Ostracism and the Provision of a Public Good – Experimental Evidence

Frank P. Maier-Rigaud

Peter Martinsson

Gianandrea Staffiero

MAX PLANCK SOCIETY

Ostracism and the Provision of a Public Good
Experimental Evidence[•]

Frank P. Maier-Rigaud[*]

Max Planck Institute for Research on Common Goods
Department of Economics, University of Bonn

Peter Martinsson

Department of Economics, Göteborg University

Gianandrea Staffiero

SP-SP Research Center
IESE Business School, University of Navarra

Abstract

We analyze the effects of ostracism on cooperation in a
linear public good experiment with fixed partner design.
Our results show that introducing ostracism increases
contribution levels. Despite reductions in group size due
to ostracism, the net effect on earnings is positive and
significant. This effect is in contrast to alternative
mechanisms aimed at increasing cooperation rates studied
in the literature on public good experiments.

Keywords: Ostracism, Exclusion, Public Good,
Experiment.

JEL Classification: C92, H41.

1. Introduction

The concept of excluding members of communities and groups to enforce norm conformity and cooperation has been evidenced in almost all civilizations and known cultures (Gruter and Masters 1986, Williams 2001). Ostracism, the act of excluding, has been widely documented and analyzed in many disciplines. Indeed, regulating and sanctioning social behavior by ostracizing non-contributing members can be found in animals (Goodall 1986, Lancaster 1986), and humans (Wiessner 2005, Kurzban and Leary 2001, Williams et al. 2000, Boehm 1999, Mahdi 1986) alike. The term ostracism comes from the Greek *ostrakismos*, a practice originating in Athens as a political device instituted, probably by Cleisthenes in 508 B.C., as a constitutional safeguard for the Athenian democracy. Athenian citizens would cast a vote by writing their preference on *ostraca*, shards of pottery, to remove for a period of ten years any person who threatened the harmony and tranquility of the body politic.

Ostracism has not only been observed in animal groups, primitive cultures and ancient civilizations but has also been employed in modern societies for instance with respect to strike-breakers or whistle-blowers (See Durkheim 1933, Gordon 1975, Francis 1985, Williams 2001). There exist many economic contexts, such as team production or other dilemma problems, where it is feasible to ostracize individuals when monitoring and punishment are decentralized. Gaspart and Seki (2003) for instance give an empirical example of a local public good fishery with elements of ostracism.

In light of the ubiquity and pervasiveness of ostracism, the aim of this study is to analyze the effectiveness of ostracism as regulatory instrument in a controlled strategic environment. More specifically, the objective of this paper is to investigate

the effect of exclusion as a punishment device (based on majority voting) on contributions in a repeated linear public good game with fixed partners. Theoretical research on the voluntary provision of public goods indicates that selfish individuals have incentives to free-ride, leading to an inefficient provision under voluntary contribution.[1] In contrast to this, people do contribute to public goods both in experimental laboratories (e.g. Ledyard, 1995, and Zelmer, 2003) and in real life (Ostrom 1990, Gaspart and Seki 2003, Wiessner 2005). Experimental results have, however, consistently shown that it is difficult to sustain a high contribution level over time (e.g. Isaac and Walker 1988, Andreoni 1988, Croson 1996, and Keser and van Winden 2000). As a consequence, several mechanisms aimed at fostering cooperation have been explored experimentally. For instance, the availability of costly monetary punishment mechanisms increases contribution levels almost to full cooperation (see for instance Fehr and Gächter 2000, or Bochet et al. 2005). Interestingly, once the cost of punishment is considered, the effect on net earnings is neither positive nor significant. One variant of this is non-monetary punishment communicated through disapproval. Masclet et al. (2003) found increased contribution levels when points indicating disapproval were allocated, but this effect did not persist over time.[2] In contrast, Carpenter et al. (2004a, 2004b) found an increasing level of contribution in the treatments where participants could signal disapproval of the contributions made by others by buying unhappy faces to be displayed to the group.

Kerr (1999) has shown that the threat of ostracism can stimulate cooperation in social

---

[1] See Hirshleifer and Rasmusen (1989) for a theoretical discussion of ostracism as an effective tool for promoting cooperation in repeated finite and infinite prisoner's dilemma games.
[2] See Noussair and Tucker (2005) for an analysis of the effects of combining monetary and non-monetary sanctions. See also Ostrom et al. (1992) for an early analysis in a common-pool resource context. See Apesteguia and Maier-Rigaud (2006) for a discussion of the difference between public goods and common-pool resources.

dilemmas. Similarly, Kerr et al. (2006) have analyzed the threat of exclusion on the relationship between cooperators and defectors based on previous findings that defectors have a negative impact on the behavior of other group members, i.e. the phenomenon that defectors are like bad apples spoiling the whole barrel.[3] Cinyabuguma et al. (2005) investigated ostracism based on majority voting in an innovative public good experiment, where a lump sum cost was imposed on those members voting for ostracism if the member they voted for was excluded during that period. The excluded members were then assigned to another public good experiment with lower endowment. Their results show an almost maximal level of contribution to the public good among non-excluded members. Masclet (2003) designed a multi-period public good experiment, where each period consisted of two successive public good phases, the first relating to production and the second to some social activity. After the first phase, each participant could ostracize members for one period (only one vote was required for ostracism) from the second phase, i.e. the social activity, either at no cost or at some cost depending on the treatment. In both cases contribution levels in the first phase increased.

In contrast to Cinyabuguma et al. (2005), where the potential reduction in contributors was low since each group consisted of 16 members, we study how the contribution levels are affected by introducing "life-time" ostracism in relatively small groups. The direct effect of ostracizing a member is that the group size decreases, which automatically reduces maximal contribution levels to the public good for all remaining periods. Thus, we also study the impact of ostracism on average net contribution levels where contributions by ostracized participants are necessarily zero.

---

[3] See also Ouwerkerk et al. (2005).

We choose a rather small group size (six members) and thus render ostracism costly through the rather substantial loss in potential future contributions. Another difference, in line with the field observations cited above indicating that exclusion may go as far as threatening the survival of the excluded group member, is that we consider that ostracized participants are left only with their endowment. This is in contrast to Cinyabuguma et al. (2005) who let the ostracized individuals continue to play in another public good game with lower marginal private return. In that sense, our experiment renders ostracism costly to both, the group and also to the individual that has been excluded.[4]

2. Experimental design and procedures

96 students were recruited from different departments at Bonn University, Germany, to participate in the two experimental sessions of a computerized experiment, programmed in Z-Tree (Fischbacher, 1999). The experiment consists of two treatments: (i) a traditional linear public good experiment and (ii) a public good experiment with ostracism.[5] Each treatment consisted of ten periods followed by an additional ten periods of the other treatment. We control for the order effect by running the experiment in both orders. Each session, i.e. ordering of the two treatments, involved eight groups with six participants each. Participants were randomly assigned to groups and stayed in the same groups throughout the experiment.

---

[4] From our reading of the psychological literature, allowing the ostracized individual to participate in another public good game presumably dilutes the effect of being ostracized and resembles more an opt-out option than ostracism.
[5] Before each treatment, participants received information about the structure of that treatment only.

In each round, participants simultaneously choose how much to contribute to the public good out of an endowment of 10 tokens. Participant i's payoff is calculated according to the following function
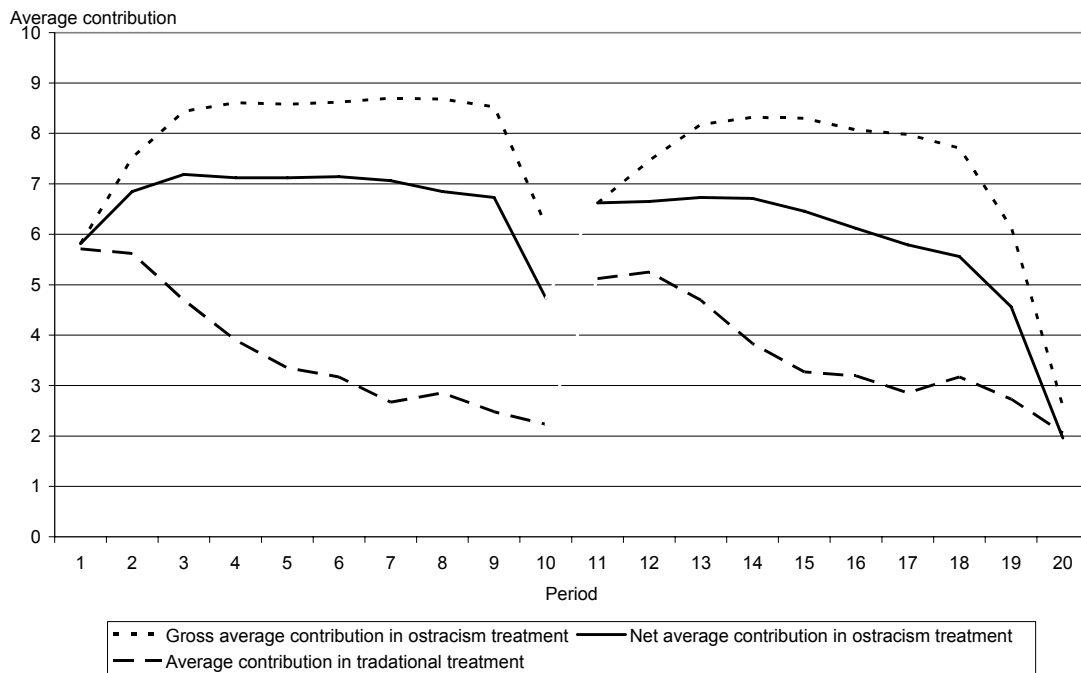
$$\pi_i = 10 - g_i + 0.6\sum_j g_j, \tag{1}$$

where g is the contribution to the public good. With such a payoff function, individuals have incentives to free-ride, as the marginal private return from contribution (0.6) is smaller than the marginal cost (1). The choice of these parameter values ensures, irrespective of group size, the social optimum is to invest fully in the public good, while the individuals' optimum is to invest nothing. At the end of each period, participants are informed about individual contribution levels and their earnings. In the ostracism treatment, there is a second stage in each period, where participants either cast a vote for ostracizing another member or refrain from voting (note that only one vote per participant was possible). In order to exclude reputation effects as much as possible, participants remained anonymous and votes could be cast based on contributions in the ongoing period only. Participants were subsequently informed about the aggregate number of votes. The minimum number of votes required for ostracism was three if the group consisted of five or six members, two if the group consisted of three or four members and one when there were only two remaining participants. Since the marginal benefit from the public good is set to 0.6, and is independent of the size of the group, the decision to ostracize a member always reduces the maximum group return by one-sixth. Ostracized participants continued to receive 10 tokens for all remaining periods, but were excluded from further decision-making.

3. Results

Figure 1 depicts the time series of average contributions for the two sessions, separated by the type of treatment: public good experiment with and without ostracism. Each treatment lasted for 10 periods. We distinguish between *gross* average contribution based only on the non-ostracized participants, and *net* average contribution based on the original group size of six participants to consider the overall effect on contribution levels of introducing ostracism.

Figure 1 Average contribution to the public good over time.

As expected, we find a sharp decline in the average contributions in the traditional public good experiment after the initial periods in both sessions. In the ostracism treatment, in contrast, the gross average contributions increased to a level above 80% of the maximum contribution levels among the remaining participants after the first

7

periods, while the net average contribution is around 70%.[6] Thus, even when considering that group size has been reduced because of ostracism, the net average contributions are higher than in the traditional public good experiment. In a Wilcoxon test we reject equality between the treatments at 1% significance level. Voting behavior in the beginning of the ostracism treatment was fairly active with 70% of the participants casting a vote in the first period followed by a sharp decline reaching 22%, in the eighth period, before increasing again as a response to lowered contribution levels. In the first period with ostracism, 9 members out of 16 groups were ostracized followed by 7 in the second period. During the next six periods, 9 members were ostracized while the number increased again with 4 members in each of the last two periods. Focusing on group averages over all of the periods together, rather than on averages in each period, we reject at 1% significance level using a Wilcoxon sign test that the average contributions to the public good are the same in both ostracism and traditional treatments based on gross earnings. We also reject the hypothesis at a weak 7% significance level for net earnings.

Table 1 shows the results of three separate regression analyses of the treatments with ostracism. In the first column, we estimate what determines the change in contribution from one period to another as a function of the proportion of votes received, the others' average contribution, the absolute positive deviation from others' average contribution and the absolute negative deviation from others' average contribution, where the latter was measured in the previous period. As expected, the proportion of votes received from others has a significant and positive effect on the changes in

---

[6] As costs of exclusion are reduced in the last periods, end game effects were observed in all treatments.

contributions.[7] Then we analyzed what determines the proportion of votes obtained in a period as a function of others' average contribution, absolute positive deviation from others' average contribution and absolute negative deviation from others' average contribution measured in the same period. As expected, negative absolute deviations from others' average contribution significantly increased the proportion of votes received. The last regression analyses the circumstances that lead to participants being ostracized. The results are similar to the previous regression, i.e. negative deviations from others' average contribution have a significant positive impact on the probability of being ostracized.

Table 1 Regression analysis.

Dependent variable	Change in contribution to public good (OLS)		Relative amount of votes obtained in percentage (Tobit)		Ostracized (Probit)	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Proportion of votes obtained in previous period	0.021*	0.006	-	-	-	-
Others' average contribution in previous period	-0.482*	0.068	-	-	-	-
Absolute positive deviation in previous period	-0.604*	0.073	-	-	-	-
Absolute negative deviation in previous period	0.305*	0.071	-	-	-	-
Others' average contribution	-	-	-1.444	1.352	-0.685	0.108
Absolute positive deviation	-	-	0.094	1.502	0.010	0.144
Absolute negative deviation	-	-	11.729*	0.972	0.473*	0.624
Constant	3.376*	0.633	-3.008	12.028	-3.024*	1.056
Number of observations		613		709		709

Note: * denotes significance at 1% level. The last period in the ostracism treatment is not included in the analyses due to end-game effects. Group dummies have been included in the regressions to control for group fixed effects, but omitted in the presentation above.

---

[7] The results of a regression using the absolute number of votes and whether or not a vote was received in the previous period were similar.

4. Conclusion

In a traditional public good experiment, the average contribution level typically declines over time and converges to zero as predicted by standard theory. Despite the draconic nature of punishment, contribution levels under ostracism are substantially and significantly higher than in the standard public good game. Furthermore and in contrast to other costly punishment mechanisms, ostracism has a significant positive effect on net earnings. Our results go beyond Cinyabuguma et al. (2005) by demonstrating that even in small groups with high costs of ostracism participants are willing to ostracize those that contribute the least even if this decreases maximum possible earnings. Moreover, these participants were not relocated to another group as in Cinyabuguma et al. (2005). As remaining participants step up their contribution levels, the total effect of ostracism on net earnings is positive. Not surprisingly, however, the cooperation-enhancing effect vanishes as the interaction approaches the end, and the potential loss of being ostracized becomes less significant: in that case, the temptation of free-riding becomes stronger. This suggests that punishment mechanisms based on exclusionary devices are effective in presence of sufficiently large, albeit not "infinite", time horizons. The experimental results corroborate the empirical evidence from field studies on the effectiveness of ostracism as a regulatory instrument to enforce norm conformity and cooperation in groups.

References

Apesteguia, J. and F. P. Maier-Rigaud (2006) The Role of Rivalry: Public Goods versus Common-Pool Resources, *Journal of Conflict Resolution*, forthcoming.

Andreoni, J. (1988) Why free ride? Strategies and Learning in Public Good Experiments, *Journal of Public Economics*, 37, 291-304.

Bochet, O., T. Page and L. Putterman (2006) Communication and punishment in voluntary contribution experiments, *Journal of Economic Behavior and Organization*, 60, 11-26.

Boehm, C. (1999) *Hierarchy in the Forest: The Evolution of Egalitarian Behavior*. Cambridge: Harvard University Press.

Carpenter, J. P., A. G. Daniere and L.M. Takahashi (2004a) Cooperation, Trust, and Social Capital in Southeast Asian Urban Slums, *Journal of Economic Behaviour and Organization*, 55(4), 533-551.

Carpenter, J. P., A. G. Daniere and L.M. Takahashi (2004b) Social Capital and Trust in South-east Asian Cities, *Urban Studies* 41, 853-874.

Cinyabuguma, M., T. Page and L. Putterman (2005) Cooperation under the threat of expulsion in a public goods experiment, *Journal of Public Economics* 89, 1421-1435.

Croson, R. (1996) Partners and Strangers Revisited, *Economics Letters* 53, 25-32.

Durkheim, E. (1933) *The Division of Labor in Society*, New York: Free Press.

Fehr, E. and S. Gächter (2000) Cooperation and Punishment in Public Goods Experiments, *American Economic Review* 90, 980-994.

Fischbacher, U. (1999) Z-tree: Zürich Toolbox for Readymade Economic Experiments. Instructions for Experimenters, Mimeo, University of Zürich.

Francis, H. (1985) The Law, Oral Tradition and the Mining Community, *Journal of Law and Society*, 12(3), 267-271.

Gaspart, F. and E. Seki (2003) Cooperation, status seeking and competitive behaviour: theory and evidence, *Journal of Economic Behavior and Organization*, 51(1), 51-77.

Goodall, J. (1986) Social Rejection, Exclusion, and Shunning among the Gombe Chimpanzees, *Ethnology and Sociobiology*, 7, 227-236.

Gordon, M. A. (1975) The Labor Boycott in New York City, 1880-1886, *Labor History*, 16(2), 184-229.

Gruter, M. and R. D. Masters (1986) Ostracism as a Social and Biological Phenomenon: An Introduction, *Ethology and Sociobiology*, 7, 149-158.

Hirshleifer, D., Rasmusen, E. (1989) Cooperation in A Repeated Prisoners' Dilemma With Ostracism, *Journal of Economic Behavior and Organization*, 12, 87-106.

Isaac R. and Walker, J. (1988) "Group Size Effects in Public Group Provision: the Voluntary Contribution Mechanism", *Quarterly Journal of Economics*, 103, 179-99.

Kerr, N. L. (1999). Annonymity and social control in social dilemmas. In M. Foddy et al. (Eds.), *Resolving social dilemmas* (pp. 103-119). Philadelphia, PA: Psychology Press.

Kerr, N. L., A. C. Rumble, E. S. Park, J. W. Ouwerkerk, C. D. Parks, M. Gallucci and P. A. M. van Lange (2006) How many bad apples does it take to spoil the whole barrel?: Social Exclusion and Toleration for Bad Apples, mimeo

Keser, C. and van Winden, F. (2000) Conditional Cooperation and Voluntary Contributions to Public Goods, *Scandinavian Journal of Economics*, 102(1), 23-39.

Kurzban, R. and M. R. Leary (2001) Evolutionary Origins of Stigmatization: The Functions of Social Exclusion, *Psychological Bulletin*, 127(2), 187-208.

Lancaster, J. B. (1986) Primate Social Behavior and Ostracism, *Ethnology and Sociobiology*, 7, 215-225.

Ledyard, J. (1995) Public Goods: a Survey of Experimental Research, in "Handbook of Experimental Economics", by Roth, A. and Kagel, J. (eds.), Princeton University Press.

Mahdi, N. Q. (1986) Pukhtunwali: Ostracism and Honor among the Pathan Hill Tribes, *Ethnology and Sociobiology*, 7, 295-304.

Masclet, D. (2003) Ostracism in Work Teams: a Public Good Experiment, *International Journal of Manpower* 24, 867-887.

Masclet, D., C. Noussair, S. Tucker and M.–C. Villeval (2003) Monetary and Non-Monetary Punishment in the Voluntary Contributions Mechanism, *American Economic Review,* 93, 366-380.

Noussair, C. and S. Tucker (2005) Combining Monetary and Social Sanctions to Promote Cooperation, *Economic Inquiry*, 43(3), 649-660.

Ostrom, E. (1990) *Governing the Commons. The Evolution of Institutions for Collective Action*, Cambridge: Cambridge University Press.

Ostrom, E., J. Walker and R. Gardner (1992) Covenants With and Without a Sword: Self-Governance is Possible, *American Political Science Journal*, 86(2), 404-417

Ouwerkerk, J. W., van Lange, P. A. M., Gallucci, M. and Kerr, N. L. (2005) Avoiding the Social Death Penalty: Ostracism and Cooperation in Social Dilemmas, in Williams, K. D., Forgas, J. P., & von Hippel, W. (Eds.) *The social outcast:*

Ostracism, social exclusion, rejection, and bullying. New York: The Psychology Press, 539-558.

Wiessner, P. (2005) Norm Enforcement among Ju/`hoansi Bushmen. A Case of Strong Reciprocity? Human Nature, 16(2), 115-145.

Williams, K. D. (2001) *Ostracism: The power of silence*. New York, NY: Guilford Publications.

Williams, K. D., Cheung, C. K. T., Choi, W. (2000) Cyberostracism: Effects of Being Ignored over the Internet, *Journal of Personality and Social Psychology*, 79(5), 748-762.

Zelmer, J. (2003) Linear public goods experiments: A meta-analysis, *Experimental Economics* 6, 299-310.