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Inequality, Social Sanctions and Cooperation within South African Fishing Communities

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Inequality, Social Sanctions and Cooperation within South African Fishing Communities

Martine Visser*and Justine Burns†

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Abstract

We explore the effect of income inequality and social attitudes on the cooperation and sanctioning in nine South African fishing communities where allocation of fishing rights have been unequal and controversial. In the Punishment treatment aggregate contributions towards the public good are significantly higher amongst unequal groups, with low endowment players contributing the greatest endowment share. Sanctioning is significantly lower in unequal groups but demand for punishment is similar, irrespective of differences in relative costs. Free-riding drives punishment, but retaliation is another important motivator (specifically in unequal groups). In equal groups "antisocial" punishment of cooperators is more common. The effect of real wealth and inequality on contributions and punishment is less salient possibly due to real wealth not being discernible in the experimental context. Interestingly, social attitudes are important in explaining sanctioning behavior, indicating that distrust in formal institutions and specifically in the top-down quota allocation process may have a significant impact on behavioral outcomes and the effectiveness of community sanctioning mechanisms.

JEL classification: C9,D63,H41,Q2

Keywords: Inequality, cooperation, punishment, public goods experiments

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1 Introduction

In this paper we present the results of public goods experiments conducted with individuals from nine fishing communities in South Africa where access to fishing rights has been restricted and unequally allocated through quotas and permits. We introduce treatments with inequality in endowments and also the opportunity for peer punishment in order to study the impact inequality has on groups' ability to sustain and enforce cooperation through social sanctioning. We are interested how individuals from such communities cooperate in an experimental context and whether experimentally induced inequality can help us to understand dynamics of inequality in a real world setting. To this end we also examine the effect of a host of socio-economic variables, including measures of real wealth and inequality, as well as attitudes towards the fishing rights allocation process and illegal harvesting on cooperative and sanctioning behavior.

Our sample specifically draws from individuals with extensive experience of social dilemmas and sanctioning since their livelihoods depend directly or indirectly on fishing. Moreover, irregular allocation of fishing quota by government has resulted in externally imposed income inequality (with allocations often perceived as benefitting a small elite instead of previously disadvantaged individuals), leaving subsistence and small-scale commercial fishing communities divided (O'Riordan, 1999; Isaacs, 2006; Sowman, 2006).[1] Allocation of quota is generally perceived as unfair and arbitrary by the community members: complicated application procedures and exorbitant application fees restrict entry, and there is an overall lack of transparency (Isaacs et al., 2005; Hauck and Kroese, 2006). Corruption amongst officials is another factor that undermines compliance efforts (Hauck and Kroese, 2006), rendering poaching a common and lucrative activity pursued by both quota holders and those who did not receive a fishing quota.[2] We therefore include both these groups and also members from the community with indirect exposure to fishing activities in the experiments.

In the absence of well functioning formal institutions associated with effective centralized regulation, the role of social institutions at a local level is essential in securing provision of public goods and in resolving social dilemmas related to natural resource extraction. In

[1] Table 1 provides a summary of our sample indicating that average income for those with fishing rights are markedly higher than for those without such rights.

[2] In a related paper Brick, Visser and Burns (2012) find that those with access to fishing rights are more likely to poach given that they have a legal motivation for being out at sea.

this context a well-functioning society becomes a public good in itself, insofar as it lowers the transaction costs of doing business, enables the provision of communal infrastructure and support systems and allows for collective initiatives in managing local resources which is often at the core of sustaining the livelihoods of those involved (Alesina and La Ferrara, 2000; Romer, 1986; Lucas, 1996). Poverty, lack of employment opportunities and competition for scarce resources put additional pressure on individuals to act in the interest of their own households to secure basic needs often in conflict with mutual needs of others in the community. Moreover, the majority of developing countries are characterized by large inequalities in income, education and opportunities to accumulate private wealth. It has been reported that extremely unequal societies may be limited in their capacity to interact as communities due to a breakdown in cooperation (Alesina and La Ferrara, 2000; Bowles and Gintis, 2002). A number of empirical studies (Gaspart et al. 1998; Baland and Platteau, 1999; La Ferrara 2002) have indicated that the overall effect of inequality on the provision of public goods can be ambiguous, but that incentives to participate are greater for those who are able to appropriate greater net benefits from the public good (Rapoport, 1988; La Ferrara, 2000; Alesina and Angeletos, 2005).

While some experimental studies on inequality and the provision of public goods conducted with students in labs confirm this (Cherry et al., 2004 and Anderson et al., 2004), others have found that inequality has a positive effect on aggregate contributions (Buckley and Croson, 2006; Chan et al., 1993, 1997, 1999). Studies of behavior within unequal groups, report high endowment players to contribute more in *absolute* terms to a public good when group members are allowed to contribute a *part* of their endowment (Van Dijk and Grodzka, 1992; Van Dijk and De Cremer 2006)[3] , but that low endowment players contribute a higher *share* (relative to their endowment) towards provision of the public good than high endowment players in repeated (Chan et al., 1997, 1999; Buckley and Croson, 2006) and one-shot (Cherry et al., 2004) public goods games where no threshold is required.

Insightful studies on the effect of peer sanctioning on cooperation has also been done (see for example Fehr and Gächter, 2000; Masclet et al., 2003; Nikiforakis, 2008 and Cinyabubuguma et al., 2005&2006). The role of internal sanctions aimed at mitigating free-riding behavior are important in developing countries given demanding administration and costs associated with external monitoring and enforcement. Studies by Tyran and Feld (2006) and Noussair and Tucker (2005) suggest that internal sanctions may be more

[3]Cardenas (2003) in turn conducted non-linear CPR experiments with heterogeneous groups and found wealthier individuals to extract less from the CPR than poorer individuals in absolute terms.

efficient than externally enforced sanctions. Evidence from the field (see Van Soest and Vyrastekova, 2004),[4] as well as experimental studies on the provision of public goods (Fehr and Gächter, 2000; Bochet et al., 2006; Falk et al., 2005; Sefton et al. 2001; Carpenter, 2004a&b), have indicated that individuals use peer sanctioning to express disapproval and successfully coerce free-riders into contributing, even if such actions are costly to undertake.

However, very little research has been done on a) the role of social sanctioning on contributions in the presence of inequality or b) the level of sanctioning provided under such conditions.

As far as the level of sanctioning is concerned, Masclet and Villeval (2008) studies the effect of inequality that arises endogenously during play on sanctioning. They observe that players will attempt to adjust pay-off differences by allocation of punishment and that over repeated interaction inequality is reduced in the presence of punishment, since it curbs free-riding. Tan (2008) considers the effect of productivity differentials (by varying the MPCR in a public goods game) on sanctioning and subsequent welfare. She finds that, conditioned on individual contributions, high productivity individuals receive more punishment. While allowing for punishment using this design increases cooperation, it does not increase welfare. Reuben and Riedl (2009) also varies the marginal benefit received from the public good by different players in a group to study the extent to which privileged groups are able to use sanctioning mechanisms to increase contributions. Their findings indicate that privileged groups are less efficient at using sanctions to punish free-riders and also to raise overall contributions.

The only study besides ours, that we are aware of, that introduces differences in endowments (initial wealth) when studying the effect of inequality on sanctioning behavior in the presence of peer monitoring is that of De Cremer and Van Dijk (2009). Focussing on the provision towards sanctioning (as a second order dilemma), they find that there is no positive relationship between endowment size and allocation of punishment unless high endowment players in unequal groups are accountable to the group[5].

Recent research has shown that culture (Gächter et al., 2012) and also social background (Kocher et al., 2011) can be important determinants in provision of public goods and

[4]The authors cite examples of fishermen in the Bahia region in Brazil who destroyed the nets of fellow fishermen that did not adhere to quotas.

[5]In their accountability treatment players were asked to justify their behavior to the rest of the group at the end of the session.

social sanctioning. In this study we also examine the impact of social attitudes within communities on contributions and punishment behavior. We are particularly interested in how individuals' attitudes towards the quota allocation system and corruption of officials responsible for allocating quota affect behavior. Bowles and Gintis (2002) highlights the complementarity of communities, markets and states and the concern that poorly designed markets and states have the capacity to crowd out community governance. In contrast, a recent experimental study by Kube and Traxler (2011) shows that centralized and decentralized norm enforcement are substitutes, with legal sanctions tending to crowd out social sanctioning.

This study involves a repeated public goods experiment, combining treatments with inequality and peer sanctioning. In Part I of the experiment we compare contributions in a linear public goods experiment for equal and unequal treatments - inequality is randomly introduced via differing endowments. In Part II we introduce a peer punishment treatment for both equal and unequal groups. Each treatment has 6 periods and involves partner matching where individuals remain in the same groups over rounds. We study the effect of inequality on cooperation and peer sanctioning experimentally and also using measures for real wealth and inequality within communities. In addition we examine the role of social attitudes towards governance structures and management of fishing resources on cooperation and sanctioning behavior.

Section 2 describes the experimental design, while the results are discussed in section 3. The paper concludes with section 4.

2 Experimental Design

In this section we outline the design, parameters and procedures of the public goods experiments employed here. We also describe the field setting and recruitment process involved.

Our public goods experiment uses a repeated linear public goods (PG) design similar to that used by Fehr and Gächter (2000) and Masclet et al. (2003). Subjects within a group each receive an endowment which they can allocate to either a private account or to a public account. Each subject is provided with a very simple pay-off formula where the Nash-equilibrium is to contribute nothing and the Social Optimum is attained when

everyone in the group contributes their entire endowment.

In Part I of the experiment, two treatments are conducted to compare the effect of allocating equal versus unequal endowments to individuals in the voluntary contribution mechanism (VCM). The first treatment consists of a standard VCM where all four players in a group receive equal endowments. In the second treatment all groups are divided into two players with high endowments and two players with low endowments. In Part II of the experiment we conduct further treatments, where we introduce the opportunity for players to punish each other after contributions are made. Each treatment involves 6 rounds with fixed matching over all treatments.

2.1 Part I: Pay-off structure for the VCM treatment

In every round, each of $n = 4$ subjects receives a fixed endowment of y Experimental Currency units (ECUs) from which they may invest g_i tokens in a public account. The investment decision is made simultaneously by all players. The pay-off function used in the VCM treatment and also the first stage (I) of the punishment treatment is

$$\Pi_{Ii} = (y_i - g_i) + 0.5 \sum_j g_j$$

for each round, where $0 \leq g_i \leq y$ and 0.5 is the marginal per capita return (MPCR) where $0 < 0.5 < 1 < n \times 0.5$, implying that the dominant strategy for rational and self-interested individuals is not to contribute anything whereas the social optimum for the group is achieved if each individual contributes his or her full endowment to the public account.

In the equal treatment, y is fixed at 40 ECUs for all players. In the unequal treatment 2 players each receive $y_L = 30$ ECUs and 2 players each receive $y_H = 50$ ECUs. The pay-off function for a high endowment player, H_1, is

$$\Pi_{I_{H1}} = (y_H - g_{H1}) + 0.5(g_{H1} + g_{H2} + g_{L1} + g_{L2})$$

and similarly the pay-off function for a low endowment player, L_1, is

$$\Pi_{I_{L1}} = (y_L - g_{L1}) + 0.5(g_{L1} + g_{L2} + g_{H1} + g_{H2}).$$

2.2 Part II: Pay-off structure for the treatment with punishment

The punishment treatment involves a second stage during which subjects can reduce the first stage payoff (Π_{Ii}) of other players. Subjects are provided with information about the endowments received by other players, along with their respective contributions. The pay-off (Π_{Ii}) for player i from both stages of the punishment treatment is

$$\Pi_i = max\left[0, \Pi_{Ii} - \left(5\sum_{j\neq i} p_{ji} + \sum_{j\neq i} p_{ij}\right)\right]$$

where p_{ji} is the punishment points that player i receives from player j and p_{ij} is the punishment points player i within a group assigns to player j. Each punishment point received by player i therefore reduces her pay-off by 5 ECUs, whereas each punishment point assigned by player i cost her 1 ECU. Aggregate pay-off from this treatment is then just the sum of Π_i over six rounds.[6]

Theoretically there is no incentive for any self-interested individual to allocate punishment to free-riders, given that punishment has second-order public good characteristics which makes it optimal for the individual to rely on others in the group to undertake costly punishment of free-riders within the group.

2.3 Parameters and Procedures

The experiments were manually performed with a sample of 568 participants in field laboratories in each of nine communities. Various subjects knew one another, but within the experiments the identity of other players in a group were never revealed.[7] The group size across all treatments was four. Of the 142 groups involved 70 participated in the equal treatment and 72 in the unequal treatment. All groups participated in both the VCM treatment and the Punishment treatment.

[6]Given low numeracy levels within our sample, we prevent individuals from having negative earnings at the end of each punishment round. Nobody can therefore allocate more punishment points than their stage I earnings from that round. Similarly the cost of the person receiving punishment can never exceed their stage I earnings. If the cost of receiving punishment reduces an individual's income below zero, their income is automatically set to zero.

[7]We control for the "number of persons that you know in your group", in the regression analysis section of the paper, but this is not significant.

The marginal per capita return (MPCR) in each round was 0.5 for both the equal and the unequal treatments.[8] In both scenarios the return from the group account under full cooperation was therefore equal to 80 tokens.

In the equal treatments each subject received an endowment of 40 tokens. In the unequal treatments 2 players randomly received endowments of 50 tokens and 2 players randomly received endowments of 30 tokens. The rules of the game were explained in detail to each group before starting each treatment.[9]

In the second stage of the punishment treatment, individuals could view the endowments received by all players, as well as their corresponding contribution on a punishment template. Players then had the choice to anonymously allocate "fine" points to other players by making entries on this punishment template. Each punishment or "fine" point received reduced a player's stage I earnings by 5 tokens.[10] Allocating "fine" points was costly, with 1 token being deducted for each point awarded to another player. Individuals within the group did not have access to information about the punishment decisions of other players in the group: each was just given the aggregate number of punishment points allocated to them in each round.[11]

The experimental sessions lasted for 2–3 hours. In some communities two or three sessions were scheduled per day.[12] Each experimental token earned the participant 10 cents and

[8]Although a number of studies have used a MPCR of 0.4 and group size of 4 following the work of Fehr and Gächter (2000), varying designs with group size ranging from 3–10 members and MPCRs ranging from 0.2–0.75 (Bowles et al., 2001, Cinyabuguma et al., 2005, Sefton et al., 2001, Carpenter, 2007b, and also Anderson and Putterman, 2005), have also been used.

[9]Instructions and survey instruments are available from the authors on request.

[10]Fehr and Gächter (2000) and others following their design use a punishment scale where each point allocated reduces a player's pay-off by 10%. Carpenter (2004b) suggests a simpler punishment design which allows for a constant price of punishment. We use such a design (given low literacy and numeracy rates among our subjects), but receiving punishment is costly and probably at the upper limit of a number of studies that have varied the cost of punishment across treatments (Nikiforakis and Normann, 2008; Carpenter, 2004a; Anderson and Putterman, 2005). Denant-Boemont et al. (2006) use a similar punishment structure to Fehr and Gächter which resulted in reductions in earnings in the range 4.6–16.24%. The reduction in income observed in our study ranges from 39% in equal groups to 24% and 22% for high and low endowment players in unequal groups (on average).

[11]We did not test for order effects of the punishment treatment given previous findings by Fehr and Gächter (2000) indicating that the order of treatments did not affect the results in any significant way.

[12]We control for spill-over effects by randomly allocating sessions as equal or unequal for the public goods experiments. We also test for spill-over effects in the regression analysis that follows.

on average participants earned about R110 (US12, 54) for the entire experiment. In most cases this translated to about two days' wages.

2.4 Sample Description and Recruitment Procedure

Our study focusses on nine rural fishing communities along the West Coast of South Africa. Participants were recruited in a number of ways to minimize the potential for sample selection problems. They were contacted through key persons in the community, representatives of fishers' groups, posters, and local newspapers and school functions. Attrition rates between the survey and the experiments were relatively low.

A survey was executed one and a half months before the experiment. Table 1 gives an overview of the basic sample demographics. In total, 568 individuals participated in both the survey and experiments. 58% of our sample were male and 65% classified themselves as colored whereas the the other 35% classified themselves as black or African, which is commensurate with population demographics in these fishing communities. Participants were on average 41 years old and had lived in their communities for most of their lives. Most reported Afrikaans as their home language, so the survey and the experiments were executed in Afrikaans. Educational attainments were low, with 14% of the sample having completed their primary schooling, and 8% having completed high school. Unemployment among participants was high, with only 48% reporting that they were currently employed at the time of the survey, while 59% of individuals reported to be the main breadwinner in the household.[13] Average household income (including grants) were R1102/month (125,52USD/month).

Access to fishing rights varied significantly across communities ranging from 27% to 78%, where fishing rights included quota and seasonal fishing permits. On average 40% had access to quota, while 54% had access to fishing permits (See Table 1).[14] The extent to which the fishing rights allocation process goes hand in hand with inequality is evident from the fact that the average income of those without access to fishing rights were R739/month (84.17USD/month) whereas for those with rights it was almost double that at R1458/month (166USD/month).

[13]This level of employment is reflective of prevailing unemployment in these communities according to the Census data.

[14]The same information is available at community level in Appendix I & II.

Table 1: Descriptive Statistics

	Pooled	
Variable	**Obs**	**Mean**
Experimental Variables		
Contribution share of endowment in VCM	3413	0,44
		(0,27)
Contribution share of endowment in Punishment treatment	3322	0,51
		(0,27)
Punishment allocated to partner per round	9647	1,22
		(2,87)
Demographic and Socio-economic Variables		
Age	565	40,36
		(13,63)
Education (educ)	544	9,41
		(2,68)
Female (%)	566	0,42
		(0,49)
Coloured (%)	566	0,65
		(0,48)
Breadwinner (%)	557	0,59
		(0,49)
Total Income (incl. grants) (ZAR)	566	1101,95
		(1837,49)
Logarithm of Total Income (including grants)	447	6,74
		(1,08)
ABOVE log of total average income (%)	566	0,61
		(0,49)
Variance of log of total average income (including grants)	566	1,09
		(0,27)
Access to Fishing Rights and related Income		
Access to fishing rights (%)	459	0,58
		(0,49)
Access to fishing quota	512	0,40
		(0,49)
Access to fishing permits	482	0,54
		(0,50)
Average income (ZAR) of those with access to fishing rights	256	1458
		(1840)
Average income (ZAR) of those without access to fishing rights	194	739
		(1507)
Social Attitudes related to Fishing Regulation and Poaching		
Officials allocating quota are corrupt (%)	517	0,77
		(0,42)
Quota allocation percieved as unfair (%)	536	0,82
		(0,39)
Would report a fishing crime (%)	554	0,51
		(0,50)
Will get into trouble for reporting a fishing crime to officials (%)	559	0,48
		(0,21)
Others in community have been involved in petitions (%)	549	0,40
		(0,32)
Willing to report a fishing related crime (reportfc)	554	0,51
		(0,50)
Willing to report a crime (reportc)	560	0,75
		(0,43)
It is right to arrest violators of fishing regulations in this community	524	0,65
		(0,48)
People change there behavior after being arrested for fishing violations	535	0,54
		(0,50)

Social attitudes gleaned from our survey instrument provides insights about the level of distrust amongst community members towards existing formal governance structures. For example, 77% of individuals in our sample viewed officials allocating quota as being corrupt, while 82% viewed the quota allocation process as unfair. Attitudes towards social sanctioning were revealed by several questions raised in our survey. Interestingly 75% of individuals in the sample indicated that they would report a crime upon witnessing one, while only 51% of individuals in the sample said that they would report a *fishing related crime*. This may partly be explained by the fact that many do not view the current quota allocation process as legitimate. For instance 35% of individuals in our sample did not believe it right that others in the community who violate fishing rights should be arrested and of those who fish more than 60% admitted to having caught more than their quota or fished without a permit in the past.[15] Other reasons for not wanting to report crimes might be that 48% of individuals believed they would get into trouble for reporting a fishing crime to officials, while 46% of participants did not believe punishing a perpetrator for a fishing related crime would change their subsequent behavior.

Appendix III further gives an overview of the level of involvement of our sample in training and conservation programs, participation in community activities and prosocial involvement, as well as, membership in societies and clubs. Comparing individuals *above* and *below* the mean income in our sample yielded some interesting findings. Firstly while 32% of those *above* compared to $22,4\%$ of those *below* the mean income have attended training/conservation workshops, the number of such workshops attended for those *above* is also higher (5.57) than for those *below* (1.04). However these findings may be tempered by selection bias since 62% of those *above* the mean income have access to fishing rights whereas only 50% of those *below* have access to such rights.

In terms of community involvement and prosocial engagement we do not see major differences between these two groups, however for a number of variables that considers actual involvement in the community, we do see differences which indicates that those *above* the mean income level are somewhat more involved. The group of individuals *above* the mean household income for instance spend about 1.5 hours a week more on voluntary activities in the community. Since we do not have information about the amount of leisure

[15]Given the sensitivity of this question we had a lot of inconsistency in people's answers here, with some admitting that i) they had fished more than their fishing rights allocation, while others denying i) but responding to the question about whether they thought they were rightfully arrested for fishing more than their permit and quota allowed and another group also giving a negative answer to i) but indicating that they did (or did not) change their behavior after being arrested for a fishing related crime.

hours available to these respective groups and poorer households even though faced with higher unemployment rates may spend a larger amount of time looking for food, gathering firewood, etc. it is hard to draw conclusive evidence from these statistics.

Further comparisons of our study with that of Census data from these communities shows that our sample is representative in most respects, other than the fact that we intentionally over-sampled those involved in fishing.

3 Results of the Experiments

We use non-parametric tests, as well as, empirical estimation procedures for analysis of panel data (given that each treatment comprises several rounds). The non-parametric procedures we use for within sample comparisons is the Wilcoxon's matched-pairs signed rank test whereas for between sample comparisons we employ the two-sample Wilcoxon ranksum test.

We model the fraction of an individual's endowment contributed to the public account. For our empirical estimations we use Stata's xtmixed and xttobit specifications for multilevel hierarchical modeling (MLHM) and random effects tobit models for panels respectively. Both models takes into account individual and group level random effects, and also controls for individual nesting within groups (Rabe-Hesketh and Skrondal, 2005 and StataCorp, 2009). Models are specified to include initially experimental variables and subsequently also variables containing socio-economic and self-reported attitudinal information to account for individual level observed heterogeneity.

3.1 Cooperation in Equal and Unequal Groups for our VCM and Punishment treatments

In this section we compare contributions as a fraction of endowment first for equal and unequal groups and then also for low and high endowment players in unequal groups. Thereafter follows our analysis of punishment behavior for equal and unequal treatments.

In Figure 1 average contributions as a fraction of endowments (or tokens received) in the VCM and Punishment treatments are illustrated, both for players in equal groups (40

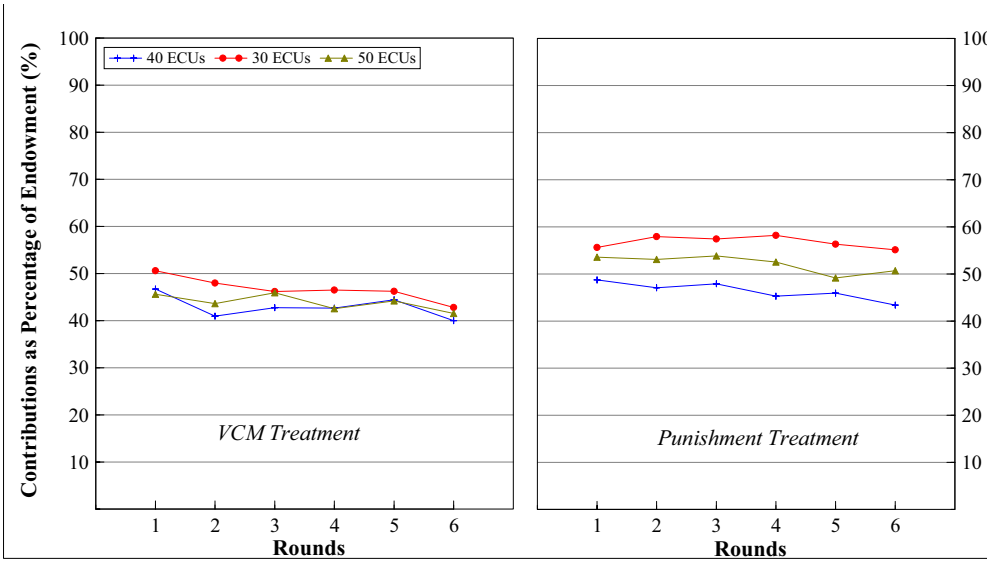

Figure 1: Average fraction of endowment contributed in the VCM and Punishment treatments, for players in equal groups (40 ECUS) and for low endowment (30 ECUs) and high endowment (50 ECUs) players in unequal groups.

ECUs) and for high (50 ECUs) and low (30 ECUs) endowment players in unequal groups.[16]

> ***RESULT 1a****: In the VCM and Punishment treatments aggregate contributions in unequal groups is higher on average than in equal groups and unequal groups are also more effective in using punishment to increase cooperation.*

> ***RESULT 1b****: Low endowment players in unequal groups contribute a higher share of their endowment toward the public good than high endowment players on average.*

Wilcoxon's matched-pairs signed rank test indicates that the increase in average contributions between the VCM and Punishment treatments is significant for the equal ($z = -4.231; p < 0.0001$) and unequal ($z = -11.746; p < 0.0001$) treatments (see Figure 1). The average increase in contributions between the VCM and Punishment treatment is 2.7% for equal groups and 8% for unequal groups indicating that punishment was more effective in raising contributions in unequal groups (in contrast with findings by Reuben and Riedl (2009) for privileged groups).

[16]Contributions and punishment allocation is described in more detail in Appendix IV.

Average contributions for players in the equal VCM treatment varies from 46.7–40% of their token endowment between rounds 1 and 6. For the unequal treatment contributions are somewhat higher, ranging between 47.45–41.98% over the six rounds.[17]

In the Punishment treatment the gap in contributions between equal and unequal groups is even greater: for equal groups the average contribution starts at 48.76% and declines to 43.4% in the last round, while for unequal groups average contributions range between 55.63% and 55.13%. For both treatments the two-sample Wilcoxon ranksum test confirms that the average fraction of contributions is significantly higher for unequal than for equal groups (VCM: $z = -2.98; p < 0.0029$; Punishment: $z = -8.84; p < 0.0001$). Our econometric estimations in Table 2 gives further credence to these results for the Punishment treatment, whereas in the VCM the difference in contributions between equal and unequal groups is not significant (see columns 2 & 5).

In both the VCM and Punishment treatments low endowment players contribute a higher share of their endowment towards provision of the public good. In the Punishment treatment this difference between contributions of low and high endowment players is further enhanced (see Figure 1) with average contributions for high endowment players being 52.2% of their endowment, while the average contribution for low endowment players is 56.8%. These results are significant according to the two sample Wilcoxon ranksum test for both treatments (VCM: $z = 1.86$; $p < 0.07$, Punishment: $z = 3.052$; $p < 0.0023$), as well as, in our econometric estimations for the VCM (xttobit: column 5) and Punishment treatment (xtmixed: column 8 & xttobit: column 11) as reflected in Table 2.

La Ferrara (2000) argues that the economic gains from participation in the provision of public goods are asymmetric in unequal communities, with higher-income households having less to gain from joining social groups than poorer low-income households. Gaspart et al.(1998) and also Baland and Platteau (1999) similarly find that those who appropriate greater net benefits from a public good are more inclined to participate in its provision. A possible explanation for why low endowment players in our study are observed to make higher relative contributions may also be that the potential net gains from cooperation is relatively higher for them[18]. The relative marginal per capita return (MPCR) from the

[17]This is in line with studies that have been performed with students (see Fehr and Schmidt (1999) and Cardenas and Carpenter (2005)), but we do not see the characteristic rapid decline towards full free-riding that marks experiments with students (Davis and Holt, 1993). Similar findings has been made for other studies with non-students (Cardenas and Carpenter, 2005)

[18]That said, the same is true for the relative marginal gain from free-riding.

Table 2: Fraction of Endowment Contributed - Experimental variables only

	VCM Treatment						Punishment Treatment					
	XTMIXED			XTTOBIT			XTMIXED			XTTOBIT		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Round	-0.008	-0.008	-0.009	-0.009	-0.009	-0.010	-0.007	-0.007	-0.005	-0.008	-0.008	-0.005
	(3.88)**	(3.89)**	(3.31)**	(4.05)**	(4.06)**	(3.46)**	(4.09)**	(4.09)**	(2.06)*	(3.92)**	(3.92)**	(1.83)+
Unequal treatment (dummy)	0.025			0.027			0.079			0.084		
	(1.20)			(1.46)			(3.18)**			(4.15)**		
Player is LOW (30 tokens)		0.039			0.043			0.100			0.113	
		(1.64)			(1.88)+			(3.74)**			(4.60)**	
Player is HIGH (50 tokens)		0.012	-0.027		0.012	-0.030		0.057	-0.043		0.055	-0.056
		(0.51)	(1.35)		(0.53)	(1.28)		(2.12)*	(2.14)*		(2.25)*	(2.20)*
Constant	0.463	0.463	0.544	0.456	0.456	0.546	0.535	0.535	0.729	0.533	0.533	0.744
	(17.31)**	(17.32)**	(16.36)**	(18.54)**	(18.56)**	(16.64)**	(8.64)**	(8.64)**	(7.96)**	(10.24)**	(10.27)**	(9.41)**
lns1_1_1_cons	-2.399	-2.397	-2.671				-2.154	-2.150	-2.356			
	(20.24)**	(20.30)**	(12.30)**				(22.46)**	(22.58)**	(15.17)**			
lns2_1_1_cons	-1.862	-1.865	-1.905				-1.831	-1.838	-1.859			
	(42.62)**	(42.63)**	(31.06)**				(43.65)**	(43.71)**	(32.25)**			
lnsig_e_cons	-1.624	-1.624	-1.651				-1.740	-1.740	-1.790			
	(122.28)**	(122.28)**	(89.04)**				(129.22)**	(129.22)**	(95.91)**			
sigma_u_cons				0.203	0.203	0.184				0.223	0.222	0.204
				(27.31)**	(27.30)**	(19.21)**				(28.61)**	(28.60)**	(20.55)**
sigma_e_cons				0.213	0.213	0.205				0.188	0.188	0.178
				(70.71)**	(70.71)**	(51.14)**				(70.17)**	(70.16)**	(50.83)**
Wald Statistic (chi2)	18.9	20.6	18.3	23.8	25.2	21.7	31.5	35.9	21.6	43.0	47.4	29.8
Prob>chi2	0.041	0.038	0.050	0.008	0.008	0.017	0.000	0.000	0.017	0.000	0.000	0.001
Loglikelihood	205.916	206.751	163.845	-451.793	-451.097	-134.550	497.524	499.704	347.690	-128.745	-126.618	39.638
Observations	3,401	3,401	1,745	3,401	3,401	1,745	3,31	3,31	1,722	3,310	3,310	1,722

+ $p<0.1$; * $p<0.05$; ** $p<0.01$

public good favors 30 token players over 50 token players. Conceding that there may be incentives for strategic behavior in repeated interaction (Axelrod, 1997; Fehr and Gächter, 2000) lower endowment players may have a greater willingness to signal their intent to commit to cooperative behavior. For instance, our results for the punishment treatment indicate that net gains realized by low endowment players relative to their initial endowment, is significantly higher (10 times) on average than for high endowment players.

Moreover, in the Punishment treatment the relative expense (as a fraction of endowment) suffered by a low endowment player from being punished is roughly 1.5 times that which a high endowment player incur on average (Relative cost: Low endowment, 13.3/30=0.433; High endowment, 14.6/50=0.292). Both Egas and Riedl (2005) and Nikiforakis and Normann (2008), in testing the effect of altering cost of punishment, indicate that the higher the cost of receiving punishment the more efficient groups are at maintaining cooperation. Fear of punishment and or retaliation may therefore be further factors in explaining the higher relative contributions of low endowment players in the Punishment treatment.[19] Understanding the role of differences in expectations between equal and unequal groups with regards to expected punishment may also yield important insights for future research.

3.2 Punishment Behavior in Equal and Unequal Groups

> ***RESULT 2a****: Unequal groups allocate significantly less punishment that equal groups, but are also less likely to punish if the rest of the group's contribution share is high.*

> ***RESULT 2b****: Within unequal groups demand for punishment by low endowment and high endowment players are not significantly different, even though low endowment players face higher relative costs in allocating punishment.*

In this section we investigate the demand for punishment and determinants for punishment in equal and unequal groups. The average number of punishment points allocated by one player to another in equal groups is 1.51, whereas in unequal groups it is 0.92. Also the two sample Wilcoxon ranksum test indicates that this difference in punishment allocation is significant ($z = 8.328; p < 0.0001$).

[19] In our subsequent analysis analysis we do find that players in unequal groups are more likely to retaliate.

In Table 3 we show the regression results for punishment awarded to another player from xtmixed and xttobit estimations for our pooled sample (where we compare behavior of equal and unequal treatments) and for unequal groups (where we compare the behavior of low and high endowment players) controlling only for experimental variables: treatments, behavior of the player being punished (whether the player's contribution is above or below that of the punisher) and whether the punisher was the recipient of punishment in the previous round.

These results confirm our non-parametric results, namely that unequal groups punish significantly less than equal groups (see columns 1, 3 and 5). Unequal groups (see columns 3 and 5) and particularly low endowment players (see columns 4 and 8) are however also more likely to curb punishment allocation if the rest of the group's contribution share is high. These results are significant for our xtmixed and xttobit regressions for unequal groups.

Notwithstanding the relative cost (which includes the direct cost of assigning punishment points and the possible additional cost of retaliation), the amount of punishment assigned by the high and low endowment players in unequal groups is very similar. The average punishment points allocated per individual to another player for the high endowment players is 0.9 points and for the low endowment players 0.93 points. This difference in demand for punishment is not significant according to the two sample Wilcoxon ranksum test ($z = 0.99; p < 0.322$). Our estimation results in Table 3 reported for the xtmixed and xttobit regressions confirm these results (see columns 2, 4, 6 and 8).

These results contrast with those of Anderson and Putterman (2005) and Nikiforakis and Normann (2008), who find that demand for punishment diminishes with the cost. De Cremer and Van Dijk (2009) focussing on the provision towards sanctioning (as a second order dilemma), finds that there is no positive relationship between endowment size and allocation of punishment unless high endowment players in unequal groups are accountable to the group. Moreover, Carpenter (2007a) specifically tests income elasticity of demand for punishment within subjects with respect to stage I pay-offs in each round. He finds that demand for punishment is rather income inelastic. Our findings similarly negate strong evidence of an income effect.

One of the research questions we posed was the extent to which punishment would be used to discriminate based on endowment status in heterogeneous groups. Our non-parametric analysis indicates that, on average, a high endowment player in an unequal group receives

Table 3: Punishment Awarded to another player - Experimental variables only

	XTMIXED				XTTOBIT			
Dependant Var.: Punishment Awarded	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Round	-0.038	-0.054	-0.039	-0.055	-0.087	-0.106	-0.097	-0.115
	(2.92)**	(3.85)**	(2.95)**	(3.96)**	(3.39)**	(3.43)**	(3.75)**	(3.74)**
Unequal Treatment	-0.690		-0.574		-1.281		-0.179	
	(3.06)**		(1.79)+		(3.39)**		(0.31)	
Other Player is HIGH (dummy)		0.096		0.095		0.158		0.157
		(1.14)		(1.12)		(0.83)		(0.82)
Average contribution share of the rest of the group (excl. punisher)			-0.024	-0.872			-0.930	-3.914
			(0.08)	(2.53)*			(1.59)	(5.16)**
Average contribution share of the rest of the group (excl. punisher) x Unequal Treatment			-0.213				-1.988	
			(0.47)				(2.30)*	
Average contribution share of the rest of the group (excl. punisher) x Punisher is HIGH				1.098				2.521
				(2.30)*				(2.40)*
Pos. deviation of other player from group mean share (excl. other player)	-0.131	0.231	-0.129	0.231	-0.532	-1.421	-0.468	-1.346
	(0.60)	(0.68)	(0.59)	(0.68)	(1.27)	(1.89)+	(1.11)	(1.80)+
Pos. deviation of other player from group mean share (excl. other player) x Unequal Treatment	-0.158		-0.153		-1.161		-1.088	
	(0.48)		(0.47)		(1.81)+		(1.69)+	
Pos. deviation of other player from group mean share (excl. other player) x Punisher is HIGH		-0.713		-0.719		0.032		-0.020
		(1.86)+		(1.88)+		(0.04)		(0.02)
Pos. deviation of other player from group mean share (excl. other player) x Other player is HIGH		-0.256		-0.227		-0.111		0.167
		(0.66)		(0.59)		(0.13)		(0.20)
Neg. deviation of other player from group mean share (excl. other player)	1.742	2.607	1.742	2.590	5.369	5.780	5.345	5.916
	(7.45)**	(6.84)**	(7.45)**	(6.79)**	(12.72)**	(7.49)**	(12.66)**	(7.67)**
Neg. deviation of other player from group mean share (excl. other player) x Unequal Treatment	0.175		0.166		0.776		0.750	
	(0.51)		(0.48)		(1.25)		(1.20)	
Neg. deviation of other player from group mean share (excl. other player) x Punisher is HIGH		-1.438		-1.397		-0.835		-0.939
		(3.60)**		(3.49)**		(1.04)		(1.17)
Neg. deviation of other player from group mean share (excl. other player) x Other player is HIGH		0.062		0.046		0.152		-0.029
		(0.16)		(0.12)		(0.19)		(0.04)
Punisher is HIGH		0.277		-0.311		0.205		-1.037
		(1.40)		(0.96)		(0.46)		(1.48)
Punishment received in previous round	0.002	0.013	0.002	0.013	0.008	0.024	0.008	0.024
	(1.08)	(5.70)**	(1.09)	(5.76)**	(3.26)**	(5.38)**	(3.33)**	(5.60)**
Punishment received in previous round x Unequal Treatment	0.008		0.008		0.016		0.016	
	(3.15)**		(3.14)**		(3.56)**		(3.56)**	
Punishment received in previous round x Punisher is HIGH		-0.004		-0.004		-0.004		-0.005
		(1.20)		(1.21)		(0.65)		(0.82)
Constant	0.581	0.220	0.607	0.744	-3.185	-3.839	-2.586	-1.434
	(1.12)	(0.39)	(1.12)	(1.25)	(3.61)**	(3.08)**	(2.82)**	(1.10)
lns1_1_1_cons	-0.095	-1.325	-0.098	-1.447				
	(0.80)	(1.51)	(0.82)	(1.32)				
lns2_1_1_cons	0.423	0.337	0.423	0.334				
	(10.61)**	(6.18)**	(10.62)**	(6.13)**				
lnsig_e_cons	0.780	0.490	0.780	0.489				
	(105.08)**	(46.56)**	(105.07)**	(46.52)**				
sigma_u_cons					3.714	3.041	3.676	2.978
					(24.76)**	(17.31)**	(24.68)**	(17.28)**
sigma_e_cons					3.220	2.672	3.219	2.665
					(70.48)**	(48.79)**	(70.47)**	(48.81)**
Wald Statistic (chi2)	221.0	263.9	221.7	272.2	620.2	421.4	639.1	446.0
Prob>chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Loglikelihood	-21,800	-9,497	-21,800.189	-9,493.676	-11,392	-5,121	-11,381.169	-5,106.245
Observations	9,611	4,788	9,611.000	4,788.000	9,611	4,788	9,611.000	4,788.000

+ $p<0.1$; * $p<0.05$; ** $p<0.01$

more punishment in total than a low endowment player (0.96 versus 0.86 punishment points). The two-sample Wilcoxon ranksum test ($z = -2.527; p < 0.0115$) indicates that there is a significant difference in the punishment received by low and high endowment players. This is also reflected in the bottom histogram in Figure 3 indicating punishment received within unequal groups. However, in Table 3 the coefficient obtained for the endowment dummy ("Other player is HIGH") while positive for both xtmixed and xttobit models (columns 2, 4, 6, and 8)) are not significant.

> ***RESULT 3****: Punishment allocation is motivated mainly by free-riding, with low endowment players in unequal groups tending to punish free-riding more severely than high endowment players. "Antisocial" punishment is more prevalent in equal groups whereas retaliation is also a significant determinant of sanctioning behavior, particularly in unequal groups.*

Figure 2 shows average punishment allocated to another player based on that player's positive or negative deviation in contribution from the average group share (excluding that player) which is in line with findings by Cubitt et al., (2011) and also Masclet and Villeval (2008).[20] The bar labels indicate the percentage of total deviations represented by the specific category, and error bars give 95% confidence intervals for the reported figures. In both equal and unequal groups, larger negative deviation from the rest of the group share are clearly associated with higher levels of punishment.

Our regression estimates in Table 3 indicate a similar pattern with allocation of punishment being strongly driven by free-riding (a negative deviation in contribution share between the punisher and the receiver of punishment). In unequal groups free-riding elicits more punishment from low endowment players (this is significant for our xtmixed specification seen in columns 2 and 4). This result is also reflected in the upper histogram in Figure 3 (indicating punishment allocated within unequal groups) with low endowment (30 ECU) players punishing *negative deviation in the contribution share of the other player from that of the punisher* more than high endowment (50 ECU) players.

"Antisocial" punishment of individuals who contribute more than the social norm (or the punisher's own contribution) is common in the literature (Cinyabuguma et al., 2006 and

[20] In this histogram we exclude punishment allocated by individuals who punish more than 20 points in total per round (which accounts for only 3% of observations and slightly biases the observed effects), given that there is no control for individual fixed effects.

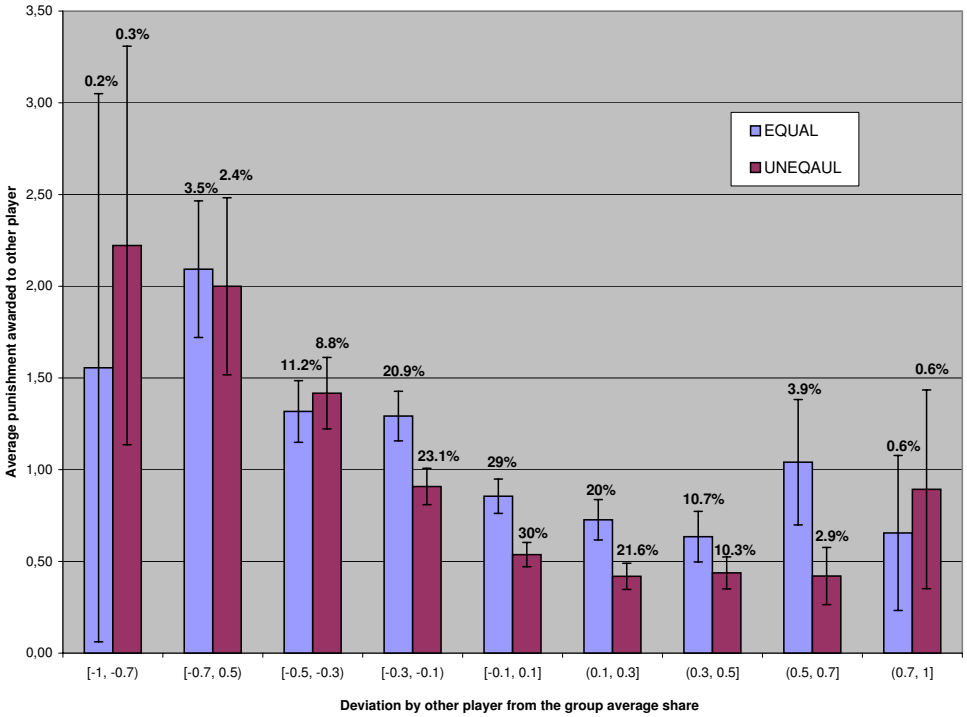

Figure 2: Histogram of punishment allocated: equal versus unequal groups.

Gächter and Herrmann, 2006 and Herrmann et al., 2008) and also observed in our sample. In this study we find that individuals in unequal groups are less likely to allocate perverse punishment towards those who contribute a greater fraction than themselves. In particular high endowment players are significantly less inclined to punish cooperators in unequal groups (the result is significant for our xtmixed specification seen in Table 3, columns 2 and 4). It may be that a "social norm" is less salient in unequal groups compared to equal groups where contributions may tend to cluster around a common mean and that in unequal groups the awareness of existing inequalities based on wealth may influence perceptions of what constitutes a social norm.

Retaliation has been identified as another driving force behind punishment (Fehr and Fischbacher, 2002; Falk et al., 2005). We also find that retaliation is a significant determinant for punishment allocation, particularly in unequal groups (See Table 3, columns 2-8). This is also relevant to our findings in the next subsection dealing with the influence of social attitudes (and fear of being sanctioned for reporting fishing crimes) on social sanctioning.

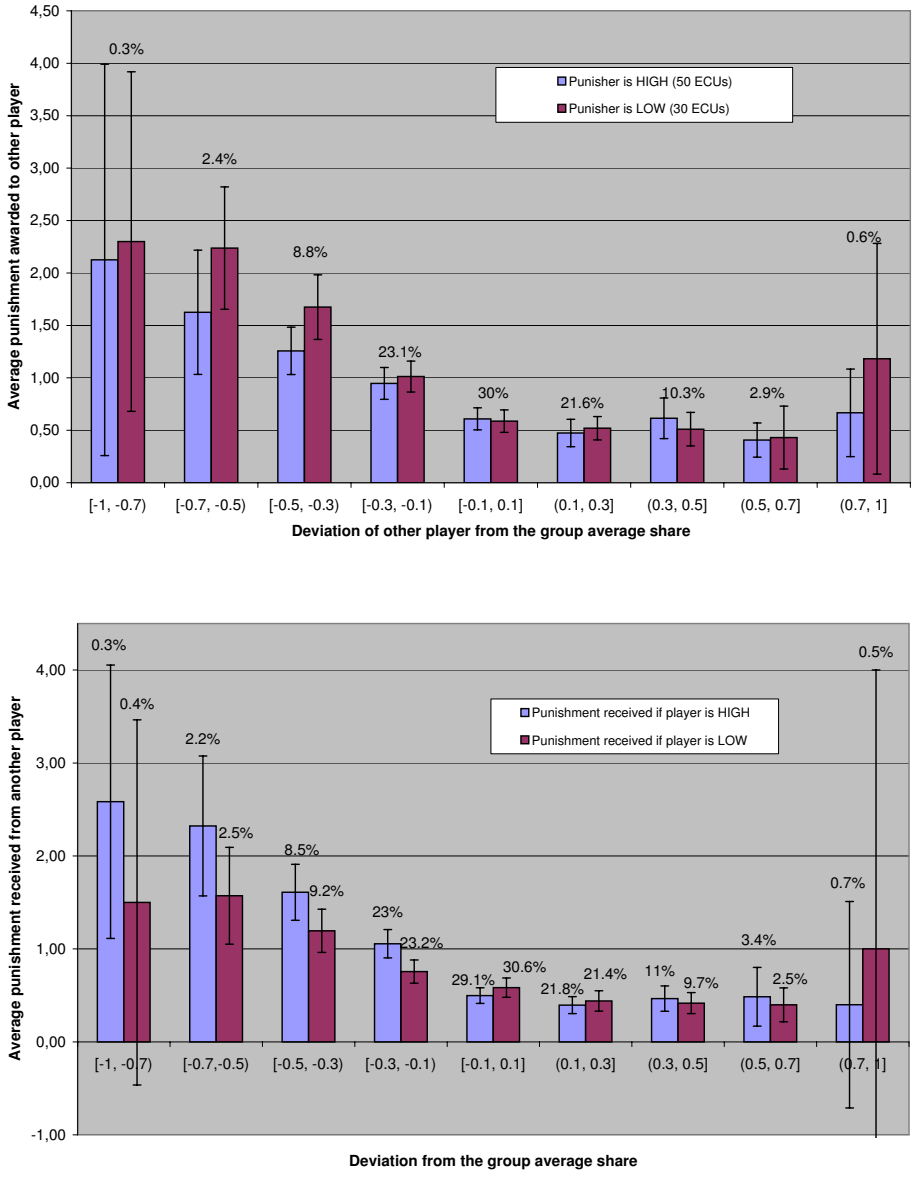

Figure 3: Histograms of punishment allocated and received in unequal groups.

3.3 The role of socio-economic covariates and social attitudes on cooperation and punishment

3.3.1 Real Wealth and Inequality

> ***RESULT 4****: The effect of our proxies of real wealth and inequality does not play a significant role in contributions or in the allocation of punishment. However, being ABOVE the average household income is positive and significant in driving contributions in the Punishment treatment.*

Since the experimental treatments introduced a simplified form of inequality in the lab setting via the introduction of different endowments in unequal groups, we are interested to what extent measures of real wealth and inequality which subjects bring with them into the experimental setting affect their behavior. We therefor control for the logarithm of total income (including grants), *loginctotg*, but also construct a variable, *ABOVEloginctotg*, which takes a value of 1 if an individual's income is above the average income of other experimental subjects from the same community and 0 otherwise.[21]

We also construct a proxy for inequality, *VARloginctotg*, for subjects from each community which is the variance of income (including grants) of experimental subjects from each particular community. Given that our experimental sample was purposively obtained and not a random sample of the population in each community we worked with, we go further and construct a similar variable, *VARloginctotC*, for each of our communities from the Census data.[22]

Our measure of real wealth, *loginctotg*, is not significant in determining the level of experimental contributions in the VCM or Punishment treatments and neither is it significant in the allocation of punishment. While the measure, *ABOVEloginctotg*, is not significant for contributions in the the VCM treatment, it is positive and significant for contributions in the Punishment treatment.

The level of inequality within each community measured as the variance of income (including grants) of our experimental sample, *VARloginctotg*, is not significant in determining

[21] This measure is of course not directly comparable with low (30 token) vs high (50 token) endowment players in the unequal treatment which is a very simplified construct of inequality.

[22] We were not able to construct a similar measure for *ABOVEloginctotg* based on the Census average income levels, since most of our subjects falls above the the census average which is low due to 50-60 percent of individuals in the Census reporting having zero income.

Table 4: Contributions - VCM treatment (incl. socio-economic & attitudinal regressors)

	XTMIXED							XTTOBIT						
Dependant variable: Contribution share	[1]	{2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
Round	-0.007 (3.14)**	-0.007 (3.14)**	-0.010 (3.19)**	-0.007 (3.14)**	-0.007 (3.14)**	-0.006 (2.30)* 0.023	-0.006 (2.30)*	-0.008 (3.29)**	-0.008 (3.29)**	-0.011 (3.25)**	-0.008 (3.29)**	-0.008 (3.29)**	-0.007 (2.40)*	-0.007 (2.40)*
Unequal Treatment	0.038 (1.65)+			0.037 (1.59)		0.023 (0.95)		0.040 (1.81)+			0.038 (1.74)+		0.032 (1.23)	
Tokens30		0.056 (2.18)*			0.053 (2.08)*		0.044 (1.56)		0.059 (2.26)*			0.056 (2.14)*		0.052 (1.70)+
Tokens50		0.019 (0.71)	-0.036 (1.62)		0.018 (0.68)		-0.002 (0.05)		0.018 (0.69)	-0.039 (1.41)		0.019 (0.70)		0.008 (0.26)
Age	-0.002 (0.48)	-0.002 (0.50)	-0.005 (0.92)	-0.002 (0.42)	-0.002 (0.44)	-0.002 (0.48)	-0.003 (0.60)	-0.003 (0.63)	-0.003 (0.64)	-0.004 (0.57)	-0.003 (0.58)	-0.003 (0.59)	-0.003 (0.56)	-0.004 (0.64)
Age squared	0.000 (0.59)	0.000 (0.60)	0.000 (0.84)	0.000 (0.58)	0.000 (0.58)	0.000 (0.53)	0.000 (0.64)	0.000 (0.66)	0.000 (0.66)	0.000 (0.42)	0.000 (0.67)	0.000 (0.67)	0.000 (0.59)	0.000 (0.68)
Education	-0.014 (0.96)	-0.015 (1.05)	-0.011 (0.53)	-0.015 (1.03)	-0.016 (1.11)	-0.042 (2.19)*	-0.042 (2.20)*	-0.022 (1.24)	-0.023 (1.32)	-0.018 (0.73)	-0.024 (1.39)	-0.025 (1.45)	-0.053 (2.38)*	-0.053 (2.40)*
Education squared	0.000 (0.35)	0.000 (0.44)	0.000 (0.05)	0.000 (0.38)	0.000 (0.46)	0.001 (1.44)	0.001 (1.48)	0.000 (0.58)	0.001 (0.65)	0.000 (0.17)	0.001 (0.67)	0.001 (0.73)	0.002 (1.56)	0.002 (1.60)
Female	0.010 (0.44)	0.008 (0.36)	0.017 (0.56)	0.014 (0.59)	0.012 (0.51)	0.002 (0.06)	-0.001 (0.03)	0.009 (0.31)	0.007 (0.25)	0.013 (0.36)	0.015 (0.53)	0.013 (0.47)	0.004 (0.11)	0.001 (0.03)
Coloured	-0.045 (2.20)*	-0.045 (2.21)*	-0.034 (1.29)	-0.044 (2.15)*	-0.044 (2.17)*	-0.052 (2.10)*	-0.050 (2.05)*	-0.051 (2.11)*	-0.051 (2.13)*	-0.048 (1.59)	-0.049 (2.07)*	-0.049 (2.08)*	-0.060 (2.10)*	-0.059 (2.06)*
Loginctotg	-0.002 (0.27)	-0.003 (0.31)	-0.010 (0.86)	-0.019 (1.34)	-0.019 (1.35)	-0.025 (1.35)	-0.026 (1.38)	0.001 (0.05)	0.000 (0.03)	-0.006 (0.44)	-0.014 (0.87)	-0.014 (0.87)	-0.019 (0.86)	-0.019 (0.87)
ABOVEloginctotg				0.046 (1.57)	0.045 (1.55)	0.058 (1.57)	0.056 (1.52)				0.043 (1.24)	0.043 (1.22)	0.053 (1.22)	0.051 (1.17)
VARloginctotg				-0.188 (1.31)	-0.175 (1.21)	-0.036 (0.20)	-0.019 (0.10)				-0.276 (1.91)+	-0.266 (1.84)+	-0.106 (0.52)	-0.092 (0.45)
Unemployed						-0.005 (0.22)	-0.006 (0.23)						-0.003 (0.09)	-0.002 (0.08)
Breadwinner						-0.054 (2.03)*	-0.051 (1.94)+						-0.070 (2.24)*	-0.069 (2.21)*
Fishing rights						-0.012 (0.48)	-0.012 (0.49)						-0.020 (0.67)	-0.020 (0.68)
Officials corrupt						0.014 (0.49)	0.015 (0.52)						0.011 (0.31)	0.011 (0.32)
Unfair quotas						-0.044 (1.30)	-0.045 (1.34)						-0.040 (1.02)	-0.040 (1.04)
Report fishing crime						0.012 (0.51)	0.013 (0.60)						0.009 (0.35)	0.011 (0.41)
Trouble for reporting						0.018 (0.33)	0.024 (0.43)						0.004 (0.06)	0.009 (0.15)
Community petitions						-0.049 (1.35)	-0.051 (1.43)						-0.064 (1.53)	-0.068 (1.61)
_cons	0.644 (4.73)**	0.654 (4.81)**	0.855 (4.45)**	0.976 (4.11)**	0.967 (4.07)**	1.050 (3.37)**	1.035 (3.33)**	0.702 (4.33)**	0.711 (4.39)**	0.881 (3.95)**	1.145 (4.46)**	1.140 (4.45)**	1.216 (3.46)**	1.204 (3.43)**
lns1_1_1_cons	-2.389 (17.57)**	-2.382 (17.73)**	-2.559 (11.86)**	-2.413 (17.22)**	-2.405 (17.38)**	-2.770 (8.70)**	-2.719 (9.31)**							
lns2_1_1_cons	-1.875 (35.93)**	-1.881 (35.93)**	-1.958 (26.12)**	-1.877 (35.90)**	-1.882 (35.89)**	-1.838 (28.23)**	-1.850 (28.12)**							
lnsig_e_cons	-1.647 (107.98)**	-1.647 (107.98)**	-1.666 (78.28)**	-1.647 (107.98)**	-1.647 (107.98)**	-1.652 (90.79)**	-1.652 (90.79)**							
sigma_u_cons								0.205 (23.84)**	0.205 (23.83)**	0.183 (16.66)**	0.204 (23.78)**	0.203 (23.77)**	0.199 (19.69)**	0.198 (19.68)**
sigma_e_cons								0.208 (61.57)**	0.208 (61.57)**	0.202 (44.40)**	0.208 (61.56)**	0.208 (61.57)**	0.207 (51.60)**	0.207 (51.61)**
Wald Statistic (chi2)	32.6	35.3	29.3	37.1	39.5	44.4	46.7	36.0	37.9	33.8	41.5	43.1	48.7	50.4
Prob>chi2	0.013	0.009	0.032	0.008	0.006	0.019	0.015	0.005	0.004	0.009	0.002	0.002	0.006	0.006
Loglikelihood	207.550	208.809	145.889	209.648	210.758	159.172	160.323	-300.130	-299.208	-97.341	-297.533	-296.758	-196.482	-195.723
Observations	2,579	2,579	1,325	2,579	2,579	1,812	1,812	2,579	2,579	1,325	2,579	2,579	1,812	1,812

+ $p<0.1$; * $p<0.05$; ** $p<0.01$

contributions in the VCM or Punishment treatments for our xtmixed estimations. Its effect as observed for our xttobit estimations is negative in some instances, but this effect is not robust for different model specifications.[23] The effect of our inequality measure based on the variance of income for each community from the census data, *VARloginctotC* is not significant for either contributions in the VCM or the Punishment treatments (see Appendix V).

Neither measures for being above the mean income or inequality has a significant effect on allocation of punishment (see Table 5, columns 4-7 and 11-4). Moreover the measure of inequality constructed from the Census data (Appendix V) does not have a significant effect on punishment behavior either. These results for allocation of punishment confirm our earlier experimental findings that demand for punishment does not differ between player types.

What we *don't* see is that real world inequality results in lower allocation of punishment as we observe in the experimental treatments when comparing equal and unequal groups.

It is important to note that significant differences in behavior in our experimental findings between equal and unequal groups and within unequal groups between low endowment and high endowment players emerged in the Punishment treatment both with respect to contributions and the allocation of punishment. In the Punishment treatment actual contribution levels as well as the endowment status of each individual was observable after each round which meant that players could base their decision to allocate punishment to another member in their group based on this information. The real wealth status of other groups members were however *not* observable in the experimental context which meant that a player would *not* be able to deduce relative differences in real wealth between themselves and other group members *nor* could they allocate punishment based on the wealth status and contributions relative to real wealth of other groups members. This is an important starting point in comparing behavior in the experiments based on experimental and real world wealth status and inequality levels.

Nonetheless, while the explicit differences in endowments and contributions are directly observable in the experiment, it is also highly plausible that individuals within communities in their daily interactions know the proximate wealth status (and quota allocations which

[23]In the VCM and Punishment treatments it is negative and significant for our xtmixed specifications when included without other socio-economic variables (see Table 4 and 5, columns 11-12). In the xttobit regression it also looses its significance if the correlated community fixed effects are dropped.

Table 5: Contributions - Punishment treatment (incl. soc.econ. & attitudinal regressors)

	XTMIXED							XTTOBIT						
Dependant variable: Contribution share	[1]	{2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
rnd	-0.007	-0.007	-0.004	-0.007	-0.007	-0.004	-0.004	-0.007	-0.007	-0.004	-0.007	-0.007	-0.004	-0.004
	(3.56)**	(3.56)**	(1.63)	(3.56)**	(3.56)**	(1.91)+	(1.91)+	(3.40)**	(3.40)**	(1.33)	(3.40)**	(3.40)**	(1.77)+	(1.77)+
Unequal Treatment	0.092			0.090		0.082		0.097			0.095		0.087	
	(3.54)**			(3.51)**		(2.79)**		(4.08)**			(4.05)**		(3.09)**	
Tokens30		0.115			0.113		0.102		0.124			0.121		0.112
		(4.03)**			(3.97)**		(3.17)**		(4.40)**			(4.33)**		(3.41)**
Tokens50		0.066	-0.048		0.065		0.058		0.067	-0.055		0.067		0.056
		(2.26)*	(1.98)*		(2.24)*		(1.73)+		(2.31)*	(1.85)+		(2.33)*		(1.62)
Age	0.007	0.007	0.000	0.007	0.007	0.011	0.011	0.008	0.008	0.003	0.009	0.009	0.011	0.011
	(1.55)	(1.54)	(0.06)	(1.66)+	(1.65)+	(2.22)*	(2.12)*	(1.59)	(1.59)	(0.44)	(1.68)+	(1.68)+	(1.77)+	(1.68)+
Age squared	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(1.44)	(1.44)	(0.01)	(1.50)	(1.50)	(2.18)*	(2.08)*	(1.54)	(1.55)	(0.46)	(1.57)	(1.57)	(1.73)+	(1.64)
Education	0.011	0.009	0.005	0.010	0.009	-0.016	-0.017	0.009	0.007	-0.003	0.007	0.005	-0.026	-0.026
	(0.70)	(0.59)	(0.23)	(0.66)	(0.56)	(0.83)	(0.86)	(0.50)	(0.40)	(0.11)	(0.35)	(0.26)	(1.10)	(1.13)
Education squared	-0.001	-0.001	-0.000	-0.001	-0.001	0.000	0.000	-0.001	-0.000	0.000	-0.000	-0.000	0.001	0.001
	(0.84)	(0.74)	(0.23)	(0.84)	(0.74)	(0.33)	(0.38)	(0.59)	(0.50)	(0.10)	(0.50)	(0.41)	(0.74)	(0.79)
Female	0.003	0.001	-0.007	0.007	0.005	-0.016	-0.019	-0.002	-0.005	-0.011	0.005	0.003	-0.006	-0.009
	(0.14)	(0.05)	(0.20)	(0.28)	(0.20)	(0.52)	(0.61)	(0.08)	(0.15)	(0.29)	(0.16)	(0.08)	(0.15)	(0.24)
Coloured	-0.012	-0.012	-0.021	-0.010	-0.010	-0.012	-0.010	-0.014	-0.014	-0.019	-0.012	-0.012	-0.019	-0.017
	(0.53)	(0.53)	(0.74)	(0.45)	(0.46)	(0.48)	(0.41)	(0.53)	(0.53)	(0.56)	(0.46)	(0.46)	(0.61)	(0.56)
Loginctotg	0.000	0.000	0.002	-0.022	-0.023	-0.035	-0.035	0.001	0.001	0.006	-0.020	-0.020	-0.030	-0.031
	(0.04)	(0.01)	(0.13)	(1.48)	(1.52)	(1.84)+	(1.88)+	(0.11)	(0.09)	(0.40)	(1.12)	(1.16)	(1.30)	(1.34)
ABOVEloginctotg				0.063	0.063	0.106	0.106				0.062	0.063	0.097	0.097
				(2.02)*	(2.04)*	(2.81)**	(2.80)**				(1.65)+	(1.67)+	(2.10)*	(2.09)*
VARloginctotg				-0.158	-0.136	-0.163	-0.142				-0.267	-0.252	-0.260	-0.239
				(1.09)	(0.94)	(0.88)	(0.77)				(1.86)+	(1.76)+	(1.30)	(1.20)
Unemployed						0.043	0.043						0.054	0.055
						(1.72)+	(1.73)+						(1.76)+	(1.79)+
Breadwinner						-0.041	-0.039						-0.047	-0.046
						(1.54)	(1.47)						(1.40)	(1.37)
Fishing rights						0.014	0.013						0.003	0.002
						(0.52)	(0.50)						(0.11)	(0.07)
Officials corrupt						0.018	0.019						-0.004	-0.003
						(0.61)	(0.65)						(0.10)	(0.09)
Unfair quotas						-0.018	-0.020						-0.004	-0.005
						(0.53)	(0.60)						(0.10)	(0.12)
Report fishing crime						-0.010	-0.008						-0.002	0.000
						(0.44)	(0.34)						(0.08)	(0.00)
Trouble for reporting						0.068	0.072						0.041	0.048
						(1.19)	(1.27)						(0.61)	(0.72)
Community petitions						-0.043	-0.045						-0.076	-0.081
						(1.19)	(1.25)						(1.72)+	(1.82)+
Constant	0.337	0.352	0.686	0.501	0.509	0.529	0.532	0.306	0.319	0.668	0.503	0.512	0.577	0.579
	(2.13)*	(2.23)*	(3.01)**	(2.90)**	(2.95)**	(2.40)*	(2.42)*	(1.68)+	(1.75)+	(2.58)**	(2.52)*	(2.57)*	(2.22)*	(2.24)*
lns1_1_1_cons	-2.240	-2.225	-2.385	-2.258	-2.241	-2.177	-2.165							
	(17.67)**	(17.95)**	(12.14)**	(17.43)**	(17.70)**	(16.50)**	(16.72)**							
lns2_1_1_cons	-1.787	-1.796	-1.846	-1.791	-1.801	-1.891	-1.901							
	(35.90)**	(35.96)**	(26.59)**	(35.87)**	(35.89)**	(29.14)**	(29.16)**							
lnsig_e_cons	-1.761	-1.761	-1.796	-1.761	-1.761	-1.788	-1.788							
	(113.97)**	(113.97)**	(84.04)**	(113.97)**	(113.97)**	(97.13)**	(97.13)**							
sigma_u_cons								0.224	0.223	0.206	0.222	0.221	0.216	0.216
								(24.95)**	(24.94)**	(17.87)**	(24.90)**	(24.89)**	(20.75)**	(20.74)**
sigma_e_cons								0.185	0.185	0.178	0.185	0.185	0.179	0.179
								(60.98)**	(60.98)**	(44.10)**	(60.98)**	(60.97)**	(51.29)**	(51.29)**
Wald Statistic (chi2)	34.5	38.3	19.1	40.2	43.7	45.8	48.5	41.5	44.9	23.7	48.1	51.2	46.6	49.0
Prob>chi2	0.007	0.004	0.321	0.003	0.002	0.013	0.009	0.001	0.000	0.128	0.000	0.000	0.011	0.008
Loglikelihood	411.96	413.84	269.23	414.550	416.33	346.97	348.11	-73.328	-71.737	12.48	-70.289	-68.845	8.34	9.41
Observations	2,514	2,514	1,314	2,514	2,514	1,77	1,77	2,514	2,514	1,314	2,514	2,514	1,77	1,77

+ $p<0.1$; * $p<0.05$; ** $p<0.01$

translates into wealth) of other members in their community. Similarly participation in provision of public goods may also be highly visible (depending on the nature of the public good). So also may involvement in poaching activities at least be partially observable or identifiable based on rumors (or boasting) by poachers themselves, other crew members and through social networks. Even during the surveys we conducted individuals freely talked about their involvement in poaching (viewed by many as legitimate in the context of the current fishing rights allocation process which is perceived as unfair) and as mentioned before, more than 60% of those involved in fishing admitted that they had been caught for fishing violations.

3.3.2 Socio-economic Status and Social Attitudes

Besides for the effect of real wealth and inequality on experimental behavior we also controlled for other socio-economic variable and various social attitudes obtained from our survey instrument. These results are reported in Tables 6-8 (columns 6-7 and 13-14).

Being a breadwinner has a negative and significant effect on contributions in the VCM for all different model specifications, indicating that such persons' responsibility in securing the livelihoods of all other household members preclude them from being altruistic in the wider community sense.

In the VCM, the level of education is negative and significant for xtmixed and xttobit estimations (see Table 4, Columns 6-7 and 13-14) when other socio economic variables are also included. This finding is however not robust since its significance disappears in other model specifications where correlation is less likely to be a factor (see columns 1-5 and 8-12). In the Punishment treatment (see Table 5) contributions are to some extent driven by age(+), being unemployed(+) and being a breadwinner(−), but these results are not robust for different model specifications.

Being unemployed however consistently has a negative and significant effect on punishment behavior for our xttobit and xtmixed regression specifications (Table 6, columns 6-7 and 13-14).

> ***RESULT 5****: Both the belief that officials involved in allocation of fishing rights are corrupt and an individual's own willingness to report fishing crimes have a positive effect on punishment behavior. Those who believe that reporting people*

Table 6: Punishment awarded (incl. socio-economic & attitudinal regressors)

	XTMIXED							XTTOBIT						
Dependant variable: Punishment awarded	[1]	{2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
Round	-0.023	-0.023	-0.036	-0.023	-0.023	-0.048	-0.048	-0.046	-0.046	-0.041	-0.046	-0.046	-0.098	-0.098
	(1.51)	(1.51)	(2.10)*	(1.51)	(1.51)	(2.67)**	(2.67)**	(1.49)	(1.49)	(1.08)	(1.49)	(1.49)	(2.56)*	(2.56)*
Unequal Treatment	-0.500			-0.504		-0.478		-0.832			-0.783		-0.295	
	(2.00)*			(2.01)*		(1.64)		(1.92)+			(1.80)+		(0.54)	
Tokens30		-0.492			-0.499		-0.412		-0.747			-0.695		-0.157
		(1.80)+			(1.82)+		(1.29)		(1.44)			(1.33)		(0.24)
Tokens50		-0.509	-0.092		-0.510		-0.563		-0.925	-0.175		-0.880		-0.464
		(1.82)+	(0.43)		(1.82)+		(1.68)+		(1.73)+	(0.35)		(1.64)		(0.68)
Age	-0.071	-0.071	-0.055	-0.070	-0.070	-0.076	-0.078	-0.155	-0.155	-0.080	-0.154	-0.154	-0.043	-0.046
	(1.80)+	(1.80)+	(1.06)	(1.77)+	(1.77)+	(1.47)	(1.50)	(1.62)	(1.62)	(0.68)	(1.60)	(1.60)	(0.34)	(0.37)
Age squared	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.001
	(1.70)+	(1.70)+	(0.95)	(1.69)+	(1.69)+	(1.67)+	(1.70)+	(1.53)	(1.54)	(0.62)	(1.52)	(1.52)	(0.58)	(0.61)
Education	-0.122	-0.123	-0.461	-0.128	-0.128	-0.027	-0.025	-0.015	-0.020	-0.462	-0.014	-0.019	0.480	0.483
	(0.84)	(0.85)	(2.18)*	(0.88)	(0.88)	(0.13)	(0.13)	(0.04)	(0.06)	(0.97)	(0.04)	(0.06)	(1.03)	(1.04)
Education squared	0.002	0.002	0.019	0.002	0.002	-0.002	-0.002	0.002	0.002	0.023	0.002	0.002	-0.021	-0.021
	(0.28)	(0.29)	(1.83)+	(0.30)	(0.31)	(0.22)	(0.23)	(0.11)	(0.13)	(1.01)	(0.12)	(0.13)	(0.94)	(0.94)
Female	0.015	0.014	-0.005	0.023	0.022	-0.107	-0.117	0.504	0.497	0.759	0.441	0.433	-0.457	-0.478
	(0.06)	(0.06)	(0.02)	(0.10)	(0.09)	(0.34)	(0.37)	(0.91)	(0.89)	(1.14)	(0.79)	(0.78)	(0.61)	(0.64)
Coloured	-0.123	-0.123	-0.117	-0.112	-0.112	0.090	0.100	-0.236	-0.234	-0.011	-0.229	-0.227	0.035	0.049
	(0.63)	(0.62)	(0.49)	(0.57)	(0.57)	(0.36)	(0.40)	(0.51)	(0.50)	(0.02)	(0.49)	(0.49)	(0.06)	(0.08)
Loginctotg	0.028	0.028	0.149	-0.025	-0.025	-0.240	-0.238	0.232	0.232	0.310	0.473	0.474	0.292	0.295
	(0.34)	(0.34)	(1.48)	(0.20)	(0.20)	(1.47)	(1.46)	(1.16)	(1.16)	(1.35)	(1.54)	(1.55)	(0.73)	(0.73)
ABOVEloginctotg				0.161	0.161	0.489	0.478				-0.691	-0.694	0.192	0.174
				(0.58)	(0.58)	(1.37)	(1.34)				(1.03)	(1.03)	(0.23)	(0.20)
VARloginctotg				-0.481	-0.480	-1.073	-1.062				-0.526	-0.516	-2.242	-2.223
				(0.57)	(0.57)	(1.12)	(1.11)				(0.35)	(0.34)	(1.23)	(1.22)
Unemployed						-0.644	-0.645						-1.403	-1.397
						(2.57)*	(2.58)**						(2.40)*	(2.39)*
Breadwinner						-0.236	-0.232						-0.987	-0.979
						(0.89)	(0.87)						(1.56)	(1.54)
Fishing rights						0.134	0.130						-0.911	-0.917
						(0.52)	(0.50)						(1.47)	(1.48)
Officials corrupt						0.654	0.658						0.482	0.488
						(2.16)*	(2.18)*						(0.68)	(0.69)
Unfair quotas						-0.361	-0.370						0.374	0.359
						(1.04)	(1.06)						(0.46)	(0.44)
Report fishing crime						-0.076	-0.069						0.998	1.006
						(0.33)	(0.30)						(1.82)+	(1.83)+
Trouble for reporting						-0.989	-0.975						-3.356	-3.312
						(1.74)+	(1.72)+						(2.62)**	(2.58)**
Community petitions						-0.313	-0.317						-1.117	-1.129
						(0.84)	(0.85)						(1.27)	(1.28)
Constant	2.951	2.953	3.401	3.370	3.370	5.246	5.218	-1.088	-1.073	-2.930	-2.290	-2.283	-1.941	-1.998
	(2.06)*	(2.06)*	(1.77)+	(2.20)*	(2.20)*	(2.51)*	(2.50)*	(0.33)	(0.32)	(0.68)	(0.64)	(0.64)	(0.40)	(0.41)
lns1_1_1_cons	0.056	0.056	-0.543	0.054	0.054	0.035	0.034							
	(0.50)	(0.50)	(1.86)+	(0.48)	(0.48)	(0.23)	(0.22)							
lns2_1_1_cons	0.414	0.414	0.354	0.414	0.414	0.465	0.465							
	(8.69)**	(8.69)**	(5.47)**	(8.67)**	(8.67)**	(7.67)**	(7.66)**							
lnsig_e_cons	0.813	0.813	0.561	0.813	0.813	0.800	0.800							
	(95.70)**	(95.70)**	(46.38)**	(95.70)**	(95.70)**	(78.87)**	(78.87)**							
sigma_u_cons								3.993	3.992	3.304	3.989	3.989	4.098	4.097
								(21.73)**	(21.73)**	(15.29)**	(21.74)**	(21.74)**	(17.97)**	(17.97)**
sigma_e_cons								3.470	3.470	2.960	3.470	3.470	3.559	3.559
								(61.06)**	(61.06)**	(43.21)**	(61.06)**	(61.06)**	(49.58)**	(49.58)**
Wald Statistic (chi2)	20.3	20.3	19.8	21.0	21.0	36.7	37.0	20.5	20.6	12.9	21.7	21.8		41.6
Prob>chi2	0.260	0.317	0.282	0.338	0.399	0.100	0.119	0.251	0.302	0.743	0.301	0.353	0.038	0.048
Loglikelihood	-16,871	-16,871	-7,434	-16,871	-16,871	-11,791	-11,791	-9,032	-9,032	-4,241	-9,031	-9,031	-6,097	-6,097
Observations	7,331	7,331	3,618	7,331	7,331	5,147	5,147	7,331	7,331	3,618	7,331	7,331	5,147	5,147

+ $p<0.1$; * $p<0.05$; ** $p<0.01$

for fishing crimes would get them into trouble are also significantly less likely to allocate punishment.

As noted previously, 77% of persons in our sample believed that officials allocating fishing rights are corrupt. This belief has a positive and significant impact on punishment allocation in our xtmixed specifications. Also people who indicated that they would report a fishing crime to officials allocate significantly more punishment according to our xttobit estimations (see Table 6, column 13-14).

People who believe that they will get into trouble for reporting fishing crimes to the officials are in turn significantly less likely to allocate punishment behavior (see Table 6, columns 6-7 and columns 13-14), which is consistent with the fear of retaliation in the experimental context as seen earlier.

4 Conclusion

The effect of inequality on communities' ability to provide public goods or manage local resources may have important consequences for welfare outcomes of those involved, and also for the management of common resources. We use repeated public goods experiments with equal and unequal treatments, as well as punishment treatments, to study the interaction of inequality, cooperative behavior and social sanctioning in a controlled environment.

While South Africa is one of the most unequal countries in the world, the allocation of fishing quota amongst coastal communities has introduced additional inequalities, resulting in ongoing strife. Our sample draws from a large sample of 568 people from nine of the affected communities, with daily exposure to social dilemmas, inequality and conflict over natural resource management.

Interesting differences in behavior between equal and unequal groups and also within unequal groups emerged in the presence of peer sanctioning. We find that aggregate contributions are significantly higher in unequal groups and that they are able to use punishment more effectively to increase cooperation. Within unequal groups low endowment players contribute a greater fraction of their endowment than high endowment players. While these differences in behavior within unequal groups could emanate from differences in relative marginal benefits derived from cooperation and also fear of punishment, understanding

how expectations about contributions and punishment functions in unequal groups may be important for future research.

Sanctioning is also significantly lower in unequal groups whereas demand for punishment by low and high endowment players in unequal groups are similar, irrespective of differences in relative costs. Allocation of punishment is mainly driven by cooperation levels and free-riding within groups (with low endowment players in unequal groups more inclined to sanction free-riding), but retaliation also seems to be an important determinant of sanctioning (specifically in unequal groups). Equal groups are in turn more likely to engage in "antisocial" punishment of cooperators, perhaps due to a social norm being easier to establish in homogenous groups.

The effect of real wealth and inequality on experimental contributions and punishment is less salient, but likely to be due to real wealth not being discernible in the experimental context. We do however find that those *above* the mean household income tends to contribute more in the Punishment treatment. Our basic data analysis of involvement in community activities, prosocial activities and membership in societies, also indicate a tendency for greater involvement by those *above* the group mean in *absolute* terms.

While controlling for wealth effects that subjects bring into the experimental setting with them to examine the effect on experimental cooperation and sanctioning is useful, the experimental design has features which is distinctly different from the real world. Given the small group size of 4 and the fact the players are identifiable by type in the punishment treatment, it is simpler to recognize the level of inequality, the extent of free-riding by different types and also to target sanctioning toward specific types in the experimental setting. Nonetheless as we pointed out earlier, in real world interactions many of these differences in wealth status and contributions to provision of public goods in smaller communities would be well known or at least partially observable.

While we would be careful to overstretch the external validity of our experimental findings, the experimental design has brought interesting dynamics to the fore, yielding insights which may be valuable for understanding provision of public goods (or poaching behavior) and sanctioning in real communities. Conceding also that the nature the public goods being considered may differ and that cooperation and sanctioning in these communities may take various forms, it would be useful to take this work further in the form of randomized control trials to examine the effect of real wealth differences on different measurable outcomes for cooperation and sanctioning.

Socio-economic variables that does impact on cooperation and punishment include employment status, education and being a breadwinner. We also find that social attitudes are important in explaining sanctioning behavior. Given the prevailing levels of distrust towards the top-down quota allocation process, it is interesting that individuals who view officials allocating fishing rights as being corrupt and those who indicated that they would take it upon themselves to report a fishing crime, are also more likely to allocate punishment in the experimental context. Individuals who believe they would get into trouble for reporting a fishing crime are in turn less likely to engage in punishment behavior.

While our research has pointed to a severe lack of trust in formal institutions amongst participants, our results also indicates that communities may rely on social institutions and individuals willing to engage in monitoring and sanctioning activities. The current lack of credibility associated with the quota allocations may however erode internal sanctioning mechanisms by rendering poaching acceptable. Mobilizing communities to become actively involved in co-management of the local commons without having to fear retaliation (if there is buy-in from the greater community) and inviting them to participate in the rights allocation process may therefor be more successful than relying on a top-down approach that is no longer credible.

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Appendix I: Basic Descriptives by Community

	Pooled		Oceanview		Kalkbay		Lambertsbay		Elandsbay		Veldrif		Saldanha		St Helena		Vredenburg		Paternoster	
Variable	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**
Contribution share of endowment in VCM	3413	0,44	768	0,43	353	0,47	546	0,44	510	0,45	642	0,42	138	0,48	96	0,42	144	0,49	216	0,44
		(0,27)		(0,29)		(0,27)		(0,26)		(0,24)		(0,27)		(0,26)		(0,28)		(0,27)		(0,24)
Contribution share of endowment in Punishment treatment	3322	0,51	694	0,49	354	0,51	546	0,54	492	0,51	642	0,52	138	0,54	96	0,41	144	0,51	216	0,45
		(0,27)		(0,28)		(0,28)		(0,26)		(0,24)		(0,27)		(0,27)		(0,29)		(0,29)		(0,27)
Punishment allocated to partner per round	9647	1,22	1799	1,35	1044	1,48	1656	1,28	1476	1,10	1926	1,05	414	0.442	288	1,65	432	1,56	648	1,27
		(2,87)		(3,15)		(3,47)		(2,91)		(2,46)		(2,57)		(0,96)		(2,71)		(3,14)		(3,19)
Age	565	40,36	128	37,38	58	46,59	91	41,82	85	34,65	106	39,13	22	54,00	16	45,38	24	48,54	35	38,34
		(13,63)		(12,05)		(14,96)		(11,67)		(13,01)		(12,99)		(12,00)		(15,08)		(18,50)		(8,31)
Education (educ)	544	9,41	124	9,35	51	8,55	87	9,49	84	9,76	102	9,97	21	8,86	16	8,69	24	8,42	35	9,57
		(2,68)		(2,64)		(2,63)		(2,80)		(2,27)		(2,55)		(2,37)		(2,94)		(3,37)		(3,00)
Female (%)	566	0,42	128	0,48	58	0,19	91	0,07	85	0,34	107	0,82	22	0,36	16	0,06	24	0,46	35	0,57
		(0,49)		(0,50)		(0,40)		(0,25)		(0,48)		(0,38)		(0,49)		(0,25)		(0,51)		(0,50)
Coloured (%)	566	0,65	128	0,76	58	0,48	91	0,63	85	0,59	107	0,62	22	0,55	16	0,75	24	0,63	35	0,86
		(0,48)		(0,43)		(0,50)		(0,49)		(0,50)		(0,49)		(0,51)		(0,45)		(0,49)		(0,36)
Breadwinner (%)	557	0,59	125	0,60	56	0,91	90	0,71	84	0,62	107	0,42	22	0,68	16	0,56	23	0,48	34	0,26
		(0,49)		(0,49)		(0,29)		(0,46)		(0,49)		(0,50)		(0,48)		(0,51)		(0,51)		(0,45)
Total Income (incl. grants) (ZAR)	566	1101,95	128	1312,50	58	1685,14	91	1284,25	85	783,82	107	851,42	22	905,45	16	1271,88	24	480,08	35	902,29
		(1837,49)		(2062,36)		(2001,63)		(1684,12)		(1127,68)		(1655,34)		(752,05)		(1431,63)		(3722,51)		(1429,72)
Logarithm of Total Income (including grants)	447	6,74	106	6,75	46	7,18	80	6,79	67	6,45	80	6,60	18	6,85	13	6,75	16	6,84	21	6,88
		(1,08)		(1,19)		(1,17)		(1,07)		(1,09)		(0,88)		(0,58)		(1,37)		(1,02)		(0,93)
ABOVE log of total average income (%)	566	0,61	128	0,59	58	0,64	91	0,54	85	0,65	107	0,64	22	0,55	16	0,69	24	0,54	35	0,71
		(0,49)		(0,49)		(0,48)		(0,50)		(0,48)		(0,48)		(0,51)		(0,48)		(0,51)		(0,46)
Variance of log of total average income (including grants)	566	1,09	128	1,32	58	1,07	91	1,24	85	1,10	107	0,76	22	0,32	16	1,53	24	1,03	35	1,19
		(0,27)		(0,06)		(0,07)		(0,02)		(0,06)		(0,06)		(0,00)		(0,35)		(0,05)		(0,00)
Access to fishing rights (%)	459	0,58	96	0,67	44	0,61	79	0,78	77	0,56	89	0,31	16	0,50	11	0,27	18	0,56	29	0,69
		(0,49)		(0,47)		(0,49)		(0,41)		(0,50)		(0,47)		(0,52)		(0,47)		(0,51)		(0,47)
Officials allocating quota are corrupt (%)	517	0,77	114	0,80	53	0,62	85	0,80	83	0,69	97	0,74	17	0,94	15	1,00	20	0,85	33	0,85
		(0,42)		(0,40)		(0,49)		(0,40)		(0,47)		(0,44)		(0,24)		(0,00)		(0,37)		(0,36)
Quota allocation percieved as unfair (%)	536	0,82	120	0,77	52	0,69	89	0,90	84	0,83	100	0,81	21	0,90	15	0,93	21	0,76	34	0,91
		(0,39)		(0,42)		(0,47)		(0,30)		(0,37)		(0,39)		(0,30)		(0,26)		(0,44)		(0,29)
Would report a fishing crime (%)	554	0,51	127	0,55	54	0,56	90	0,47	85	0,49	106	0,49	21	0,62	15	0,47	23	0,52	33	0,48
		(0,50)		(0,50)		(0,50)		(0,50)		(0,50)		(0,50)		(0,50)		(0,52)		(0,51)		(0,51)
Will get into trouble ofr reporting a fishing crime to officials	559	0,48	128	0,46	53	0,47	91	0,49	84	0,46	107	0,49	21	0,44	16	0,40	24	0,47	35	0,52
		(0,21)		(0,21)		(0,21)		(0,21)		(0,21)		(0,20)		(0,19)		(0,13)		(0,22)		(0,23)
Others in community has been invovled in petitions (%)	549	0,40	120	0,41	54	0,28	91	0,46	84	0,38	104	0,38	22	0,26	15	0,40	24	0,39	35	0,58
		(0,32)		(0,32)		(0,23)		(0,33)		(0,32)		(0,31)		(0,22)		(0,31)		(0,36)		(0,34)

Appendix II: Fishing related statistics

Variable	Pooled		Oceanview		Kalkbay		Lambertsbay		Elandsbay		Veldrif		Saldanha		St Helena		Vredenburg		Paternoster	
	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean
Access to fishing quota	512	0,40	111	0,48	47	0,21	87	0,51	84	0,37	98	0,32	19	0,32	15	0,27	19	0,26	32	0,72
		(0,49)		(0,50)		(0,41)		(0,50)		(0,49)		(0,47)		(0,48)		(0,46)		(0,45)		(0,46)
Access to fishing permits	482	0,54	102	0,65	51	0,63	84	0,70	78	0,59	88	0,27	17	0,47	13	0,38	19	0,53	30	0,37
		(0,50)		(0,48)		(0,49)		(0,46)		(0,50)		(0,45)		(0,51)		(0,51)		(0,51)		(0,49)
Access to fishing rights (quota and/or permit)	459	0,58	96	0,67	44	0,61	79	0,78	77	0,56	89	0,31	16	0,50	11	0,27	18	0,56	29	0,69
		(0,49)		(0,47)		(0,49)		(0,41)		(0,50)		(0,47)		(0,52)		(0,47)		(0,51)		(0,47)
Average income (ZAR) of those with access to fishing rights	256	1458	64	1793	27	1888	62	1336	43	1132	28	983	8	1052	3	2000	10	2153	20	1282
		(1840)		(1742)		(2060)		(1706)		(1394)		(846)		(673)		(1732)		(4827)		(1754)
Average income (ZAR) of those without access to fishing rights	194	739	32	419	17	1699	17	666	34	436	61	905	8	1040	8	891	8	76	9	399
		(1507)		(451)		(2146)		(1001)		(635)		(2069)		(956)		(1563)		(1563)		(639)
Willing to report a fishing related crime (reportfc)	554	0,51	127	0,55	54	0,56	90	0,47	85	0,49	##	0,49	21	0,62	15	0,47	23	0,52	33	0,48
		(0,50)		(0,50)		(0,50)		(0,50)		(0,50)		(0,50)		(0,50)		(0,52)		(0,51)		(0,51)
Willing to report a crime (reportc)	560	0,75	128	0,74	55	0,73	90	0,66	85	0,69	##	0,81	21	0,90	16	0,56	24	0,96	35	0,83
		(0,43)		(0,44)		(0,45)		(0,48)		(0,46)		(0,39)		(0,30)		(0,51)		(0,20)		(0,38)
It is right to arrest violators of fishing regulations in this community	524	0,65	115	0,75	52	0,73	90	0,59	82	0,61	99	0,61	19	0,79	14	0,57	21	0,71	32	0,41
		(0,48)		(0,44)		(0,45)		(0,49)		(0,49)		(0,49)		(0,42)		(0,51)		(0,46)		(0,50)
People change there behavior after being arrested for fishing violations	535	0,54	125	0,54	52	0,54	89	0,50	82	0,56	98	0,53	20	0,75	14	0,50	22	0,64	33	0,52
		(0,50)		(0,50)		(0,50)		(0,50)		(0,50)		(0,50)		(0,44)		(0,52)		(0,49)		(0,51)

Appendix III: Pro-Social Activities and Attitudes of those ABOVE and BELOW the mean income respectively

Variable	obs	ABOVE mean income	obs	BELOW mean income
Access to fishing rights (%)	282	0,62	177	0,51
		(0,49)		(0,50)
lnvolvement in conservation workshops				
Participated in any training/conservation workshops in the last year (train58)	218	0,33	116	0,224
		(0,47)		(0,42)
Number of training/conservation workshops attended (numb59)	181	5,57	113	1,04
		(59,30)		(3,08)
Community involvement				
Belong to a community service/volunteer organization (%)	308	0,12	196	0,14
		(0,35)		(0,36)
Hours a week spent on community activities (voln80)	187	7,16	119	6,08
		(13,73)		(11,83)
Someone from household participated in community activities in the last year (hhcom93)	331	0,32	216	0,27
		(0,47)		(0,45)
If YES, Number of times hh member participated in community activities in last year (com94)	95	9,8	47	29,9
		(38,85)		(79,78)
Would allocate time to a community project (time89)	338	0,84	219	0,78
		(0,36)		(0,41)
Hours willing to allocate to a community project (hrs90)	231	6,81	150	7,64
		(8,14)		(13,12)
Membership to societies				
Belong to church or mosque (church)	221	0,86	127	0,79
		(0,35)		(0,41)
Belong to a burial society (burial) (%)	313	0,46	196	0,40
		(0,50)		(0,49)
Belong to a development committee (develop) (%)	313	0,10	201	0,04
		(0,30)		(0,21)
Belong to a sports club (%)	311	0,24	205	0,15
		(0,43)		(0,36)
Member of a choir (choir) (%)	317	0,10	199	0,09
		(0,30)		(0,29)
Activist activities				
Reported local issue to a newspaper/radio/tv in the last year (news) (%)	312	0,16	206	0,17
		(0,36)		(0,38)
Reported local issue to the police in the last year (polc) (%)	325	0,29	206	0,24
		(0,46)		(0,43)
Voted in last election (vote) (%)	343	0,74	218	0,72
		(0,44)		(0,45)
Participated in a protest meeting in the last year (prot) (9%)	315	0,29	207	0,24
		(0,45)		(0,43)
Participated in a public meeting in the last year (pub101a/publ) (%)	323	0,45	208	0,39
		(0,50)		(0,49)

Appendix IV: Contributions and Punishment allocated by 30 Token, 40 Token and 50 Token Players

Variable	Pooled	Oceanview	Kalkbay	Lambertsbay	Elandsbay	Velddrift	Saldanha	St Helena	Vredenburg
Absolute contributions in VCM (40 Token players)	17,2	15,5	18,6	18,0	18,0	16,6	17,8	18,2	18,
Share of endowment contributed in VCM (40 Token players)	0,43	0,39	0,47	0,45	0,45	0,42	0,45	0,45	0,4
Absolute contributionsin VCM (30 Token players)	14,0	15,3	13,5	13,5	13,7	13,1	16,1	12,8	16,
Share of endowment contributed in VCM (30 Token players)	0,47	0,51	0,45	0,45	0,46	0,44	0,54	0,43	0,5
Absolute contributions in VCM (50 Token players)	22,0	22,7	24,0	20,3	22,2	21,0	26,5	17,9	23,
Share of endowment contributed in VCM (50 Token players)	0,44	0,45	0,48	0,41	0,44	0,42	0,53	0,36	0,4
Absolute contributions in Punishment treatment (40 Token players)	18,6	16,7	18,4	18,9	19,5	19,4	18,6	16,6	21,
Share of endowment contributed in VCM (40 Token players)	0,47	0,42	0,46	0,47	0,49	0,48	0,47	0,42	0,5
Absolute contributions in Punishment treatment (30 Token players)	16,9	17,3	17,0	17,9	16,7	17,0	20,3	13,1	16,
Share of endowment contributed in Punishment treatment (30 Token players)	0,56	0,58	0,57	0,60	0,56	0,57	0,68	0,44	0,5
Absolute contributions in Punishment treatment (50 Token players)	26,1	27,1	27,5	28,7	25,0	26,8	34,3	18,5	19,
Share of endowment contributed in Punishment treatment (50 Token players)	0,52	0,54	0,55	0,57	0,50	0,54	0,69	0,37	0,4
Punishment Awarded to another player (40 Token players)	1,51	1,53	1,76	1,58	1,47	1,48	0,33	2,15	1,5
Punishment Awarded to another player (30 Token players)	0,93	0,63	0,95	1,04	1,06	0,73	0,39	1,51	1,3
Punishment Awarded to another player (50 Token players)	0,90	1,45	1,20	1,04	0,55	0,58	0,20	0,78	1,8

Appendix V: Contributions (VCM and Punishment Treatment) and Punishment Awarded (Punishment Treatment) controlling for inequality using Census data

	VCM Treatent				Punishment Treatment				Punishment Treatment - Punishment awarded			
	XTMIXED		XTTOBIT		XTMIXED		XTTOBIT		XTMIXED		XTTOBIT	
Dep Var.: Contribution Share	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Round	-0.007	-0.006	-0.008	-0.007	-0.007	-0.004	-0.007	-0.004	-0.023	-0.048	-0.046	-0.099
	(3.14)**	(2.30)*	(3.29)**	(2.40)*	(3.56)**	(1.91)+	(3.40)**	(1.77)+	(1.51)	(2.67)**	(1.49)	(2.56)*
Unequal Treatment	0.038	0.028	0.040	0.039	0.092	0.092	0.099	0.100	-0.475	-0.426	-0.715	-0.246
	(1.64)	(1.15)	(1.84)+	(1.50)	(3.52)**	(3.09)**	(4.17)**	(3.53)**	(1.89)+	(1.46)	(1.66)+	(0.45)
Age	-0.002	-0.002	-0.004	-0.003	0.007	0.012	0.009	0.014	-0.069	-0.075	-0.160	-0.069
	(0.60)	(0.43)	(0.83)	(0.51)	(1.69)+	(2.45)*	(1.82)+	(2.21)*	(1.77)+	(1.48)	(1.70)+	(0.56)
Age squared	0.000	0.000	0.000	0.000	-0.000	-0.000	-0.000	-0.000	0.001	0.001	0.002	0.001
	(0.71)	(0.45)	(0.87)	(0.52)	(1.58)	(2.43)*	(1.76)+	(2.18)*	(1.62)	(1.60)	(1.65)+	(0.79)
Education	-0.015	-0.041	-0.024	-0.053	0.011	-0.015	0.008	-0.028	-0.141	0.009	-0.114	0.480
	(1.04)	(2.16)*	(1.38)	(2.42)*	(0.70)	(0.77)	(0.46)	(1.19)	(0.97)	(0.05)	(0.33)	(1.04)
Education squared	0.000	0.001	0.001	0.002	-0.001	0.000	-0.000	0.001	0.003	-0.004	0.006	-0.021
	(0.39)	(1.39)	(0.66)	(1.58)	(0.83)	(0.30)	(0.52)	(0.89)	(0.38)	(0.42)	(0.37)	(0.98)
Female	0.003	-0.015	-0.005	-0.020	0.006	-0.015	0.004	-0.008	-0.023	-0.163	0.176	-1.035
	(0.16)	(0.56)	(0.21)	(0.63)	(0.26)	(0.54)	(0.15)	(0.24)	(0.11)	(0.58)	(0.37)	(1.60)
Coloured	-0.042	-0.044	-0.047	-0.052	-0.014	-0.012	-0.018	-0.021	-0.089	0.107	-0.006	0.219
	(2.08)*	(1.81)+	(2.00)*	(1.84)+	(0.62)	(0.48)	(0.71)	(0.68)	(0.45)	(0.43)	(0.01)	(0.37)
loginctotg	-0.002	-0.004	0.001	0.000	0.001	0.005	0.002	0.004	0.026	-0.078	0.215	0.328
	(0.25)	(0.30)	(0.08)	(0.01)	(0.08)	(0.39)	(0.18)	(0.28)	(0.31)	(0.70)	(1.07)	(1.21)
VARloginctotC	0.000	-0.004	0.000	-0.007	-0.004	-0.004	-0.003	-0.005	0.002	0.000	-0.143	-0.214
	(0.06)	(0.62)	(0.04)	(0.89)	(0.55)	(0.51)	(0.43)	(0.57)	(0.03)	(0.00)	(1.19)	(1.38)
Unemployed		-0.008		-0.004		0.029		0.039		-0.661		-1.260
		(0.33)		(0.14)		(1.15)		(1.26)		(2.68)**		(2.17)*
Breadwinner		-0.058		-0.077		-0.048		-0.057		-0.263		-1.047
		(2.20)*		(2.50)*		(1.79)+		(1.71)+		(1.00)		(1.67)+
Fishing rights		-0.010		-0.018		0.011		0.001		0.183		-0.869
		(0.39)		(0.62)		(0.41)		(0.02)		(0.72)		(1.44)
Officials corrupt		0.020		0.018		0.017		-0.008		0.675		0.661
		(0.70)		(0.53)		(0.56)		(0.21)		(2.25)*		(0.94)
Unfair quotas		-0.046		-0.045		-0.007		0.007		-0.378		0.075
		(1.38)		(1.18)		(0.22)		(0.18)		(1.10)		(0.09)
Report fishing crime		0.009		0.003		-0.010		-0.004		-0.086		0.814
		(0.39)		(0.13)		(0.45)		(0.14)		(0.38)		(1.49)
Trouble for reporting		0.023		0.010		0.067		0.038		-0.949		-3.094
		(0.42)		(0.16)		(1.15)		(0.56)		(1.68)+		(2.42)*
Community petitions		-0.042		-0.057		-0.038		-0.074		-0.201		-0.890
		(1.18)		(1.37)		(1.02)		(1.64)		(0.54)		(1.02)
Constant	0.645	0.940	0.727	1.077	0.346	0.357	0.295	0.436	4.040	4.981	2.745	1.095
	(4.19)**	(4.86)**	(4.18)**	(4.87)**	(2.07)*	(1.73)+	(1.58)	(1.83)+	(2.63)**	(2.44)*	(0.81)	(0.24)
lns1_1_1_cons	-2.376	-2.752			-2.210	-2.153			0.091	0.097		
	(17.71)**	(8.75)**			(18.17)**	(16.64)**			(0.84)	(0.70)		
lns2_1_1_cons	-1.874	-1.824			-1.788	-1.865			0.414	0.463		
	(35.91)**	(28.19)**			(36.02)**	(29.23)**			(8.68)**	(7.68)**		
lnsig_e_cons	-1.647	-1.652			-1.761	-1.788			0.813	0.800		
	(107.98)**	(90.79)**			(113.97)*	(97.13)**			(95.70)**	(78.87)**		
sigma_u_cons			0.206	0.202			0.226	0.223				
			(23.87)**	(19.78)**			(24.99)**	(20.87)**			4.050	4.177
sigma_e_cons			0.208	0.207			0.185	0.179			(21.77)*	(18.02)**
			(61.57)**	(51.61)**			(60.98)**	(51.30)**			3.470	3.559
											(61.06)**	(49.58)**
Wald Statistic (chi2)	30.2	36.5	32.4	40.0	30.9	30.8	34.6	29.6	14.9	29.8	10.2	32.3
Prob>chi2	0.001	0.006	0.000	0.002	0.001	0.030	0.000	0.041	0.137	0.040	0.424	0.020
Loglikelihood	206.419	155.629	-301.831	-200.432	410.349	340.265	-76.587	0.671	-16.873	-11.794	-9.037	-6.101
Observations	2.579	1.812	2.579	1.812	2.514	1.770	2.514	1.770	7.331	5.147	7.331	5.147

southern africa labour and development research unit

The Southern Africa Labour and Development Research Unit (SALDRU) conducts research directed at improving the well-being of South Africa's poor. It was established in 1975. Over the next two decades the unit's research played a central role in documenting the human costs of apartheid. Key projects from this period included the Farm Labour Conference (1976), the Economics of Health Care Conference (1978), and the Second Carnegie Enquiry into Poverty and Development in South Africa (1983-86). At the urging of the African National Congress, from 1992-1994 SALDRU and the World Bank coordinated the Project for Statistics on Living Standards and Development (PSLSD). This project provide baseline data for the implementation of post-apartheid socio-economic policies through South Africa's first non-racial national sample survey.

In the post-apartheid period, SALDRU has continued to gather data and conduct research directed at informing and assessing anti-poverty policy. In line with its historical contribution, SALDRU's researchers continue to conduct research detailing changing patterns of well-being in South Africa and assessing the impact of government policy on the poor. Current research work falls into the following research themes: post-apartheid poverty; employment and migration dynamics; family support structures in an era of rapid social change; public works and public infrastructure programmes, financial strategies of the poor; common property resources and the poor. Key survey projects include the Langeberg Integrated Family Survey (1999), the Khayelitsha/Mitchell's Plain Survey (2000), the ongoing Cape Area Panel Study (2001-) and the Financial Diaries Project.

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