"Culture, Cooperation and Economic Consequences"

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Introduction

Social dilemmas as illustrated by the well known Prisoners' Dilemma are omnipresent in the interactions among humans. Examples include warfare, cooperative hunting, voting, paying taxes, contributing to public goods, teamwork, tackling climate change and so on. All these situations feature an incentive structure where individual and collective rationality are in conflict: group payoff would be maximal if all individuals fully contribute while each individual maximizes his payoff by not contributing.

Innumerable studies were written on social dilemmas (Dawes, 1980; Kollock, 1998) and the topic has also received a lot of attention in experimental economics (Ledyard, 1997). One stylized fact is that a majority of the subjects in experimental social dilemmas is ready to contribute as long as others do so as well. Observing others free riding has devastating effects on contributions, which means that in repeated social dilemmas cooperation is bound to fail. Numerous mechanisms have been proposed to overcome this 'tragedy of the commons', of which so-called 'altruistic punishment' (Fehr & Gächter, 2002) is among the few successful ones. If subjects in an experiment are given the chance to punish other subjects for not contributing, then they can use this punishment option to teach the free riders a lesson and make them contribute. Early empirical results on these games have shown that the punishment option indeed leads to high contributions and efficient outcomes. More recent data shows that this is not always the case. Grechenig, Nicklisch, & Thöni (2010) show that when subjects are only imperfectly informed about whether other subjects are free riders or not then the punishment mechanism has much weaker effects. In this article I present data that shows that there is large cross-cultural variety in how subjects react to the introduction of the punishment mechanism.

Tool: The public goods game

The public goods game is among the most widely used tools in experimental economics to study social dilemma situations. In a typical public goods game there is a number of n players. Each player is endowed with $e > 0$ units of the experimental currency. The players decide anonymously and simultaneously how many units they want to con-

tribute to the public good, i.e., they choose a contribution $0 \leq c_i \leq e$. All contributions are summed up and multiplied by a factor $1 < \alpha < n$ and divided equally among all n players. Monetary payoff functions are

$$\pi_i(c_i, c_{-i}) = e - c_i + \frac{\alpha}{n}\sum_{j=1}^{n} c_j \qquad \text{with } 1 < a < n\,. \tag{1}$$

Players keep the units they did not contribute and they earn an equal share of the money in the public good, whether or not they contributed themselves. Under standard assumptions (i.e., $u_i = f(\pi_i)$, $f' > 0$) this game has a unique Nash equilibrium with for all players. However, from the group's perspective contributing is efficient, because joint income is maximized at $c_i = e$ for all players. This game models the typical incentive structure of numerous social situations in everyday life, like working in a team, keeping public space clean, respect for others' property and the like. However, it mimics a situation where there is no possibility to express ones agreement or discontent with the decisions of the other group members.

In many social situations a certain degree of mutual monitoring is possible and people have ways to express their content or discontent with other people's choices. The public goods game with punishment models a situation in which players observe the other players' contributions to the public good and are given the chance to punish others dependent on their behavior. The game has two stages. First, players choose their contribution similar to the normal public goods game. In the second stage players learn the contributions of the other players. They then can assign punishment points p_{ij} to other players and other players can do so as well (p_{ji}). The punishment points reduce the income of both players involved, the punisher and the punished player. The profit function is

$$\pi_i(c, p) = e - c_i + \frac{a}{n}\sum_{j=1}^{n} c_j - \gamma\sum_{j\neq i} p_{ij} - \sum_{j\neq i} p_{ji}\,, \tag{2}$$

where $0 < \gamma \leq 1$ measures the cost of a reducing another player's income by one unit. Under standard assumptions the game still has only one subgame perfect equilibrium, in which neither of the players contribute nor punish. The equilibria discussed so far hold for the static game. In many situations we are interested in the dynamics of contribution and punishment decisions and look at repeated public goods games. How-

ever, the equilibria of the stage game remains the unique subgame perfect equilibrium play of the stage game in repeated public goods games as long as the number of periods is known to the players.

Theories that depart from standard assumptions are capable of predicting non-minimal contributions and punishment. A prominent example is the Fehr-Schmidt model (Fehr & Schmidt, 1999). This model postulates a utility function that incorporates inequality aversion, i.e., the notion that people dislike unequal outcomes. In the public goods game this model allows for equilibria with non-minimal contributions by some of the players. However, only players who are sufficiently inequality averse will contribute. On the other hand, the establishment of cooperative equilibria becomes easier when punishment is available. In such equilibria typically all players contribute. The selfish players do so because the threat of being punished by the inequality averse players is credible and strong enough to make contributing worthwhile.

Data: A cross-cultural study on cooperation

In this article I use the data from Herrmann, Thöni, & Gächter (2008). They conducted public goods games and public goods games with punishment in 16 cities spanning a wide variety of cultural backgrounds around the globe. They observe groups of four subjects over ten periods in a partner matching. In each period subjects are endowed with $e = 20$ monetary units, the efficiency parameter of the public good was $\alpha = 1.6$ and punishment costs were $\gamma = .33$. Subjects first played ten periods of the normal public goods game (N-experiment) followed by ten periods of the public goods game with punishment (P-experiment). Figure 1 shows the locations of the experimental sessions. The experimental subjects were always students of local universities. Instructions were translated to the local language and backtranslated to check consistency. All experiments were conducted in computer laboratories and subjects' anonymity was preserved. The computers were separated by cardboards such that subjects were not able to see the decisions of other subjects in the room. In all locations subjects were paid according to the outcome of the experiment. The total earnings from the N and P-experiment were summed up and converted to the local currency at a predefined exchange rate. Monetary incentives were set to match the

subjects' opportunity cost of participating in the experiment, i.e., subjects earned about as much as they could have earned in the same time when working in a typical part-time job for students. These procedures are important as they ensure that the observations from different locations are highly comparable.

Figure 1: Locations of the experimental sessions.

Results: Cross-cultural variety in antisocial punishment

For the data analysis I use the classification of Gächter, Herrmann, & Thöni (2010) to separate the locations into cultural areas. Observations from Boston, Nottingham, and Melbourne are called *English speaking*; Copenhagen, Bonn, Zurich, and St.Gallen *Protestant Europe*; Minsk, Dnipropetrovs'k, and Samara *Orthodox/Ex-Communist*; Athens and Istanbul *Southern Europe*; Riyadh and Muscat *Arabic speaking*; Seoul and Chengdu *Confucian*. Figure 2 shows the average contribution over the ten periods of the N and P-experiment separated by subject pool (thin line) and on average (diamond dots). Each panel represents a cultural area. It turns out that within a culture, behavior is very homogeneous in both the N and P-experiments. Contributions in the P-experiments are, however, strikingly different between cultures while still homogeneous within cultures.

Herrmann, Thöni, & Gächter (2008) argued that the reason for the striking cross-cultural differences in the P-experiment lies in the subjects' punishment decisions. Recall that when punishing others the subjects

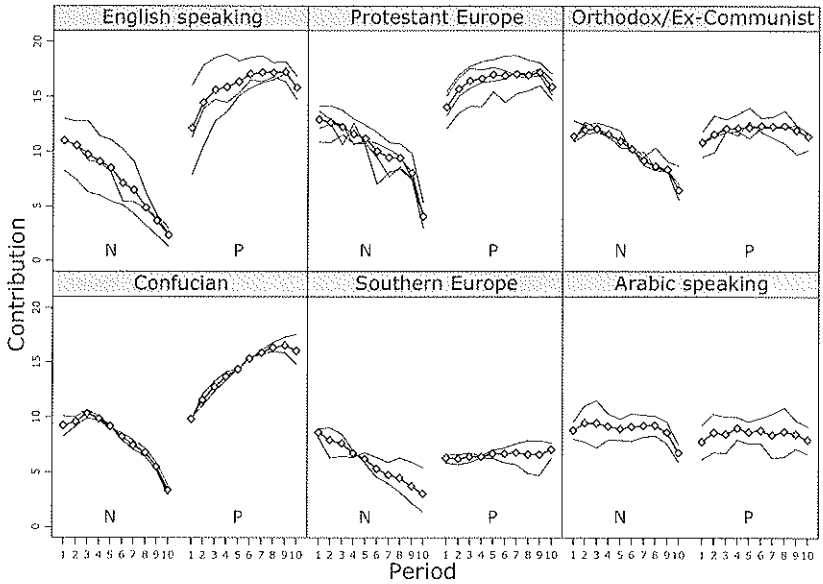

Figure 2: Contributions in N and P-experiments over the ten periods separated by culture. Thin lines show subject pool averages (i.e. cities), diamond dots show averages over all subject pools within a culture.

were informed about the contributions of the other group members' contributions. In the left panel of Figure 3 we distinguish between punishment of 'free riders' and antisocial punishment. The former is defined as punishing a subject who chose a lower contribution than the punisher himself; the latter is defined as punishment of a subject who was (weakly) more cooperative than the punisher. Free rider punishment is stronger than antisocial punishment in all cultures in our sample. Furthermore there are only weak cross-cultural differences in free rider punishment. On the other hand there are very strong cross-cultural differences in antisocial punishment. The differences span from a low average of 0.1 punishment points per occasion in our English speaking subject pools to 0.9 punishment points in the Arabic speaking subject pools.

The right panel of Figure 3 shows that antisocial punishment is strongly connected to the efficiency gains realized by the subjects. Efficiency gains directly relate to the amount of money subjects earned in the experiment. The horizontal axis measures the strength of antisocial pun-

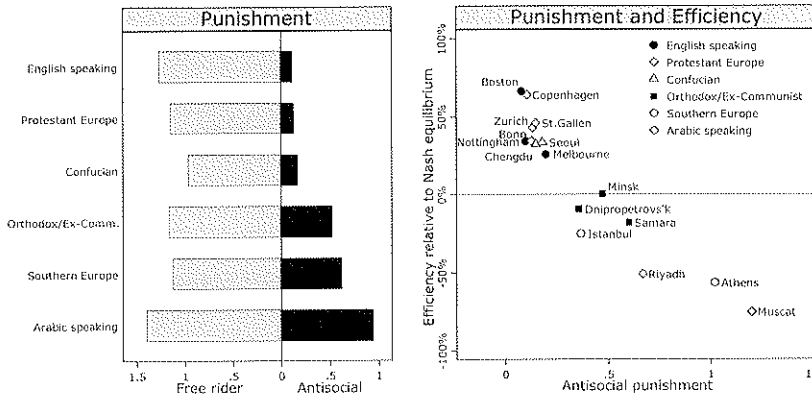

Figure 3: Left panel: Average number of punishment points targeted to less (more) cooperative subjects are denoted as Free rider (antisocial) punishment, separated by cultural area. Right panel: Antisocial punishment and efficiency relative to the Nash equilibrium under standard assumptions.

ishment. The dots correspond to the subject pools in the sample, with identical shaped dots belonging to the same cultural area. The vertical axis measures the efficiency gains relative to the Nash equilibrium under standard assumptions. In this equilibrium all players earn 20 monetary units per round (0% in the Figure 3). If all players fully cooperate and none of the players punishes then they earn 32 monetary units per round (100% in Figure 3). None of the subject pools reaches 100% percent efficiency despite the very high contributions observed in some locations. The reason for this is that it takes some punishment to discipline free riders. Since punishment is costly to both players involved, efficiency is reduced. On the other hand, some subject pools realize even substantially lower efficiency than in the Nash equilibrium. In these locations the efficiency gains of non-minimal contributions are offset by the efficiency losses caused by punishment. Aside from the strong negative connection between antisocial punishment and efficiency the figure also confirms the cultural differences discussed above. For three of the cultural areas all subject pools achieved efficiency gains relative to the Nash equilibrium. In the other three cultural areas only one subject pool (Minsk) surpassed the Nash equilibrium by a tiny margin. All other locations did not achieve efficiency gains relative to the equilibrium.

Cooperation in the Lab - Economic Prosperity in the Field

The experimental results presented here suggest that the cultural background has a strong influence on the way people approach cooperation problems when informal sanctions are possible. This leads to the question whether cultural differences identified in the experiment do have consequences on economic prosperity. Scholars in the literature on social capital argue that traditional growth theory neglects the influence of 'soft factors' like e.g. peoples' trust in others or the strength of civic norms. Based on survey data Knack & Keefer (1997) show that incorporating measures of trust and civic norms adds in explaining differences in economic growth between countries. In the following I investigate whether there is a connection between the experimental measures of cooperativeness and the economic prosperity of a location, measured by a country's per capita gross domestic product (GDP). Figure 4 shows the results. The left panel shows the average contributions in the N-experiment in comparison with the per capita GDP. Interestingly, there is basically no connection between the two measures. The regression line is almost completely flat and the confidence interval of the slope (shaded area) is very large. This is surprising given that contributions in the public goods game can be interpreted as an act of trust (see e.g. Gächter, Herrmann, & Thöni, 2004) and trust is argued to be

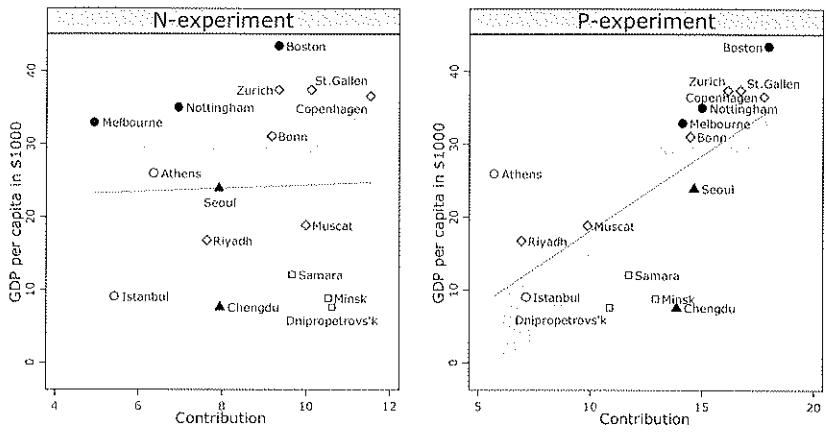

Figure 4: Average contribution in the experiment and GDP per capita in the 16 subject pools for the N and P-experiment.

connected with economic prosperity. On the other hand there seems to be a strong connection between the contributions in the P-experiment and economic prosperity across the different subject pools (right panel of Figure 4).

Conclusions

The data presented here suggests that culture strongly influences the way in which people apply informal sanctions but has little impact on peoples' cooperativeness as such. Presumably in some subject pools the punishment option is simply used as a device to enforce cooperation norms, because punishment is almost exclusively targeted at free riders. In other subject pools punishment is basically targeted at everyone, bearing no clear message about what a subject can do to avoid getting punished. The link to macro-economic data such as the per capita GDP is surprisingly strong for the contributions in the experiment with punishment. This suggests that cultures in which people clearly endorse cooperation norms might have had an advantage in economic development over cultures in which the punishment option is used against basically everyone who stands out, be it as a cooperator or a free rider.

Acknowledgements

I would like to thank the International Latsis Foundation for the generous award and my co-authors Simon Gächter and Benedikt Herrmann for the good teamwork. I would also like to thank Monika Bütler for her academic support and Therese Fässler for her support with the manuscript.

References

Dawes, R. M. (1980). Social dilemmas. *Annual Review of Psychology*, *31*(1), 169-193. Annual Reviews.

Fehr, E., & Gächter, S. (2002). Altruistic punishment in humans. *Nature*, *415*, 137-140.

Fehr, E., & Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics*, *114*(3), 817-868.

Grechenig, K., Nicklisch, A., & Thöni, C. (2010). Punishment Despite Reasonable Doubt—A Public Goods Experiment with Sanctions Under Uncertainty. *Journal of Empirical Legal Studies*, *7*(4), 847-867.
Gächter, S., Herrmann, B., & Thöni, C. (2004). Trust, voluntary cooperation, and socio-economic background: survey and experimental evidence. *Journal of Economic Behavior & Organization*, *55*, 505-531.
Gächter, S., Herrmann, B., & Thöni, C. (2010). Culture and cooperation. *Philosophical Transactions of the Royal Society B*, *365*, 2651-2661.
Herrmann, B., Thöni, C., & Gächter, S. (2008). Antisocial punishment across societies. *Science*, *319*(5868), 1362-1367.
Knack, S., & Keefer, P. (1997). Does Social Capital Have An Economic Payoff? A Cross-Country Investigation. *Quarterly Journal of Economics*, *112*(4), 1251-1288.
Kollock, P. (1998). Social Dilemmas: The Anatomy of Cooperation. *Annual Review of Sociology*, *24*(1), 183-214.
Ledyard, J. O. (1997). Public Goods: A Survey of Experimental Research. In J. H. Kagel & A. E. Roth (Eds.), *The Handbook of Experimental Economics*. Princeton University Press.