Who Cooperates? Reciprocity and the Causal Effect of Expected Cooperation in Representative Samples*

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Abstract

When do societies succeed in providing public goods? Previous research suggests that public goods contributions correlate with expectations about cooperation by others among students and other demographic subgroups. However, we lack knowledge about whether the effect of expected cooperation is causal and a general feature of populations. We fielded representative surveys (N=8,500) in France, Germany, the United Kingdom, and the United States that included a public goods game and a novel between-subjects experiment. The experiment varied expectations about cooperation by others. We find that higher expected cooperation by others causes a significant increase in individual contributions. When classifying contribution schedules we find that almost 50% of the population employs a conditionally cooperative strategy. These individuals are on average richer, younger and more educated. Our results help explain the varying success of societal groups in overcoming cooperation problems and assist policymakers in the design of institutions meant to solve social dilemmas.

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Societies face numerous public goods problems and their solution requires cooperation. Examples cover a wide range of policy areas such as global warming (Barrett 2003), economic crises and poverty (Kaul, Grunberg and Stern 1999), international security (Sandler and Hartley 1999), regime change (Hollyer, Rosendorff and Vreeland 2015), public health (Smith, Beaglehole, Woodward and Drager 2003), and knowledge (Stiglitz 1999). What explains the varying success of societies in realizing cooperation in the face of collective action problems? A large set of literatures in political science and many other academic disciplines has addressed this question both theoretically and empirically (Hume 2003 [1740]; Olson 1965; Axelrod 1984; Ward 1990; Keohane and Ostrom 1995). The cumulative empirical insights of lab and lab-in-the-field experiments investigating why groups succeed or fail in providing public goods have been central to this body of research. These studies strongly suggest that reciprocity, or the willingness to cooperate if one expects others to do so, constitutes a particularly influential determinant of actors' 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, Herrmann and Thöni 2004; Henrich, Boyd, Bowles, Camerer, Fehr, Gintis and McElreath 2001).

This work has also inspired a growing literature in political science that highlights the importance of conditional cooperation for crafting political solutions to collective action problems. Examples include climate change (Bechtel, Genovese and Scheve 2017; Tingley and Tomz 2014; Bechtel and Scheve 2013), tax policy (Frey and Torgler 2007), political participation (Bolsen, Ferraro and Miranda 2014), and ethnic conflict (Habyarimana, Humphreys, Posner and Weinstein 2007). These studies have in common that conditional cooperation appears to play an important role for our understanding of when societies succeed in solving collective action problems. Recent micro-level research has even 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) and in ethni-

cally diverse societies (Habyarimana et al. 2007). This is because the exact functional form that individuals use to map from other contributions to their own contribution in public goods games may vary greatly and this variation in strategy types can have profound consequences for both the possibility of cooperation and the role of institutions in promoting the provision of public goods (Ostrom 2000).

Although much has been learned from this work, a widely shared concern about these results has been that they are largely based on student populations. Do more diverse and representative samples of subjects behave differently in social dilemmas? This question mirrors similar concerns that have been articulated in the case of online labor markets for political science experiments (Huff and Tingley 2015; Berinsky, Huber and Lenz 2012) or regarding the samples used in education research that may not be representative of the population that researchers are actually interested in (Kern, Stuart, Hill and Green 2016).

While examining students or other selected subgroups of the adult population will yield generalizable results under the assumption of homogeneous treatment effects (Druckman and Kam 2011), the plausibility of this assumption needs to be assessed empirically. Scholarship has begun to address this question primarily by moving labs to the field and examining behavior in ultimatum and trust games in more diverse, non-student samples (Gächter, Herrmann and Thöni 2004; Bellemare and Kröger 2007; Holm and Danielson 2005; Tsai 2007; Habyarimana et al. 2007). Yet, 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. More importantly, the results from theses studies suggest that our ability to generalize from students to other subgroups of the population may be limited. For example, Japanese fishermen (Stoop, Noussair and van Soest 2012), adult trainee truckers (Anderson, Burks, Carpenter, Götte, Maurer, Nosenzo, Potter, Rocha and Rustichini 2013), as well as adults from Oxford (Belot, Duch and Miller 2015) exhibit more cooperative behavior than students when making decisions in a laboratory environment. In fact, Belot, Duch and Miller (2015) find that pro-social behavior

differs most strongly when comparing students and non-student populations. Therefore, we still lack knowledge about public goods contributions and conditional cooperation among the general population in industrialized democracies. Filling this gap in the literature requires the use of nationally representative samples.

This paper provides the first evidence on public goods contributions in representative samples for four industrialized democracies and implements a novel between-subjects design for estimating the causal effect of expected cooperation. We fielded a large-scale survey (N=8,500) in France, Germany, the United Kingdom, and the United States that included a two-player, simultaneous, anonymous public goods game. Our design uses both correlational variation within subjects and experimental variation between subjects to explore the effects of expected cooperation on individuals' contributions to a public good. The causal evidence we present is based on a novel randomized experiment in the game instructions to respondents and an instrument that elicited the individual's conditional contribution schedules (Rauhut and Winter 2010; Fischbacher, Gächter and Fehr 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 version of an encouragement design experimentally manipulated whether respondents believed they were acting in a more or less cooperative environment. It provides between-subjects causal evidence that expectations about the cooperative behavior of others influence public goods contributions.

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 between-subjects estimate of the causal effect of expected cooperation on public goods 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 conditional cooperation: 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 conditional cooperation, we investigate who employs reciprocal strategies and how these reciprocity types condition the causal effect of expected cooperation. We classify our $8,500$ respondents into different groups of conditional cooperators (Fischbacher, Gächter and Fehr 2001; Thöni, Tyran and Wengström 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 they are not evenly spread throughout the populations. Specifically, we find that positive reciprocity types, i.e., individuals that contribute more if others contribute more, are significantly more widespread among female, younger, wealthier, and more 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 experimental 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 provide new and compelling evidence of the important causal role that reciprocity plays in the provision of public goods. Further, our analysis suggests that the ability of researchers to generalize from student samples to other subgroups depends on the research question and the target population of interest. Our results indicate that the overall level and distribution of contributions in public goods games are similar in representative and student samples. However, we also find important differences in the extent and type of conditional cooperation across different sociodemographic groups. Individuals that employ conditionally cooperative strategies are disproportionately younger,

wealthier, and more educated. We also show that the causal effect of expected cooperation is greater among individuals employing conditionally cooperative strategies. These socio-demographic characteristics vary either slowly over time or are largely time-invariant. Since previous research has suggested that social preferences exhibit a high degree of stability over the long run (Carlsson, Johansson-Stenmann and Nam 2014), this heterogeneity could be substantively consequential for understanding cooperation across groups and helps to shed light on when researchers may find employing more representative albeit more costly samples useful. 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.

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 marginal distributions of socio-demographics in the sample and the populations (see Table A-1 in the Appendix). These descriptives reveal that the socio-demographic margins of the samples in the four country are very similar to that of the target populations. However, since matching is approximate, survey weights were computed based on official information about the distribution of socio-demographic characteristics to eliminate the remaining imbalances. The results we report below are based on weighted data but remain virtually unchanged when reestimated without weights.

The survey had two parts. The first part was an anonymous, two-player public goods game that was embedded in a randomized experiment. This component of the survey pro-

vides us with exogenous between-subjects variation in individuals' levels of expected cooperation. The experiment did not involve deception. The second part elicited respondents' contribution schedules using the strategy method (Selten 1967) which asks individuals to indicate how much they are willing to contribute given the other player's contribution.

Public Goods 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. The survey left the probability of winning a gift card unspecified.[1] 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 equals the amount of money that the group takes from the experimenter. Formally, the payoff function for an individual i is: $\Pi_i = 100 - c_i + 2c_j$, with c_i denotes 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 €/£/$ 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)€/£/$* and they will receive *(90, 70, 40, 10)€/£/$*."

[1] The true probability was .1% in France, Germany, and the United Kingdom and .08% in the United States. In the public goods game the gift card winners received $140 on average. Independent of their answers all respondents also received a fixed incentive for taking part in the survey administered by YouGov.

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 exogenously varied whether respondents were acting in a more or less cooperative environment. The design of our other contribution experiment therefore resembles a mild version of an encouragement design that typically invites subjects randomly to participate in a treatment condition if a randomized control trial does not seem feasible because of ethical or practical reasons (West, Duan, Pequegnat, Gaist, Jarlais, Holtgrave, Szapocznik, Fishbein, Rapkin, Clatts and Mullen 2008).[2] In our application, informing subjects that the other winner would contribute a specific amount would be dishonest (Morton and Williams 2010; Dickson 2011). Our version of an encouragement design which merely provides examples included in the instructions to explain the payoff mechanism enables us to avoid deception.

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. When comparing our results with those reported in lab-experimental studies with selected subsets of the population, it may be relevant to consider the level of incentives. However, a review of more than 70 experiments concludes that differences in incentivization do not affect subjects' contributions on average (Camerer and Hogarth 1999). Moreover, Gillis and Hettler (2007) show that even hypothetical incentives tend to replicate behavior in public goods games that are incentivized.

[2]There exist several possible mechanisms that could bring about the variation in individual expectations about what the other person will contribute, for example, anchoring or demand effects (Roux and Thöni 2015). We remain agnostic about the exact mechanism as our primary purpose is to create exogenous variation in respondents' expectations about the other individual's contribution.

Measuring Different Types of Conditional Cooperation

The second part of the survey asked respondents about their conditional contribution schedules. To determine individuals' types of conditionally cooperative strategies, 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, Gächter and Fehr 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 with darker lines indicating higher frequency. 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, which asked respondents to indicate how much they would contribute given the other player's contribution. 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. This suggests that the answers in these two parts of the survey are consistent. The results are reported in Table A-6 in the Appendix (see also footnote 7).

To explore the distribution of strategy 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). Our approach employs a computational algorithm in the spirit of Kurzban and Houser (2005) and uses a slightly more fine-grained classification than previous work (Fischbacher, Gächter and Fehr 2001; Thöni, Tyran and Wengström 2012) to distinguish five types: Freerider, Positive Nonconditional, Positive Reciprocity, Inverse U-shaped Reciprocity, and Other. We add the category of "Positive Nonconditional" individuals because we empirically observe a non-negligible share of respondents (about 10% or 800 individuals) that make constant, positive contributions. Those individuals do not plausibly exhibit an erratic pattern that one would want to classify as "other". Given that also this type of behavior also seems theoretically important, we add it as an additional category.[3]

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 strategy 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.

[3]The fact that this type was not observed in Fischbacher, Gächter and Fehr (2001) may either be due to their small sample of students (44 subjects) or reflect that students are truly less non-conditionally cooperative on average.

Finally, about one third of our representative sample uses some other functional form to map from their expectations about other contributions to their own contribution level.

How does the distribution of strategy types, which is based on a large, representative sample, compare with those reported in lab-experimental studies with students as subjects? We find that the share of positive reciprocators largely equals that reported in lab-experimental studies (Fischbacher, Gächter and Fehr 2001). However, we observe a smaller share of freeriders (10%) than previous work examining students as subjects. For example, Fischbacher, Gächter and Fehr (2001) classify 13 out of 44 students (30%) as purely selfish. Also, in our large, representative sample the share of "hump-shaped" contribution schedules is smaller (about 5%) than in their student sample (14% or 6 out of 44).

Results

Own Contribution Behavior and Expected Contributions

Figure 2 shows the distribution of individual contributions in the public goods game for 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 €/£/\$. 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.[4]

[4]For example, Fischbacher, Gächter and Fehr (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.

Figure 2 reveals substantial variation in the distribution of public goods contributions in a representative population. What explains this variation and what is the relative importance of socio-demographic characteristics as opposed to norms of conditional cooperation? Since we examine cooperative behavior in representative samples with over 8,000 respondents who offer a lot of variation in socio-demographics attributes, we have the rare opportunity to explore if public goods contributions cluster along socio-demographic cleavages or whether they mostly reflect the presence or absence of reciprocal expectations. Thereby, our study also provides evidence on the generalizability of lab-experimental findings with selected subgroups of populations. To the extent that socio-demographic differences do not exist, studying selected subgroups reduces research costs without compromising on the generalizability of the findings.

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 stands in contrast to most lab-experimental studies with students and other selected subgroups of the population which report that female subjects tend to contribute more than male individuals.[5] This discrepancy could indicate that female students in lab-experimental studies behave differently than women in the overall population, although other explanations, for example, that women respond more strongly to implicit or explicit cues provided by the experimental setting (Croson and Gneezy 2009) remain possible. We also found no significant differences

[5]See Croson and Gneezy (2009) for a detailed review of this work.

in our pooled analyses by marital status, employment status, and ideology.[6]

Overall, there exists little evidence in our data to suggest that some socio-demographic groups cooperate more in our public goods game than others. This evidence helps in assessing the plausibility of explanations for variation in public goods contributions. For example, it is inconsistent with the idea that high income individuals feel better able to afford contributions and thus find it easier to cooperate among themselves. These results are also inconsistent with explanations based on the idea that higher educated individuals have the ability to realize the advantages of everyone contributing and thus cooperate more easily.

Our primary interest is in determining the importance of conditional cooperation in explaining contribution behavior in our large-scale, representative sample. We converted our continuous measure of the expected contribution of the other respondent, *Expected Contribution*, 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. This finding remains unchanged if we re-estimate the model using a continuous measure of expectations, *Expected Contribution*, where we obtain a highly significant and positive coefficient (0.73, $p < 0.001$).

In an additional analysis reported in Table A-2 (Model 2) in the Appendix we add a

[6]See Table A-2 in the Appendix for additional results including tobit estimations that account 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.

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 (the median donation was zero). Consistent with previous laboratory results, we find that more altruistic individuals contribute significantly more in the public goods 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.

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 Expected Cooperation

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. Individuals with particular unobserved characteristics could tend to be both more likely to think others will contribute generously and therefore, they would 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. 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 (IV) 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 does not mean that individuals systematically over-reciprocate because when we construct a 95% confidence interval for this estimate, we find that the

estimate is not significantly greater than 1 (the interval is $(0.65, 2.11)$). The 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, Tyran and Wengström 2012).[7] A natural interpretation of these findings is that cooperative expectations play an important causal role in explaining behavior in social dilemma situations while socio-demographic characteristics of individuals are not particularly important. At the same time, however, we do not know whether some reciprocity types are more or less widespread among specific socio-demographic groups.

The Socio-Demographic Distribution of Reciprocity Types

To explore 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 (Table A-7 in the Appendix reports the multinomial logit estimates used for these simulations). We find that female, younger, wealthier, and highly educated respondents are all systematically 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 strategy 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.

[7] In additional analyses we also explored whether our other contribution experiment increased the contributions respondents indicated to be willing to make in the strategy method part of our survey. When we estimate the treatment effect we find that those in the high other contributions treatment increase their own contribution in the strategy part by 2.5 €/£/\$, which is almost exactly the estimate reported above. The IV estimate is 1.45 €/£/\$ which is again almost identical to the effect we estimate when using respondents' initial contribution choice. However, this level effect does not affect the classification of respondents as positive reciprocity types in the results reported below.

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 exact elasticity of conditional cooperation, i.e., the extent to which an individual's own contribution to a public good increases in response to a unit increase in expected contributions by others. The higher the elasticity of conditional cooperation, the better the prospects for lasting cooperation (Fischbacher and Gächter 2010).[8]

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 €/£/$).[9] 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 significantly 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.

[8]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).

[9]See Kurzban and Houser (2005) for a comparable approach to determine the contribution elasticity.

The Causal Effect of Expectations by Strategy Type

We now explore whether strategy type conditions the cooperation-enhancing effect of expectations about the contribution behavior of others in theoretically meaningful ways. Specifically, we expect that the causal effect of expected cooperation should be most evident for Positive Reciprocity types. In contrast, the level of cooperation an individual expects should not matter for those employing a freerider strategy. To evaluate these predictions 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. For the remaining category of Positive Nonconditional types, the IV coefficient is smaller (0.89) and only marginally significant.[10]

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—conditional cooperation 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

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

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 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 demographic groups more likely to cooperate and if so why? Is the correlation between public goods contribution and expected cooperation by others 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 cooperative environments 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 goods contributions. Moreover, we implement a new between-subjects design for establishing that this relationship is causal. Our causal estimate based on representative samples further underscores the importance of reciprocity as promoting cooperation in industrialized

countries.

We also provide several results that are either in tension with findings in studies on students and other non-representative samples or have not been previously explored. When coding the distribution of conditionally cooperative strategies that individuals employ 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. 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. These types are unequally distributed in the population with younger, richer, and more educated individuals more likely to employ positive reciprocal strategies and thus be more likely to respond to treatments that manipulate expectations about others cooperative behavior. This second set of results suggests the potential usefulness of complementing studies of students and other convenience samples with representative samples when studying conditionally cooperative strategies.

A noteworthy implication of our 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. These individuals react positively to institutions that stabilize expectations about the cooperative behavior of others. Thus, political 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, for example, to reduce pollution, tax fraud, or global warming, 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.

Finally, our study of conditional cooperation in representative samples also promises to shed some light on the long-term evolution of societies in the presence of multiple equilibria with *ex ante* uncertainty about whether a society will realize a more or less cooperative equilibrium in the long-run (Axelrod 1984). While we have focused on four industralized countries, subsequent research could begin to map out the distribution of social norms such as conditional cooperation in less developed countries as this may not only improve our ability to understand the dividing lines in political choices on public goods problems but could also explain more fundamental equilibrium selection phenomena that account for differences in countries' economic, social, and political long-term trajectories.

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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 Effect of Expected Contribution on Own Contribution: Reduced Form and Instrumental Variable Results* 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) OLS: Basic	(2) OLS: Extended	(3) Tobit
Female	-0.05***	-0.05***	-0.05***
	(0.010)	(0.010)	(0.010)
Age: 30-49	-0.02*	-0.02	-0.02
	(0.013)	(0.014)	(0.014)
Age: 50-69	-0.10***	-0.10***	-0.10***
	(0.014)	(0.015)	(0.015)
Age: 70+	-0.12***	-0.11***	-0.11***
	(0.027)	(0.029)	(0.029)
Income: Middle	0.01	0.01	0.01
	(0.014)	(0.015)	(0.015)
Income: High	0.03**	0.03*	0.03*
	(0.015)	(0.016)	(0.016)
Education: High	0.04***	0.04***	0.04***
	(0.011)	(0.011)	(0.011)
Altruism: High		-0.02**	-0.02**
		(0.011)	(0.011)
Married		-0.01	-0.01
		(0.014)	(0.014)
Separated		-0.04	-0.04
		(0.037)	(0.037)
Divorced		-0.02	-0.02
		(0.020)	(0.020)
Widowed		-0.06*	-0.06*
		(0.033)	(0.033)
Dompart		-0.02	-0.02
		(0.017)	(0.017)
Unemployed		-0.02	-0.02
		(0.019)	(0.019)
Ideology		-0.00	-0.00
		(0.002)	(0.002)
Germany	0.01	0.00	0.00
	(0.014)	(0.014)	(0.014)
United Kingdom	0.05***	0.05***	0.05***
	(0.014)	(0.014)	(0.014)
United States	0.03**	0.03**	0.03**
	(0.014)	(0.014)	(0.014)
Constant	0.68***	0.70***	0.70***
	(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 ordinary least squares (OLS) regressions. Column 3 reports tobit estimates.

	Freerider	Positive Nonconditional	Positive Reciprocity	Inverse U-shaped Reciprocity	Other
Expected Contribution (IV)	-1.55	0.89*	1.26**	0.20	-6.81
	(3.547)	(0.484)	(0.503)	(7.614)	(47.802)
Female	-1.44	-1.55	-0.50	-0.77	-22.13
	(2.318)	(2.499)	(1.256)	(18.738)	(136.931)
Age: 30-49	0.91	-2.98	0.97	3.85	-16.66
	(4.279)	(3.104)	(0.967)	(24.637)	(117.201)
Age: 50-69	-3.61	-0.61	-0.23	1.45	-26.70
	(4.821)	(3.390)	(1.237)	(3.611)	(181.515)
Age: 70+	-6.14	-2.63	-1.15	-0.65	-48.11
	(10.221)	(3.972)	(1.603)	(5.123)	(317.082)
Income: Middle	2.22	-0.44	1.33	0.34	6.24
	(3.216)	(2.176)	(1.191)	(36.647)	(41.657)
Income: High	-1.07	-0.47	0.21	-3.95	12.09
	(3.816)	(3.179)	(1.112)	(93.314)	(71.497)
Education: High	-1.16	4.34***	1.75**	3.22	-5.76
	(1.915)	(1.683)	(0.808)	(38.018)	(44.019)
County Fixed Effects	yes	yes	yes	yes	yes
Own Contribution Treatment	yes	yes	yes	yes	yes
Observations	927	1,130	3,727	409	2,302

Table 3: *The Causal Effects of Cooperative Environment on Own Contributions by Strategy Type: Instrumental Variable Results* This table reports instrumental variable estimates of *Expected Contribution* on *Own 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

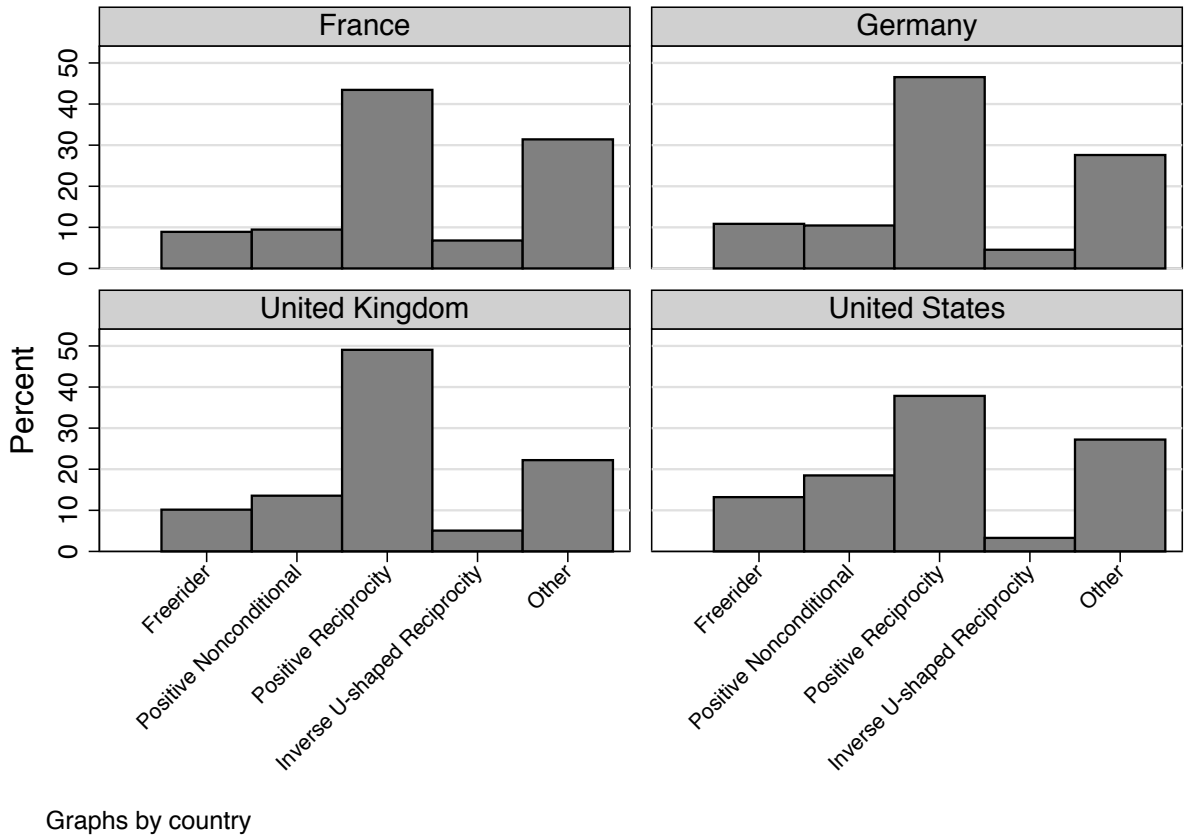

Figure 1: *Distributions of Strategy Types by Country.* This plot shows the distribution of individuals' strategy types. Strategies are elicited using the strategy method (see section on "Coding of Strategies" for details).

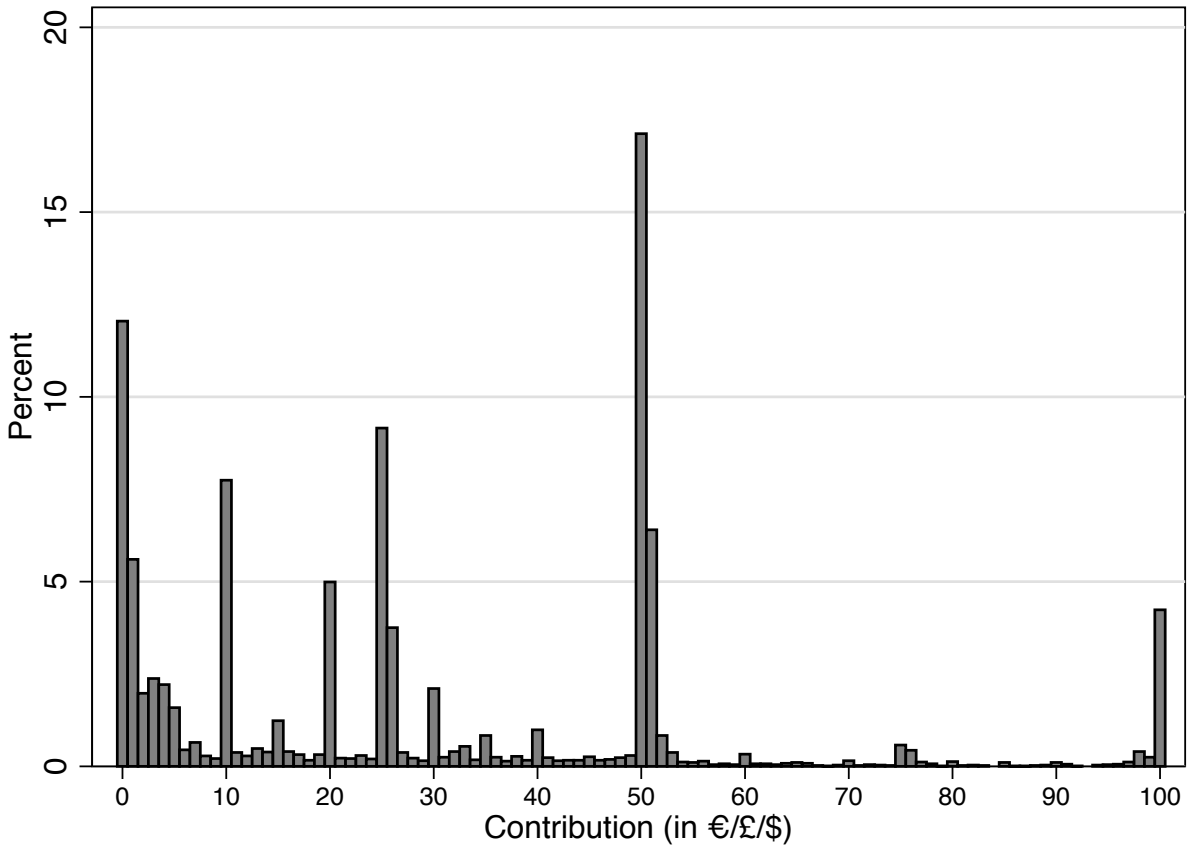

Figure 2: *Distribution of Own Contributions to the Public Good in Representative Samples.* The plot shows the distribution of contributions to the public good (pooled data, $N = 8,500$). Countries included are France ($N = 2,000$), Germany ($N = 2,000$), the United Kingdom ($N = 2,000$), and the United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

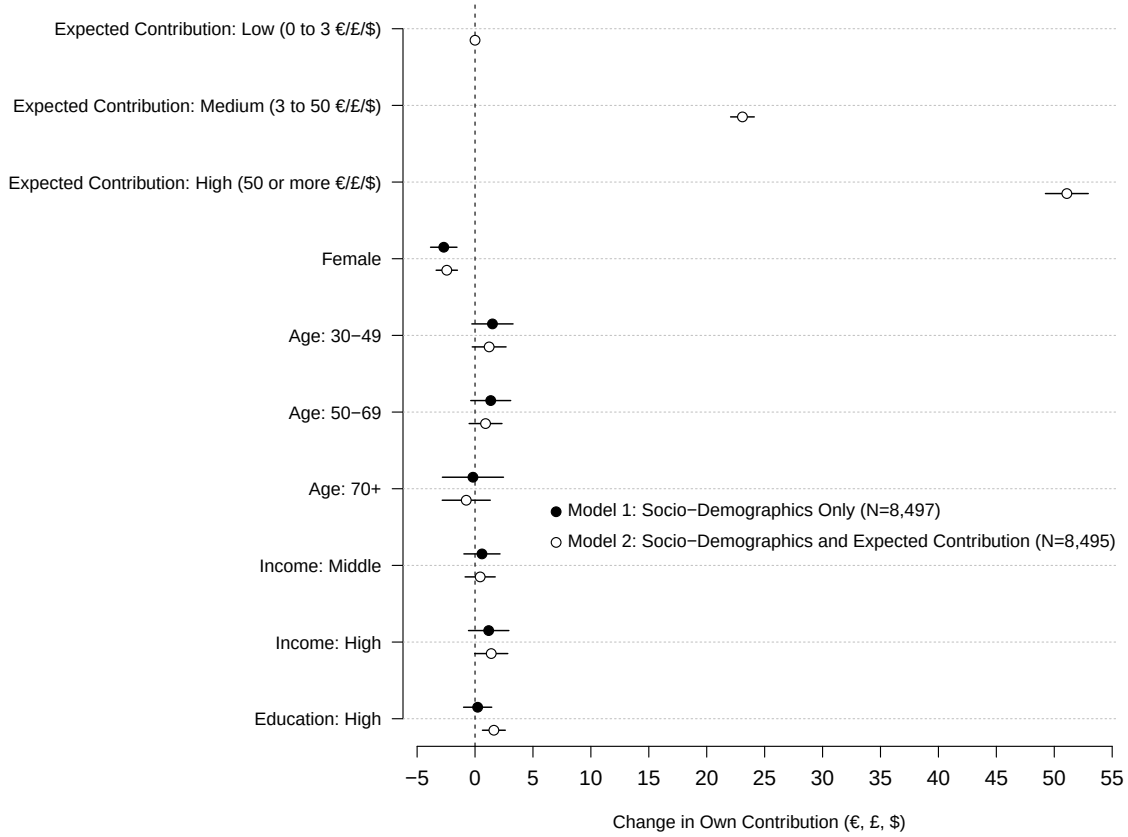

Figure 3: *Correlates of Cooperative Behavior in France, Germany, the United Kingdom, and the United States (pooled data).* This plot shows OLS coefficients (dots) and 95% confidence intervals computed from heteroskedasticity-robust standard errors (Model 1 $N = 8,497$, Model 2 $N = 8,495$). In Model 1 we regressed an individual's own contribution on socio-demographic characteristics. In Model 2 we regressed an individual's own contribution to the public good on the socio-demographics and two indicator variables that capture how much a respondent expects the other player to contribute. 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.

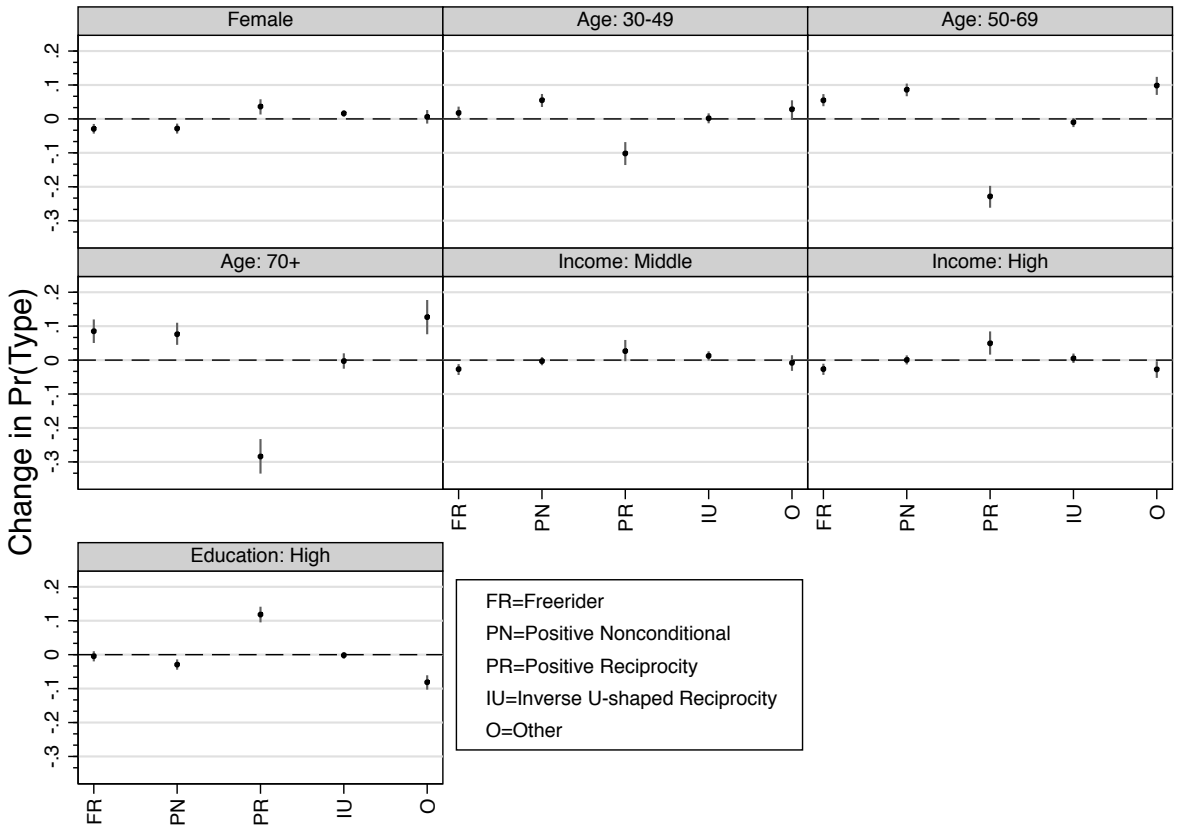

Figure 4: *The Socio-demographics of Strategy Types in France, Germany, the United Kingdom, and the United States (pooled data).* This plot shows how the probability of a specific strategy type responds to a change in socio-demographic variables together with 95% confidence intervals computed from heteroskedasticity-robust 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*.

Appendix
For Online Publication

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 2014) 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 YouGovs 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, Gächter and Fehr 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. Freerider: 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. Inverse U-shaped reciprocity: The contribution function is concave and the difference between the maximum and the minimum contribution is greater than 5

5. Other: All cases that do not fit the 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 goods game. The pay-off relevance of the contribution choice was made explicit. The second part used the strategy method, to elicit respondents contribution schedules (Selten 1967). The strategy method asks respondents to indicate how much they would contribute given the contribution of the other player. This provides us with each individual's conditional contribution schedule. The strategy method part of the survey was not explicitly incentivized. However, 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 the 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 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 goods 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: 18-34	23.1	23.1	24.8
Age: 35-54	36.6	36.6	32.3
Age 55+	40.3	40.3	42.9
Gender: Male	49.0	49.0	49
Gender: Female	51.0	51.0	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	26.5	27.1	25.4
Age: 35-54	36.5	37.1	44.5
Age 55+	37.0	35.8	30.2
Gender: Male	47.3	48.1	48.1
Gender: Female	52.7	52.0	51.9
Education: 16 or fewer	55.3	53.7	50.7
Education: 17 to 19 yrs	21.2	23.1	25.9
Education: 20 yrs or more	23.5	23.3	23.5
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
Education: Post-Graduate	8.8	8.8	9.5

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 Kingdom: August-September 2010 Eurobarometer survey and 2011 UK Census. United States: 2007 American Community Survey, 2008 Current Population survey, 2007 Pew Religious Landscape Survey.

	(1) Socio-demographics	(2) Socio-demographics and Expected Contribution	(3) Own Contribution First	(4) Expected Contribution Other First	(5) Expected Contribution Indicator	(6) Tobit: All
Expected Contribution: Medium		22.20***	23.42***	22.63***	23.09***	31.11***
		(0.540)	(0.648)	(0.876)	(0.522)	(0.693)
Expected Contribution: High		50.36***	51.86***	49.99***	51.10***	61.08***
		(0.944)	(1.216)	(1.498)	(0.942)	(1.147)
Female	-2.61***	-2.34***	-2.46***	-2.34***	-2.44***	-2.30***
	(0.582)	(0.471)	(0.593)	(0.763)	(0.469)	(0.548)
Age: 30-49	1.93**	1.45*	1.18	1.37	1.21	1.59*
	(0.943)	(0.779)	(0.932)	(1.235)	(0.745)	(0.882)
Age: 50-69	1.55	0.97	1.36	0.17	0.91	1.38
	(0.985)	(0.814)	(0.910)	(1.188)	(0.723)	(0.855)
Age: 70+	-0.79	-1.17	0.03	-1.90	-0.75	-0.27
	(1.452)	(1.162)	(1.345)	(1.704)	(1.058)	(1.235)
Income: Middle 0.08	0.08	0.05	1.02	0.45	0.68	
	(0.827)	(0.686)	(0.892)	(0.992)	(0.662)	(0.772)
Income: High	0.43	0.82	1.02	1.90*	1.40*	1.54*
	(0.957)	(0.786)	(0.970)	(1.113)	(0.729)	(0.856)
Education: High	-0.02	1.50***	1.68***	1.61**	1.63***	1.72***
	(0.619)	(0.505)	(0.642)	(0.811)	(0.503)	(0.586)
Altruism: High	9.30***	5.71***				
	(0.679)	(0.602)				
Married	0.03	0.25				
	(0.783)	(0.644)				
Separated	-2.87*	-2.20				
	(1.734)	(1.424)				
Divorced	-0.93	-0.58				
	(1.076)	(0.872)				
Widowed	-0.45	-0.70				
	(1.593)	(1.335)				
Domestic Partnership	0.73	-0.41				
	(1.882)	(1.507)				
Unemployed	-0.83	-0.32				
	(1.159)	(0.954)				
Ideology	0.02	0.04				
	(0.121)	(0.099)				
First: Other					-0.67	
					(0.545)	
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,495	8,493	5,247	3,248	8,495	8,495
R-squared	0.029	0.361	0.356	0.350	0.353	

Table A-2: *The Socio-demographic Correlates of Contributions.* This table reports results from regressions of an individual's own contribution behavior on socio-demographic variables and their expectations about how much the other player will contribute (Expected Contribution). Own contribution is measured by the observed contribution behavior in the payoff-relevant public goods 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 indicate the contribution they expected from the other player. Model 5 includes an indicator variable that distinguishes between those subjects that were first asked to indicate their own contribution and those that were first asked to indicate the contribution they expect from the other player. Model 6 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 Strategy 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 Strategy 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 contributions in the payoff-relevant public goods 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	22.19***	21.52***	-0.66
	(0.540)	(0.514)	(0.463)
Expected Contribution: High	50.36***	53.58***	3.23***
	(0.944)	(0.885)	(0.837)
Female	-2.34***	-1.77***	0.56
	(0.471)	(0.468)	(0.406)
Age: 30-49	1.45**	1.73**	0.27
	(0.779)	(0.748)	(0.704)
Age: 50-69	0.97	2.19***	1.23*
	(0.814)	(0.785)	(0.734)
Age: 70+	-1.17	0.67	1.84*
	(1.162)	(1.178)	(0.981)
Income: Middle	0.08	-0.45	-0.56
	(0.686)	(0.684)	(0.618)
Income: High	0.82	0.74	-0.11
	(0.786)	(0.781)	(0.685)
Education: High	1.50***	0.31	-1.19***
	(0.505)	(0.505)	(0.429)
Altruism: High	5.71***	6.36***	0.65
	(0.602)	(0.605)	(0.478)
Married	0.25	0.41	0.14
	(0.644)	(0.423)	(0.551)
Separated	-2.20*	-1.75	0.45
	(1.424)	(1.471)	(1.343)
Divorced	-0.58	0.40	1.00
	(0.872)	(0.888)	(0.776)
Widowed	-0.70	0.35	1.05
	(1.335)	(1.285)	(1.129)
Domestic Partnership	-0.41	0.80	1.21
	(1.507)	(1.646)	(1.411)
Unemployed	-0.32	-0.53	-0.24
	(0.954)	(0.911)	(0.780)
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 an 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 the contribution behavior observed in the payoff-relevant public goods game. Predicted contribution is measured using individuals strategies and the contribution they expected from the other actor in the payoff-relevant public goods 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	0.07	0.36***	0.61***	0.30***
	(0.091)	(0.077)	(0.123)	(0.080)
Age: 30-49	0.43**	-0.39***	-0.16	-0.07
	(0.176)	(0.132)	(0.198)	(0.146)
Age: 50-69	0.30*	-1.05***	-0.78***	-0.17
	(0.167)	(0.125)	(0.192)	(0.136)
Age: 70+	0.01	-1.40***	-0.93***	-0.32*
	(0.222)	(0.180)	(0.293)	(0.184)
Income: Middle	0.26**	0.38***	0.56***	0.28***
	(0.124)	(0.103)	(0.170)	(0.107)
Income: High	0.31**	0.42***	0.46**	0.17
	(0.136)	(0.113)	(0.191)	(0.119)
Education: High	-0.20**	0.31***	-0.04	-0.25***
	(0.098)	(0.082)	(0.132)	(0.086)
Germany	-0.10	-0.23**	-0.67***	-0.35***
	(0.145)	(0.115)	(0.172)	(0.119)
United Kingdom	0.25*	-0.08	-0.50***	-0.46***
	(0.141)	(0.116)	(0.170)	(0.122)
United States	0.32**	-0.54***	-1.03***	-0.47***
	(0.131)	(0.108)	(0.176)	(0.112)
Observations	8,499			
Log-Pseudo-Likelihood	-11233			

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

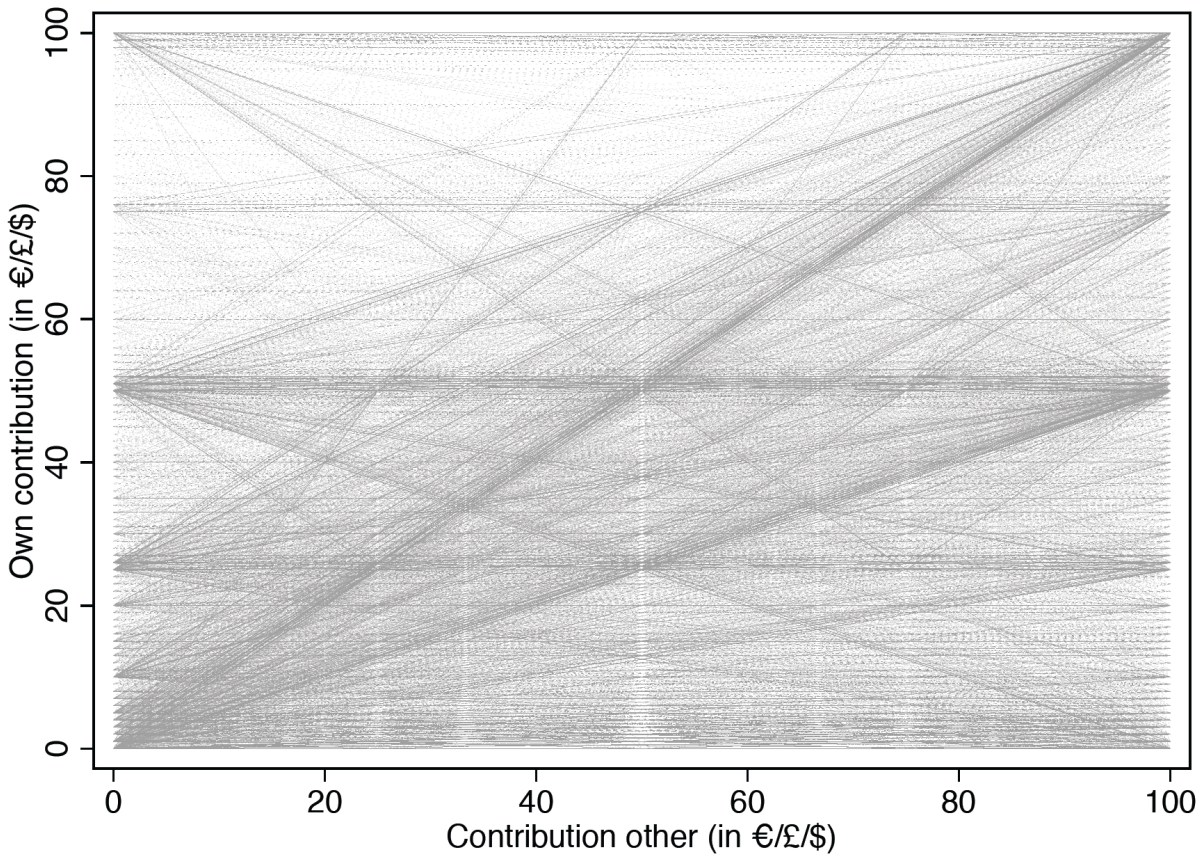

Figure A-1: *Distribution of Conditional Contribution Schedules (N=8,500).* The plot shows the willingness to contribute to the public good conditional on the contribution by the other player in representative samples of the adult population in France (N=2,000), Germany (N=2,000), the United Kingdom (N=2,000), and the United States (N=2,500). Darker lines indicate higher frequency. Strategies are elicited using the strategy method (see section on "Coding of Strategies" for details).