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Gender effects and third-party punishment in social dilemma games


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Gender effects and third-party punishment in social dilemma games

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Gender effects and third-party punishment in social dilemma games

Daniela Di Cagno*  Michalis Drouvelis**  Paola Paiardini***
LUISS University  University of Birmingham  University of Birmingham

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Abstract

This paper investigates whether altruistic punishment when cooperation norms are violated is sensitive to gender effects. Our framework is a one-shot social dilemma game with third-party punishment in which subjects are informed of the others’ gender within their group. This allows us to test whether third-party punishment depends on the punisher’s as well as on the contributors’ gender. We include treatments where the contributors have either the same or different gender from that of the third-party punishers. Our findings indicate that the assignment of altruistic punishment is gender sensitive. While third-party punishment is assigned similarly when contributors have the same gender as third-party punishers, this is not the case when the gender of the contributors and third-party punishers is different. Third-party male punishers sanction significantly harsher female contributors and earn significantly less relative to third-party female punishers when matched with male contributors. Overall, our results have important implications for the design of teams in the presence of free-riding incentives.

Keywords: gender, third-party punishment, social dilemmas, laboratory experiment.

JEL Classification: C91, D64, D70, H41.

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1. Introduction

Punishment plays a central role in regulating self-interested behaviour and sustaining societal stability when strong free-riding incentives are present. Recent experimental research has shown that punishment is of critical importance for the enforcement of social norms even when it is meted out by impartial third-party observers who are not materially affected by the decisions of norm violators (e.g., Fehr and Fischbacher 2004; Leibbrandt and López-Pérez, 2012; Tan and Xiao, 2012; 2014). Yet, we still know little about the determinants that shape the content of third-party sanctioning. Existing evidence demonstrates that the willingness of individuals to assign third-party punishment depends on factors such as social distance (Bernhard et al., 2006), observability of punishment (Kurzban et al., 2007) and age (Lergetporer et al., 2014). The literature, however, remains silent about whether third-party punishment is sensitive to gender disparities. This is surprising given that past experimental studies have recognised the role of gender as one fundamental factor that influences several facets of economic behaviour (see Croson and Gneezy, 2009). For example, prominent gender differences have been uncovered when preferences over competition are elicited. As surveyed in Niederle and Vesterlund (2011), typical findings from this literature are that women tend to shy away from competition with men and underperform when competing against men. More related to our study, previous research has investigated the presence of gender effects in relation to altruistic and cooperative behaviour, with the literature producing mixed results (e.g., Bolton and Katok, 1995; Eckel and Grossman, 1998; Andreoni and Vesterlund, 2001; Balliet et al., 2011). As Niederle (2015, pp. 523) points out, the vast majority of papers on gender differences fall into a somewhat narrow band of games (mainly dictator and public good games).

The overarching objective of our paper is to broaden the existing literature by identifying the pure effects of gender differences on monetary third-party punishment when cooperation norms are violated. The related literature is very scant1 and we are aware of no other study which is specifically designed to test for gender effects in social dilemma games with third-party punishment. There are only a few relevant studies which report gender data

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1 In Niederle’s (2015, ch. 8) comprehensive review on gender effects, there appears to be lack of evidence in the literature with regards to whether the assignment of punishment is a function of gender. There is only a mention in a paper by Gaechter and Poen (2013) who analyse data from 17 papers on social dilemma games without and with second-party punishment. They report significant gender differences in cooperative behaviour in the sense that men contribute significantly more than women in a public good game with punishment in societies where mostly free-riders are punished. However, no specific reference to how gender affects the assignment of punishment is made. Additionally, the experiments included in the Gaechter and Poen (2013) paper is related to second-party punishment social dilemma games, whereby players’ contribution decisions materially affect the punishers’ earnings.
as part of their analysis. Using a series of third-party punishment allocation games, Leibbrandt and López-Pérez (2012) find that women punish socially efficient choices significantly more than men do. Carpenter and Matthews (2012) report results from regression analyses showing than women are more committed to norm enforcement (using different definitions of the contribution norm). In a field experiment, Balafoutas and Nikiforakis (2012) show that compared to males, females have a much lower willingness to assign non-monetary third-party punishment (as measured by disapproval expression towards norm violations such as littering and queue cutting). Taken together, the existing evidence suggests that gender seems to be a crucial factor in determining third-party sanctioning and provides us with motivation to study more systematically the impact of gender on third-party punishment in social dilemma games.

Since our main concern is with gender differences, we decided to inform subjects about their counterpart’s gender in a group. Our choice is motivated by numerous real-life environments in which individual characteristics, and especially gender, can naturally be identified in social interactions. For example, in teamwork environments, the monitoring authority (which can take the form of an employer or a supervisor in a firm) can easily find out whether the other members in the group are men or women. In laboratory experiments, however, interactions among subjects frequently take place without providing information about others’ individual characteristics. This abstracts from what is often observed in many naturally-occurring environments in which individual characteristics, and in particular gender identity, become salient. By providing information about the gender of the other members in a group, our setting conforms to real-world interactions and also allows us to draw causal conclusions about whether monetary third-party punishment depends on the punisher’s as well as on the contributors’ gender, which also has not been addressed by previous studies.

We are specifically interested in how third-party males and females mete out costly punishment when cooperation norms are violated. The reason for this is that the ability to enforce social norms is one of the distinguishing features of human societies (see Fehr and Fischbacher, 2004) and it is therefore important to shed more light on the forces determining the content of acceptable standards of behaviour in such environments. In particular, gaining a better understanding of the role of gender has important implications for the design of institutions that promote cooperation when strong free-riding incentives are present. We analyse one-shot interactions which enable us to assess the gender content of third-party punishment when strategic motives are ruled out. Our framework consists of a three-player social dilemma game with third-party punishment. Specifically, two members in a group have
to decide whether and if so, how much to contribute to the common resource. The parameters are chosen such that not contributing maximises individual earnings, whereas joint earnings are maximised when both members in a group contribute fully. Their contribution decisions have no material influence on the earnings of the third-party punisher, who acts in the role of an uninvolved bystander. More specifically, after contributions have been made, the third-party punisher observes the profile of contributions of each group member and has to decide whether and if so, how much to sanction them. The third party-punishers can reduce their own as well as the contributors’ earnings but is unaffected from the contributors’ decisions.

Our experiment employs a between-subjects design, consisting of four treatments in which the gender of the contributors and that of the third-party punishers can either be the same or different. This implies that third-party male (female) punishers are matched with either male or female contributors, depending on the treatment. Our main findings indicate that in groups where the gender of all subjects is the same, third-party male and female punishers sanction similarly. However, third-party punishment is sensitive to gender effects when the gender of the contributors is different from that of the third-party punisher. In particular, we find that third-party male punishers sanction significantly harsher female contributors compared to the punishment assigned by third-party female punishers towards male contributors, ceteris paribus. As a result, third-party male punishers earn significantly less when matched with female contributors compared to third-party female punishers when matched with male contributors. Our results have implications about the importance of gender composition in team settings characterised by strong free-riding incentives and highlight the gender perspective that needs to be considered when the assignment of roles within teams in the workplace and elsewhere is determined.

Our paper is organised as follows. Section 2 outlines the experimental design and procedures. Section 3 presents the experimental results. Section 4 discusses our findings and concludes.

2. Laboratory experiment with third-party punishment

2.1 Framework

We conduct an experiment which is specifically designed to shed light on how gender affects strong negative reciprocity, as measured in a one-shot third party game with punishment. For this purpose, we adopt the framework developed by Fehr and Fischbacher (2004). In particular, subjects participate in a two-stage game. At the beginning of the experiment,
subjects are divided into groups of three. In the first stage, two members in the group (to which we refer as “contributors”) are each endowed with 10 tokens and have to decide (simultaneously and independently) whether and if so, how much to contribute to the public good (described to subjects as “project”). Each token a group member keeps in her/his own private account yields a return of 1 ECU to that group member. Each token invested in the group project yields a return of 1.5 ECUs to the group, which is equally divided between the two group members (meaning that the marginal per capita return is equal to 0.75).

After contribution decisions from the first stage have been made, the third group member (to which we refer as the “third party punisher”) is informed of the contributions’ profile of each of the other two group members and is given the opportunity to sanction them by assigning negative points. Specifically, the third-party punisher, who is not materially affected by the contributions of other two members in her/his group, is endowed with 20 tokens and can assign between 0 and 10 negative points to each other two group members. Assigning negative points is costly both for the punisher and the recipient of the punishment. We used a cost-to-impact which is equal to 1:3. This means that each punishment point costs the third party punisher 1 ECU and the recipient of the punishment 3 ECUs.

2.2 Experimental design

Since we are interested in measuring the effects of gender on altruistic punishment, in all our treatments subjects were informed of the gender of the other members in their group. We vary whether the third-party punisher has the same or different gender with that of the other two “contributors” (depending on the treatment), while keeping the gender of the two contributors always the same within a group. Thus, our experimental design consists of four treatments: (1) “All Males” in which both contributors and third party punisher in a group are males; (2) “All Females” in which both contributors and third party punisher in a group are females; (3) “Two Males – One Female” in which both contributors are males and the third party punisher is a female; and (4) “Two Females – One Male” in which both contributors are females and the third party punisher is a male. Table 1 summarises our experimental treatments.²

² Note that we are concerned with how punishment behaviour is affected when subjects are aware of their counterparts’ gender as typically happens in many real-life instances. Thus, we do not include a treatment in which subjects are not informed as this would introduce an additional confound (namely, knowing or not
Our design allows evaluating the causal effect that gender composition of a group has on altruistic punishment as measured by observing the sanctioning behaviour of the third-party punisher towards the contributors. In particular, we are able to understand whether third-party males and females punishers are more or less willing to assign harsher punishment for violations of cooperation norms, when the gender group composition of the contributors is the same or different from the gender of the punishers.

Beliefs’ elicitation: While the contributors were deciding about their own contribution decisions, we asked third-party punishers to indicate how much they expected the contributors to contribute to the public good, on average. We did not want the belief elicitation to interfere with the incentive structure of the social dilemma game by creating income effects and opted to not pay for correct beliefs. We also wanted to avoid third-party punishment being motivated by disappointment about low payoffs resulting from inaccurate beliefs.

2.3 Procedures

In total, 306 subjects participated in the experiment. Table 1 presents an overview of our treatments, along with a breakdown of the number of subjects who participated in each treatment separately.

<table>
<thead>
<tr>
<th>Contributors’ gender</th>
<th>Third-party punisher’s gender</th>
<th>No. of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>Male</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>All Males</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Two Males – One Female</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>All Females</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Two Females – One Male</td>
<td>72</td>
</tr>
</tbody>
</table>

knowing the others’ gender) which would convolute identifying the pure effects of gender on third-party punishment behaviour.
All subjects were recruited at the University of Birmingham, using the ORSEE software (Greiner, 2015) and the experiment was computerized and programmed with the software z-Tree (Fischbacher, 2007). At the end of each session, subjects were privately paid according to their total amount of experimental currency units (ECUs), using an exchange rate of £0.40 per ECU. Average earnings (excluding a show-up fee of £2.50) were £8.16. Sessions lasted 50 minutes, on average. Before subjects played the game, they received the instructions reproduced in the Appendix. As we wanted to ensure that subjects understood the decision situation and the mechanics of payoff calculations, all participants answered several control questions. The experiment did not proceed until every subject had answered these questions correctly.

3. Experimental results

In presenting our experimental results, we first report how subjects behaved in terms of contribution across treatments. Following this, we present our results on third-party punishment behaviour, which addresses our main research question of whether and if so, how altruistic punishment is sensitive to gender effects.

3.1 Contribution behaviour

Figure 1 shows the distribution of the absolute levels of contributions in each of the four treatments. We observe that in all treatments most subjects contribute their full endowment (i.e. 10 tokens) to the public good. Specifically, the percentage of full contributors is equal to 28% (14/50 subjects) in the “All Males” treatment, 32.76% (19/58 subjects) in the “All Females” treatment, 41.67% (20/48 subjects) in the “Two Males – One Female” treatment and 37.50% (18/48 subjects) in the “Two Females – One Male” treatment. In contrast, it is also common across all four treatments that complete free-riding (i.e. contributing zero tokens) occurs quite rarely. A non-parametric Kruskal-Wallis test reveals insignificant differences in the distributions of contributions among mood treatments (p = 0.326).3

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3 All p-values reported here refer to two-sided tests unless otherwise stated.
Figure 1. Distribution of contributions across treatments

The average contributions are reported in Table 3. Overall, we observe similar contribution levels across treatments. In particular, average contributions range from 6 tokens (in the “All Males” treatment) to 7.19 tokens (“Two Females – One Male” treatment). When we perform non-parametric Wilcoxon tests, we find that contributions are not statistically significant different from each other for any pairwise comparison among treatments ($p > 0.122$). This finding indicates that average contributions are similar across treatments, irrespective of the contributor’s and the third-party punisher’s gender.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>No. of subjects</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Males</td>
<td>50</td>
<td>6.00</td>
<td>3.40</td>
</tr>
<tr>
<td>All Females</td>
<td>58</td>
<td>6.40</td>
<td>3.11</td>
</tr>
<tr>
<td>Two Females – One Male</td>
<td>48</td>
<td>7.19</td>
<td>2.90</td>
</tr>
<tr>
<td>Two Males – One Female</td>
<td>48</td>
<td>7.02</td>
<td>2.98</td>
</tr>
</tbody>
</table>

Our first result is summarised below.

**RESULT 1:** In the presence of third party punishment opportunities, average contribution behaviour is not sensitive to gender effects.
However, our main concern is with third party punishment behaviour, as this is our vehicle to answer our initial research question. In the next section, we explore whether subjects treat free-riding behaviour differently by punishing differently (for given contribution behaviour) across our treatments.

3.2 Third-party punishment behaviour

We start our analysis by examining subjects’ third-party punishment behaviour for each treatment. Figure 2 shows the distribution of third-party punishment as measured by the number of negative points assigned by the third party to each of the other two group members. In all treatments, the majority of third-party punishers assign no punishment at all. Across all treatments, the average percentage of punishment assigned is equal to 25.49%. When punishment is assigned, it typically ranges from 1 to 5 negative points (with the only exception being the “All Females” treatment in which we observe that subjects assign more than 5 negative points but only in very few occasions (that is, 2 out of 58 punishment decisions)). Our observation that subjects are willing to assigned third-party punishment is consonant with existing results from previous studies which also document the presence of altruistic punishment in their experiments (e.g., Fehr and Fischbacher, 2004).

In terms of average punishment assigned by the third parties to the contributors, we find that the highest number of negative points are assigned in the “Two Females – One Male” treatment (0.71 points), whereas, the lowest number of negative points are assigned in the “Two Males – One Female” treatment (0.29 points). For the “All Males” and the “All Females” treatments, the average negative points assigned by the third party punisher are equal to 0.52 and 0.67, respectively. By performing a non-parametric Wilcoxon test, we find insignificant differences in how third party punishment is assigned in all pairwise comparisons (p > 0.228) except for the comparison between the “Two Females – One Male” and the “Two Males – One Female” treatments (p = 0.097). This implies that third-party males punish harsher females contributors compared to how third-party females punish males contributors.
We next test more formally, using parametric regression analyses, for the presence of differences among our treatments. This analysis allows us to control for important features which may affect the assignment of third-party punishment. We report the results from two regression models in Table 4. In both models, the dependent variable is the number of punishment points the third party assigns to the contributors. As a result, we perform Tobit regressions since our dependent variable exhibits censoring at 0 and 10 points. The independent variables include three dummy variables which correspond to the “All Males”, “All Females” and “Two Females – One Male” treatments. The “Two Males – One Female” treatment represents the baseline category in both regression models. In Model (1), we test for treatment differences when we control for contribution levels (as captured by the variable “Contribution” which indicates the number of tokens contributed by a subject). Model (2) includes two further independent variables which relate to how many tokens the third-party punishers expect the contributors to contribute. Specifically, the variable called “absolute negative contribution deviation from third-party punisher’s beliefs” is the absolute value of the actual deviation of a contributor’s decision from the third-party punishers’ belief about others’ contribution, when the third-party punisher expectations are below the contributor’s decision; and zero otherwise. The variable “positive contribution deviation from third-party punisher’s beliefs” is constructed in an analogous way. The regression results are given in Table 4.
Table 4 reveals our second main finding. In both regression models, we document that the coefficient of the “Two Females – One Male” treatment is positive and statistically significant. This implies that third-party male punishers sanction female contributors significantly harsher than third-party female punishers sanction male contributors, ceteris paribus. Interestingly, we observe that, in Model (2), the coefficients of the “absolute negative contribution deviation from third-party punisher’s beliefs” and “positive contribution deviation from third-party punisher’s beliefs” variables are negative and positive, respectively, albeit statistically insignificant.4

**Table 4. Assignment of third party punishment across treatments – Regression results**

<table>
<thead>
<tr>
<th></th>
<th>Dependent variable: Punishment assigned by the third party to contributors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model (1)</td>
</tr>
<tr>
<td>Contribution</td>
<td>-0.380</td>
</tr>
<tr>
<td></td>
<td>(0.091)</td>
</tr>
<tr>
<td>Absolute negative contribution deviation from third-party punisher’s beliefs</td>
<td>-0.247</td>
</tr>
<tr>
<td></td>
<td>(0.177)</td>
</tr>
<tr>
<td>Positive contribution deviation from third-party punisher’s beliefs</td>
<td>0.212</td>
</tr>
<tr>
<td></td>
<td>(0.159)</td>
</tr>
<tr>
<td>All Males</td>
<td>0.307</td>
</tr>
<tr>
<td></td>
<td>(0.861)</td>
</tr>
<tr>
<td>All Females</td>
<td>0.996</td>
</tr>
<tr>
<td></td>
<td>(0.914)</td>
</tr>
<tr>
<td>Two Females – One Male</td>
<td>1.613*</td>
</tr>
<tr>
<td></td>
<td>(0.867)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.520</td>
</tr>
<tr>
<td></td>
<td>(0.997)</td>
</tr>
<tr>
<td>Obs.</td>
<td>204</td>
</tr>
</tbody>
</table>

Notes: Tobit estimates. The variable “Contribution” is variable which indicates the number of tokens contributed by a contributor. The variable “Absolute negative contribution deviation from third-party punisher’s beliefs” is the absolute value of the actual deviation of a contributor’s decision from the third-party punishers’ belief about others’ contribution, when the third-party punisher expectations are below the contributor’s decision; and zero otherwise. The variable “positive contribution deviation from third-party punisher’s beliefs” is constructed in an analogous way. The variable “All Males” is a dummy variable which takes on the value “1” for the “All Males” treatment and “0” otherwise. The variable “All Females” is a dummy variable which takes on the value “1” for the “All Females” treatment and “0” otherwise. The variable “Two Females – One Male” is a dummy variable which takes on the value “1” for the “Two Females – One Male” treatment and “0” otherwise. The “Two Males – One Female” treatment is the baseline category. Robust standard errors are presented in parentheses. * denotes significance at the 10-percent level, ** denotes significance at the 5-percent level, and *** at the 1-percent level.

Our second result is summarised below.

4 The interpretation of these coefficients means that when the actual contribution decision is lower (higher) than the third-party punishers’ expectations about others’ contribution, then third-party punishment is harsher (less harsh).
RESULT 2: The assignment of third-party punishment is sensitive to gender effects, ceteris paribus: subjects in the “Two Females – One Male” treatment punish significantly harsher than those in the “Two Males – One Female” treatment.

3.3 Earnings

Our findings from the previous analysis indicate significant differences in how punishment is assigned across treatments. A well-established experimental literature has documented that, in the short-run or even in one-shot interactions, the assignment of punishment has detrimental effects on subjects’ welfare as measured by their net earnings (e.g., Gächter et al., 2008; Drouvelis and Grosskopf, 2016). In this section, we test whether the average earnings of third-party punishers differ among our treatments. To do this, we perform two OLS regressions, in which the dependent variable is the final net earnings that a third-party punisher receives. The independent variables are the four treatment dummy variables. The baseline category is the “Two Males – One Female” treatment. The regression results are given in Table 5.

Table 5. Earnings – Regression results

<table>
<thead>
<tr>
<th></th>
<th>Dependent variable: Final net earnings for third-party punisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Males</td>
<td>-0.457</td>
</tr>
<tr>
<td>(0.461)</td>
<td></td>
</tr>
<tr>
<td>All Females</td>
<td>-0.761</td>
</tr>
<tr>
<td>(0.620)</td>
<td></td>
</tr>
<tr>
<td>Two Females – One Male</td>
<td>-0.833*</td>
</tr>
<tr>
<td>(0.469)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>19.417***</td>
</tr>
<tr>
<td>(0.240)</td>
<td></td>
</tr>
<tr>
<td>Obs.</td>
<td>102</td>
</tr>
</tbody>
</table>

Notes: OLS estimates. The variable “All Males” is a dummy variable which takes on the value “1” for the “All Males” treatment and “0” otherwise. The variable “All Females” is a dummy variable which takes on the value “1” for the “All Females” treatment and “0” otherwise. The variable “Two Females – One Male” is a dummy variable which takes on the value “1” for the “Two Females – One Male” treatment and “0” otherwise. The “Two Males – One Female” treatment is the baseline category. Robust standard errors are presented in parentheses. * denotes significance at the 10-percent level, ** denotes significance at the 5-percent level, and *** at the 1-percent level.

The regression results from Table 5 indicate that subjects in the “Two Females – One Male” treatment earn significantly less than those in the “Two Males – One Female” treatment. Taken together, our findings show that the harsher sanctioning assigned by third-
party male punishers to females is detrimental and reduces efficiency at least in the very short run.

Our third result is summarised below.

**RESULT 3:** Average earnings are sensitive to gender effects, *ceteris paribus:* third-party punishers in the “Two Females – One Male” treatment earn significantly less than those in the “Two Males – One Female” treatment.

4. Discussion and conclusions
This paper presents an experimental investigation of the impact of gender on shaping altruistic punishment in relation to issues of human cooperation. Our framework is a social dilemma game with third-party punishment game, which has played a key role in the social preferences literature. This set-up encompasses a broad range of real-world contexts and situations that epitomise the conflict of interests between personal interests and collective goals. Its study is therefore of great importance as it enables us to understand the proximate sources behind human cooperation. Our interest is to assess whether altruistic punishment as measured by observing third-party punishers’ decisions is sensitive to gender effects. To address our research questions, we included treatments in which the gender of the contributor and the third-party punishers is either the same or different. Motivated by naturally-occurring situations such as monitoring of teamwork in the workplace, subjects in our experiment are informed of each other’s gender within their group. Our main findings show that the assignment of third-party punishment is susceptible to gender effects and this has significant implications on third-party punishers’ welfare. In groups where the gender of the contributors and that of the third punishers is the same, we find no evidence that third-party punishment is assigned significantly different. By contrast, we document significant differences when the gender of the contributors is different from the third-party punishers’ gender. Specifically, third-party male punishers sanction female contributors significantly harsher than third-party female punishers do for male contributors, *ceteris paribus.* As a result, the assignment of harsher punishment by male third-parties has detrimental effects on their welfare as measured by their net earnings.

We contribute to the literature in at least three important ways. First, from a theoretical perspective, we show that measures of social preferences such as strong
reciprocity are sensitive to gender effects. Our findings, hence, provide further evidence for inspiring theory development that can account for gender effects.

Second, from an empirical perspective, there is already a growing empirical literature identifying that aspects of pro-sociality such as altruistic and cooperative behaviour (e.g., Bolton and Katok, 1995; Eckel and Grossman, 1998; Andreoni and Vesterlund, 2001; Balliet et al., 2011) depend on subjects’ gender. Most of the literature focuses on a narrow band of games such as dictator and social dilemma games and even in these settings, the evidence on whether and if so how, negative reciprocity is influenced by gender is scarce. This calls for the need of more systematic investigations which analyse the issue of gender sensitivity in a broader set of games. Our paper extends the existing literature by providing new evidence showing that measures of strong negative reciprocity (such as monetary third-party punishment) are affected by gender effects in that third-party male punishers negatively reciprocate in a harsher way towards female contributors compared to the corresponding behaviour of third-party female punishers to male contributors.

Third, our results have implications pertaining to the group composition and the role assignment in a teamwork environment. Our finding that third-party male monitors earn significantly less when matched with female contributors as opposed to third-party female monitors when matched with male contributors is due to over-use of punishment by male punishers compared to female ones. This suggests that, in mixed gender teams, placing males in positions of monitoring authority when it comes to norm enforcement may make them exercise a high degree of negative reciprocity towards females, which also has negative welfare consequences for the punishers (as measured by their average net earnings).

Our study gives rise to a number of different future research avenues. The role of gender needs to receive more attention in economic analysis as their effects remain to be a challenge to behavioural decision-making theories. In particular, more empirical evidence is necessary to better understand the channels through which gender effects influence behaviour. Our observation that third-party male punishers sanction female contributors harsher than third-party females do for male contributors (for given contribution levels) could be due to different expectations that third-party punishers form before they decide on how much punishment to assign. In our study, we collect non-incentivised data on beliefs of third party punishers about others’ contributions. Preliminary analysis of these data suggests that third-party punishers’ beliefs about others’ contributions are weakly different in that third-party male punishers expect that female will contribute less compared to the expectations that third-party female punishers have for their male contributors. This suggests that third-party
punishers’ beliefs about others’ contributions may play an important role in their decision about how much punishment to assign. However, it is important to note that our belief elicitation is not incentivised, and we thus believe that further systematic investigations by economists are warranted in order to shed more empirical light on the channels through which gender effects influence behaviour in such contexts.

Finally, we focus on the effects of gender in a one-shot interaction game. Yet, the persistence of this effect is of great relevance, especially in the light of our evidence that the welfare of the third-party punishers is sensitive to the specific gender of the punisher and the contributors. Therefore, the long-run impact of gender disparities on economic behaviour is important to be quantified as it will improve our understanding of the survival and success of human societies.
References


Appendix – Experimental Instructions

[Note: These are the written instructions as presented to subjects facing the “All Females” treatment. Regarding the three remaining treatments, corresponding amendments were made.]

INSTRUCTIONS

Welcome! You are about to take part in a decision-making experiment. This experiment is run by the “Birmingham Experimental Economics Laboratory” and has been financed by various research foundations. Just for showing up you have already earned £2.50. You can earn additional money depending on the decisions made by you and other participants. It is therefore very important that you read these instructions with care.

It is important that you remain silent and do not look at other people’s work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your following of these rules.

We will first jointly go over the instructions. After we have read the instructions, you will have time to ask clarifying questions. We would like to stress that any choices you make in this experiment are entirely anonymous. Please do not touch the computer or its mouse until you are instructed to do so. Thank you.

In the instructions, unless otherwise stated, we will not speak in terms of Pounds, but in terms of Experimental Currency Units (ECUs). Your entire earnings will, thus, be calculated in ECUs. At the end of the session the total amount of ECUs you have earned will be converted to Pounds at the following rate: 1 ECU = £0.40. The converted amount will privately be paid to you in cash.

At the beginning of the experiment, you will be matched with two other people, randomly selected from the participants in this room, to form a group of three. Each person in the group will be assigned a role, either ‘Participant A’, ‘Participant B’ or ‘Participant C’. All participants in your group will be females. You will not learn the identity of the other participants in your group. Participants will be identified simply as ‘Participant A’, ‘Participant B’ or ‘Participant C’. When we have finished reading the instructions you will be informed of your role.
Detailed Information about the Experiment

The experiment consists of two stages as described below.

**Stage 1**

At the beginning of the experiment Participant A and Participant B each will be given 10 tokens. Participant A and Participant B must choose how many of these tokens to invest in a group project and how many to keep in their private accounts. They do so independently of each other and without any communication. So at the moment they make their own choice, they do not know the choice of the other participant. Participant C does not make any choice during Stage 1 and is not affected by the choices made by Participant A and Participant B.

Each token a participant keeps in her private account yields a return of one ECU to that participant.

Each token a participant invests in the group project yields a return of 1.5 ECUs to the group. This amount will be divided equally among both Participants A and B. Thus every Participant (A and B) receives 0.75 ECUs.

Hence, if you are Participant A or B, your earnings in ECUs will be:

\[
(Number \text{ of tokens kept in your private account}) + 0.75 \times (Total \text{ number of tokens invested in the group project by Participant A and B})
\]

If you are one of Participants A or B, you will make your decision by entering the number of tokens you invest in the group project. Any tokens you do not invest will automatically be kept in your private account.

You will enter your decisions on a screen like the one shown below.
On the top of the screen, there is a message informing you of which role (Participant A or B) you have been assigned (in this example, Participant A). You have to decide how many tokens you want to invest in the group project by typing a number between 0 and 10 in the input field. This field can be reached by clicking it with the mouse. After entering the amount of tokens you want to invest you must press the OK button using the mouse. Once you have done this, your decision can no longer be revised.

**Stage 2**

During Stage 2, Participant A and Participant B will not make any choice. Participant C can decrease or leave unchanged the income of each of the other two participants (A and B) by assigning negative points to them.

If you are Participant C, you will see the following input screen for Stage 2.
Participant C will be informed of the number of tokens each of the other two participants (A and B) has invested in the group project as well as their corresponding incomes from Stage 1. Participant C will be endowed with 20 points (which correspond to 20 ECU's) and has to decide how many negative points to assign to each of them. She can assign between 0 and 10 negative points to each other two participants (A and B). That is, Participant C can assign up to 10 negative points to Participant A and up to 10 negative points to Participant B.

If Participant C does not wish to change the income of the other two participants, then she should enter 0 in the corresponding box. If Participant C wishes to decrease another participant’s income, she should enter instead the number of negative points that she wishes to assign to each of them, preceded by a minus sign (without spaces between them). The leading minus sign “–” is required. For example, to assign 5 negative points to another participant, type –5 in the relevant box.

Assigning negative points is costly. Each point that Participant C assigns costs her one ECU. Thus, the total cost in ECU's of assigning points to the other two participants (A and B) is given by the total number of points assigned to each participant. The impact of assigning points to other participants is as follows: If Participant C assigns 0 points to another participant, she will not have any effect on the other participants’ income. However, for each negative point that Participant C assigns to another participant, she will decrease their income

<table>
<thead>
<tr>
<th>Number of tokens invested in the group project</th>
<th>Income from Stage 1</th>
<th>Negative Points (with the minus sign)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participant B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
by 3 ECUs (unless their income is already exhausted). For example, if Participant C assigns 5 negative points to another participant, she will decrease their income by 15 ECUs. And so on.

Therefore, the total income of each participant at the end of Stage 2 is calculated as follows:

- **Participant A’s total income (in ECUs) =** Income from Stage 1 – 3*(points assigned to Participant A by Participant C)

- **Participant B’s total income (in ECUs) =** Income from Stage 1 – 3*(points assigned to Participant B by Participant C)

- **Participant C’s total income (in ECUs) =** 20 ECUs – (sum of points assigned to Participant A and Participant B)

At the end of Stage 2, you will be informed of the choices made by each participant in your group and the resulting payoffs. You will be paid £0.40 for every ECU, in addition to your £2.50 show-up fee. You will be paid in private and in cash.

Do you have any questions? Please raise your hand and an experimenter will come to your desk. Please do not ask any question out loud.

To ensure everybody understands, each of you will need to answer a few control questions, which you can find in the next page.
Control Questionnaire

Please complete the questions below. In a couple of minutes someone will come to your desk to check your answers. Once everybody answers the following questions correctly, the experiment will start. (The decisions and earnings used for the questions below are simply for illustrative purposes. In the experiment decisions and earnings will depend on the actual choices of the participants.)

1. How many participants are there in a group? 

2. Suppose that Participant A and Participant B each invests 0 tokens in the group project. What is:
   - Participant A’s income from Stage 1 (in ECUs)?
   - Participant B’s income from Stage 1 (in ECUs)?

3. Suppose that Participant A and Participant B each invests 10 tokens in the group project. What is:
   - Participant A’s income from Stage 1 (in ECUs)?
   - Participant B’s income from Stage 1 (in ECUs)?

4. Suppose that Participant A and Participant B each invests 5 tokens in the group project. What is:
   - Participant A’s income from Stage 1 (in ECUs)?
   - Participant B’s income from Stage 1 (in ECUs)?

5. Suppose that Participant C assigns 2 negative points to each of the other two participants (A and B). What is the impact of the negative points assigned to each of them?

6. By how many ECUs will Participant C’s income be changed if she assigns 5 negative points to each of the other two participants?

7. What is the gender of the participants in a group?