.637)	(0.687)	(2.255)	(0.973)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	927	1,130	3,727	409	2,302
R-squared	0.088	0.238	0.374	0.320	0.279

Table A-3: *The Correlates of Contributions by Reciprocity Type.* This table reports coefficients from OLS regressions of own contribution behavior on expected contributions and socio-demographics by reciprocity type. Robust standard errors are reported in parentheses (*** $p < .01$, ** $p < .05$, *$p < .10$).

	(1) All	(2) Freerider	(3) Positive Nonconditional	(4) Positive Reciprocity	(5) Inverse U-shaped Reciprocity	(6) Other
Own Contribution Treatment: Medium Low (30)	2.92***	-0.24	3.46	2.96***	-1.65	2.49*
	(0.811)	(0.955)	(2.416)	(1.125)	(3.304)	(1.499)
Own Contribution Treatment: Medium (60)	2.03**	0.71	3.44	1.74	1.65	0.25
	(0.816)	(1.089)	(2.320)	(1.140)	(3.390)	(1.541)
Own Contribution Treatment: High (90)	2.41***	2.13*	2.78	1.06	-0.06	1.23
	(0.805)	(1.264)	(2.372)	(1.091)	(3.430)	(1.499)
Female	-2.75***	-0.67	-5.29***	-3.17***	-1.22	-2.66**
	(0.581)	(0.814)	(1.670)	(0.807)	(2.509)	(1.060)
Age: 30-49	1.51*	-0.13	-4.88	1.35	4.49	-0.21
	(0.905)	(1.903)	(3.348)	(1.104)	(3.846)	(1.928)
Age: 50-69	1.34	-2.28	-4.29	1.89*	1.43	-1.05
	(0.875)	(1.735)	(3.223)	(1.131)	(3.743)	(1.782)
Age: 70+	-0.14	-2.18	-3.53	1.68	-0.22	-3.26
	(1.340)	(1.858)	(4.263)	(1.965)	(5.461)	(2.359)
Income: Middle	0.64	1.68	-1.34	-0.16	-0.67	0.49
	(0.794)	(1.289)	(2.374)	(1.139)	(3.545)	(1.390)
Income: High	1.16	0.00	3.72	-0.19	-6.20	1.94
	(0.886)	(1.083)	(2.678)	(1.235)	(3.949)	(1.576)
Education: High	0.22	-0.94	4.86***	0.92	4.07	0.39
	(0.619)	(0.778)	(1.848)	(0.861)	(2.590)	(1.127)
Country Fixed Effects	yes	yes	yes	yes	yes	yes
Own Contribution Treatment	yes	yes	yes	yes	yes	yes
Observations	8,497	927	1,130	3,727	409	2,304
R-squared	0.010	0.066	0.072	0.018	0.031	0.013

Table A-4: *The Causal Effects of Cooperative Environments on Own Contributions by Reciprocity Type - All Treatment Indicators.* This table reports coefficients from OLS regressions of own contribution behavior on treatment group indicators. *Other Contribution Treatment: 10* is the reference group. Robust standard errors are reported in parentheses (*** $p < .01$, ** $p < .05$, *$p < .10$).

	(1) Own Contribution	(2) Own Contribution
Other Contribution Treatment: 30	2.79***	2.92***
	(0.814)	(0.811)
Other Contribution Treatment: 60	2.00**	2.03**
	(0.819)	(0.816)
Other Contribution Treatment: 90	2.35***	2.41***
	(0.805)	(0.805)
Female		-2.75***
		(0.581)
Age: 30-49		1.51*
		(0.905)
Age: 50-69		1.34
		(0.875)
Age: 70+		-0.14
		(1.340)
Income: Middle		0.64
		(0.794)
Income: High		1.16
		(0.886)
Education: High		0.22
		(0.619)
Country Fixed Effects	No	Yes
Own Contribution Treatment	No	Yes
Root MSE	26.22	26.12
Observations	8,498	8,497

Table A-5: *The Causal Effects of Expected Contribution on Own Contribution.* This table reports OLS estimates of the effects of the Other Contribution Treatments on Own Contribution as measured by individuals contributions in the payoff-relevant public good game. The control group is Other Contribution Treatment: 10. Robust standard errors are reported in parentheses (*** $p < .01$, ** $p < .05$, *$p < .10$).

	(1) Own Contribution	(2) Predicted Contribution (Strategy Method)	(3) Difference: Predicted vs. Observed
Expected Contribution: Medium	22.20***	21.53***	-0.67
	(0.540)	(0.514)	(0.463)
Expected Contribution: High	50.37***	53.60***	3.23***
	(0.944)	(0.884)	(0.837)
Female	-2.31***	-1.74***	0.56
	(0.471)	(0.468)	(0.406)
Age: 30-49	1.55**	1.84**	0.29
	(0.781)	(0.751)	(0.707)
Age: 50-69	1.07	2.31***	1.25*
	(0.819)	(0.788)	(0.735)
Age: 70+	-1.05	0.80	1.85*
	(1.166)	(1.181)	(0.982)
Income: Middle	0.15	-0.39	-0.56
	(0.689)	(0.687)	(0.620)
Income: High	0.94	0.85	-0.11
	(0.794)	(0.787)	(0.691)
Education: High	1.48***	0.28	-1.19***
	(0.506)	(0.506)	(0.431)
Altruism: High	5.71***	6.35***	0.64
	(0.602)	(0.605)	(0.477)
Married	-0.16	0.01	0.15
	(0.736)	(0.700)	(0.623)
Separated	-2.59*	-2.12	0.46
	(1.461)	(1.500)	(1.370)
Divorced	-0.97	0.02	1.01
	(0.933)	(0.935)	(0.821)
Widowed	-1.11	-0.05	1.06
	(1.377)	(1.320)	(1.164)
Domestic Partnership	-1.22	-0.87	0.35
	(0.869)	(0.861)	(0.786)
Unemployed	-0.35	-0.56	-0.25
	(0.952)	(0.912)	(0.779)
Ideology	0.04	0.07	0.03
	(0.099)	(0.096)	(0.088)
Country Fixed Effects	yes	yes	yes
Additional Covariates	yes	yes	yes
Observations	8,493	8,488	8,486
R-squared	0.362	0.394	0.020

Table A-6: *The Socio-demographic Correlates of Observed and Predicted Contributions.* This table reports OLS regressions of individuals own contribution behavior (model 1), predicted contribution behavior (model 2), and the difference between these two measures (model 3) on socio-demographic variables. Own contribution is measured by individuals contribution behavior in the payoff-relevant public good game. Predicted contribution is measured using individuals strategies and the contribution they expected from the other actor in the payoff-relevant public good game (see Appendix for details). Robust standard errors reported in parentheses (*** $p < .01$, ** $p < .05$, *$p < .10$).

	(1) Positive Nonconditional	(2) Positive Reciprocity	(3) Inverse U-shaped Reciprocity	(4) Other
Female		0.35***	0.60***	0.29***
	(0.090)	(0.075)	(0.122)	(0.079)
Age: 30-49	0.38**	-0.41***	-0.19	-0.10
	(0.173)	(0.130)	(0.193)	(0.143)
Age: 50-69	0.25	-1.05***	-0.79***	-0.18
	(0.164)	(0.123)	(0.189)	(0.134)
Age: 70+	-0.02	-1.43***	-0.86***	-0.31*
	(0.218)	(0.177)	(0.288)	(0.181)
Income: Middle	0.28**	0.37***	0.57***	0.29***
	(0.122)	(0.101)	(0.167)	(0.105)
Income: High	0.33**	0.41***	0.42**	0.19
	(0.133)	(0.111)	(0.187)	(0.117)
Education: High	-0.19**	0.31***	-0.00	-0.25***
	(0.096)	(0.081)	(0.130)	(0.085)
Germany	-0.11	-0.22*	-0.67***	-0.33***
	(0.145)	(0.114)	(0.171)	(0.119)
United Kingdom	0.24*	-0.09	-0.49***	-0.46***
	(0.140)	(0.115)	(0.169)	(0.121)
United States	0.31**	-0.58***	-1.13***	-0.49***
	(0.129)	(0.107)	(0.173)	(0.110)
	-0.37*	1.69***	-0.47*	1.17***
Observations	8,499			
Log-Pseudo-Likelihood	-11255.86			

Table A-7: *The Socio-demographic Correlates of Strategy Choice.* This table reports coefficients from multinomial regression models with freerider as the base outcome. Robust standard errors are reported in parentheses (*** $p < .01$, ** $p < .05$, *$p < .10$).

E Appendix Figures

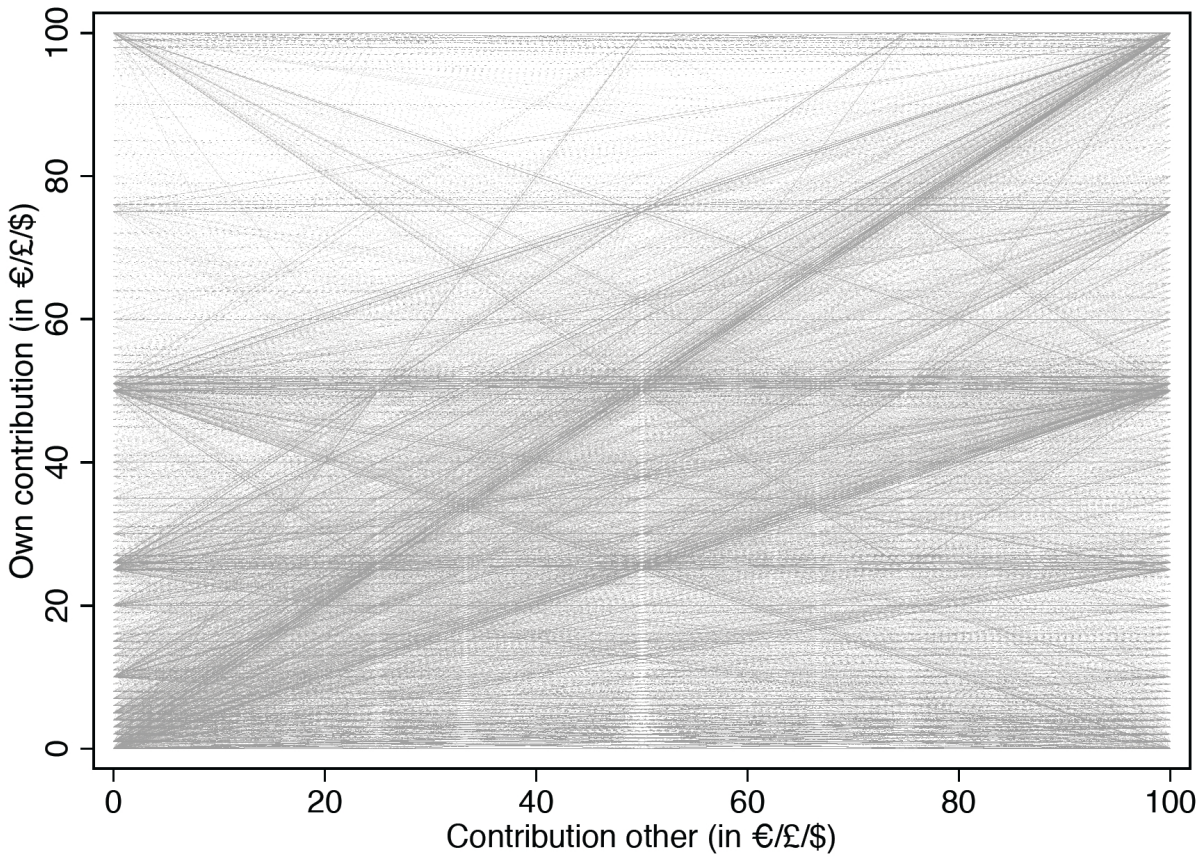

Figure A-1: *Distribution of Conditional Contributions Schedules.* The plot shows the distribution of contributions to the public good game conditional on the contribution by the other respondents in representative samples of the adult population in France (N=2,000), Germany (N=2,000), the United Kingdom (N=2,000), and the United States (N=2,500). Strategies are elicited using the strategy method (see section on "Coding of Strategies" for details).