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Endowment heterogeneity and peer punishment in a public good experiment: Cooperation and normative conflict

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ABSTRACT

The provision of public goods motivates the creation of institutions designed to compel individuals to cooperate. Peer punishment mechanisms have garnered particular attention and suggest that groups are able to self-govern. Research suggests that the effectiveness of peer punishment depends on a group's capacity to establish and enforce contribution norms. This paper investigates the effectiveness of such institutions when normative conflict makes contribution norms ambiguous. In an interior solution public good experiment, endowment heterogeneity and peer punishment are interacted. Results suggest that peer punishment induces greater contributions when endowments are homogeneous but does not increase contributions when endowments are heterogeneous. Across the payoff equivalent endowment conditions with the opportunity to punish, contributions and earnings are significantly lower when endowments are heterogeneous. This research suggests that the capacity of groups to self-govern is limited when normative conflict makes contribution norms ambiguous.

1. Introduction

When behavior consistent with self-interest conflicts with social welfare, markets often fail and society may benefit from the creation of institutions designed to induce cooperation. For example, roommates may avoid chores, citizens may avoid taxes, or countries may under-invest in their own security if they are members of an alliance. The institutions that develop to solve such conflicts are as complex and varied as the conflicts themselves but may, broadly, be informal, suggesting peer to peer self-governance, or formal, suggesting established rules enforced by a central authority.

Within the experimental public goods literature both types of institutions have been shown able to enhance cooperation and improve welfare. This research investigates the effectiveness of informal, peer to peer, punishment. Understanding the capacity, and the determinants limiting the capacity, of groups to self-govern is important because formal institutions are not always practical. The practicality of formal institutions may be limited because the costs of monitoring behavior and administering the institution outweigh the potential benefits, such institutions are underdeveloped, or because no single institution has authority over all involved parties.[1]

Much of the research suggesting the effectiveness of peer punishment considers behavior in linear, boundary solution, public good experiments with homogeneous subjects.[2] Such experiments are unique in that behavior consistent with efficiency (maximized

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[1] See Tryan and Feld (2006), Galbiati and Vertova (2008), Kosfeld, Okada, and Riedl (2009), Putterman, Tryan, and Kamei (2011), Markussen, Putterman, and Tyran (2013), and Kamei, Putterman, and Tryan (2015) for detailed discussions concerning formal institutions within the public goods literature.

[2] The literature on linear voluntary contribution mechanism (VCM) public good experiments has established that initial contributions are roughly half of one's endowment, decline with repetition, and typically remain above the level predicted by self-interest (Ledyard, 1995; Davis and Holt, 1993). Introducing the opportunity to punish allows each subject to impose a sanction on other group members. Punishment is costly, so welfare is only improved when contributions rise sufficiently to offset these costs. Results from linear public good experiments with homogeneous subjects suggest that contributions can increase sufficiently to offset the punishment costs (Fehr and Gachter, 2000, 2002; Chaudhuri, 2011). However, it is not uncommon to observe no significant increase in contributions when peer punishment is relatively weak or expensive (Sefton, Shupp, and Walker, 2007; Egas and Riedl, 2008; Nikiforakis and Normann, 2008). Further, even when contributions increase large amounts of perverse punishment (the targeting of high contributors) has been shown to reduce net earnings below baseline levels (Bochet, Page, and Putterman, 2006; Cinyabuguma, Page, and Putterman, 2006; Ertan, Page, and Putterman, 2009).

group earnings) coincides with common notions of fairness such as equality of earnings and contributions. In this context the normative appeal of equal contributions is intuitive, suggesting an ease of coalescing around this welfare improving contribution norm (Reuben and Riedl, 2013; Neitzel and Sääksvuori, 2013; Bernard, Reuben, and Riedl, 2014).[3] Where the contribution norm is unambiguous peer punishment may be effective because deviations are easily identified.[4]

However, individuals often make decisions characterized by normative conflict where several normatively appealing rules of behavior coexist (Cappelen et al., 2007; Nikiforakis, Noussair, and Wilkening, 2012).[5] Several sources of normative conflict inducing heterogeneity have been investigated within the public goods literature. The effectiveness of peer punishment among heterogeneous groups is mixed and depends on the source of the heterogeneity.

Individuals may differ in how much they benefit from the public good, for example, those who live close to a park benefit more from any level of provision than those who live further away.[6] In privileged groups (those within which at least one member benefits enough from the public good to make contributing in their self-interest) punishment hinders cooperation (Reuben and Riedl, 2009; Kölle, 2015). In non-privileged groups peer punishment increases contributions but there is no positive impact on earnings (Reuben and Riedl, 2013). Alternatively, individuals may differ in how much their contributions benefit the group. For example, consider work teams who produce joint projects. Some individuals are more productive and thus their contributions to the joint project benefit the group more than contributions made by others. Tan (2008) and Kölle (2015) suggest that introducing peer punishment into productive heterogeneous groups increases contributions. Fellner et al. (2011) suggest that this result is sensitive to the level of information available in the punishment stage such that contributions rise when observed contributions are linked to productivity types.

This research interacts endowment heterogeneity and peer punishment within an interior solution public good experiment. The contribution of this research is to investigate the effectiveness of peer punishment across payoff equivalent public good experiments which differ only in how endowments are distributed. There are two closely related papers.

Cason and Gangadharan (2015) investigate the effectiveness of peer punishment within an interior solution public good with homogeneous subjects. Results suggest that the cooperation inducing effect of punishment is delayed and has no effect on earnings. Reuben and Riedl (2013) investigate the effectiveness of peer punishment in a linear public good with heterogeneous endowments. With the opportunity to punish, contributions of both high and low endowment members increase but no significant effect on earnings is observed.

There are three noteworthy differences between the design implemented by Reuben and Riedl (2013) and the one presented here. First, this design employs an interior solution public good experiment. As discussed below, the advantage of an interior solution is that many combinations of contributions are consistent with efficiency.[7] This allows several plausibly appealing contribution norms to be consistent with efficiency. This is important because Reuben and Riedl (2013) show that, regardless of the source of heterogeneity, groups find efficiency normatively appealing. However, beyond the appeal of efficiency, research suggests that there is a plurality of appealing contribution norms (Cappelen et al., 2007; Nikiforakis, Noussair, and Wilkening, 2012). For example, equality suggests contributions which provide earnings equality across subjects while equity may be defined as equal contributions or as contributing an equal proportion of one's endowment. The concepts of equality and equity are used to determine contribution norms consistent with 3 prominent fairness principles (Konow, 2003; Reuben and Riedl, 2013; Bernard, Reuben, and Riedl, 2014).

The interior solution allows us to cleanly manipulate the normative conflict across endowment conditions. A single pattern of contributions is consistent with all three fairness principles in the homogeneous endowment condition. On the other hand each fairness principle requires a different pattern of contributions across high and low endowment members in the heterogeneous endowment condition. Therefore there is greater normative conflict among subjects in the heterogeneous condition than there is among subjects in the homogeneous condition.

Second, endowment heterogeneity is introduced by manipulating the distribution, rather than the aggregate level, of endowments within the group. Each group, across endowment condition, has the same amount of resources available to contribute to the public good across the payoff equivalent endowment conditions. This allows us to directly compare contributions and earnings across endowment conditions with punishment to determine the effect of normative conflict.

Third, no information regarding the endowment of subjects accompany observed contributions in the punishment stage. This is realistic, it is not always clear how much one has to contribute towards a public good. This research intends to answer the following question. In the absence of information regarding endowment type, does normative conflict inducing endowment heterogeneity lessen the effectiveness of peer punishment?

Results suggest that in the absence of peer punishment, endowment heterogeneity has no impact on average contributions or earnings. The opportunity to punish increases average contributions in the homogeneous endowment condition. In contrast, the opportunity to punish does not increase average contributions of either the high or low endowment members in the heterogeneous endowment condition. As a result, average contributions and earnings are significantly higher in the homogeneous endowment condition with punishment than they are in the heterogeneous endowment condition with punishment.

[3] We use the term contribution norm to describe a normative contribution rule. Following Nikiforakis, Noussair, and Wilkening (2012) a contribution rule is a pattern of contributions that, at least, some subjects find normatively appealing. The literature differentiates between normative rules and social norms. A social norm is a rule of behavior that develops within a group either because sufficiently many people know the rule exists and agree with it is normative appeal or there exists an opportunity, and sufficiently many people are willing, to punish deviations from this rule (Bicchieri, 2006; Young, 2008). Further, social norms emerge when people expect the norm to be followed (referred to as an empirical expectation) and when people believe that others expect them to conform (referred to as a normative expectation) (Bicchieri and Xiao, 2009).

[4] Research suggests that the effectiveness of peer punishment is driven by a minority of subjects, referred to as *strong reciprocators*, who are able to establish and enforce cooperation (Gurerk, Irlenbusch, and Rockenbach, 2006).

[5] Nikiforakis, Noussair, and Wilkening (2012) introduce the concept of normative conflict in an experimental design investigating the likelihood and duration of retaliatory counter punishment (feuds) in a public good experiment with heterogeneous benefits.

[6] Fisher et al. (1995) were the first to introduce within group benefit heterogeneity and showed that subjects respond to their individual benefit, contributing more as their individual return from the public good increases. Palfrey and Prisbrey (1997) investigate heterogeneity in one's return from the private account so that subjects differ in their opportunity cost of contributing and similarly find that subjects contribute more as their cost of doing so falls. More recently, Güth and Sääksvuori (2012) have investigated behavior in an interior solution, multi-level, public good where-in subjects benefit more from local level provision than global level provision. Results suggest that subjects prioritize local level PGs over global level PGs.

[7] In linear, boundary solution, experiments efficiency requires each subject to contribute their entire endowment regardless of heterogeneity.