Ethnic heterogeneity, cooperation, and anti-social punishment

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Oct 10, 2011

Abstract

Empirical and field evidence on both industrialized and developing countries shows that cooperation levels decrease in the presence of ethnic divisions. Although several experimental works deal with ethnic differences, so far most studies restrict their attention to cross-cultural comparisons among internally homogeneous societies. This paper investigates the effects of introducing a varying number of foreign subjects as a source of heterogeneity within an ethnically homogeneous pool of native subjects. Our preliminary results indicate that foreigners contribute significantly less than natives and that the degree of ethnic heterogeneity negatively affects contribution levels. We find that the degree of ethnic heterogeneity impacts on subjects' choice of behaving as free riders or as reciprocators. In terms of sanctioning, we observe no difference in the overall amount of assigned and received punishment points, but natives are more often victims of anti-social punishment. In the absence of institutional restrictions ruling out antisocial punishment, this might reduce or even vanish the effectiveness of punishment.

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1. Introduction

All over the world, social and economic interaction often takes on an ethnic character. Groups frequently mobilize along ethnic lines for civil war (Cederman and Girardin, 2007) and ethnic divisions may impact on the formation of political parties and the distribution of public resources (Chandra, 2004). Further, economic activities might take place in ethnic enclaves (Fafchamps, 2000), especially under asymmetric information (Greif, 1993). Ethnic fragmentation turns out to be correlated with national government corruption and low economic growth (Mauro, 1995; Easterly and Levine, 1997), lower participation in voluntary or civic organizations (Alesina and La Ferrara, 2000) and lower levels of trust (Alesina and La Ferrara, 2002). A large and growing literature relates high levels of ethnic diversity to low levels of public goods provision (e.g., Alesina and Levine, 1997; Alesina et al., 1999; Khwaja, 2002; Miguel and Gugerty, 2005). Such negative correlation emerges both within industrialized and developing countries and Banerjee et al. (2005) describe it as "one of the most powerful hypotheses in political economy" (p. 639). Despite the availability of a wealth of empirical evidence, however, the specific channel(s) through which this relationship operates remains poorly understood. *Why*, then, does ethnic diversity undermine the provision of public goods? Why is public goods provision more successful in homogeneous communities?

The advantage of economic experiments is the higher degree of control allowed by the lab, compared to the field. So far, however, most laboratory studies have restricted their attention to culturally homogeneous groups formed by subjects sharing the same nationality (see e.g. Roth et al., 1991; Henrich et al., 2001): the key methodological feature of such *cross-cultural* studies is that they are typically based on a comparative approach, with the same experiment being run in a number of (culturally) different locations and a subsequent comparison of the results obtained in each location. By contrast, only a few experimental studies have been explicitly targeted at *intercultural* environments, i.e. heterogeneous groups formed by subjects from ethnically different societies. We claim that a significant advantage of the latter approach is that it makes it possible to look at how subjects from *different* countries interact within a common social environment and play the *same* game. Our work falls in this second category, as we conducted a public goods game experiment in Italy in which sessions differed in terms of their ethnic composition: subjects were mainly Italian, but a sizeable minority of participants was from African and Eastern Europe countries. Hence, we focused on an interethnic but relatively homogeneous environment, where the majority of subjects can be viewed as 'natives' and the minority as 'foreigners'.

Our findings indicate that natives and foreigners do differ in cooperation levels from the outset and that the degree of ethnic heterogeneity significantly lowers both natives' and foreigners' contribution levels in the game. Next, our analysis illuminates three major complementary mechanisms relevant to understanding this negative correlation, that is a type-based, a belief-based and a sanction-based explanation. The structure of the remainder of the paper is as follows. Section 2 reviews the related empirical literature on ethnic diversity and cooperation, including references to laboratory studies. Section 3 contains an illustration of our experimental design and procedure. Section 4 shows the major results and Section 5 concludes.

2. Related literature

A rich empirical evidence from the field shows that public goods like years of schooling, school funding and facilities, health care, paved roads, the efficiency of the electricity network, water provision and water well-maintenance are inversely related to ethnic fragmentation (Alesina and Levine, 1997; Alesina et al., 1999; Miguel and Gugerty, 2005). Vigdor (2004) documents such negative association by considering mail responses to the 2000 Census in the United States. As he observes, to date researchers have devoted little effort to providing an economic motivation for ethnic fragmentation effects. Despite the robustness of this result with regard to both advanced and developing economies, however, a crucial question remains largely open: why do we observe this negative correlation between ethnic heterogeneity and public goods provision?

Existing work on the issue suggests that a number of mechanisms might be simultaneously at work. First, different ethnic groups have different *preferences* about the type and size of the public good to be financed (Alesina et al., 1999; Alesina and La Ferrara, 2005). Second, a group's utility deriving from getting access to the public good might be reduced when a different ethnic group also uses it. As Vigdor (2002) observes, an individual's willingness to pay for a local public good or service derives partly from the fact that the benefits that the public good confers on other members of her community enter directly into her utility function. However, the individual might differentially value those benefits depending on their being conferred to members of her own ethnic group or to members of different ethnic groups[iv]. Third, heterogeneous groups show some inability to impose social *sanctions* (Miguel and Gugerty, 2005). A fourth channel which has been identified in the

[iv] He adds that Luttmer's (2001) model is based on a similar intuition: here, agents derive utility (or disutility) from the outcomes of others, but different people are attached different weights in the utility function.

empirical literature is *trust*. Banerjee et al. (2005) emphasize that in market economies even in non-war times "trade often requires trust, providing public goods needs collective action and the rule of law is only possible if everyone accepts the rights of others" (p. 639). Bahri et al. (2005) refer to trust in order to account for the presence of higher cooperation in homogenous societies: higher trust has been associated with greater citizen involvement in politics, lower corruption, more effective public services, higher economic growth. Similarly, Alesina and La Ferrara (2000, 2002) show that heterogeneous local community exhibit lower levels of trust and of other components of social capital: ethnic differences determine the rise of more particularized trust, where confidence is restricted to a narrow set of ingroups like family and friends.

In terms of empirical methods, it is worth noting that while a large number of field works document a negative association between ethnic heterogeneity and cooperation, only a few experimental papers specifically deal with this relationship. As we anticipated in the previous section, a plethora of studies confine their attention to cross-cultural comparisons. Roth et al.'s (1991) pioneering analysis is based on the same two-person bargaining and multiperson market setups being conducted with four culturally and geographically distant subject pools in the United States, Yugoslavia, Israel and Japan. Burlando and Hey (1997) compared British vs. Italian subjects' behavior in a repeated public goods game framework. Ockenfels and Weimann (1999) focused on Eastern vs. Western Germans. Henrich at al. (2001) wondered whether the same qualitative results obtained with Western subjects hold also when participants come from fifteen small-scale societies in developing countries. Cason et al. (2002) concentrated on American vs. Japanese players. Recently, Gächter and Hermann (2009) compared Russians' vs. Swiss' behavior, including their willingness to punish others at a cost. Beyond the social dilemma framework, Fershtman and Gneezy (2001) were interested in looking at Israeli subjects from different ethnic groups playing a trust game and an ultimatum game and Eckel and Petrie (2011) compared white and nonwhite subjects playing a trust game. A common feature in all these experiments is that each session only includes participants from a single ethnic group, i.e. the comparison was made among homogeneous environments. In contrast, Finocchiaro Castro's (2008) lab experiment investigated the effects of interactions between Italian and British subjects by comparing the behavior of groups formed by subjects of the same nationality but also considering the behavior of mixed groups composed of half British and half Italian subjects: his results show no country effect, but significantly lower individual contribution levels in heterogeneous groups. Carpenter and Cardenas (2011) allowed participants from different cultures (Colombia and the United States) to play a common pool resources game by interacting in real time within the same session and to make decisions in the same experimental context.

Further, it is worth mentioning Habyarimana at al.'s (2007) work, where a set of experimental games, typically played in laboratory environments, has been run in Kampala, Uganda, a place where ethnicity is highly salient in everyday social interactions. In their experiment, the information on other players' ethnicity is critical, and treatments differ as subjects might interact face-to-face or using a computer interface where images of other players could be made available. The aim of that work was to disentangle plausible explanations about why ethnic homogeneity favors public goods provision: commonality of tastes, common cultural material (language, experience, modes of interaction) that makes it easier for community members to communicate and work together, and strategy selection mechanisms in settings with multiple equilibria where ethnic groups possess both norms and networks that facilitate the sanctioning of community members who defect.

3. An interethnic public goods game experiment

3.1. Experimental design

The experiment consists of a finitely repeated VCM with punishment options that is grounded on Fehr and Gäcther's (2000) seminal work. In each of the twenty periods, participants take part into a two-stage game: at stage 1, players simultaneously choose how much to contribute to the public good (contribution stage) and at stage 2 they have access to punishment options (punishment stage). We have recourse to two treatments (Baseline and Restricted) that differ for the presence of 'virtuous' restrictions to sanctioning opportunities: whereas in the Baseline each participant can punish any other peer in the group, regardless her contribution behavior at stage 1, in the Restricted treatment a subject is entitled to punish another subject at stage 2 only if her contribution at stage 1 has been higher than the contribution of the peer she wants to punish (see Faillo et al. (2010) for a paper with an explicit focus on this form of 'legitimate punishment'). The presence of virtuous restrictions rules out by construction the possibility to observe antisocial punishment (Herrmann et al., 2008). Like in a standard, finitely repeated VCM, insofar as all the subjects are supposed to be driven by material self-interest only and this information is common knowledge, the unique subgame perfect equilibrium is for all agents to free ride in every period and never punish.

Three key features of our experimental environment can be described as follows. As we anticipated in the previous section, our major goal was to shed light on the relationship between

ethnic diversity and cooperation by exploiting the higher degree of control made possible by having recourse to the experimental laboratory rather than to other empirical methods in the field.

First, in a public goods game framework, the existence of a single public good to be voluntarily provided allows us to rule out that underprovision depends on different ethnic groups having diverging tastes about which specific public goods should be provided (Alesina et al., 1999; Alesina and La Ferrara, 2005). Given our research question, we view this as an important advantage of the experimental methodology, as in the field it is often extremely difficult to rule out that a negative association between ethnic heterogeneity and cooperation depends on taste divergence among different ethnic groups.

Second, unlike several existing studies, we focus on this relationship within a relatively homogeneous society, in terms of ethnicity. Our experiment has been conducted in Italy, which is the country where all the components of our subject pool live, but where Italians are the 'natives' and Non-Italians are 'foreigners'. More specifically, since our subject pool is made of university students, our foreigners are mainly people who only recently arrived in Italy in order to enroll as undergraduate students. Therefore, it is very likely that these participants' values, beliefs and behavioral choices are affected to a significant extent by their own ethnic and cultural background. Since we hypothesize that a similar dependence on one's ethnic and cultural background holds for natives, it is possible to argue that our interethnic setup resembles to some extent a natural experiment.

Next, we purposely provided no cues about ethnicity to the subjects: even though our major research question was about the behavioral relevance of participants being either natives or foreigners, we never made the existence of such 'groups' salient to the players. In other words, our subjects never knew, neither before, nor during and after the experiment, that we were interested in focusing on the potential impact of the ethnic dimension on their choices throughout the game. To do this, we departed from some of previous experimental studies on ethnicity (where participants were provided with pictures or surnames of their coplayers) and avoided to make subjects' nationality salient in our treatments. In this regard, we claim that we went even beyond the so well-known 'minimal group paradigm', where membership was made salient through arbitrary and virtually meaningless 'labels' signaling group membership (see e.g. Frank and Gilovich, 1998). In our experiment, we were totally neutral in this regard, so that we argue that in our setup salience of ethnicity was even more minimal than in the classical minimal group studies. By so doing, we can rule out that the results we obtained (see Section 4) can to some extent depend on experimenters' *demand effects* (see on this Zizzo, 2010).

3.2. Experimental procedure

A total of 112 subjects participated voluntarily in the experiment at the CEEL Lab of the University of Trento. A total of 6 sessions were conducted, between March 2010 and November 2010. Four sessions had 20 participants and the other two had 16 participants. The data represent a subset of the ones described in our companion paper on 'legitimate punishment' (Faillo et al., 2010). The experiment was programmed by using the z-tree platform (Fischbacher, 2007). The subjects were undergraduate students (58% from Economics, 49.2 % females, 79.4 % Italian). No individual participated in more than one session. In each session, the participants were paid a 5 euro show-up fee, plus their earnings from the experiment. The average payment per participant was 14.5 euros (including the show-up fee) and the sessions averaged approximately 1 hour and 30 minutes. At the beginning of each session, participants met in a common room, then were welcomed and asked to draw lots, so that they were randomly assigned to terminals. Once all of them were seated, the instructions were handed to them in written form before being read aloud by the experimenter. We took great care to ensure that the participants understood both the rules of the game and the monetary incentives. They had to answer several control questions and we did not proceed with the actual experiment until all participants had answered all questions correctly.

In each session, there were twenty periods of interaction that proceeded under identical rules. The participants in a session were randomly assigned to groups of size four, so that they did not know the identities of the other members of their group. Like other experimental studies (see e.g. Cinyabuguma et al., 2006; Denant-Boemont et al., 2007), we used a partner protocol that kept the composition of each group constant over rounds, so that, at the end of each period, individuals remained in the same group. However, individuals' labels were reassigned on a random basis in each period. For example, the same player could be designated as player 45 in period t, as player 6 in period t + 1, and as player 38 in period t + 2. Therefore, our partner protocol was also characterized by anonymity of the components of the group and change of participants' labels across rounds. The design and the parametric structure of the experiment are based on Fehr and Gächter (2000).

3.3. Treatments

We implemented two experimental treatments: a baseline, unrestricted punishment and full information (Baseline) treatment, and a restricted punishment with full information (Restricted) treatment. There were 3 sessions (20 subjects in two sessions and 16 in the other) for the Baseline, and 3 sessions (with 20 subjects in two sessions and 16 in the other) for the Restricted. For each treatment, in each session the subjects were divided in groups of $N=4$ (in line with many VCM experiments) subjects, who played a two-stage finitely repeated public goods game with punishment options for $T=20$ periods. Participants were aware of the number of rounds they were going to play and of the number of stages: information on the following stages allows to evaluate the effect of the threat of being punished at stage 2 and on contribution decisions at stage 1.

At stage 1, at the beginning of each period each participant receives a fixed amount $e = 20$ of tokens. Each participant i has to decide whether she wants to invest into a public project or not an amount $g_i \leq e$. Decisions are made simultaneously and with no information about peers' choices. At the end of stage 1, each participant is informed about her current earnings, which consist of two components:

a.   The proportion of her initial 20 tokens that she has kept for herself (i.e. 20 tokens – Her Contribution to the project);

b.   Her income from the project. The income to her is equal to 40% of the total of the four individual contributions to the project.

 Therefore, her earnings at the end of stage 1 are calculated by the computer in the following way:

Each participant's earnings after stage 1 = (20 – her contribution to the project) + 40%*(total group contribution to the project)

$$= (20 - \mathbf{g}_i) + 0.4 \sum_{j=1}^{4} g_j$$

In the Baseline treatment, any participant has access to stage 2, i.e. there are no limitations over who can punish and who can be punished. By contrast, in the Restricted treatment participants know that they can go on with stage 2 only if they contribute *more* than their peers. Specifically, player i will be entitled to sanction player j at stage 2 only if $g_i > g_j$. At stage 2, subjects are given the opportunity to simultaneously punish those who contributed less than them by assigning a certain amount of

points. This implies that the highest contributor in a group is fully immune from punishment. Potential punishers might decide to assign up to 10 points to each punishee: point assignment is costly and costs are charged according to a standard convex cost function as in Fehr and Gächter (2002) (Table 2).

Each point that a subject receives reduces her earnings at stage 1 by 10%.
Each participant's earnings at the end of stage 2 are calculated by the computer in the following way:

Each participant's earnings after stage 2 = earnings at the end of stage 1- cost of points she assigned at stage 2 - 10%* number of points received*earnings at the end of stage 1

4. Results

4.2. Descriptive analysis

Table 1 describes the degree of ethnic heterogeneity in the sample: more specifically, it summarizes the number of Italian and foreign (specifying their own nationality) subjects in all the experimental sessions.

Table 1

Table 1. Subjects distribution by country

Session	Treatment	Country															Tot non Italian	Tot
		IT	AL	BR	CAM	CD	ER	ETH	GH	LT	MA	MD	MK	MOC	SRB	UA		
1	Baseline	17							1						1	1	3	20
2	Baseline	12			2	1	1			2		1	1				8	20
3	Baseline	13	2	1													3	16
4	Restricted	11	2		1							1	1				5	16
5	Restricted	18						1			1						2	20
6	Restricted	18	2														2	20
	Tot	89	6	1	3	1	1	1	1	2	1	2	2	0	1	1	23	112

Table 2 relates sessions' ethnic heterogeneity to subjects' average contribution levels and summarizes natives' and foreigners' contribution decisions in the first period and in all the periods .

Table 2. Average contribution levels by session

Treatment	Tot non Italian	(1) Average contribution Italians first period	(2) Average contribution foreigners first period	(3) Average contribution all subjects all periods	(4) Average contribution Italian all periods	(5) Average contribution foreigners all periods
Baseline1	3	6.64	5	12.25	12.72	9.58
Baseline2	8	7.83	2.75	3.84	4.94	2.20
Baseline3	3	6	6.66	9.03	9.14	8.53
Restricted1	5	8.45	4	11.79	14.41	5.98
Restricted2	2	11.38	3	15.5	16.44	10.06
Restricted3	2	10.11	12	15.74	15.57	17.25
Tot.	23					

In the first period, the average contribution of foreigner is lower in both the treatments. But for both natives (column 1) and foreigners (column 2), there are sessions characterized by low ethnic heterogeneity (Baseline3, Restricted3) where average contribution levels are lower than average contribution levels in more heterogeneous sessions (Baseline2, Restricted1). However, if we look at all the twenty periods of interaction, the lowest level of average contribution occurs in the sessions with a larger number of foreigners (Baseline2, Restricted1): this happens for all subjects (column 3), regardless of their being natives (column 4) or foreigners (column 5).

4.2. Quantitative analysis

Our goal is testing the following hypotheses: (1) Foreign subjects contribute less than non-foreign subjects; (2) Ethnic divisions within groups decrease overall contribution levels; (3) Homogeneous groups exhibit higher efficiency levels; (4) Homogeneous groups exhibit a higher level of trust; (5) Foreign subjects use punishment differently (in terms of amount of points or destination) than non-foreign subjects. Furthermore, we are interested in exploring the mechanisms and motivations behind these phenomena. Therefore, we classify subjects according to their 'behavioral type' (altruist, free riders or reciprocators; see Section 4.2.1) and analyze subjects' cooperative behavior in conditions of ethnic homogeneity or heterogeneity.

In the aim of exploring the influence of subjects' nationality and sessions' heterogeneity, we estimate the following equation:

$$contribution_{it} = \beta_0 + \beta_1 nat_i + \beta_2\, hetero_s + \beta_3 baseline \quad (Eq.\,1)$$

where nat_i indicates subject i's nationality, $hetero_s$ is a dummy variable that is equal to 1 when the session s is heterogeneous (i.e. the number of foreigners is at least equal to 4) and 0 when homogeneous, and baseline is a dummy variable that is equal to 1 when no punishment restrictions are working and is 0 elsewhere. This equation is estimated in the first period (when no interaction has occurred), in all the 20 periods and in subgroups of periods. Results are summarized in Table 3.

Table 3. Determinants of contribution levels

Contribution at t	Period 1	Periods 1-5	Periods 1-10	Periods 1-15	Periods 1-20
Nationality	4.25**	6.47***	7.04***	7.24***	7.61***
	(1.70)	(1.41)	(1.57)	(1.70)	(1.83)
Heterogeneity	-1.54	-2.36*	-4.60***	-5.50***	-6.56***
	(1.45)	(1.21)	(1.36)	(1.46)	(1.58)
Baseline	-3.61**	-6.42***	-7.83***	-8.01***	-8.21***
	(1.27)	(1.06)	(1.19)	(1.28)	(1.39)
Costant	6.22	5.16	1.30	-0-63	-1.95
	(5.87)	(4.85)	(4.42)	(5.80)	(6.33)
Log-likelihood	-327.71	-1475.74	-2746.22	-3910.18	-5042.80
Wald Chi(2)	22.48	83.28	101.63	100.19	100.55
N. Of obs.	112	560	1120	1680	2240

Controls: gender, age, major, and number of experiments in which the subject has been involved in the past.
The dependent variable takes values from 0 to 20.

***Result 1**. Foreign subjects' contribution levels are significantly lower than natives' ones.*

Regardless of the number of periods we restrict our attention to, nationality is always significant in affecting contribution levels. Two possible interpretations of this first result can be emphasized: (1) there could be a so-called 'country effect' in shaping contribution levels, i.e. Italians are more cooperative than foreigners; (2) there could be a 'majority vs. minority group effect', if natives (the majority group) and foreigners (the minority group) react differently to the degree of ethnic

heterogeneity they experience in the game (see below). Foreigners come mainly from African and Eastern Europe countries and the difference in contribution levels between these two sub-groups of foreign participants is not significant: regression have been replicated by adding the dummy 'African' (p=0.983).

Result 2*. Apart from the first period, the degree of heterogeneity in the session matters and significantly reduces contribution levels. However, this negative effect disappears in the presence of virtuous restrictions to punishment.*

After a few periods of learning, subjects have enough information to compare peers' observed behavior to the inferences on the composition of the group they have made before the beginning of the experiment: subjects seem to be able to understand the degree of heterogeneity of the group[v] and make their decisions consistently[vi]. Interestingly, both natives and foreigners' contribution levels are negatively and significantly affected by the degree of heterogeneity in the group, and foreigners' reaction is even stronger (the coefficient of the variable 'heterogeneity' is higher for foreigners than for natives: -8.39 vs. -6.90). However, as shown in Table 4 (see below), in the presence of virtuous restrictions the number of foreigners in the session (heterogeneity) turns out to play no role: if antisocial punishment is ruled out, we observe that: (1) overall contribution levels rise, and (2) the number of foreigners in the session is not significant. We conjecture that the underlying mechanism at work might be as follows: in the absence of restrictions, native high contributors expect to be victims of antisocial punishment on the part of foreign low contributors and decrease their contributions in sessions when they infer a non-negligible probability to be matched with (at least) a foreign peer; when restrictions operate, they feel safer and the number of foreigners does not affect their contribution behavior. We aim at providing a better test of this hypothesis by analyzing the percentage of antisocial punishment points distributed by natives and by foreigners.

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[v] An alternative explanation might be related to the fact that high contributors (who are mainly native) react to the presence in the group of low contributors (who are mainly foreigners) by reducing their own contribution. This explanation is consistent with the observation (see below) that natives behave more frequently as reciprocators.

[vi] Alesina et al.'s (1999) results are mainly driven by the way the majority group reacts to varying minority group size: the higher the heterogeneity level, the lower the spending on core public goods.

Table 4. Heterogeneity and role of restrictions

Contribution at t	Baseline	Restricted
Nationality	4.28**	11.64***
	(1.96)	(3.71)
Heterogeneity	-1.72***	-0.59
	(0.34)	(1.06)
Costant	-2.53	-3.41
	(8.63)	(10.43)
Log-likelihood	-2774.05	-2244.20
Wald Chi(2)	43.91	23.94
N. Of obs.	1120	1120

Result 3. *Neither nationality nor heterogeneity affect the amount of punishment points assigned (and received), but natives are victims of anti-social punishment more frequently.*

This result is illustrated by Table 5 and Table 6.

Table 5. Punishment points received

Punishment points received at t	Tobit Random Effect
Nationality	0.005
	(0.86)
Heterogeneity	1.31
	(0.79)
Baseline	0.017
	(0.73)
Constant	-1.26
	(2.88)
Log-likelihood	-2062.78
Wald Chi(2)	11.30
N. Of obs.	1840

Controls: gender, age, major, number of experiments in which the subject
has been involved in the past and time spent to answer control questions.
The dependent variable takes values from 0 to 30.

Table 6. Percentage of antisocial punishment points received

% Antisocial punishment points received at t	OLS
Nationality	0.28***
	(0.06)
Heterogeneity	-0.04
	(0.06)
Constant	0.04
	(0.26)
R-squared	0.07
N. Of obs.	414

Controls: gender, age, major, number of experiments in which the subject
has been involved in the past and time spent to answer control questions.
The dependent variable takes values from 0 to 1.

Table 6 reports the percentage of received anti-social punishment points: as punishment options are limited to pro-social points in the Restricted treatment, the table refers to the Baseline only. As far as existing explanations of the phenomenon of antisocial punishment are concerned, it is worth noting that, at a macro level, Herrmann et al. (2008) found that it occurred mainly in societies with weak social norms of cooperation, weak rules of law and weak democracies. At the individual level, it may be motivated by revenge (Denant-Boemont et al., 2007; Nikiforakis, 2008).

4.2.1. Behavioral types

Aggregate contribution levels typically observed in the first periods of repeated public good experiments are higher than the ones predicted by standard economic theory assuming that agents are driven by material self-interest ('overcontribution'). Furthermore, cooperation levels are quite uneven and decline over time ('decay'). One possible explanation of these phenomena is the presence, within groups, of different types of players (Fischbacher et al., 2001): experiments in Fehr and Gäcther's (2000) tradition "cannot be understood without recognizing the presence of subjects having different preferences" (Ones and Putterman, 2007, p. 496). Therefore, the composition of a group becomes decisive for the prospect of maintaining cooperation. In public goods experiments there is a growing consensus that different types of individuals exist (Weimann, 1994). Three major types of players have been typically identified: 'free riders', who do not invest in the public good (or invest a small percentage of their endowment) and get advantage from peers' contributions

regardless of their peers' behavior; 'pure altruists', who invest a relevant amount of their endowment, regardless of their peers' behavior; 'reciprocators' or 'conditional cooperators', who are willing to invest significant proportions of their endowment, provided that also their peers are ready to cooperate (Ones and Putterman, 2007, p. 498)[vii].

Classification of 'types' has been carried out by following different approaches: by eliciting subjects' willingness to conditionally cooperate using variants of the strategy method[viii], usually in one-shot games (e.g. Fischbacher et al., 2001), by observing subjects' behavioral reactions to peers' behavior (e.g. Kurzban and Houser, 2005; Rustagi et al., 2010), or by having recourse to a combination of these two methods (Burlando and Guala, 2005; Fischbacher and Gäcther, 2009; Fischbacher and Gäcther, 2010). As far as measures of actual behavior are concerned, Burlando and Guala (2005) rely on the "Decomposed Game Technique" used by Offerman et al. (1996), where a 'motivational vector' is built by asking subjects to make several incentive-compatible choices between pairs of allocations (tokens paid to the subject and tokens paid to the peer). In Fischbacher and Gäcther (2009; 2010), subjects make contribution choices in a "direct response standard linear public good game", where contribution choices are made in each round and subjects are informed about the sum of contributions in their group in the period and may react to this information in the subsequent round. Rustagi et al. (2010) use the correlation between a subject's and a peer's contribution to elicit a subject's behavioral type.

Kurzban and Houser (2005) classify subjects on the basis of a subject's linear conditional-contribution profile: each profile is defined as the outcome of a regression of her contribution on the average contribution she observes before making a contribution decision. The intercept of the profile provides the subject's willingness to cooperate when peers' contribution level is close to zero, whereas the slope represents the subject's responsiveness to peers' contribution[ix]. Following Kurzban and Houser's approach, we have classified subjects as belonging to three behavioral types: free riders, pure altruists and reciprocators. In our sample, 51.79% of participants are free riders, 18.75% act a pure altruists and 29.46% of them are reciprocators. Result 4 summarizes the way how demographic and experimental variable affect the probability of belonging to a specific type.

[vii] Burlando and Guala (2005) emphasize that the latter category includes a number of behaviors compatible with a variety of motivations: sucker aversion, conformity, miming, achievement orientation and tit-for-tat strategies.
[viii] The strategy method consists of asking subjects to take hypothetical decisions, that is either to make an 'unconditional' contribution (without knowing peers' contribution levels) or to fill in a 'conditional' contribution table presenting possible peers' average contribution levels.
[ix] Both theoretical analyses and agent-based simulations of the evolutionary dynamics of interacting strategies suggest that the evolutionary dynamics of cooperation can generate "a polymorphic population that consists of individuals that vary in their degree of cooperativeness" (Kurzban and Houser, 2005): the study of the group behavior turns into the study of the "ecology of interacting types" base on the "ecology of micromotives" (Schelling, 1971).

In light of this classification, we wondered whether such 'social tastes' are to some extent ethnicity-specific. Supposing that culture can produce an impact on the formation of behavioral types, within a given social environment, appears to be entirely plausible. The cultural environment is likely to exert an influence on the nature and extent of pro-social and anti-social behavior as people have an innate ability to learn from others (Boyd and Richerson, 1995; Tomasello et al., 2005) and cultural learning mechanisms will induce members of social groups to adopt similar values and beliefs about how others around them will reward and punish their behavior (Sober and Wilson, 1998; Henrich and Henrich, 2007). Insofar as people's social tastes are culture-dependent, they will indirectly but significantly impact on individuals' preferences over the size and type of public goods to be provided.

Result 4. *There is no significant difference between natives and foreigners with regard to altruistic behavior. In contrast, foreigners behave as free riders more frequently, whereas natives reciprocate more frequently. Ethnic heterogeneity implies a decrease in reciprocity and an increase in free riding. The presence of virtuous restrictions to punishment decreases the tendency to reciprocate.*

Table 7. Probability of belonging to a "cooperative type"

Probability	Freerider	Altruist	Reciprocator
Nationality	-0.19	0.12	0.37***
	(0.09)	(0.18)	(0.11)
Heterogeneity	1.83***	hetero!=0 predicts	-1.71***
	(0.11)	failure perfectly	(0.11)
Baseline	-0.28***	-1.86***	1.52***
	(0.08)	(0.14)	(0.09)
Gender	-0.26***	-0.09	0.59***
	(0.06)	(0.10)	(0.08)
Age	-0.06***	-0.013	0.09***
	(0.01)	(0.01)	(0.001)
Timecontrol	0.008***	-0.08***	-0.009***
	(0.001)	(0.12)	(0.001)
Faculty	0.10	0.028	-0.08
	(0.07)	(0.11)	(0.08)
# Experiments	-0.03***	0.08***	-0.005
	(0.007)	(0.102)	(0.008)
Constant	1.48***	-0.27	-3.58***
	(0.32)	(0.52)	(0.37)
Log-likelihood	-1030.78	-518.03	-795.26
LRChi(2)	475.29	382.63	636.74
N. Of obs.	1840	1440	1840

The empirical literature described in Section 2 considers some possible explanations for the negative relation between ethnic heterogeneity and cooperation. Our design contemplates one type of public good only, therefore the explanation grounded on different ethnicity-based preferences for different public goods does not apply. In contrast, with our design we cannot rule out that two other mechanisms are at work: decrease in native (foreign) subjects' utility when foreign (native) peers can benefit from the public good, and lower effectiveness of the devices that should sustain cooperation, such as punishment.

Let us consider the effectiveness of punishment and investigate how punishment is able to determine an increase in contribution according to the behavioral type the subject belongs to.

For each behavioral type, we estimate the following equation:

$$contribution_{it} - contribution_{it-1}$$
$$= \beta_0 + \beta_1 distance\ from\ average_{it-1} + \beta_2\ points\ received_{it-1} + \beta_3 nat_i$$
$$+ \beta_4 hetero_s \quad (Eq.2)$$

Result 5a. *Ethnic heterogeneity undermines the effectiveness of punishment directed to free riders. Once punished, free riders increment their level of contribution significantly only in the presence of virtuous restrictions. When antisocial punishment is possible, free riders react to punishment by reducing their contribution level.*

Table 8a. Determinants of the change in contribution levels

	FREE RIDERS	
Contribution at t - contribution at t-1	**Baseline**	**Restricted**
Distance from average at t-1	-0.96***	-0.53***
	(0.05)	(0.07)
Points received at t-1	-0.18**	1.02***
	(0.08)	(0.19)
Nationality	0.11	0.72
	(0.64)	(0.95)
Heterogeneity	-0.20*	0.16
	(0.11)	(0.29)
Constant	1.39	-2.49
	(3.53)	(2.80)
Log-likelihood	-1512.06	-1407.52
Wald Chi(2)	346.57	164.06
N. Of obs.	608	494

The dependent variable takes values from -20 to 20.
Controls: gender, age, nationality, timecontrol, number of experiments.

Result 5b. *Altruists' reaction to punishment is not influenced by ethnic heterogeneity. Once punished, altruists increment their level of contribution significantly only in the presence of virtuous restrictions. When antisocial punishment is possible, altruists do not react to punishment.*

Table 8b. Determinants of the change in contribution levels

| | ALTRUIST | |
Contribution at t - contribution at t-1	Baseline	Restricted
Distance from average at t-1	-0.63**	-0.74***
	(0.31)	(0.07)
Points received at t-1	0.60	0.45***
	(0.39)	(0.17)
Nationality	.	-0.16
	.	(1.57)
Heterogeneity	.	-0.21
	.	(0.30)
Constant	-0.39	-2.53
	(0.27)	(4.02)
Log-likelihood	-13.74	-1013.57
Wald Chi(2)	9.77	199.63
N. Of obs.	19	380

The dependent variable takes values from -20 to 20.
Controls: gender, age, nationality, timecontrol, number of experiments.

Result 5c. *Like free riders and altruists, once punished, reciprocators increment their level of contribution significantly only in the presence of virtuous restrictions, but this reaction is weaker and less significant. Surprisingly, ethnic heterogeneity undermines the effectiveness of punishment directed to reciprocators only in the presence of virtuous restrictions.*

19

Table 8c. Determinants of the change in contribution levels

	RECIPROCATORS	
Contribution at t - contribution at t-1	**Baseline**	**Restricted**
Distance from average at t-1	-0.70***	-0.93***
	(0.07)	(0.10)
Points received at t-1	0.11	0.41*
	(0.12)	(0.20)
Nationality	0.67	0.37
	(0.95)	(0.66)
Heterogeneity	0.26	-0.68*
	(0.20)	(0.32)
Constant	0.74	0.99
	(2.81)	(3.65)
Log-likelihood	-1102.61	-482.66
Wald Chi(2)	122.87	168.45
N. Of obs.	437	190

The dependent variable takes values from -20 to 20.
Controls: gender, age, nationality, timecontrol, number of experiments.

Result 6. *Profits are negatively affected by heterogeneity. Natives earn significantly more than foreigners, and virtuous restrictions rise overall profit levels.*

Table 9. Determinants of profits

Profits	**OLS**
Nationality	2.39***
	(0.44)
Heterogeneity	-4.61***
	(0.41)
Baseline	-2.43***
	(0.37)
Constant	20.56***
	(1.51)
Adj. R-squared	0.215
N. Of obs.	1840

Controls: gender, age, major, and number of
experiments in which the subject has been
involved in the past and time to answer control questions.

Result 7. *Native subjects exhibit a significantly lower level of trust than foreigners. Furthermore, both native and foreign subjects who experienced higher heterogeneity show a significantly lower level of trust.*

Table 10. Determinants of self-reported trust

Self-reported trust	Tobit
Nationality	-0.99***
	(0.14)
Heterogeneity	-1.54***
	(0.12)
Baseline	0.76***
	(0.13)
Constant	1.61
	(0.55)
Log-likelihood	3110.35
LRChi(2)	312.32
N. Of obs.	1520

Controls: gender, age, major, and number of experiments in which the subject has been involved in the past and time to answer control questions.

The dependent variable takes values from 0 to 10.

The variable 'trust' is defined as a discrete variable ranging from 1 to 10, where the score correspond to a self-reported level of "general trust in other people", as it is now standard in the literature on the topic. This result is consistent with findings from previous literature. Alesina and La Ferrara (2002) show that ethnic fragmentation is associated with lower levels of trust.

5. Discussion and concluding remarks

In our public goods game experiment, ethnic diversity has a detrimental effect on cooperation both when we consider the whole sample and under unrestricted punishment only (baseline treatment). Further, what reduces cooperation is the number of foreigners in the session. Hence, we experimentally confirm the existence of a negative association between ethnic diversity and cooperation. We also show that ethnic heterogeneity lowers contribution levels of both natives and foreigners. Next, natives contribute more than foreigners to the public good to be provided. Vigdor (2004) points out that his findings are consistent with a model where members of minority groups choose to support collective action initiatives in diverse communities only when their share of the population is high. In line with this interpretation, in our experiment we find that the minority group (foreigners) contributes less than the majority group (natives) from the outset.

The degree of control provided by the experimental lab allowed us to shed light on some specific channels through which the above relationship operates, so that we can contribute to answer the question concerning the reasons *why* ethnic heterogeneity negatively impacts on public goods provisions. In particular, our data suggest that this correlation passes through three distinct channels: (1) behavioral types; (2) beliefs about the behavior of subjects who do not belong to one's ethnic group (this aspect should be investigated further) and (3) effectiveness of sanctions. In other words, three broad classes of explanations seem to play a complementary role in accounting for the negative correlation under study: a (social) *preference*-based explanation, a *belief*-based explanation and a *sanction*-based explanation.

A first important finding is that individual tastes play a role in accounting for the relationship under exam. However, unlike in field works dealing with the same issue (see e.g. Alesina et al., 1999; Alesina and La Ferrara, 2005), it is not individual tastes over the nature and size of the public good to be provided that matter here, but tastes over how to behave with *other participants* to the same game, that is 'social tastes'. An established result from previous laboratory work is that people differ in their attitudes towards others. Behavioral heterogeneity within public goods game environments has been identified among others by Weimann (1994), Burlando and Hey (1997) and Burlando and Guala (2005). As we recalled in the previous section, free riders, reciprocators and altruists are the three most relevant stable types which have been isolated by experimental studies. One of the key findings of our analysis is that the probability that a subject belongs to a specific behavioral types seems to depend on the degree of ethnic heterogeneity. In presence of ethnic heterogeneity, both natives and foreigners behave more frequently as free riders. Hence, the extent

and nature of other-regardingness seem to possess an ethnicity-dependent component. We claim that while this is an important result with regard to the negative correlation under study, it is also leads to potentially interesting implications from a more general viewpoint, even beyond the social dilemma framework.

Our data also suggest a second, belief-based interpretation of the negative correlation between ethnic diversity and cooperation. Since we found that what matters in determining such a negative correlation is the number of foreigners *per session*, we argue that an important reason why ethnic heterogeneity negatively affects cooperation has to do with subjects' 'fear of diversity', that is with people fearing that foreigners will contribute less than them to the public good to be provided. This is in general what might happen when high-contributors and low-contributors interact: the specificity of our paper is the source of this different attitude. Since we purposely avoided to make participants' nationality salient, the only way people could be informed about the presence of foreigners in their group throughout the game was by making an inference based on observation of their session's participants both before and during the experiment itself. Such beliefs seem to have driven subjects' choices in the game. Although admitting this is generally unpleasant and difficult, in many real-life contexts the general reaction to the arrival of new, foreign people in a country is often associated with the arousal of negative feelings and worries. When a homogenous society experiences the arrival of foreign people, natives (but also foreigners) have to deal with the consequences of ethnic heterogeneity. Interestingly, ethnic heterogeneity might end up producing detrimental effects due to pessimistic expectations on foreigners' antisocial behavior (and not to *actual* antisocial behavior), that might turn into self-fulfilling prophecies.

The third explanatory factor is provided by the sanctioning mechanism. In this regard, we showed that the relationship between the (unrestricted vs. restricted) nature of punishment and ethnicity is important. In particular, in sessions where antisocial punishment is possible, punishment appears to be ineffective in sustaining cooperation, and this result is stronger the higher the number of foreigners: even though nationality does not impact on actual punishment behavior, natives seem to expect to receive sanctions by foreigners even when they behave virtuously, and do not react to punishment in the proper way (i.e. increasing cooperation). This result is consistent with a lower level of trust that natives (compared to foreigners) report in the end of the experiment. However, our results also indicate that while under an unrestricted punishment regime ethnic diversity negatively affect public good provision, restricted punishment favors the enforcement of cooperation despite the presence of ethnic diversity. The reason why this occurs is that restricted punishment (a) rules out a quantitatively significant phenomenon such as antisocial punishment by construction; (b) exerts a

differential impact on natives' and foreigners' behavior, by inducing natives to contribute more and (c) it prevents ethnic heterogeneity from having a direct negative impact on cooperation.

Moreover, we found that interesting interplays occur between the identified mechanisms. For eample, as far as the type-based and the sanction-based explanations are concerned, we showed that even though ethnic heterogeneity makes it more likely for a player to act as a free rider, restricted punishment succeeds in inducing free riders to contribute more. When the institution does not protect from antisocial punishment, the free riders who have been punished decrease cooperation further. This mechanism let the prophecy of a decrease in cooperation to be fulfilled: both natives' and foreigners' earnings are lower in the presence of heterogeneity. This effect is partially mitigated when virtuous restriction are at work.

Hence, it is worth noting that on the whole not only our findings illuminate some specific mechanisms driving the emergence of a negative relationship between ethnic diversity and cooperation, they also identify a possible solution for the problem under study. Our analysis revealed that a sanctioning institution based on legitimacy, that is an institutional arrangement where peer punishment, far from being unrestricted, depends on a principle of legitimacy (Faillo et al., 2010), is effective in preventing the negative effect of ethnic diversity on cooperation. This result suggests that ethnically heterogeneous communities can be successful in providing public goods insofar as they rely on shared rules based on a common, socially acceptable principle, such as a sanctioning institution based on a principle of legitimacy. When an institution is grounded on fair principles, it is more likely that even people of different ethnic origin will agree on its implementation and act accordingly.

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