Microfoundations of Social Capital

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Abstract:

Research on social capital routinely relies on survey measures of trust which can be collected in large and heterogeneous samples at low cost. We validate such survey measures in an incentivized public goods experiment and show that they are importantly related to cooperation behavior in a large and heterogeneous sample. We provide evidence on the microfoundation of this relation by use of an experimental design that enables us to disentangle preferences for cooperation from beliefs about others' cooperation. Our analysis suggests that the standard trust question used in the World Values Survey is a proxy for cooperation preferences rather than beliefs about others' cooperation. In contrast, the "fairness question", a recently proposed alternative to the standard trust question, seems to operate through beliefs rather than preferences.

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1. Introduction

Trust has been proposed as an important determinant of various economic phenomena, including growth (Knack and Keefer 1997, Zak and Knack 2001), financial development (Guiso, Sapienza and Zingales 2004), civic participation (La Porta et al. 1997), investment decisions and patterns of international trade (Guiso, Sapienza and Zingales 2009). Such studies suggest that survey measures of trust like the standard trust question ("Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?") is a good proxy for "social capital" and that social capital promotes economic efficiency by facilitating cooperation and the enforcement of incomplete contracts. However, this literature has been challenged on the grounds that it is unclear what survey measures such as the trust question actually measure (see e.g. Sobel 2002, Durlauf 2002, Beugelsdijk 2006).

This paper combines survey measures and experimental data to shed light on the behavioral validity of such measures. By showing that the survey measures importantly relate cooperation when actual money is at stake we provide evidence for the behavioral validity of standard survey measures, and by uncovering that the standard trust question is related to preferences for cooperation rather than beliefs about others' cooperativeness we provide a more accurate interpretation of what is actually measured by "survey trust". Thus, our paper adds to the literature on the microfoundations of social capital.

We report results from a public goods experiment with close to 1500 randomly selected participants from the Danish population. We find that both self-reported trust and observed cooperation levels are high, and regression analysis shows that trust attitudes have significant explanatory power for cooperation behavior. While these results are interesting per se, the main focus of this paper is to study the microfoundation of this relation. We argue that cooperation choices are driven by preferences and beliefs. Some people have no preference for cooperation, and choose to free ride regardless of the contribution level of others (15 percent in our sample are free riders), but most have a preference for cooperating given that others do (69 percent are conditional cooperators). Beliefs about other peoples' inclination to cooperate do not matter for free riders but are a main determinant of contribution choices of conditional cooperators.

Our main finding is that trust attitudes appear to be a proxy for the strength of people's cooperation preferences but not for beliefs. In particular, we find that responses to the standard trust question (*Trust* for short) explain how much people contribute given their beliefs about others' contributions, but not how optimistic they are about other peoples' tendency to cooperate. We also find that the fairness question ("Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?"), an alternative to the trust question that has recently been added to the World Values Survey, is a proxy for beliefs but not for preferences. In particular, we show that responses to the fairness question (*Fairness* for short) explain how optimistic people are, but do not explain the strength of their preferences for cooperation. We speculate that the two survey measures capture different aspects of social capital because *Trust* evokes thoughts about what the respondent generally does ("*you* can't be too careful") while *Fairness* evokes thoughts about how other people generally behave ("would *they* try to be fair?").

Our paper contributes in several ways to a recent stream of research combining survey and experimental measures of social capital. First, we relate *Trust* to cooperation behavior while the literature has to a large extent focused on behavior in experimental trust games.[1] This focus on trust experiments in the literature is surprising given that "social capital" is a multifaceted concept (Dasgupta and Serageldin 1999), and that most definitions of social capital involve notions of trust and cooperation. In fact, many contributors to the economics literature see trust and cooperation as intimately related concepts (e.g. Knack and Keefer 1997, La Porta et al. 1997). In social psychology, the notions of trust and cooperation have long been thought to be closely related. For example, Yamagishi (1986: 111) argues that "mutual trust is the key to actual cooperation". The public goods game used in this study is played in groups and may therefore better reflect important aspects of everyday cooperation problems which are often multilateral rather than bilateral as in the experimental trust game.[2]

[1] For the trust game results are mixed: Glaeser et al. (2000) find that *Trust* has no predictive power for trust as measured in the trust game but it predicts trustworthiness in a sample of students at Harvard University. In contrast, Fehr et al. (2003) find a relation of survey-measured trust to experimentally measured trust but not to trustworthiness in a sample representative of the German population. Sapienza, Toldra and Zingales (2007) find that survey trust predicts trust in a sample of MBA students at the University of Chicago. Yet, Bellemare and Kröger (2007) do not find a significant relation either to trust or trustworthiness in a heterogeneous Dutch sample. Holm and Danielsson (2005) find that survey measures of trust predict trust in an experiment in Sweden but not, using the same protocol, in Tanzania.

[2] An additional concern with using trust games is that first-mover choices in the trust game may not only reflect genuine trust but may also be affected by risk attitudes (Karlan 2005, Schechter 2007), altruism and reciprocity (Cox 2004), or betrayal aversion (Bohnet et al. 2008).

Second, we provide strong evidence that survey measures of social capital are significant predictors of cooperation behavior in the Danish population. Previous evidence on the relation between survey trust and cooperation suggests that there is a positive relation between the two measures. For example, an early study by Yamagishi (1986) finds that "high-trustors" contribute more than "low-trustors" in a sample of Japanese subjects, while Ahn et al. (2003), using prisoner's dilemma games, find no relation between a survey measure of trust and cooperation behavior in a sample of US students. Anderson et al. (2004) find in a sample of US students that both *Fairness* and *Trust* are positively related to contributions in a public good experiment. In a comparable sample, Capra et al. (2008) find that the two survey measures are jointly (but not separately) related to contributions. Similarly, Gächter et al. (2004) find that *Fairness* is related to cooperation behavior in a sample from Russia and Belarus. Using a sample of Peruvian microcredit borrowers, Karlan (2005) finds that a summary variable of several survey measures does not relate to contributions in a public goods experiment when social capital is measured at the individual level. However, when aggregating the answers of the survey questions for each group of the public goods game, the resulting social capital measure is positively related to the share of subjects in the group that contributes.[3]

Third, our findings suggest that different survey measures of social capital capture different determinants of cooperation and, thus, of social capital. More specifically, we find that *Trust* is related to cooperation preferences but not to beliefs about cooperation, while it is the other way around for *Fairness*. We are able to disentangle these two channels because we measure individual choices, beliefs and preferences using two versions of the public good game.[4] The first is a standard one-shot cooperation game which we refer to as the Standard game. In this game, participants are endowed with money, approximately $10 each. Participants are anonymously matched into groups of four and simultaneously decide how much to contribute to a common project. All contributions are doubled and equally shared among the four participants. Not to contribute is therefore the individually money-maximizing choice, while contributing the total amount is the efficient choice since only money contributed will be doubled by the experimenter. Participants also indicate their expectation

[3] As pointed out by an anonymous referee, Karlan (2005) includes the proportion passed in a trust game as a control variable in these regressions. This may reduce the estimated effect of the survey measures on contributions.

[4] The need to disentangle the causal channels, but also the difficulties in doing so have been recognized by many contributors to the literature. For example, Putnam (2001: 137) notes that "The causal arrows among civic involvement, reciprocity, honesty, and social trust are as tangled as well-tossed spaghetti. Only careful, even experimental, research will be able to sort them apart definitively."

about the average contribution of others. In the second game, referred to as the Strategy game below (developed by Fischbacher, Gächter and Fehr 2001), participants provide a complete contribution schedule conditional on the contribution choices of others. That is, they decide to contribute *a*, *b*, *c given that* others on average contribute *x*, *y*, *z*. Thus, beliefs about the average contributions of others do not matter for contributions in the Strategy game by design. Other large-scale studies have not been able to distinguish between the preference and belief channels of cooperation. The closest match to our study in this respect is Sapienza et al. (2007). In contrast to our results, these authors find that *Trust* captures the belief-based component but not the preference-based component of behavior in trust games.[5] However, our finding is broadly in line with Gächter et al. (2004) for cooperation behavior, and with Fehr et al. (2003) for choices in a trust game. These authors find that the trust question remains significant for explaining trust behavior even when controlling for beliefs about the money sent back by second movers (i.e. beliefs about others' trustworthiness).

On a methodological level, our findings validate widely used survey measures of social capital with measures of cooperative behavior in a controlled environment with monetary incentives.[6] In a broader perspective, our paper therefore contributes to an ongoing debate on the relative merits of hypothetical vs. experimental (incentivized) measures (e.g. Camerer and Hogarth 1999). Survey measures are inexpensive to collect in large and heterogeneous samples, but have been criticized by economists as being unreliable because answers are not incentive-compatible and respondents may therefore be inattentive or insincere. Controlled experiments come at a considerable administrative and monetary cost and may not be able to capture the heterogeneity present in the general population when implemented with relatively homogeneous convenience samples of students. We are able to provide a valuable validation because we implement a controlled and incentivized experiment with a sample that closely parallels the samples used in survey studies. We are able to do so because we use a "virtual lab" approach to recruit a large heterogeneous sample and to implement an experiment with a level of control comparable to the conventional laboratory.

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[5] However, the studies are not directly comparable because of differences in experimental protocol (they use a trust game) and subject pool (they use a relatively homogenous student sample). In addition, their regression analysis does not include *Fairness*, which makes it hard to compare the results. Comparing the results by Sapienza et al. (2007) to our results is also difficult because they use in many specifications a measure for unconditional cooperation as a control, which is exactly what *Trust* measures according to our results.

[6] The validation of survey measures by experimental measures has spurred recent interest in the context of risk preferences, see Anderson and Mellor (2009), Ding et al. (2010), Dohmen et.al. (2011), Hardeweg et al. (2011).

On a practical level, our finding that alternative survey measures capture different aspects of social capital has potentially important implications for the choice of policies aimed at clamping down on uncooperative behavior like tax evasion, petty crime or traffic rule violations. Recent evidence suggests that cooperation preferences are likely to be more stable and more difficult to influence than beliefs about cooperativeness in society.[7] If so, policies targeted at correcting pessimistic beliefs about other peoples' compliance with cooperation norms may be a cost-effective alternative in improving efficiency to more conventional measures based on sanctions to deter non-compliance. For example, the OECD guidelines on improving tax compliance (OECD 2004: 38) explain that "If a person believes that non-compliance is widespread they are much more likely not to comply themselves. Studies indicate that it is effective in reducing non-compliant behaviour to ensure that taxpayers have an accurate understanding of the compliance behaviour of others." In line with this view, a field experiment by Fellner, Sausgruber and Traxler (forthcoming) demonstrates that providing social information on compliance rates (paying fees for public TV) increased compliance in areas with low compliance rates. Asking the appropriate survey question can thus serve as an inexpensive diagnostic tool in evaluating policy choices. makers in their evaluation of whether policies aimed at correcting pessimistic beliefs might be effective in a particular (sub-)population. Our results suggest that policies aimed at correcting overly pessimistic beliefs might be effective if a (sub-)population scores low on *Fairness*. When a (sub-)population is found to score low on *Trust*, other policy measures – perhaps using the threat of punishment to deter uncooperative behavior – may be more effective.

2. Design and Procedures

Section 2.1 explains that we use two types of public goods games to investigate how survey measures of trust relate to cooperation behavior and to analyze the role of preferences and beliefs in this relation. Section 2.2 explains that we use a "virtual lab" approach enabling us to run controlled and incentivized experiments with a large and heterogeneous sample which closely parallels the samples used in survey-based social capital research. Section 2.3 explains

[7] Naef and Schunk (2010) report that prior experience of untrustworthy behavior affects trust in the trust game and that this effect is mainly driven by changes in peoples' beliefs on others' trustworthiness. When controlling for changes in beliefs, they find only a weak effect of prior exposure to untrustworthiness on trust, which indicates that beliefs are likely to be more malleable than preferences. Volk et al. (forthcoming) find in an experiment that cooperation preferences are highly stable over time in the aggregate.

procedural details of recruiting, presentation of instructions etc. Section 2.4 describes the sample and key variables used in the empirical analysis.

2.1 Experimental design

Our study uses within-subjects data from an experimental part and a survey part. In the experimental part, participants play two public goods games in sequence without feedback. In the survey part, participants respond to two survey questions supposed to measure social capital, and report socio-economic data. These main measures are complemented by measures of cognitive ability and risk aversion.

The first public goods game (the Standard game) serves to elicit cooperation choices and beliefs. Subjects are randomly assigned to groups of 4 and endowed with 50 Danish Kroner (Dkr.), or approx. $10, each. They simultaneously choose to contribute an integer number of Dkr. between 0 and 50 to a public good. The total amount contributed in a group is doubled and shared equally among group members. That is, for each Dkr. a player contributes to the public good he or she earnes half a Dkr. while the group as a whole earns Dkr. 2, creating a conflict between individual and collective rationality. After the contribution choices, we elicit beliefs about the other group members' contributions. Participants indicate a belief about the average contribution of the other three group members. Participants are rewarded for belief accuracy using the quadratic scoring rule.[8]

The second game (the Strategy game) serves to elicit cooperation preferences. The Strategy game has the same parameters and payoffs as the Standard game but now contribution decisions are elicited conditionally on the average contribution of the other 3 subjects in the group (following Fischbacher et al. 2001). More specifically, participants receive another endowment of Dkr. 50 each and they know that they are randomly re-matched to new groups of 4 participants. All subjects indicate an unconditional contribution and a conditional contribution. The latter is a complete contribution schedule for all possible levels of average contributions by the other 3 subjects rounded to multiples of Dkr. 5. Such a conditional contribution strategy consists of 11 contribution decisions, one for each average contribution by the other 3 subjects of Dkr. 0, 5, 10,…, or Dkr. 50. A random draw then selects one subject in each group to be the conditional contributor. For all other subjects the unconditional

[8] Participants are paid (in Dkr.) $10 - 0.004\, d^2 \geq 0$, where d is the absolute difference between the belief and the true value.

contribution determines payoffs while the chosen subject contributes according to the average of other group members' unconditional choices and to her contribution strategy.[9]

In the survey part, subjects respond to two questions measuring attitudes towards trust and fairness. To ensure comparability with previous studies, the wording of the questions is taken from the Danish version of the World Values Survey.[10] The questions are:

Trust: "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" Possible answers were coded as 1 if the answer was "most people can be trusted" and as 0 if the answer was "can't be too careful";

Fairness: "Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?" Possible answers range from 1: "would take advantage of you" to 10: "would try to be fair".[11]

The overall sequence of the data collection process is as follows. At the very start of the study, subjects fill in a questionnaire, providing, among other items, information about age, gender, salary and education. The questionnaire is followed by the public goods games.[12] Subjects then participate in an incentivized risk elicitation task and complete the cognitive reflection test proposed by Frederick (2005).[13] Finally, in the survey part, subjects first answer a range of other questions before reaching the social capital questions.[14] Hence, there was some time in-between the public good games and the social capital questions, which should help mitigate possible spillover effects from the experiment to these questions.

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[9] The order of the two games is fixed across participants. One might therefore worry that cooperation choices in the Standard game spill over to the measure of cooperation preferences in the Strategy game. Fischbacher and Gächter (2010) show that this concern is unwarranted. They find that the measures are independent of the order of play.

[10] http://www.worldvaluessurvey.org/

[11] Participants had the option to answer "don't know / don't want to answer". Only 3 percent of participants chose not to answer at least one of the questions.

[12] The overall experiment had 6 treatments with random allocation of participants to treatments. This paper only reports results from one treatment (Give, Standard). Details about the recruitment procedures, participation, and the design of the experiment (including screenshots) can be found in the Online Appendix which can be downloaded from the authors' personal homepages.

[13] Risk aversion is elicited using a modified version of Tanaka et al. (2010). Subjects are presented with a list of 10 choices between two lotteries. Each lottery has two possible outcomes that are equally likely. The paired gambles are constructed such that a risk neutral individual starts choosing the games presented to the left and then switches to the gambles to the right as they move down the list. A later switch point indicates a higher degree of risk aversion. The cognitive reflection test consists of three questions aimed at capturing the individuals' ability or disposition to reflect on a question rather than to report the first response that springs to mind. Frederick (2005) shows that the test is predictive of subjects' behavior in a wide range of decision tasks. See the Online Appendix for more information.

[14] The sequence of screens is as follows. Questions about the respondent's work situation, including our salary variable; Questions regarding computer and IT usage; Social capital questions; Questions concerning political attitudes; Cognitive reflection test.

2.2. A virtual lab approach

Our study uses a novel "virtual lab" approach. The platform we use is called iLEE (internet Laboratory for Experimental Economics) which has been developed at the Department of Economics at the University of Copenhagen.[15] It follows the standards (e.g. no deception, payment according to choices) and procedures (e.g. with respect to instructions) as in a conventional laboratory experiment but subjects make choices remotely, over the internet. As such, iLEE serves to "bring the lab to your living room" and to recruit large heterogeneous samples of participants from the Danish population. The Dutch Center Panel is similar to our virtual lab approach in that subjects participate in experiments (e.g. Bellemare and Kröger 2007) remotely over computer or TV with a set-up box. To date, iLEE has been used to run several waves of experiments, each consisting of several modules. The experimental data reported here comes from iLEE1, the first module of the first wave of the iLEE project.

Our virtual lab approach is ideally suited for our validation purpose because it allows to recruit participants from all walks of life and thus to closely parallel the composition of the samples routinely used in social capital survey research. While survey measures of trust (as in the World Values Survey) can easily be administered at relatively low cost to large and heterogeneous samples, our virtual lab approach allows participants to make choices and give responses in their habitual environment (e.g. at home) and the internet could arguably be seen as a more natural environment for economic experiments, as most people frequently use the internet for everyday economic transactions such as e-banking and online shopping.[16] Taken together, the virtual lab approach may help reducing the perceived artificiality of the situation while maintaining a high level of experimental control. Our approach also guarantees perfect anonymity between subjects. The perfect anonymity and the one-shot nature of our experiment are particularly apt to capture what is sometimes called "thin" trust (i.e. trust towards a "generalized other" in contrast to "thick" trust in repeated interaction within a social network, see e.g. Putnam 2001: 136. See Andreoni 1988 for the effects of repeated interaction between "partners" or "strangers").

A potentially important advantage of validating survey trust in a fully anonymous, large and heterogeneous sample (rather than in a relatively homogenous convenience sample of students in the lab) is that beliefs and actions are less likely to be correlated due to

[15] For more information about the iLEE project see: http://www.econ.ku.dk/cee/iLEE

[16] Denmark has the highest broadband penetration in the world (source: EU Commission's Progress report on the single European electronic communications market 2007,13th report), and daily usage of the internet, e.g. for internet banking, is very common.

"extrapolation" of one's own behavior to others. Sapienza et al. (2007) argue that this is more likely to happen in relatively homogenous samples such as groups of students recruited from within a given University.

2.3. Procedural details

Subjects were recruited in collaboration with Statistics Denmark, the statistics agency of Denmark. Statistics Denmark drew a random sample from the Danish population (aged 18-80) and sent out letters in May 2008 by regular mail, using the official agency letterhead. The recipients of the letter were invited to participate in a scientific experiment in which money could be earned. The letter explained that all recipients were randomly selected from the Danish population, that the earnings from the experiment will be paid out via electronic bank transfer, and that choices are fully anonymous between subjects and between subjects and the researchers from iLEE. It was possible to maintain subject-experimenter anonymity because participants logged into the iLEE webpage using a personal identification code, the key of which was only known to Statistics Denmark.

When participants logged into the webpage, they were provided with detailed instructions which were carefully pretested in focus groups and designed for easy comprehension. For example, the written instructions were supplemented by graphical illustrations of the incentive structure (see Online Appendix for screenshots). Before subjects made their choices, they had to answer a series of control questions. Throughout the experiment subjects had access to page-specific help screens and could at any stage go back to review the instructions. Subjects also had access to a profit calculator to explore the relation between the payoffs and the contributions of all group members. In addition, participants were offered further assistance via phone or e-mail.[17]

Participants did not receive feedback about other participants' decisions until the very end of the experiment when they were individually paid out. Counting from the date they received the invitation letter, they were given one week to complete the experiment. During that week they could exit and re-enter at the point where they left off the experiment at their convenience. After the experiment closed, subjects were matched into groups and payoffs were calculated. Thereafter, participants could return to the website for feedback about the

[17] The median participant spent about 20 minutes to complete the Standard and the Strategy game, and it took a few additional minutes to fill in the questionnaire data used in this paper.

experimental outcome in their respective groups and their earnings. Participants were asked to state their bank account number and earnings were paid out via electronic bank transfer.

2.4 Description of the sample

Our study uses a sample of 1488 subjects, which is unusually large for an incentivized experiment and includes people from all walks of life in Denmark.[18] Our main sample analyzed below consists of all subjects who completed both cooperation games and the *Trust* and *Fairness* questions. For the regression analysis we also make use of an additional set of socio-economic control variables which reduces the sample somewhat since it was voluntary for subjects to provide this information. Our subject pool is highly heterogeneous and captures a lot of the underlying variation of the Danish population with respect to important socio-economic variables.[19] All age and educational groups are well represented, although the highly educated, the high-salary earners, and middle-aged people are somewhat over-represented.

In our estimations we use two sets of control variables. A small set contains age, age squared, and gender. Slightly more than half of the 1488 participants are male (51.7 percent) and the age of the participants spans from 18 to 80 years, with an average of 46.4 years. A larger set of controls contains information about education, salary, risk aversion and their score in the cognitive reflection test. We asked for participants' education on a four point scale. Participants with basic schooling (up to 10 years of schooling, 8 percent of the sample) are our baseline category in the regression analysis below. The categories comprised those with degrees from high school and vocational school (25.3 percent, variable *Education 1*), those with tertiary education up to 4 years (47.7 percent, *Education 2*), and those with a longer tertiary education of at least 4 years (16.5 percent, *Education 3*). Participants are sorted into three groups of about equal size by salary.[20] *Low salary* is set equal to one for participants in the bottom group, and *High salary* is set to one for those in the top salary group. For the risk aversion task we used the row at which they switched as an indicator of their risk aversion (average switch point 5.14; standard deviation 3.11). Subjects that switched back and forth are excluded from the sample. We also included a variable indicating the number of correct answers in the cognitive reflection test (on average subjects answered 1.46

[18] Examples of other large-scale studies are Fehr et al. (2003) with n = 429, Bellemare and Kröger (2007) with n = 499, Sapienza et al. (2007) with n = 508, and Gächter et al. (2004) with n = 782 participants.

[19] See Table A1 in the Online Appendix for a description of the socio-economic characteristics of our sample and a comparison with the entire Danish population.

[20] The variable is self-reported gross salary (incl. bonuses etc.).

out of the three questions correctly; standard deviation 1.11). When including the controls of the large set we lose part of the observations, either because the participants did not answer the questions or did it inconsistently (the risk task).

Denmark is placed among the countries with the highest trust level according to the World Values Survey, with 66.5 percent of respondents of the fourth wave of survey stating that "most people can be trusted". We also find that a high degree of trust among our respondents with 90.1 percent of the respondents answering yes to the *Trust* question and an average response to the *Fairness* question of 7.75 on a ten point scale.[21] The two survey measures are distinct but positively correlated (Spearman's rank correlation: $\rho = 0.326$, $p = 0.000$).[22] Table A2 in the Online Appendix provides estimates for *Trust* and *Fairness* with the two sets of controls. Both *Trust* and *Fairness* are significantly increasing in the level of education of the participants. All other controls are insignificant for *Trust*, whereas *Fairness* is higher among female participants and inverted U-shaped in age. Thus, a likely reason for why we observe higher trust than the World Values Survey may be that people with long education are overrepresented in our sample.

3. Results

The presentation of results proceeds as follows. Section 3.1 relates *Trust* and *Fairness* to beliefs and behavior in the Standard game. We show that contributions in the Standard game are positively related to beliefs and that both *Trust* and *Fairness* explain contributions, controlling for socio-economics. However, only *Trust* is found to be directly related to contributions while *Fairness* is indirectly related to contributions through beliefs. Section 3.2 discusses results for the Strategy game. We find that most participants are conditional cooperators, while only few are free riders. In line with the results from the Standard game we observe that the level of conditional cooperation is strongly linked to *Trust* but unrelated to *Fairness*.

3.1 Relating *Trust* and *Fairness* to behavior in the Standard game

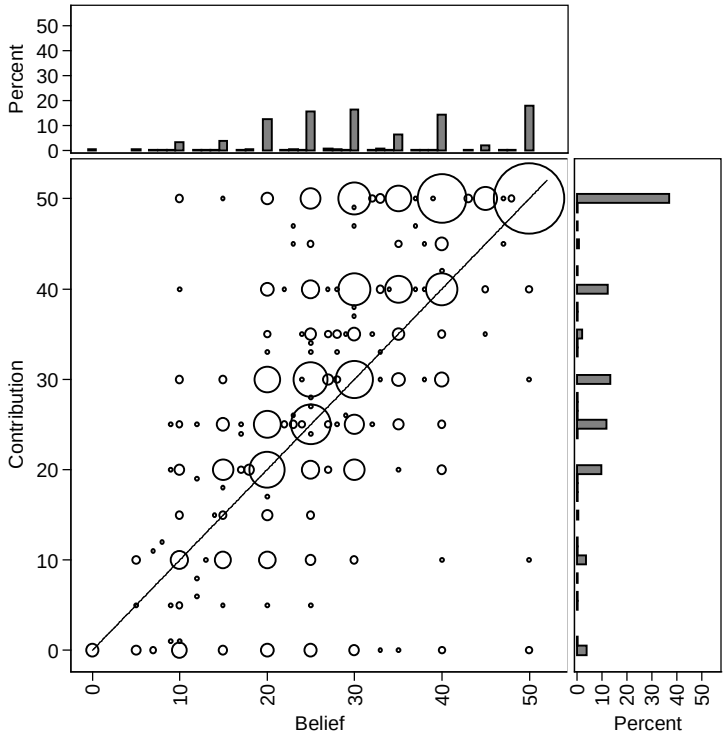
Figure 1 summarizes the relation between contribution choices and beliefs in the Standard game. The right panel of the figure shows a histogram of the contributions. The modal choice is full contribution (Dkr. 50), and focal contributions like multiples of Dkr. 5 account for

[21] Unfortunately, the *Fairness* question is not yet available for Denmark in the World Values Survey.

[22] This is also the case in the World Values Survey data. In wave 4 of the WVS, the Spearman rank correlation test between *Trust* and *Fairness* is $\rho = 0.606$ ($p = 0.000$).

almost all contribution choices. Average contributions are Dkr. 35.0 (70 percent) with a standard deviation of Dkr. 14.6. The top panel of the figure shows a histogram of beliefs about contributions by others. The average belief was Dkr. 31.8 with a standard deviation of Dkr. 12.0. The bubble plot in the center panel of figure 1 shows that there is a clear positive relation between contributions and beliefs. This finding is in line with Fischbacher and Gächter (2010) and Dufwenberg et al. (2008). However, in contrast to these studies we find that subjects tend to contribute more than they believe others to contribute (there is a large mass of observations above the 45 degree line in figure 1).

Figure 1: Relation of contribution choices and beliefs in the Standard game



Top panel: Histogram of the beliefs. Right panel: Histogram of the contributions. Center panel: Bubble plot showing the relation between beliefs and contributions. Bubble size corresponds to the number of observations (n = 1488).

Table 1 provides results for the relation of *Trust* and *Fairness* to beliefs and contribution choices in the Standard game. Columns (1) and (2) show the results of OLS estimates explaining beliefs by trust and fairness, using either only age and gender or the larger set of control variables.[23] Columns (3) to (6) show how *Trust* and *Fairness* relate to contributions. Columns (3) and (4) explain cooperation choices excluding beliefs, columns (5) and (6) including them.

[23] Since the dependent variables *Belief* and *Contribution* are censored in [0,50] we also ran Tobit estimations with similar results (see Table A6 in the Online Appendix).

Columns (1) and (2) show that beliefs are not significantly related to *Trust* but are strongly related to *Fairness*. Thus, people who expect others to be fair also believe that others generously contribute to the public good. The coefficient estimate for *Fairness* in (1) implies that subjects who express full confidence in others' fairness hold beliefs that are about Dkr. 6.1 higher than subjects who are certain that others would take advantage of them. The estimated effect is even stronger when we add controls for salary, education, risk preferences and the cognitive reflection test score in (2). Here the estimate amounts to Dkr. 8.1 between the lowest and highest *Fairness* score. The demographic variables also explain some of the variance in beliefs. In particular, we find that female subjects express significantly lower beliefs. This effect loses significance once we add the additional controls. The effect of age is nonlinear. The coefficient estimates for *Age* and *Age squared* show that age effects are inverted U-shaped, with a maximum at the age between 48 and 52. While the coefficients for *Fairness* and some of our demographic controls are significant, it should be noted that all variables taken together account only for a small portion of the observed variance in beliefs which is in line with findings from related studies (e.g. Gächter et al. 2004).

Columns (3) and (4) show that contributions are positively related to *Trust* and *Fairness*. In particular, column (3) shows that trusting participants contribute about Dkr. 2.7 more than non-trusting participants. The effect of *Trust* loses significance when we use the additional controls. The effect of *Fairness* on contributions is of similar order of magnitude as the effect on the beliefs. Participants with full confidence in others' fairness contribute about 16 to 18 percent (Dkr. 5.8 to 6.5) more than those who think that others will take advantage of the situation if they get a chance. The influence of our demographic controls on contributions mirrors the estimates for the beliefs.[24] Gender effects are significant as long as we do not add the additional controls,[25] and age has an inverted U-shaped influence on contributions. That is, contributions rise in age until they reach a maximum at age of about 46 to 49, and fall thereafter.[26]

[24] The finding that the socio-economic variables account only for little of the total variance is in line with, e.g. Gächter et al. (2004) and Bellemare and Kröger (2007). However, the role of socio-economics appears to vary across settings. Findings from less complex settings such as the distribution games in Fehr et al. (2006) indicate that differences in socio-economics between groups may lead to substantial differences in behavior.

[25] The experimental literature on gender effects in public goods games finds varying results (see Croson and Gneezy 2009 for a survey). For example, Gächter et al. (2004) find no effects, Nowell and Tinkler (1994) find that all-female groups are slightly more cooperative than all-male groups. Andreoni and Vesterlund (2001) and Solow and Kirkwood (2002) find no unambiguous gender effects. Bellemare and Kröger (2007) find that women exhibit significantly higher trust levels than men in their experimental trust games.

[26] Bellemare and Kröger (2007) report similar age effects for their trust games.

Table 1: Determinants of Beliefs and Contributions

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable					
	Belief		Contribution			
Trust	0.718	-1.594	2.775**	1.845	2.109**	3.332***
	(1.114)	(1.576)	(1.359)	(1.911)	(0.883)	(1.221)
Fairness	0.683***	0.905***	0.644***	0.717**	0.010	-0.128
	(0.201)	(0.274)	(0.245)	(0.332)	(0.160)	(0.213)
Belief					0.928***	0.933***
					(0.021)	(0.026)
Female	-2.343***	-1.304	-2.284***	-0.419	-0.109	0.797
	(0.623)	(0.897)	(0.760)	(1.087)	(0.496)	(0.695)
Age	0.400***	0.443*	0.571***	0.653**	0.200**	0.240
	(0.122)	(0.251)	(0.148)	(0.304)	(0.097)	(0.195)
Age squared	-3.887***	-4.570	-5.887***	-7.034**	-2.279**	-2.770
	(1.301)	(2.840)	(1.587)	(3.443)	(1.034)	(2.203)
Controls	No	Yes	No	Yes	No	Yes
Constant	17.613***	20.666***	15.988***	14.654**	-0.360	-4.628
	(2.921)	(5.648)	(3.564)	(6.847)	(2.343)	(4.406)
F-test	9.1	2.7	8.8	2.2	356.1	104.5
Prob > F	0.000	0.001	0.000	0.010	0.000	0.000
R^2 adjusted	0.027	0.023	0.026	0.016	0.589	0.598
N	1488	904	1488	904	1488	904

The table shows OLS estimates for *Belief* and *Contribution* in the first experiment. Dependent variable is *Belief* or *Contribution* in the first experiment, censored at 0 and 50. Independent variables are *Belief*, a dummy for *Trust* and the *Fairness* score. Further controls include a gender dummy *Female*, the *Age* of the participants, as is and squared. *Controls* contains variables for education, salary, risk preferences, and the score in the cognitive reflection test. The figures reported are coefficients, with corresponding standard errors are given in the parentheses.; * denotes significance at 10 percent, ** at 5 percent, *** at 1 percent.

Columns (5) and (6) of Table 1 show estimates of contribution choices when participants' beliefs are included as explanatory variable. Accounting for beliefs dramatically affects results.

First, it increases the share of the explained variance from about 2 percent in (3) and (4) to around 60 percent in (5) and (6). The coefficient for *Belief* is close to unity and highly significant. Thus, beliefs about other participants' contributions are a very strong predictor for contribution choices. This finding underscores the visual impression from figure 1 and lends support to the importance of conditional cooperation discussed in more detail in the next section.

Second, and more important for our purpose, is the differential effect of including beliefs on the coefficients of *Trust* and *Fairness* in columns (5) and (6). *Fairness* now has no explanatory power at all, indicating that the expected fairness of other people only indirectly affects behavior in the Standard game. That is, the effect of *Fairness* on contributions seems

to be belief-mediated. Accounting for beliefs in the regression has different consequences in the case of *Trust*. While the effect of *Trust* on beliefs was insignificant [see (1)], the effect on contributions is strong in (3) and survives the inclusion of the belief variable in (5) and (6). Thus, *Trust* does not seem to capture beliefs about others' behavior but rather about participants' own behavior

Third, we note that the age effects identified in (3) and (4) lose their significance once *Belief* is included as an explanatory variable in (5) and (6). The reason is that age is strongly related to beliefs as seen in (1) and (2) which indicates that people around the age of 45 contribute more than others because they are more optimistic about other peoples' contributions. The coefficients for female gender become positive but remain insignificant. The estimates of the additional control variables are left out from Table 1 to keep the presentation compact (the complete set of estimates is presented in Table A3 in the Online Appendix). Education tends to increase contributions when controlling for beliefs, but there is no significant effect of education in the other specifications. There does not seem to be a strong relationship between salary and contributions; if anything, respondents with low salary appear to hold more pessimistic beliefs about the contributions of others. Surprisingly, our measure for risk preferences is significantly related to beliefs but not to contributions. Thus a higher degree of risk aversion seems to lower beliefs about others' contributions but not contributions.

The Online Appendix provides several robustness checks for the results reported in Table 1. Table A4 shows a minimalistic specification in the absence of any control variables. Table A5 reports OLS models using either *Trust* or *Fairness* as explanatory variables. Table A6 reports the same specifications as Table 1, but uses Tobit estimations. Overall, these estimations confirm the results presented in Table 1: only *Fairness* is associated with beliefs, both *Trust* and *Fairness* are associated with contributions, but when beliefs enter the specification only *Trust* relates to contributions.

As an alternative to explore the heterogeneity of the sample, Tables A7-A13 in the Online Appendix report results from the regression models of Table 1 for subgroups of the sample. More precisely, we re-estimate the models separately for each gender, three age groups, and education category. This exercise reveals that our results are strongest among the young and educated, but coefficients do have the right signs for all subgroups except for the group with low education (roughly 10 percent of the sample). Tables A14-A18 address heterogeneity by use of interaction terms. We interact *Trust* and *Fairness* with the subgroups used in Tables

A7-A13. The results indicate that our main results are quite robust across subgroups, but tend to be stronger for the young.

Finally, we check whether our findings carry over when restricting attention to a sample with a low level of trust. More specifically, for each individual, we calculate the predicted probability of answering yes to the Trust question using probit regressions. We thereafter select the 25% (50%) of the total sample with lowest predicted trust and re-estimate the models of Table 1 using these low-trust subjects only. These regressions are summarized in Tables A19-A20 in the Online Appendix. With a few exceptions, our main results are again replicated, suggesting that the links between the survey measures and cooperative behavior seem to carry over also to less trusting populations.

3.2 Relating *Trust* and *Fairness* to behavior in the Strategy game

Cooperation in the Standard game is driven by preferences and beliefs. Our results from the Standard game suggest that the *Fairness* question captures beliefs while the *Trust* question captures preferences for contributing. Our Strategy game allows us to test this claim in more detail. The Standard game offers only limited information to identify preferences for contributing because we observe only one contribution decision for each participant. The Strategy game, in contrast, is designed to identify contribution strategies rather than one particular action. We conclude from our analysis of the Strategy game below that the *Trust* question indeed measures preferences while the *Fairness* question measures beliefs.

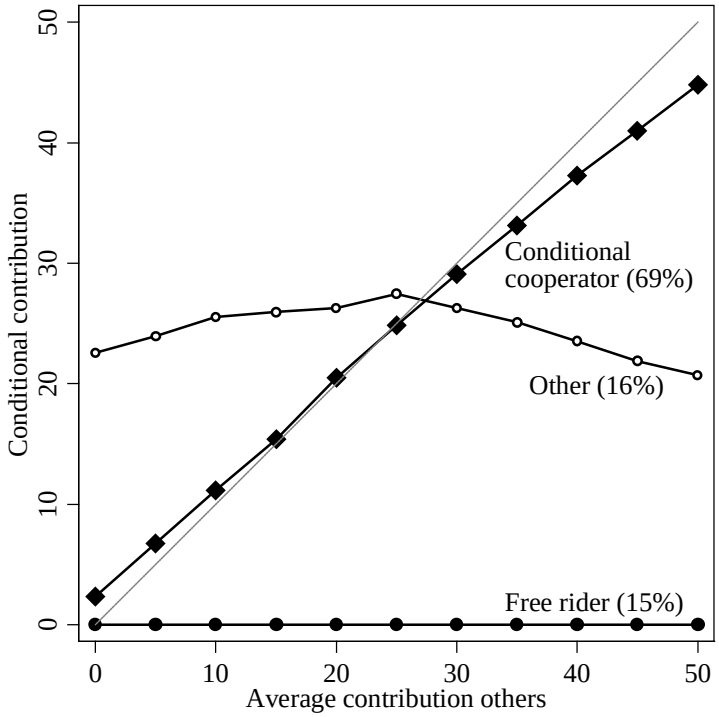
A strong majority of 69 percent of our participants are Conditional cooperators according to the classification developed by Fischbacher et al. (2001). These subjects condition their contribution on the other group members' contributions and their willingness to contribute to the common project increases with the contributions of the other group members. More specifically, a participant is classified as a conditional cooperator if his or her contribution is weakly increasing in the average contribution of the other group members (with at least one strict increase). A participant is also classified as conditional cooperator if the correlation between the participant's contributions and the average contributions of the other group members is significant and positive.[27] Participants who contribute Dkr. 0 at all levels (15

[27] We adapt the classification of Fischbacher et al. (2001) to account for the fact that we observe fewer data points per participant. In Fischbacher et al., subjects indicate conditional contributions for 21 contribution levels, while we have only 11 observations per subject. Their criterion of a Spearman rank correlation significant at 1% is thus too restrictive in our case and we therefore relax it to 10%. For the vast majority of observations the classification does not depend on the specific significance level. If we apply the 1%

percent) are called *Free riders*.[28] The remaining 16 percent do not fit into either category. For convenience, we call them *Other*.[29]

Figure 2 shows average contribution profiles for each preference type. The horizontal axis shows the average contribution of the other group members and the vertical axis the conditional contribution.

Figure 2: Cooperator types



The figure shows average contribution in Dkr. conditional on average contribution by other group members, by cooperator type. The diagonal indicates the locus of a perfect match between own and others' average contribution (n = 1488).

Tables 2 and 3 investigate how *Trust* and *Fairness* relate to cooperation preferences in two ways. First, we use the cooperator types as defined above and ask what determines whether a person is classified as *Conditional Cooperator*, relative to the other two categories. Second, we construct a measure of the strength of conditional cooperation and ask to what extent it

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criterion to our data, we classify 67% as *Conditional cooperator*s. Interestingly, many conditional cooperators (45.8 percent) perfectly match the other group members' average.

[28] Our classification results are comparable to other studies. Variation in the shares is likely to be due to differences by country. For example, the shares for *Conditional cooperators* and *Free riders* are in Fischbacher et al. (2001) 50% and 30% for Swiss subjects, in Herrmann and Thöni (2009) 56% and 6% for Russian subjects, in Kocher et al. (2007) 81% and 8% for US subjects, in Burlando and Guala (2003) 76% and 9% for Italian subjects.

[29] Classifications often also include a third type, the Triangle contributors, who, in response to increasing contribution levels, increase their contribution up to some maximum and decrease it afterwards. About a third of the subjects we classify as *Others* fall into this category.

can be accounted for by *Trust* and *Fairness*. We find that *Trust* is significant in both cases, while *Fairness* is not. These findings from the Strategy game support our interpretation of results from the Standard game that *Trust* captures cooperation preferences.

Table 2: Characteristics of *Conditional cooperators*

	(1)	(2)
	Probit for Conditional Cooperator	
Trust	0.076	0.385**
	(0.123)	(0.171)
Fairness	-0.030	-0.026
	(0.022)	(0.031)
Female	0.126*	0.056
	(0.069)	(0.101)
Age	0.006	-0.005
	(0.014)	(0.029)
Age squared	-0.146	0.036
	(0.145)	(0.325)
Controls	No	Yes
Constant	0.689**	0.715
	(0.331)	(0.650)
Model chi-square	19.0	18.1
Prob > chi2	0.002	0.112
Pseudo R-squared	0.010	0.016
N	1488	904

The table shows probit estimates for being classified as *Conditional cooperator*. Classification is according to the conditional contribution scheme in the Strategy game. Independent variables are a dummy for *Trust* and the *Fairness* score. Further controls include a gender dummy *Female*, the *Age* of the participants and its square. *Controls* contains variables for education, salary, risk preferences, and the score in the cognitive reflection test. The numbers reported are coefficients, with the corresponding standard errors shown in the parentheses. * denotes significance at 10 percent, ** at 5 percent, *** at 1 percent.

Table 2 shows probit estimates for the influence of *Trust* and *Fairness* on the probability of being a *Conditional cooperator*, with and without the additional controls. In line with the results reported in Table 1, we find that *Fairness* does not predict a subject's type while *Trust* is a significant predictor for being classified as *Conditional cooperator* when relevant controls are included.[30] The marginal effect of *Trust* is about 15 percentage points according to Model (2).

Table 3 presents results for the second way of investigating how *Trust* and *Fairness* relate to cooperation preferences. We construct a measure of the level of conditional cooperation by calculating the average contribution over all 11 conditional contributions per subject and we

[30] This result is robust to estimating the influence of *Trust* and *Fairness* separately. If we remove *Fairness*, the estimate for *Trust* is $\beta = 0.016$, se = 0.115 in Model (1) and $\beta = 0.336$, se = 0.036 in Model (2). *Fairness* remains insignificant in both models when we exclude *Trust*.

restrict our attention to those classified as *Conditional cooperators* (i.e. 69 percent of our sample). The approach presented in Table 3 also serves to address a potential objection to the analysis in Table 2. There, we compare the type *Conditional cooperator* against a heterogeneous class of *Other* and *Free rider* types. This reference category contains a wide variety of patterns, some including very high contributions. This heterogeneity in the reference category potentially blurs the results but we find that results are robust across the two approaches in Tables 2 and 3.

Table 3: Relation of *Trust* and *Fairness* to the level of conditional cooperation

	Dep. var.: Av. conditional contribution	
	(1)	(2)
Trust	2.660***	3.580***
	(0.788)	(1.186)
Fairness	-0.093	-0.106
	(0.142)	(0.197)
Female	-0.598	-0.536
	(0.425)	(0.617)
Age	0.121	0.059
	(0.084)	(0.166)
Age squared	-1.168	-0.818
	(0.912)	(1.882)
Controls	No	Yes
Constant	19.974***	22.499***
	(1.960)	(3.697)
F-test	3.7	1.6
Prob > F	0.003	0.076
R^2 adjusted	0.013	0.012
N	1029	636

Table 3 shows OLS regressions. Dependent variable is average conditional contribution. Only data from subjects classified as *Conditional cooperator*. Independent variables are a dummy for *Trust* and the *Fairness* score. Further controls include a gender dummy *Female*, the *Age* of the participants, as is and squared. *Controls* contains variables for education, salary, risk preferences, and the score in the cognitive reflection test. The numbers reported are coefficients, with corresponding standard errors in parentheses. * denotes significance at 10 percent, ** at 5 percent, *** at 1 percent.

Table 3 shows the results of OLS regressions explaining the average conditional contribution. In support of our conjecture that *Trust* proxies cooperation preferences and not beliefs, we find a highly significant positive influence of *Trust* on average conditional contribution in the Strategy game in both specifications of Table 3. In column (4) of Table 1, we found that those who trust contribute, given their beliefs, on average between Dkr. 2.1 and 3.3 more than those who do not. This finding is in line with the results in Table 3 which show that *Conditional cooperators* who trust have average conditional cooperation schedules which are between Dkr. 2.7 and 3.6 higher than those who do not trust.

None of the other explanatory variables in Table 3 are significant, meaning that *Trust* is the only variable among those considered here that explains the level of conditional cooperation. In line with our conclusions from analyzing the Standard game, we find that *Fairness* has no systematic influence on average conditional contribution.

4. Summary and conclusions

We use data from an experiment with close to 1500 participants from all walks of life in Denmark to show that the most prominent survey measure of trust (*Trust*) is an important predictor of social capital in the guise of voluntary contributions to public goods. Our analysis behaviorally validates survey measures and contributes to the microfoundations of social capital by suggesting that *Trust* proxies the preference-driven component of cooperation. *Trust* is a stronger predictor of cooperation preferences than gender, age, education or salary. In contrast, our analysis indicates that an alternative survey measure of social capital that has recently been introduced to the World Values Survey, the *Fairness* question, primarily explains optimistic beliefs about cooperation in others. These optimistic beliefs map into increased cooperation because most participants have preferences to cooperate given that others do, i.e. because they are conditional cooperators. Apart from this belief-mediated effect, we find no direct influence of *Fairness* on cooperation.

The effects of *Trust* and *Fairness* on cooperation are statistically significant in regressions which control for socio-economic variables like age, gender, salary and education. The effects are not only statistically significant, they are also sizeable. For example, those who trust contribute about 10 percent more than those who do not, and those who indicate full confidence in other people's fairness contribute about 20 percent more than those who express minimal confidence in other's fairness. These effects are remarkably strong, both compared to findings in the literature and compared to alternative explanations. First, research in social psychology suggests that the relation between attitudes and behavior is often rather weak (e.g. Eagly and Chaiken 2003), and previous studies on the relation between survey and experimental measures of social capital tend to find mixed effects (see introduction for references). Second, in line with much of the literature, we find that cooperation behavior is mainly driven by beliefs. However, if beliefs are not accounted for in regressions, *Trust* and *Fairness* variables account for more variation than our socio-economic variables.

We show that *Trust* and *Fairness* are systematically related to cooperation in a one-shot interaction with fully anonymous counterparts, i.e. in a situation without prior information about or experience with their counterparts. Thus, *Trust* and *Fairness* capture important aspects of "thin" trust towards a "generalized other" which has been found to be a relevant determinant of economic prosperity. Beliefs are likely to be particularly relevant in such anonymous one-shot interactions. After all, optimism and pessimism about others' inclination to cooperate matter most when little is known about actual cooperation. However, in everyday life, cooperation problems often loom large in groups whose members repeatedly interact, as in the workplace or repeat customer relations. Based on our results, we speculate that "thick" trust which is required in this type of repeated interaction is better predicted by *Trust* than by *Fairness*. The reason is that beliefs about cooperation are adjusted to observed contributions over time and, therefore, are likely to eventually become largely irrelevant as an independent determinant of behavior.

A long-standing debate in the social sciences concerns the appropriate choice of policies to improve cooperation. A recent focus of research in (experimental) economics has been on the relative merits of formal vs. informal sanctions to deter uncooperative behavior (see e.g. Markussen et al. 2011 for a discussion). While often effective, both types of policies can be rather costly because meting out sanctions is wasteful. In contrast, policies that rely on "belief-management" as e.g. proposed by the "broken windows" theory, do not rely on wasteful sanctions and may be effective in some circumstances (see Keizer et al. 2008 or Fellner et al. forthcoming for field experiments). Such policies aim at improving cooperation by correcting exceedingly pessimistic beliefs about other peoples' inclination to cooperate. According to our results, the survey measure of *Fairness* provides an inexpensive diagnostic tool indicating when resorting to policies involving belief-management may be worthwhile.

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