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The Social Value of Transparency and Accountability: Experimental Evidence from Asymmetric Public Goods Games[‡]

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Abstract

Transparency and accountability are often regarded as crucial for good governance and the efficient organization of public affairs. Within a laboratory experiment, we systematically explore the impact of transparency and accountability on cooperation in the provision of public goods. Specifically, we study variations of a public goods game with agents that differ in their action space: while some agents may only contribute to the public good, one (special) agent has the additional option to exploit the existing public good stock. We show that transparency backfires in absence of a sanction mechanism as it induces special agents to extract significantly more resources. Transparency helps in sustaining contributions to the public good when a peer punishment mechanism is introduced. Importantly, we identify a stigmatization effect for the special agent who receives substantially more peer punishment if only his type, but not the actions are publicly known. We show that a combination of transparency of all agents' actions and peer-punishment options is needed to create full accountability and increase contributions by all agents.

Keywords: transparency, accountability, asymmetry, public good, punishment, stigmatization

JEL: H41, C91, C92

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Good governance comprises […] transparency and accountability in the management of public affairs…
The United Nations Development Agenda

1 Introduction

Voluntary cooperation among non-kinship is a unique but also frail feature of human societies. To achieve a sufficient degree of cooperation and to restrain individuals from exploiting public resources to their private advantage, societies implement mechanisms which mostly rely on a combination of transparency and accountability: making individual actions transparent allows the identification of free-riders, while bringing free-riders to account for their behavior eliminates its attractiveness.

The impact of transparency thereby appears ambiguous. While the earlier economic literature considers transparency as commonly promoting cooperation (e.g., Alchian and Demsetz, 1972; Holmström, 1979; Kaufmann and Bellver, 2005), recent studies take a less optimistic view: transparency alone may not be sufficient (e.g., Croson, 2001; Lindstedt and Naurin, 2010) or even backfire the interests of the society as a whole (e.g., Kolstad and Wiig, 2009). Inspired by examples from financial economics, researchers have started to analyze the strategic consequences of transparent public information (e.g., Morris and Shin, 2002, Angeletos and Pavan, 2007, Lorenzoni, 2011). Within a framework, where subjects respond strategically to public information on the fundamental state of the world increasing transparency may result in efficiency-decreasing overreactions, even in the presence of active policy intervention (James and Lawler, 2011), such that partial transparency can lead to higher welfare for all agents (Cornand and Heinemann, 2008, 2014). Furthermore, identifying individual actions to establish transparency may also be problematic and costly. Examples reach from problems of team production in labor economics (e.g., Alchian and Demsetz, 1972), non-point source pollution in environmental economics (e.g., Segerson 1988) to problems of identifying the exploitation of power by corrupt administrators.

In this paper, we study conditions under which transparency may be successful in providing incentives to overcome social dilemmas. We thereby concentrate on the specific interplay between transparency and accountability which appears to be largely underexplored in the literature. More specifically, we consider a repeated linear public goods game with heterogeneous action sets of agents: one (*special*) agent in this game is allowed to extract money unilaterally from the public good – thereby reducing the payoff to other (*standard*) agents – while all (special and standard) agents may or may not cooperate by voluntarily contributing to the public good. Such asymmetries in available actions are prevalent in most of our examples: workers in teams may differ in their individual tasks, corrupt officials may create substantially larger harm to the public than ordinary citizens, households and producers differ with respect to their ability to protect or to pollute ecosystems.

In our experiment, we vary the experimental set-up along two dimensions: (i) the transparency of individual agents' identities and actions (ranging from the case where agents neither know the individual cooperation rates nor standard agents can identify the special agent – *non-transparency* –

to the case where individual cooperation rates are unknown, but special agents are identifiable for standard agents – *low transparency* – to the case where both individual cooperation rates and the identity of the special agent are common knowledge – *high-transparency*; and (ii) the opportunity to sanction agents for their (potential) misbehavior (here, we consider games with and without implemented peer-punishment opportunities – *no-punishment/punishment*, see, e.g., Fehr and Gächter, 2000).

Our results show that high transparency alone does not maintain, but rather reduces cooperation rates: when a special agent has the option to take, high transparency without punishment backfires and leads to a significant increase in the take-out rate by special agents. We show that such behavior is consistent with behavioral approaches on (self-)image concerns (Benabou and Tirole, 2006, Ellingsen and Johannesson, 2008, 2011): when actions are not transparent, the agent may limit the exploitation of the public good in order not to allow others to identify him as harming the public good. Conversely, high transparency eliminates any opportunity to hide take-out rates. Hence, abstaining from exploiting the public good becomes more costly. This result of decreased cooperation under high transparency when agents differ in their action spaces provides an important caveat to the stream of literature arguing that observing actions may enhance pro-social behavior (e.g., Bohnet and Frey, 1999), also in symmetric public goods games (Samak and Sheremeta, 2013).[1]

Our results further demonstrate the complementary nature of transparency and accountability: higher degrees of transparency significantly improve the provision of public goods *only* if punishment options exist. A closer look at the punishment patterns for different degrees of transparency thereby reveals important insights. In line with previous research on agents who receive noisy signals about the contributions of other group members (e.g., Grechenig et al., 2010, Ambrus and Greiner, 2012), agents make substantial use of their punishment opportunities even in the non-transparency treatment. Of course, this "blind" punishment does not establish any accountability, since it is not directed at exploiting special agents or at free-riding standard agents. Rather, it harms the overall sum of payoffs in the public goods game substantially.

In great contrast, punishment improves cooperation both under low and high transparency but is found to impact the behavior of special and standard agents through two different channels: punishment combined with low transparency reduces the take-out rates of special agents relative to the treatments without punishment. Here, revealing the identity of the special agent leads to their stigmatization such that standard agents target punishment points primarily at special agents whenever they observe a small aggregate provision level of the public good, believing that this results from taking. Such statistical discrimination due to stigmatization (Arrow, 1972, 1973, Phelps, 1972) has recently received much interest in the literature (e.g., Altonji and Pierret, 2001, List, 2004, Gneezy et al., 2012, Zussman, 2013).[2] In order to reduce this (sometimes undeserved)

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1 Samak and Sheremeta (2013) follow the tradition of earlier experiments with symmetric public goods games where variations of transparency have little effect on contributions (e.g., Weimann, 1994, Croson, 2001). A related question is asked in Nikiforakis (2010). Here, agents (who can also punish other agents at their own cost) receive different feedback formats. One group receives information about the individual contributions, while the other group is informed about individual payoffs. The experimental results show that information about the earnings in comparison with information about the contributions reduces cooperation significantly.

2 The concept of statistical discrimination contrasts taste-based discrimination according to Becker (1957).

punishment, the special agent increases contributions. High transparency, that is, announcing individual agents' actions, breaks this stigma effect. Here, both standard and special agents are made accountable through being punished based on their actions rather than their type. Thereby, high transparency increases the average cooperation rates of standard agents, but does not further improves the contributions of special agents beyond the level under low transparency. As a consequence, cooperation is significantly greater in the high transparency treatment with punishment than in the low transparency treatment with punishment.

Overall, our experimental design combines several research streams in the literature on voluntary giving. We employ a modification of the public goods game with asymmetric giving-and-taking action sets which is equivalent to providing higher endowments to special agents than to the standard agents in a standard public goods game. However, we find severe behavioral consequences of introducing taking options for special agents, [3] while the extant literature on to the effect of endowment heterogeneity is inconclusive.[4] Cox et al. (2012) are first in investigating giving-and-taking options that differ between agents. They show that such asymmetries amplify the differences between a taking and a giving game, but do not consider the interaction between transparency and accountability.

The impact of asymmetries on public good provision has also been studied when agents differ with respect to their marginal benefit-cost-ratios for contributing to the public good (Fisher et al., 1995; Palfrey and Prisbrey, 1997; Glöckner et al., 2011). These studies find no systematic effect of asymmetries on the provision levels. Reuben and Riedl (2009) add punishment options, but again find no significant impact of heterogeneity on the sum of contributions. Following up, Reuben and Riedl (2013) introduce heterogeneity both concerning endowment and marginal benefits from the public good and study contribution norms that trigger punishment. They find that heterogeneity has a positive effect on contributions (though, the size of the effect differs for diverse types of heterogeneity) and that the enforced contribution norms relate to equal contributions rather than equal earnings. We add to this literature by investigating the impact of transparency under heterogeneity concerning the action space which allows special agents to take from the public good, while all agents have identical options in the giving domain.

The remainder of this work is organized as follows; Section 2 describes the experimental design and procedures. Section 3 discusses behavioral predictions. In section 4 we report experimental results. Section 5 provides a concluding discussion of the insights of this work and their implications for economic theory and public policy.

[3] Difference between giving and taking frames have also been identified by Andreoni (1995) and Khadjavi and Lange (2014) in a symmetric public goods game. Similarly, giving in dictator games is impacted by the introduction of taking options (List, 2007, Bardsley, 2008).

[4] Studies report lower contributions (van Dijk et al., 2002, Cherry et al., 2005), higher contributions (Buckley and Croson, 2006), or find no effect of endowment asymmetries on aggregate provision levels (Chan et al., 1999, Sadrieh and Verbon, 2006, Reuben and Riedl, 2013).

2 Experimental Design

The starting point of our experiment is a linear public goods game (e.g., Isaac et al., 1985) where each of n agents is endowed with w Taler, which they may allocate to their private account or a public good account which is initially endowed with E Taler.

We vary this game along three important dimensions: we first alter the symmetry of the agents' action space. In two (baseline) treatments without special agents (SYM), the action set is the same for all agents: agents are able to contribute to the public good by reducing their initial endowment, i.e., $a_i \in [0, w]$. We then consider asymmetric treatments ASYM, where $n-1$ of n group members face the same action set as agents in the symmetric treatments: these *standard agents* again only have the option to contribute to the public good. We allow one agent within the group, the *special agent*, to deplete the initially existing public good account, that is, $a_i \in [-E, w]$. That is, the special agent can also contribute to the public good, but additionally has the option to extract the initial endowment of the public account for his own benefit.[5]

For the second dimension, we consider either a game with (_PUN) or without peer punishment following the "standard" approach by, for instance, Fehr and Gächter (2002). Here, each agent i receives an additional endowment p that they may use to buy punishment points $p_{i\to j}$ for agent j, such that $p_{i\to j} \in \{0, \ldots, p\}$, $\sum_j p_{i\to j} \leq p$. The marginal cost of $p_{i\to j}$ for i is 1 Taler, the marginal destruction for j is 3 Taler, that is, each Taler i invests into j's punishment destroys 3 Taler of j's earnings. Any amount of the additional endowment p that remains unspent adds to i's payoff in that period.

The third dimension varies the level of transparency. This is introduced by changes in feedback information which agents receive on their group members' decisions before deciding upon their punishment points (under _PUN) and at the end of a period. In our experiment, each agent receives a random identification number. Under low transparency (denoted as _L) the identification number of the special agent is common knowledge within the group, the same is true under high transparency (denoted as _H). Moreover, under high transparency agents receive detailed information on the decisions by each individual group member at the punishment stage (if there is one) and the end of the period, while under non-transparency (denoted as _NT) neither the identification number of the special agent nor the detailed information on the decisions by each individual group member are common knowledge. In all treatments, information on the amount of Taler at the public good account A (i.e., $A = \sum_{i=1}^{n} a_i + E$) is provided at the punishment stage (if there is one) and the end of the period.

Overall, we present seven treatments, two symmetric treatments (SYM_L and SYM_H) and two asymmetric treatments (ASYM_L and ASYM_H) without punishment.[6] Finally, we have three asymmetric treatments with punishment ASYM_NT_PUN, ASYM_L_PUN, and ASYM_H_PUN varying the magnitude of transparency. Therefore, in the treatments without

[5] Note that special agents cannot extract the contributions of the other group members.

[6] We refrain from running symmetric punishment treatments, since this case is well documented and lies beyond the scope of this paper's focus. Likewise, we refrain from running symmetric and asymmetric treatments under non-transparency without accountability, since standard agents do not have any means to discipline the special agent only.

punishment, SYM_L, SYM_H, ASYM_L, and ASYM_H, the payoff to an agent i in the respective treatments is given by

$$\pi_i = w - a_i + h\left(E + \sum_{j=1}^{n} a_j\right) \tag{1}$$

where h denotes the per capita return from the public good with $1/n < h < 1$ and a_i denotes i's transfer to the public good account. In the experiment, we chose $n = 4$, $h = 0.4$, $w = 12$ and $E = 32$.

In contrast, in the treatments with punishment, ASYM_NT_PUN, ASYM_L_PUN, and ASYM_H_PUN, the payoff to an agent i in the respective treatments is given by

$$\pi_i = w + p - a_i + h\left(E + \sum_{j=1}^{n} a_j\right) - \sum_{j \neq i} p_{i \to j} - 3\sum_{j \neq i} p_{j \to i} \tag{2}$$

In the experiment, we choose $p = 5$;[7] Table 1 summarizes the experimental design.

All games are played repeatedly for ten periods. All parameters and payoff functions are common knowledge. At the end of each period, participants receive feedback: in the non-transparency and low transparency treatments they are shown information about their earnings and the final amount of Taler in the group account (i.e., the sum of Taler in the public good net of contributions to and extraction from the group account). In contrast, in the high transparency treatments subjects are also able to identify *individual* contributions to and extractions from the group account. Participants know that the experiment terminates after ten periods; the composition of the group remains constant throughout the entire 10 periods of the experiment (partner design).

An experimental session proceeded in the following way: once the participants were seated and logged into the terminals, a set of instructions was handed out and read out loud by the experimenter.[8] In order to ensure that subjects understood the respective game, experimental instructions included several numerical examples and participants had to answer nontrivial control questions via their computer terminals.[9] At the beginning of the experiment subjects were randomly assigned to groups of four. In the ASYM treatments, one member per group was randomly determined to be the special agent for all ten periods. All experimental sessions were conducted in the computer laboratory of the Faculty of Economic and Social Sciences, University of Hamburg, Germany in March to April 2011, April and October 2012. Each session lasted approximately one hour. We used z-Tree (Fischbacher, 2007) to program and ORSEE (Greiner, 2004) for recruiting. In total, 356 subjects participated in the experiment, providing 10 independent observations for SYM_L and SYM_H, 15 independent observations for ASYM_L, 13 independent observations for ASYM_H, 15 independent observations for ASYM_NT_PUN,

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7 Notice that one may argue that participants in the PUN treatments play the game differently because they are endowed with 5 additional Taler. In contrast, we believe that it is important to endow participants in the punishment treatments additionally so that they do not save Taler from their initial endowment (that they may contribute to the public good otherwise) for consecutive punishment.

8 We mainly followed the instructions of Fehr and Gächter (2000), but slightly changed the wording. For instance, instead of 'contributions to a project', instructions asked participants to divide tokens between a private and a group account. English translations of the German instructions are enclosed in Appendix C.

9 In case a participant did not answer the questions correctly, she was given a help screen that explained the correct sample answers in detail. We believe this might further reduce experimenter demand effects compared to individual talks with subjects. See Zizzo (2010) for more information on experimenter demand effects.

14 independent observations for ASYM_L_PUN, and 12 independent observations for ASYM_H_PUN.[10] Each subject participated only once. Subjects were students of a variety of academic backgrounds, including economics. At the end of the experiment, one of the periods was randomly selected as the period that determined earnings with an exchange rate of 1 Taler equal to 30 Euro Cents. Including a show-up fee of 6 Euro, the average payment over all treatments was 11.50 Euro. Table 2 summarizes the information for all 17 sessions.

3 Predictions

When agents are pure money maximizers, the standard predictions for our finitely repeated public goods game are zero contributions for standard agents while the special agent is predicted to take the maximal amount from the public account. These predictions are denoted by $a_i^S = -E$ for the special agent and $a_i^{\sim S} = 0$ for the standard (i.e., non-special) agents. They hold even when punishment is possible (notice that punishment is a second order public good: the person who distributes a punishment point bears its cost, while the entire group benefits from disciplining free-riders from the public good).

Despite the equilibrium prediction of zero contributions, an enormous number of experiments have demonstrated positive contributions by agents (e.g., Ledyard, 1995, Chaudhuri, 2011). Punishment combined with transparency turned out to sustain cooperation very successfully in symmetric group compositions (e.g., Fehr and Gächter, 2000, 2002). Social preferences (Meier, 2007), warm-glow of giving (Andreoni, 1990), and strategic considerations might explain such departures from the standard game theoretic prediction.

Transparency is likely to play an important role in allowing agents to conditionally cooperate (e.g., Fischbacher et al., 2001, Frey and Meier, 2004, Fischbacher and Gächter, 2011): one may suppose transparency to have an effect in asymmetric settings as it allows agents to coordinate their contributions across periods conditionally on type-specific behavior.[11] That is, transparency of actions allows standard agents to calculate the average contributions of other standard agents and adjust their contribution in the consecutive period towards the average (cf. Fischbacher and Gächter, 2010).[12]

Another reason for transparency to impact behavior is an individual concern for social reputation or self-esteem which has been discussed in contemporary economic literature (e.g., Bénabou and Tirole, 2006, Ellingsen and Johannesson, 2008, 2011): transparency directly reveals the actions and therefore potentially the motivational drivers of behavior. Without transparency, however, the action is not observable such that agents cannot directly impact their reputation through their

[10] Unequal number of independent observation is due to non-show-ups of participants for sessions.

[11] Recall that transparency has no effect on contribution rates in symmetric settings (e.g., Weimann, 1994), since one can easily compute average contributions from the sum of contributions in the non-transparent setting. Thus, we do not expect a significant difference in terms of contributions between SYM_L and SYM_H.

[12] Under low transparency, standard agents may only identify type-specific average contributions if extreme take-outs or contributions are revealed: (almost) full contributions by all standard and special agents (almost) maximize the sum of contributions, whereas sums of contributions below zero indicate take-outs by the special agent. Note that the special player can identify the average contribution levels of standard agents even without transparency as he receives information about the total provision level of the public good.

action. As a consequence, transparency may lead agents to give less or – in case of the special agent to take more from the public account. For example, special players who do not want to be identified as taking from the public good may still take out moderate amounts and "hide" behind (positive) contributions by standard players if actions are not transparent. Full transparency, however, does not allow such moderate taking such that agents may well decide to extract the maximum amount. In Appendix B, we present an illustrative model based on reputation concerns to show that the effect of transparency is ambiguous when no punishment options exist. Based on these findings, we formulate

Conjecture 1: *Increasing the degree of transparency may increase or decrease contribution.*

The introduction of punishment has been found to sustain cooperation under high transparency, even in the case of asymmetrically endowed agents (see, e.g., Reuben and Riedl, 2013). We interpret this as punishment under high transparency creating accountability. That is, standard agents can hold special agents accountable for their depletion of the initial public good, while both standard and special agents may hold non-cooperative standard agents accountable for not sufficiently contributing to the public good. As such, accountability may lead to higher cooperation rates.

The crucial question is how much accountability can be implemented with punishment under lower degrees of transparency. There is substantial evidence that subjects punish even when only being poorly informed about others' behavior (see, Ambrus and Greiner, 2012; Grechenig et al. 2010). In the non-transparent treatment, however, blind punishment cannot create accountability among non-cooperators and, thereby, harms the efficiency.[13] Conversely, low transparency allows stigmatization of the special agent (e.g., Altonji and Pierret, 2001). That is, the special agent may attract punishment due to statistical discrimination as ASYM_L_PUN allows standard agents to hold the special agent accountable for her (assumed) taking from the public good. Anticipating the stigmatization, it is important for the special agent to establish a high social esteem among all standard agents which may be achieved by increasing her contributions. We therefore formulate

Conjecture 2: *Increasing the degree of transparency increases contribution when punishment options exist.*

We discuss our experimental results on the effects of punishment and transparency and in their relations in the next section.

4 Results

We craft our results by first comparing the public good provision levels in the different treatments. In a second step we have a closer look at the underlying decisions of special and standard agents. For this purpose, we apply several non-parametric and parametric methods to disentangle the data. Third, we analyze the mechanism of when and how subjects use

[13] One may argue that the special agent has an informational advantage in ASYM_NT_PUN and ASYM_L_PUN since she can compute the average contributions of the standard agents. Assuming that standard agents' contributions are sufficiently homogenous, the special agent could create some degree of accountability by punishing all standard agents equally. We suppose, however, that this scenario is very unlikely.

punishment, and under which treatment conditions punishment influences behavior of standard and special agents.

4.1 Public Good Provision

Table 3 reports summary statistics. Figure 1 illustrates the mean contribution decisions for all treatments aggregated over all agent types. Figure 2 further illustrates the time-trends across the diverse treatments. Recall that the contribution decisions range from 0 to 12 Taler in the SYM treatments and in the ASYM treatments for standard agents, while special agents' decisions in the ASYM treatments range from -32 to 12 Taler. Therefore, the mean contribution decision in ASYM lies potentially between -8 and 12 Taler.

In the treatments with symmetric action sets, SYM_L and SYM_H, mean contributions over all ten periods amount to 4.84 and 5.71 Taler, respectively. A two-tailed Mann-Whitney (hereafter MW) test does not reject the null hypothesis of equal contributions in the two symmetric treatments over all ten periods (p = 0.4963) as well as in the final period (p = 0.1605).[14] We thus confirm the result of Weimann (1994) and Croson (2001) that transparency does not significantly influence contributions in symmetric settings. These treatments serve as a baseline.

The introduction of the extraction option to a special agent unsurprisingly significantly reduces these averages to 0.66 Taler in ASYM_L and -1.38 Taler in ASYM_H. MW tests comparing SYM_H and SYM_L with ASYM_H and ASYM_L over all ten periods and in period 10 yield p-values ranging from 0.0006 to 0.0244. The downward trend of contributions appears particularly severe under asymmetry (period 10 decision average at -2.73 Taler in ASYM_L and -5.65 Taler in ASYM_H). Interestingly, high transparency in ASYM_H tends to reduce the public good provision level compared to ASYM_L (MW tests over 10 periods p = 0.1172, final period p = 0.0335). As such, more transparency does not yield more cooperation and higher public good provision; bur rather tends to backfire. We further explore drivers of this finding below.

Turning to the three punishment treatments, we see that the contribution level of 0.18 Taler in ASYM_NT_PUN does not differ from ASYM_L and ASYM_H. However, punishment increases the contribution levels to 2.98 Taler in ASYM_L_PUN and 5.85 Taler in ASYM_H_PUN, respectively. Given the punishment opportunity, we therefore find that increases in the level of transparency lead to increases in the public good provision. Comparing ASYM_NT_PUN and ASYM_H_PUN over all ten periods a MW test reports a difference at p = 0.0147.[15] This reverses the effect obtained without punishment.

A linear regression analysis with random-effects specification that we report in Table 4 confirms these findings. Model I reveals that the combination of punishment and high transparency catalyzes contributions to the public good: contributions levels are significantly higher than in reference treatment of model I, ASYM_L. Conversely, the large negative (yet insignificant) coefficient of ASYM_H shows that contributions in that treatment are equal to and tend to be

[14] For all Mann-Whitney tests one observation is a group's mean contribution in a time interval. For instance, comparing SYM_S and SYM_F we analyze ten groups per treatment yielding ten observations for each treatment.

[15] Comparing ASYM_L_PUN and ASYM_H_PUN, transparency has a minor increasing impact on average contributions (MW test over all periods, p = 0.1648; final period ASYM_H_PUN > ASYM_L_PUN, p = 0.0883).

lower than in ASYM_L. That is, transparency without punishment does not lead to greater public good provision.

Taking a look at mean income in the different treatments tells a similar story.[16] Table 3 reports mean income for all treatments; they range from 23.97 Taler in ASYM_H to 29.03 Taler in ASYM_H_PUN. Note that these are the two asymmetric treatments with high transparency – only that the punishment opportunity turns the impact of transparency from being detrimental to mean income to being beneficial for income. MW tests with mean incomes per group as independent observations reveal incomes differences such that on average agents in ASYM_H earn significantly less compared to SYM_L ($p = 0.0013$), SYM_H ($p = 0.0008$), ASYM_NT_PUN ($p = 0.0322$), ASYM_L_PUN ($p = 0.0369$) and ASYM_H_PUN ($p = 0.0502$), while agents in ASYM_L earn significantly less compared to SYM_L ($p = 0.0198$) and SYM_H ($p = 0.0047$); all other differences between treatments are insignificant (i.e., $p>0.05$). Figure 3 illustrates mean income levels by agent types.

4.2 Disentangling Standard and Special Agents

We now discuss the differences between the underlying decisions of special and standard agents in more detail. Figure 4 separates the contribution decisions by special and standard agents. Obviously, special agents in ASYM_H extract more Taler from the public good than special agents in ASYM_L (-19.95 vs. -10.51). Using an individual's mean contribution over the ten periods as the unit of observation, a MW test shows that this difference is significant ($p = 0.0421$). That is, our experimental findings qualify **Conjecture 1** such that higher transparency leads special agents to contribute substantially *less* to the public good. Conversely, contributions of standard agents in both ASYM_L (4.38 Taler) and ASYM_H (4.81 Taler) do not differ significantly (MW test, $p = 0.3941$). They also do not differ from the average contributions in the symmetric treatments. We thus deduce that a negative effect of transparency on public good provision is caused by lower contribution levels of special agents.

Regression model IV in Table 4 supports this finding. Additionally controlling for time trends by including the dummy variable Period 6_10 and its interactions with treatment dummies, model V shows no different time trend between ASYM_H and the reference treatment ASYM_L. We therefore formulate the following result:

> **Result 1:** *High transparency without punishment backfires: special agents exploit the public good to a larger extent when their actions are transparent.*

In line with our reputational preference model (see Appendix), selfish special agents exploit the moral wiggle room in the low transparency treatment. Conversely, with high transparency, special agents avoid as being identified as taker by choosing moderate extraction rates such that taking

[16] Notice that comparing payoffs of public goods games with and without punishment is by no means a trivial task: Punishment devastates efficiency, which depends crucially on marginal destruction rate of punishment points, while it (usually) facilitates efficiency by means of higher contributions. In addition, agents receive an additional endowment for punishment in our experiment for good reasons (see footnote 8). Hence, evaluating income effects between non-punishment and punishment treatments is very sensitive with respect to parameters. Here, we simply compare incomes including the additional endowment.

may increase. It is important to stress that this effect is not due to conditionally cooperating standard agents: additional taking by the special agent in ASYM_H does not induce standard agents to reduce their contributions significantly (see Figure 4). In line with the non-parametric results reported above, the regression in Table 4, model II and III, do not show a significant difference between ASYM_L as a baseline and ASYM_H or the symmetric treatments. We discuss this point in greater detail below.

The non-parametric results already indicated the potential benefits from punishment options. Depending on the magnitude of transparency, punishment makes agents accountable for their actions. As discussed above and shown by the results across Table 4, punishment in ASYM_NT_PUN is not able to foster contributions and results are very similar to ASYM_L. Table 4 however reveals quite different effects for the respective types of agents when there is low or high transparency: for special agents, we find significant positive coefficients, both for 'ASYM_L_PUN' and 'ASYM_H_PUN' in model IV and for 'ASYM_L_PUN x Period 6_10' and 'ASYM_H_PUN x Period 6_10' in model V, respectively. This result confirms **Conjecture 2**. In other words, in comparison with the reference treatment (ASYM_L), punishment leads to significantly larger contributions with this difference even becoming more pronounced in later periods. However, there is no significant difference between the coefficient for ASYM_L_PUN and ASYM_H_PUN (F-test p=0.873 in model IV) or the respective time trends implying that stigmatization under low transparency allows for accountability of special agents' behavior and similar contribution rates as punishment under high transparency.

> **Result 2:** *Punishment options under low and high transparency improve the cooperativeness of special agents.*

In contrast, we find a different picture for standard agents. Figure 4 shows the mean contributions for standard agents separately. Here, punishment with non- or low transparency does *not* lead to increased contributions. Punishment and high transparency, however, complement each other in the sense that they also create accountability for standard agents and contribution levels increase when both apply (i.e., in ASYM_H_PUN). Table 4, models II and III confirm these results: only coefficients for ASYM_H_PUN and 'ASYM_H_PUN x Period 6_10' are significantly positive. In consequence, the treatment condition with punishment and transparency is the only one where contributions of standard agents are stable over time, while they follow the typical decreasing pattern in all other treatment conditions.

> **Result 3:** *Transparency complements punishment for standard agents: if punishment is introduced under high transparency standard agents increase their contributions to the public good.*

In order to gain additional insights into the channels through which transparency and punishment affect the contribution decisions of standard and special agents, we now have a closer look at the temporal nature of decisions. As mentioned earlier, one obvious channel is conditional cooperation: higher degrees of transparency allow agents to condition their own contributions more specifically on the contributions of other group members – this channel could apply even without punishment. The threat of explicit punishment could provide another channel: without transparency punishment could only be conditioned on average contributions of others and the type of the group member, while punishment can be better targeted if actions are transparent.

To study conditional cooperation, we first concentrate on the actions of standard agents. Table 5 reports results from regression models which, for each treatment, analyze the relation between contributions by standard agents and their group members' choices in the previous period ("t-1"). Along the variable "individual's own contribution in t-1", we introduce the variable "group contribution in t-1" denoting in the symmetric treatments and the asymmetric treatments with no or low transparency the total contributions of all other three group members. In ASYM_H and ASYM_H_PUN, however, this variable denotes the total contributions by the other two standard agents in the group, while we separate the effect of the decision of the special agent by incorporating the separate variable "the special agent's contribution in t-1."

We find that standard agents positively reciprocate on the other agents' contributions: the larger the average contribution from other agents in the previous period is, the more the agent contributes. However, when transparency allows to condition actions on previous contributions from fellow standard agents and the special agents, we see that the impact from previous period contributions of the special agent tends to be smaller than the one from other standard agents.[17] That is, agents appear to be influenced more strongly by agents of their own type. As a consequence, the larger exploitation of the public good by the special agent in ASYM_H relative to ASYM_L may not induce standard agents to reduce their own contributions too much as transparency allows them to delink their actions from the special agent by comparing their actions with those fellow agents of their own type. We summarize this discussion in the following result:

Result 4: *Conditional cooperation of standard agents tends to focus on agents of the same type.*

Result 4 demonstrates that standard agents focus with their conditional cooperation – which is implicit punishment of other agents through reducing their own contributions – on agents of the own type. That is, the pure introduction of taking options for only a subset of agents generates some in-group behavior. Result 4 receives support when we analyze conditional cooperation of special agents. Table 6 presents similar specification as Table 5, but this time for special agents. In four out of five asymmetric treatments we do not find conditional cooperation of special agents with regard to the contributions of standard agents; in the remaining case the coefficient is significant only at the 10 percent level. We will now analyze in the next step how the use of explicit punishment is affected by the transparency of the actions.

4.3 The Use of Punishment

Overall, we find no significant difference between the numbers of punishment points between treatment conditions (mean in ASYM_NT_PUN is 0.86, in ASYM_L_PUN 0.99, in ASYM_H_PUN is 1.07, for all MW tests $p > 0.1$), although there is tendency that higher transparency leads to more punishment. Interestingly, although special agents have an

[17] This tendency is not statistically significant. The coefficient "group contribution in t-1" is larger than the coefficient "the special agent's contribution in t-1", p=0.106 in model IX, p=0.186 in model XI.

informational advantage in ASYM_NT_PUN and ASYM_L_PUN in the sense that they can compute the sum (and the average) of standard agents' contributions, there is no significant difference in the use of punishment between special agents (mean in ASYM_NT_PUN is 0.88, in ASYM_L_PUN 1.04) and standard agents (mean is 0.87 in ASYM_NT_PUN; 0.97 in ASYM_L_PUN).

Important insights can be obtained, however, by investigating who receives punishment. Table 3 provides summary statistics of punishment points assigned to standard and special agents in ASYM_NT_PUN, ASYM_L_PUN and ASYM_H_PUN. In ASYM_NT_PUN standard agents and special agents on average receive 0.69 and 0.93 punishment points, respectively. This difference is not statistically significant. Not surprisingly, non-transparency both with regard to identity and actions makes it impossible to sanction special agents even though the punishment opportunity is available.

Standard agents in ASYM_L_PUN receive 0.55 punishment points on average and 0.69 punishment points in ASYM_H_PUN. Special agents receive on average 2.30 punishment points in ASYM_L_PUN and 2.21 punishment points in ASYM_H_PUN. Special agents thereby receive substantially higher punishment than standard agents (MW test, $p = 0.0007$) once their identity is revealed, while the change from low to high transparency neither affects the magnitude of punishment of special nor of standard agents.

This result indicates an important stigma (or statistical discrimination) effect: even though individual actions are not observable in ASYM_L_PUN, primarily special agents receive punishment. This holds even when controlling for the individual and group contribution level as is shown in Table 7. Estimation IIXX report results from a linear regression with random-effects specification that controls the punishment points received by an agent on her type (standard being the baseline), the treatment condition, an interaction term of both the agent type and the treatment condition, her own contribution decision, the group contribution (excluding her own contribution), and time effects. The agent's own contribution has a significant and negative effect on the number of punishment points received and the higher the contributions of others are, ceteris paribus, the more punishment is given to the agent. In the baseline treatment of specification IIXX, ASYM_L_PUN, special agents attract more punishment than standard agents. Hence, punishment and behavior are directly related even under low transparency, as expected.

High transparency changes the assignment of punishment points in two manners. While transparency generally increases the number of received punishment, the interaction of special agents in ASYM_H_PUN shows that punishment of special agents is reduced. Hence, transparency shifts a share of the punishment away from the (stigmatized) special agent to all agents and the stigma is lifted. This finding is reported by the fact that the joint effect of the special agent dummy (1.339, $p = 0.001$) and the interaction effect of special agents and high transparency ("ASYM_H_PUN x special agent") (-0.568, $p = 0.447$) is not significantly different from zero (Chi square test, $p = 0.1876$). We formulate the following result:

> **Result 5:** *With possible stigmatization but without transparency of individual actions, special agents are discriminated against by receiving significantly more punishment points.*

Result 5 shows statistical discrimination against special agents. Their stigma that – just because they potentially take from the public good – they will (probably) be responsible for an apparent low total provision level, leads them to receive more punishment points. Thus punishment based on stigmatization creates accountability for special agents under low transparency. As a consequence, they try to reduce this punishment by contributing more and thereby increasing the provision level of the public good, even if actions are not transparent.

We finally have a closer look at the drivers of getting punished and the punishment magnitude separately. We employ a double hurdle model as this method is able to let us understand the drivers of punishment more thoroughly. In our experiment the idea underlying Cragg (1971)'s approach is as follows: the decision process of whether or not to assign punishment points to group members may not be the same process determining how many punishment points to assign.[18] Hence the first hurdle, a Probit model, analyzes the drivers of the *probability* of being punished. The second hurdle, a linear regression truncated at zero (i.e., only observations with positive amounts of punishment points are taken into consideration), estimates the drivers of the punishment *intensity*. The estimation results are also reported in Table 7, so that they are easily comparable to the random-effects estimation results.

We, again, confirm that higher own contribution to the public good reduces both the punishment likelihood and the magnitude of punishment. Interestingly, the first hurdle reports that the probability of punishment is not higher in ASYM_NT_PUN and ASYM_H_PUN compared to ASYM_L_PUN; the magnitude of punishment increases however. This result indicates that punishment will get more severe due to fact that agents are certain about group members' contributions in ASYM_H_PUN. Hence, transparency of actions appears to clear the doubt about whether a punishment is just or not and thereby increases intensity. Like in the random-effects estimation, the hurdle model provides further evidence that special agents both have a higher likelihood of getting punished and higher punishment intensity – yet only when there is low transparency. In ASYM_H_PUN this effect disappears by the interaction effect of special agent and ASYM_H_PUN. The results from the hurdle model thereby provide evidence that transparency shifts the focus of punishment from punishing mainly special agents to including defecting standard agents as well. In summary, we find

> **Result 6:** *Full transparency of actions lifts the stigma of special agents such that targeted punishment of non-cooperative special and standard agents applies.*

Taken together, Results 5 and 6 indicate an important channel through which transparency of identity and actions affect individual contribution decisions: when individual actions are not transparent, punishment is targeted towards those agents that are most likely to have contributed less, that is, the special agents who had the option to take from the public good. This statistical discrimination against special agents has two effects: (i) special agents contribute more in the hope of being punished less, (ii) standard agents do not have to fear punishment and therefore contribute not differently than without punishment. Transparency of individual

[18] This analysis is commonly used in the literature, e.g., by Nikiforakis (2008, 2010). We employ Burke (2009)'s STATA command *craggit*.

actions eliminates the stigma of special agents such that they receive punishment for their actions not differently from standard agents. In consequence, in ASYM_H_PUN standard agents are disciplined to contribute more to the public good as well.

5 Conclusion

Functioning societies rely on implementing mechanisms that ensure a sufficient provision of public goods by (self-interested) individuals. In this paper, we provide insights into the interplay of transparency and accountability in achieving this goal when cooperation within groups is voluntary.

Importantly, we find that transparency may backfire in classical social dilemma situations when agents differ with respect to their available actions: agents with a taking option extract more when actions are transparent. This behavior is consistent with attempts to avoid a negative social image or reputation from being identified as taking from the public account: without transparency, selfish special agents can exploit a moral wiggle room (e.g., Dana et al., 2007) as moderate taking cannot be identified. With high transparency (of identity and actions), the moral wiggle room disappears such that keeping the reputation for special players becomes costlier. Transparency also impacts decisions via a different channel: it allows agents to compare their behavior with agents of their own type. While this does not significantly change the average contributions by standard agents, we identify a peer-group effect: standard agents reciprocate primarily on the decisions of their own type such that they decouple their contribution from those of the special agent whose increased taking thereby is not sanctioned.

An explicit peer-punishment stage significantly changes the effects of transparency: combined with punishment, transparency has a positive social value. Under low transparency (only of identity, not of actions), however, special agents are stigmatized as potential extractors and therefore are more likely to receive punishment. This stigmatization appears to create sufficient accountability for special agents' actions who respond by contributing more to the public good. High transparency eliminates this statistical discrimination. It allows targeted punishment such that agents of all types are punished based on their actual actions and not based on their type. High transparency thereby particularly increases the punishment threat for standard agents and, consequentially, their contributions. As such, we find transparency and punishment to serve as complements in generating higher voluntary contributions to the public good. Hence, both transparency and punishment are necessary conditions to overcome the social dilemma of the provision of public goods.

Our results are important on several fronts. First, the impact of transparency is crucially affected by heterogeneities of agents, e.g., with respect to their action space. Potential applications reach from environmental problems to the problem of corruption or tax evasion where some agents have better access to privately beneficial options to the expense of the public. Second, punishment without or with low transparency may lead to misled punishment of some agents just based on perceived differences in actions available to them. As such, transparency and punishment may not only be complements in increasing the provision of public goods, but also be effective in reducing the negative effects of stigma. Third, and most important, the findings indicate the importance of calls by policymakers, NGOs or consumer organizations to increase transparency and accountability of publicly relevant actions (e.g., by civil servants, or managers): high transparency (in combination with punishment) is necessary condition to make *all* agents accountable for their actions.

It will be interesting to extend the scope of our results. For instance, while we imposed transparency and punishment conditions exogenously, it would be worthwhile studying how different individuals may voluntarily make their actions transparent or increase their accountability in order to provide signals of pro-social intentions. We leave investigations of such voluntary disclosure and their interaction with exogenously imposed transparency or sanction mechanisms for future research.

References

Alchian, A.A. and H. Demsetz (1972). "Production, information costs, and economic organization". *The American Economic Review*, vol. 62, 777-795.

Altonji, J.G. and Pierret, C.R. (2001). "Employer learning and statistical discrimination", *Quarterly Journal of Economics*, vol. 116, pp. 313-350.

Ambrus, A. and B. Greiner (2012). "Imperfect public monitoring with costly punishment – An experimental study". *The American Economic Review*, vol. 102, pp. 3317-3332.

Andreoni, J. (1990). "Impure altruism and donations to public goods: A theory of warm-glow giving". *The Economic Journal*, vol. 100, pp. 464-477.

Andreoni, J. (1995). "Warm-glow versus cold-prickle: The effects of positive and negative framing on cooperation in experiments". *The Quarterly Journal of Economics*, vol. 110, pp. 1-21.

Angeletos, G.-M., and A. Pavan (2007). "Efficient use of information and social value of information". *Econometrica*, vol. 75, pp. 1103-1142.

Arrow, K.J. (1972). "Models of job discrimination" in: A.H. Pascal (ed.), *Racial Discrimination in Economic Life,* pp. 83-102, Lexington, MA: Lexington Books.

Arrow, K.J. (1973). "The theory of discrimination" in: O. Ashenfelter and A. Rees (eds.), *Discrimination in Labor Markets*, pp. 3-33, Princeton: Princeton University Press.

Bag, P. K., and N. Pepito (2011). "Double-edged transparency in teams". *Journal of Public Economics*, vol. 95, pp. 531-542.

Bardsley, N. (2008). "Dictator game giving: altruism or artifact?". *Experimental Economics*, vol. 11, pp. 122-133.

Becker, G.S. (1957). *The Economics of Discrimination*. Chicago: The University of Chicago Press.

Benabou, R. and J. Tirole (2006). "Incentives and prosocial behavior". *The American Economic Review*, vol. 96, pp. 1652-1678.

Bohnet, I. and B.S. Frey (1999). "The sound of silence in prisoner's dilemma and dictator games". *Journal of Economic Behavior & Organization*, vol. 38, pp. 43-57.

Buckley, E. and R. Croson (2006). "Income and wealth heterogeneity in the voluntary provision of linear public goods". *Journal of Public Economics*, vol. 90, pp. 935-955.

Burke, W.J. (2009). "Fitting and interpreting Cragg's tobit alternative using Stata". *Stata Journal*, vol. 9, pp. 584-592.

Chan, K.S., S. Mestelman, R. Moir, and R.A. Muller (1999). "Heterogeneity and the voluntary provision of public goods". *Experimental Economics*, vol. 2, pp. 5-30.

Chaudhuri, A. (2011). "Sustaining cooperation in laboratory public goods experiments: a selective survey of the literature". *Experimental Economics*, vol. 14, pp. 47-83.

Cherry, T.L., S. Kroll, and J. Shogren (2005). "The impact of endowment heterogeneity and origin on public good contributions: Evidence from the lab". *Journal of Economic Behavior & Organization*, vol. 57, pp. 357-365.

Cornand, C., and F. Heinemann (2008). "Optimal degree of public information dissemination". *The Economic Journal*, vol. 118, pp. 718-742.

Cornand, C., and F. Heinemann (2013). "Measuring agents' reaction to private and public information in games with strategic complementarities". *Experimental Economics*, vol. 17, pp. 61-77.

Cox, J.C., E. Ostrom, V. Sadiraj and J.M. Walker (2012). "Provision versus appropriation in symmetric and asymmetric social dilemmas". *Southern Economic Journal*, vol 79, pp. 496–512.

Cragg, J.G. (1971). "Some statistical models for limited dependent variables with application to the demand for durable goods". *Econometrica*, vol. 39, pp. 829-844.

Croson, R.T.A. (2001). "Feedback in voluntary contribution mechanisms: An experiment in team production". *Research in Experimental Economics*, vol. 8, pp. 85-97.

Dana, J., R. A. Weber and J. X. Kuang (2007). "Exploiting moral wiggle room: Experiments demonstrating an illusory preference for fairness". *Economic Theory*, vol. 33, pp. 1432-1479.

Dufwenberg, M., and G. Kirchsteiger (2004). "A theory of sequential reciprocity". *Games and Economic Behavior,* vol. 47, pp. 268-298.

Ellingsen, T., and M. Johannesson (2008). "Pride and prejudice: The human side of incentive theory". *The American Economic Review*, vol. 98, pp. 990-1008.

Ellingsen, T., and M. Johannesson (2011). "Conspicuous generosity". *Journal of Public Economics*, vol. 95, pp. 1131-1143.

Fehr, E. and S. Gächter (2000). "Cooperation and punishment in public goods experiments". *The American Economic Review*, vol. 90, pp. 980-994.

Fehr, E., and S. Gächter (2002). "Altruistic punishment in humans". *Nature*, vol. 415, pp. 137-140.

Fischbacher, U. (2007). "Z-Tree: Zurich toolbox for ready-made economic experiments". *Experimental Economics*, vol. 10, pp. 171-178.

Fischbacher, U., S. Gächter and E. Fehr (2001). "Are people conditionally cooperative? Evidence from a public goods experiment". *Economics Letters*, vol. 71, pp. 397-404.

Fischbacher, U. and S. Gächter (2010). "Social preferences, beliefs, and the dynamics of free riding in public goods experiments". *American Economic Review,* vol. 100, pp. 541-556.

Fisher, J., R.M. Isaac, J.W. Schatzberg, and J.M. Walker (1995). "Heterogeneous demand for public goods: Behavior in the voluntary contributions mechanism". *Public Choice*, vol. 85, pp. 249-266.

Frey, B.S. and S. Meier (2004). "Social comparisons and pro-social behavior: testing 'conditional cooperation' in a field experiment". *The American Economic Review*, vol. 94, pp. 1717-1722.

Gächter, S., E. Renner and M. Sefton (2008). "The long-run benefits of punishment". *Science*, vol. 322, pp. 1510-1510.

Glöckner, A., B. Irlenbusch, S. Kube, A. Nicklisch, and H.-T. Normann (2011). "Leading with(out) sacrifice? A public-goods experiment with a privileged player". *Economic Inquiry*, vol. 49, pp. 591-597.

Gneezy, U., J.A. List and M.K. Price (2012). *Toward an understanding of why people discriminate: evidence from a series of natural field experiments*. Working Paper.

Grechenig, K., A. Nicklisch and C. Thöni (2010). "Punishment despite reasonable doubt – A public goods experiment with sanctions under uncertainty". *Journal of Empirical Legal Studies*, vol. 7, pp. 847-867.

Greiner, B. (2004). "An online recruitment system for economic experiments", in: Kremer, K. and V. Macho (eds.), *Forschung und wissenschaftliches Rechnen 2003*. GWDG Bericht 63, Göttingen: Ges. für Wiss. Datenverarbeitung, pp. 79-93.

Gürerk, Ö., B. Irlenbusch, and B. Rockenbach (2006). "The competitive advantage of sanctioning institutions". *Science*, vol. 312, pp. 108-111.

Herrmann, B., C. Thöni, and S. Gächter (2008). "Antisocial punishment across societies". *Science*, vol. 319, pp. 1362-1367.

Holmström, B. (1979). "Moral hazard and observability". *Bell Journal of Economics*, vol. 10, pp. 74-91.

Isaac, R., K. McCue, and C. Plott (1985). "Public good provision in an experimental environment". *Journal of Public Economics*, vol. 26, pp. 51-74.

James J., and P. Lawler (2011). "Optimal policy intervention and the social value of public information". *The American Economic Review*, vol. 101, pp. 1561-1574.

Kaufmann, D., and A. Bellver (2005). "Transparenting transparency: Initial empirics and policy applications", World Bank Policy Research Working Paper.

Khadjavi, M. and A. Lange (2014). *Doing Good or Doing Harm – Experimental Evidence on Giving and Taking in Public Good Games*. Working Paper.

Kolstad, I., and A. Wiig (2009). "Is transparency the key to reducing corruption in resource-rich countries?" *World Development*, vol. 37, pp. 521-532.

Ledyard, J.O. (1995). "Public goods: A survey of experimental research". In: Kagel, J.H. and A.E. Roth (eds.), *Handbook of Experimental Economics*. Princeton: Princeton University Press, pp. 111-194.

Levy, G. (2007). "Decision making in committees: Transparency, reputation and voting rules". *The American Economic Review*, vol. 97, pp. 150-168.

Lindstedt, C. and D. Naurin (2010). "Transparency is not enough: Making transparency effective in reducing corruption". *International Political Science Review,* vol. 31, pp. 301-322.

List, J.A. (2004). "The nature and extent of discrimination in the marketplace: Evidence from the field". *Quarterly Journal of Economics*, vol. 119, pp. 49-89.

List, J.A. (2007). "On the interpretation of giving in dictator games". *Journal of Political Economy*, vol. 115, pp. 482-493.

Lorenzoni, G. (2010). "Optimal monetary policy with uncertain fundamentals and dispersed Information". *Review of Economic Studies*, vol. 77, pp. 305-338.

Meier, S. (2007). "A survey of economic theories and field evidence on pro-social behavior". In: Frey, B.S. and A. Stutzer (eds.), *Economics and Psychology – A Promising New Cross-Disciplinary Field*. Cambridge: MIT Press, pp. 51-87.

Morris, S., and H.S. Shin (2002), "Social value of public information." *The American Economic Review*, vol. 92, pp. 1522-1534.

Nikiforakis, N. (2008). "Punishment and counter-punishment in public good games: Can we really govern ourselves?" *Journal of Public Economics*, vol. 92, pp. 91-112.

Nikiforakis, N. (2010). "Feedback, punishment and cooperation in public good experiments". *Games and Economic Behavior*, vol. 68, pp. 689-702.

Obama, B. (2009). Memorandum for the heads of executive departments and agencies - Subject: Transparency and open government. In: *General Services Administration: Transparency and Open Government, Intergovernmental Solutions Division.* GSA Office of Citizens Services and Communications, Washington DC, p. 4.

Ostrom, E., J. Walker, and R. Gardner (1992). "Covenants with and without a sword: self-governance is possible". *American Political Science Review*, vol. 86, pp. 404-417.

Palfrey, T.R. and J.E. Prisbrey (1997). "Anomalous behavior in public goods experiments: How much and why?" *The American Economic Review*, vol. 87, pp. 829-846.

Phelps, E.S. (1972). "The statistical theory of racism and sexism". *The American Economic Review*, vol. 62, pp. 659-661.

Prat, A. (2005). "The wrong kind of transparency". *The American Economic Review*, vol. 95, pp. 862-877.

Rabin, M. (1993). "Incorporating fairness into game theory and economics". *The American Economic Review*, vol. 83, pp. 1281-1302.

Reuben, E. and A. Riedl (2009). "Public goods provision and sanctioning in privileged groups". *Journal of Conflict Resolution*, vol. 53, pp. 72-93.

Reuben, E. and A. Riedl (2013). "Enforcement of contribution norms in public good games with heterogeneous populations". *Games and Economic Behavior*, vol. 77, pp. 122-137.

Sadrieh, A. and H. Verbon (2006). "Inequality, cooperation, and growth: An experimental study". *European Economic Review*, vol. 50, pp. 1197-1222.

Samak, A.C., and R.M. Sheremeta (2013). *Visibility of Contributors and Cost of Information: An Experiment on Public Goods*. Working Paper.

Segerson, K. (1988). "Uncertainty and incentives for nonpoint pollution control". *Journal of Environmental Economics and Management,* vol. 15, pp. 87-98

van Dijk, F., J. Sonnemans, and F. van Winden (2002). "Social ties in a public good experiment". *Journal of Public Economics*, vol. 85, pp. 275-299.

Weimann, J. (1994). "Individual behaviour in a free riding experiment". *Journal of Public Economics*, vol. 54, pp. 185-200.

Yamagishi, T. (1986). "The provision of a sanctioning system as a public good". *Journal of Personality and Social Psychology*, vol. 51, pp. 110-116.

Zizzo, D.J. (2010). "Experimenter demand effects in economic experiments". *Experimental Economics*, vol. 13, pp. 75-98.

Zussman, A. (2013). "Ethnic discrimination: Lessons from the Israeli online market for used cars". *Economic Journal*, vol. 123, pp. 433-468.

Appendix A: Figures and Tables

Figure 1. Decisions in all Treatments, averaged across all Agent Types.

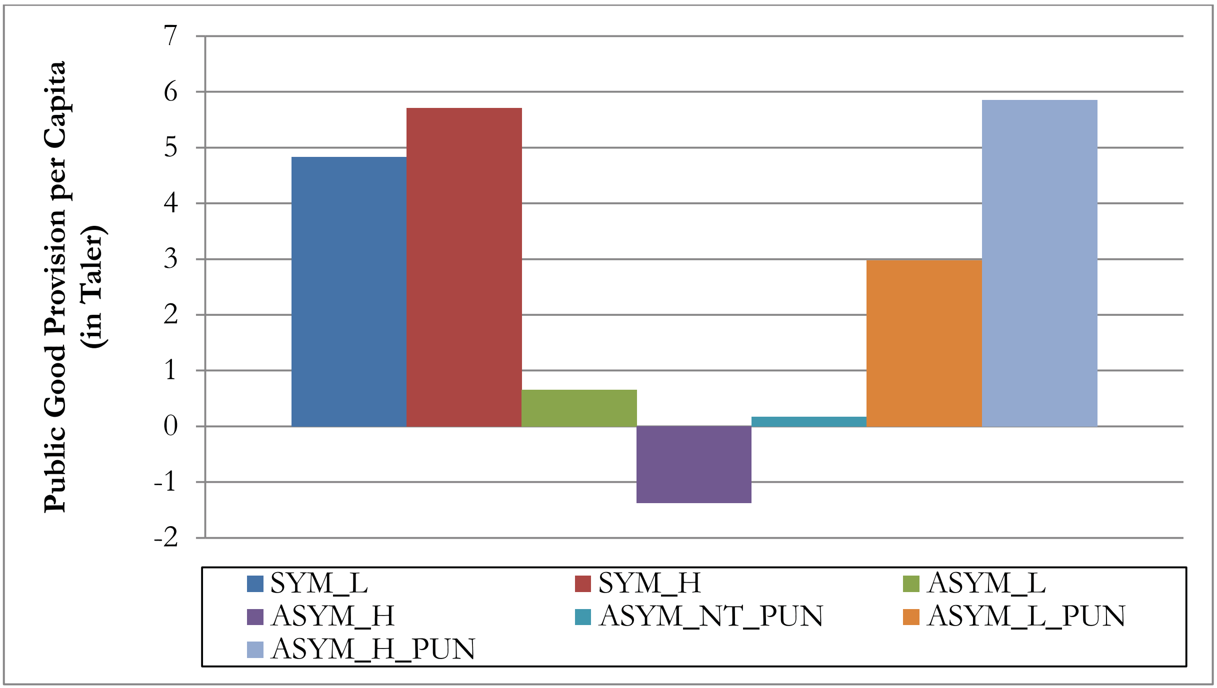


Figure 2. Public Good Provision in all Six Treatments, by Period.

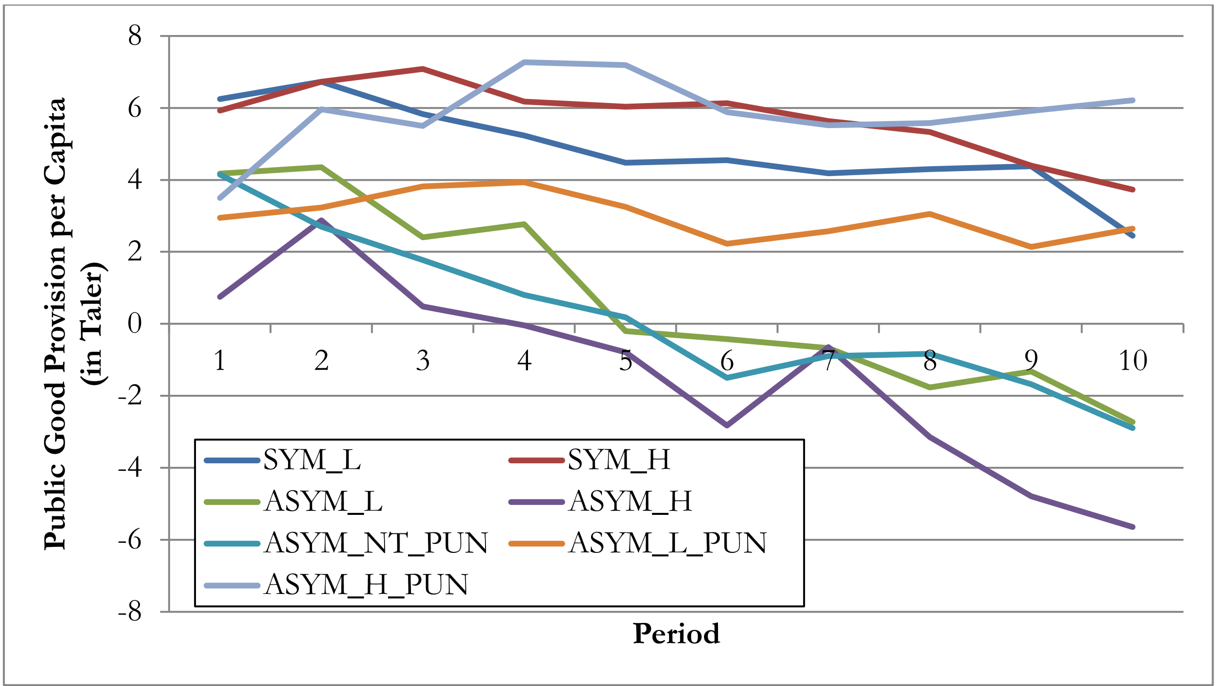


Figure 3. Mean Income in the Asymmetric Treatments, by Agent Types.

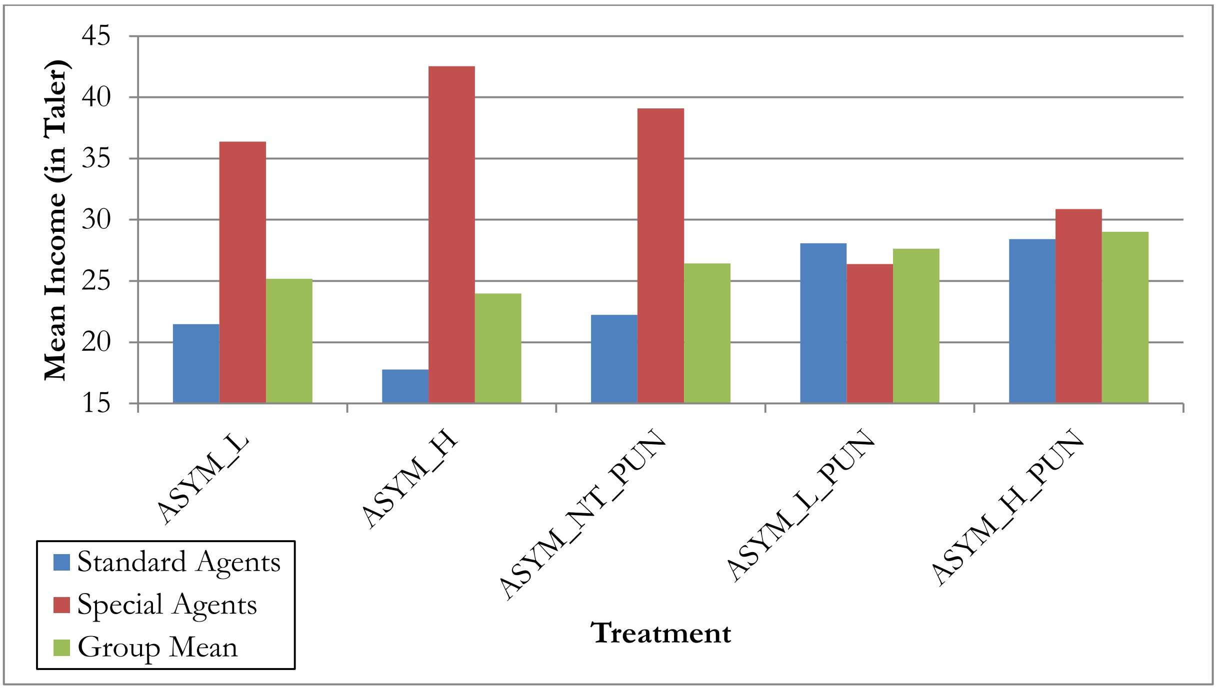


Figure 4. Decisions in all Treatments, by Agent Types.

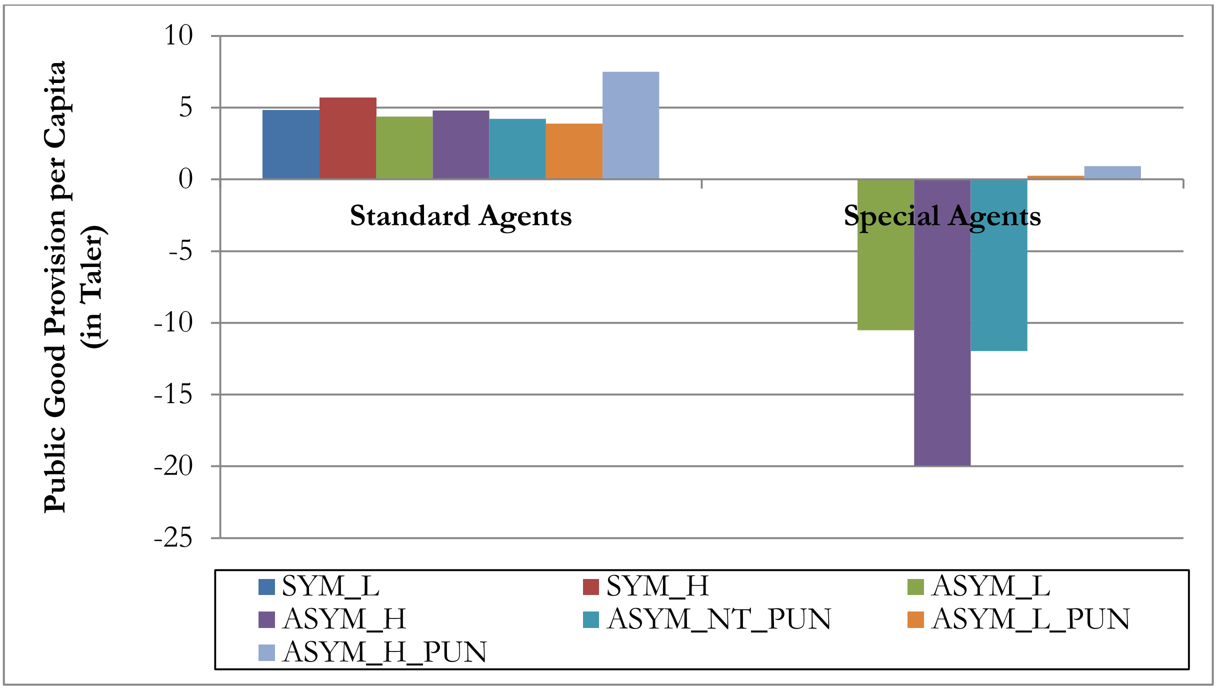


Table 1. Experimental Design.

<table>
<tr><td colspan="2"></td><td colspan="3">One Special (Give-and-Take) Agent?</td></tr>
<tr><td colspan="2"></td><td>No</td><td colspan="2">Yes</td></tr>
<tr><td rowspan="3">Transparency of Individual Contributions</td><td>None
(neither identity nor actions)</td><td></td><td></td><td>ASYM_NT_PUN</td></tr>
<tr><td>Low
(identity but not actions)</td><td>SYM_L</td><td>ASYM_L</td><td>ASYM_L_PUN</td></tr>
<tr><td>High
(both identity and actions transparent)</td><td>SYM_H</td><td>ASYM_H</td><td>ASYM_H_PUN</td></tr>
<tr><td colspan="2"></td><td colspan="2">No</td><td>Yes</td></tr>
<tr><td colspan="2"></td><td colspan="3">Punishment Stage?</td></tr>
</table>

Table 2. Summary of Experiment Sessions.

Session	Number of groups	Number of participants	Treatment
1	5	20	ASYM_L
2	5	20	SYM_L
3	6	24	ASYM_L
4	5	20	SYM_L
5	5	20	ASYM_H
6	4	16	ASYM_H
7	5	20	SYM_H
8	4	16	ASYM_H
9	5	20	SYM_H
10	4	16	ASYM_L
11	6	24	ASYM_H_PUN
12	7	28	ASYM_L_PUN
13	7	28	ASYM_L_PUN
14	6	24	ASYM_H_PUN
15	5	20	ASYM_NT_PUN
16	5	20	ASYM_NT_PUN
17	5	20	ASYM_NT_PUN

Note: Numbers of groups across treatments are not equal due to some registered subjects not showing up.

Table 3. Summary Statistics.

	All 10 periods (means)						
Statistic	SYM_L	SYM_H	ASYM_L	ASYM_H	ASYM_NT_PUN	ASYM_L_PUN	ASYM_H_PUN
Mean decision	4.84 (4.42)	5.71 (4.44)	0.66 (11.62)	-1.38 (14.78)	0.18 (11.52)	2.98 (7.32)	5.85 (9.41)
Mean decision of *standard* agents	4.84 (4.42)	5.71 (4.44)	4.38 (4.27)	4.81 (4.79)	4.23 (4.19)	3.89 (4.05)	7.49 (5.18)
Mean decision of *special* agents	-	-	-10.51 (17.89)	-19.95 (18.59)	-11.97 (16.81)	0.25 (12.49)	0.93 (15.59)
Mean pun. points	-	-	-	-	0.87 (1.46)	0.99 (1.99)	1.07 (2.38)
Mean pun. points to *special* agents	-	-	-	-	0.69 (1.29) *(agent types are unknown here)*	2.30 (3.30)	2.21 (3.79)
Mean pun. points to *standard* agents	-	-	-	-	0.93 (1.51) *(agent types are unknown here)*	0.55 (0.95)	0.69 (1.49)
Mean income	27.70 (3.59)	28.23 (3.75)	25.19 (10.75)	23.97 (13.96)	26.44 (12.07)	27.65 (7.32)	29.03 (8.47)
Mean income of *standard* agents	27.70 (3.59)	28.23 (3.75)	21.47 (8.03)	17.78 (8.28)	22.22 (9.58)	28.07 (7.41)	28.41 (8.45)
Mean income of *special* agents	-	-	36.37 (10.14)	42.55 (10.67)	39.11 (9.65)	26.38 (6.91)	30.87 (8.31)

Note: Standard deviations in parentheses.

Table 4. Linear Regressions of Contributions to the Public Good.

	Dependent Variable: Contribution				
	I	II	III	IV	V
	all treatments	all treatments	all treatments	only asymmetric treatments	only asymmetric treatments
Independent Variable	all agents	only *standard* agents	only *standard* agents	only *special* agents	only *special* agents
SYM_L	4.177*** (1.247)	0.453 (0.962)	0.704 (1.075)		
SYM_H	5.054*** (1.234)	1.330 (0.944)	1.389 (0.975)		
ASYM_H	-2.037 (1.569)	0.431 (0.821)	0.969 (0.895)	-9.441** (4.812)	-11.062** (5.441)
ASYM_L_PUN	2.324* (1.344)	-0.489 (0.859)	-0.581 (0.970)	10.763*** (3.932)	4.700 (4.338)
ASYM_H_PUN	5.194*** (1.850)	3.112** (1.344)	2.193* (1.326)	11.438** (4.527)	6.167 (4.599)
ASYM_NT_PUN	-0.480 (1.440)	-0.156 (0.728)	0.204 (0.860)	-1.453 (4.415)	-3.720 (4.405)
Period 6_10			-1.227** (0.473)		-12.627*** (3.715)
SYM_L x Per6_10			-0.503 (0.794)		
SYM_H x Per6_10			-0.118 (0.626)		
ASYM_H x Per6_10			-1.076 (0.912)		3.242 (4.787)
ASYM_L_PUN x Per6_10			0.184 (0.582)		12.127*** (4.214)
ASYM_H_PUN x Per6_10			1.838** (0.764)		10.543* (5.521)
ASYM_NT_PUN x Per6_10			-0.720 (0.652)		4.533 (4.190)
Constant	0.658 (0.946)	4.382*** (0.515)	4.996*** (0.630)	-10.513*** (3.008)	-4.200 (2.883)
Observations	3560	2870	2870	690	690
Individuals	356	287	287	69	69
Groups	89	89	89	69	69

Note: Random effects estimation with robust standard errors clustered at group level. ASYM_L is the baseline in all estimations. Standard errors in parentheses, significance: *p < 0.10, **p ≤ 0.05, ***p < 0.01.

Table 5. Linear Regressions of Contributions to the Public Good, Individual Behavior of *Standard* Agents (by Treatment).

Independent Variable	Dependent Variable: Contribution						
	VI	VII	VIII	IX	X	XI	XII
	SYM_L	SYM_H	ASYM_L	ASYM_H	ASYM_L_PUN	ASYM_H_PUN	ASYM_NT_PUN
Group contribution in t-1 (excluding *i*'s own contribution)	0.0938*** (0.025)	0.083** (0.039)	0.025*** (0.007)	0.118*** (0.034)	0.052*** (0.009)	0.088* (0.048)	0.058*** (0.013)
Individual's own contribution in t-1	0.539*** (0.072)	0.645*** (0.100)	0.604*** (0.070)	0.478*** (0.048)	0.645*** (0.050)	0.776*** (0.084)	0.407*** (0.082)
Period 6_10	-0.254 (0.276)	-0.587** (0.263)	0.051 (0.221)	-0.516 (0.432)	-0.279 (0.329)	-0.455** (0.218)	-0.148 (0.296)
The special agent's contribution in t-1	-	-	*-Not observable for standard agents-*	0.044** (0.018)	*-Not observable for standard agents-*	-0.054 (0.059)	*-Not observable for standard agents-*
Constant	0.633 (0.476)	0.704* (0.413)	1.459*** (0.248)	2.156*** (0.767)	0.944*** (0.252)	0.753** (0.297)	2.383*** (0.550)
Observations	360	360	405	351	378	324	405
Individuals	40	40	45	39	42	36	45
Groups	10	10	15	13	14	12	15

Note: Random effects estimation with robust standard errors clustered at group level. Standard errors in parentheses. Significance: *p < 0.10, **p < 0.05, ***p < 0.01.

Table 6. Linear Regressions of Contributions to the Public Good, Individual Behavior of *Special* Agents (by Treatment).

Independent Variable	Dependent Variable: Contribution				
	XIII ASYM_L	XIV ASYM_H	XV ASYM_L_PUN	XVI ASYM_H_PUN	XVII ASYM_NT_PUN
Group contribution in t-1 (excluding *i*'s own contribution)	0.214 (0.131)	0.325* (0.168)	0.123 (0.084)	0.160 (0.106)	0.147 (0.134)
Individual's own contribution in t-1	0.865*** (0.128)	0.538*** (0.100)	0.559*** (0.154)	0.621*** (0.064)	0.662*** (0.092)
Period 6_10	-2.000 (2.284)	-3.070 (2.626)	-0.483 (1.276)	-3.624** (1.704)	-1.176 (2.117)
Constant	-7.227*** (2.488)	-13.644*** (2.774)	-0.699 (1.123)	-0.568 (2.869)	-6.833** (2.907)
Observations	135	117	126	108	135
Individuals	15	13	14	12	15
Groups	15	13	14	12	15

Note: Random effects estimation with robust standard errors clustered at group level. Standard errors in parentheses. Significance: *p < 0.10, **p < 0.05, ***p < 0.01.

Table 7. Analysis of Received Punishment.

Independent Variable	IIXX **Random-Effects Regression; dependent variable: # of Received Punishment Points (continuous)**	IXX **First Hurdle; dependent variable: Being punished (dummy)**	XX **Second Hurdle; dependent variable: # of Received Punishment Points (continuous)**
Individual's own contribution	-0.108*** (0.020)	-0.046*** (0.009)	-0.250*** (0.029)
ASYM_H_PUN	0.485** (0.206)	-0.011 (0.283)	2.665*** (0.993)
ASYM_NT_PUN	0.483** (0.210)	0.262 (0.241)	2.804*** (1.012)
Special Agent	1.339*** (0.403)	0.554*** (0.185)	2.939** (1.267)
ASYM_H_PUN x Special Agent	-0.568 (0.747)	-0.437* (0.258)	-2.285 (1.789)
ASYM_NT_PUN x Special Agent	-3.417*** (0.692)	-1.665*** (0.393)	-10.141*** (2.077)
Sum of the group contribution (excluding *i*'s own contribution)	0.006 (0.006)	0.002 (0.005)	0.020 (0.024)
Period 6_10	-0.388*** (0.082)	-0.407*** (0.128)	-0.119 (0.445)
Constant	1.113*** (0.128)	-0.066 (0.183)	-1.836 (1.241)
Observations	1640	1640	
Individuals	164	164	
Groups	41	41	

Note: Regression IIXX is a random effects estimation with robust standard errors clustered at the group level.
Regressions IXX and XX are the two parts of a double hurdle analysis. The first hurdle is estimated using a Probit specification with robust standard errors clustered at group level. The second hurdle is estimated using truncated linear regression with robust standard errors clustered at group level. We used STATA 11.1 and Bill Burke's command *craggit* for double hurdle models (Cragg 1971, Burke 2009).
Standard agents in the ASYM_L_PUN treatment are the baseline. Standard errors in parentheses. Significance: *p < 0.10, **p < 0.05, ***p < 0.01.

Appendix B: The reputation based social utility model

Our social utility model with individual reputation concerns is inspired by the self-esteem model by Bénabou and Tirole (2006). Here, missing transparency allows agents, particularly special agents, to gain favorable reputation for being cooperative although they give less than under high transparency. In the following, we illustrate this reasoning with a simple model.

We assume that the utility of an agent is given by

$$u_i = \pi_i + f_i(a_i) + r_i\left(\min_{j \neq i} \hat{a}_{i \leftarrow j}\right). \qquad \text{(A1)}$$

where π_i denotes the payoff, $f_i(a_i)$ (increasing and concave) the warm glow that the agent receives from his action a_i, and $\hat{a}_{i \leftarrow j}$ denotes the view onto agent i's action by agent j. The reputation (or self-image) of agent i is given by $r_i\left(\min_{j \neq i} \hat{a}_{i \leftarrow j}\right)$ the reputation which we assume to be driven by the worst perception of agent i by another agent j. For illustrative purposes, we assume that the reputation function takes a particularly simple form:

$$r_i\left(\min_{j \neq i} \hat{a}_{i \leftarrow j}\right) = \begin{cases} 0 & \text{if } \min_{j \neq i} \hat{a}_{i \leftarrow j} < \bar{a}_i \\ \mu_i & \text{if } \min_{j \neq i} \hat{a}_{i \leftarrow j} \geq \bar{a}_i \end{cases}. \qquad \text{(A2)}$$

Here, $\bar{a}_i$ is a reverence value to gain a favorable reputation. The reverence value may depend on the action space for the special (standard) agent, $\bar{a}_i = \bar{a}^S$ ($\bar{a}_i = \bar{a}^{\sim S}$), such that a standard agent would need to give more than a special agent to gain reputation ($\bar{a}^S \leq \bar{a}^{\sim S}$). [19] For example, a special agent may gain some reputation if he does *not* take ($\bar{a}^S = 0$).

How exactly actions translate into reputation clearly depends on the level of transparency. Under high transparency, we have a one-to-one correspondence $\hat{a}^h_{i \leftarrow j}(a_i) = a_i$ and consequently

$$r_i\left(\min_{j \neq i} \hat{a}^h_{i \leftarrow j}(a_i)\right) = \begin{cases} 0 & \text{if } a_i < \bar{a}_i \\ \mu_i & \text{if } a_i \geq \bar{a}_i \end{cases}$$

where the superscript h denotes the high transparency condition. Under low transparency, agent j observes only the sum of contributions by other agents $A_{-j} = \sum_{l \neq j} a_l = A - E - a_j$. Therefore, $\hat{a}^l_{i \leftarrow j}(\cdot)$ is not just a function in a_i but also in $\sum_{l \neq j} a_l$. For convenience of notation, we nonetheless write, $\hat{a}^l_{i \leftarrow j}(a_i)$. We assume that the range of possible contributions by standard (special) agents spans the whole action range $[0,12]$ ($[-32,12]$). The most positive view onto a special agent i's action by agent j is hence given by $\hat{a}^{POS}_{i \leftarrow j}(a_i)^l = \min\{12, A_{-j}\}$, that is, the total sum of other's contributions is ascribed to the special agent. The most negative view by a standard agent j onto the

[19] Some contemporary reciprocity models (e.g., Rabin, 1993, Dufwenberg and Kirchsteiger, 2004) stress the importance for the action space for the perceived kindness of an agent, that is, actual actions are evaluated against the range of possible actions.

special agent i is given by $\hat{a}_{i\leftarrow j}^{NEG}(a_i)^l = \max\{-32, A_{-j} - 24\}$, that is, agent j may assume that the other standard agents contributed the full endowment. Conversely, the most positive view onto the action by a standard agent i as viewed from a fellow standard agent j $\hat{a}_{i\leftarrow j}^{POS}(a_i)^l = \min\{A_{-j} + 32, 12\}$ and viewed from special agent $\hat{a}_{i\leftarrow j}^{POS}(a_i)^l = \min\{A_{-j}, 12\}$. Both stem from assuming the least cooperative behavior from the two other agents. Correspondingly, the most negative view onto a standard agent i is given by $\hat{a}_{i\leftarrow j}^{NEG}(a_i)^l = \max\{0, A_{-j} - 24\}$. Note that in all cases $\hat{a}_{i\leftarrow j}^{NEG}(a_i)^l \leq a_i \leq \hat{a}_{i\leftarrow j}^{POS}(a_i)^l$. For simplicity, we assume that the view onto an agent is given by a convex combination of the worst and the best view ($\gamma \in [0,1]$):

$$\hat{a}_{i\leftarrow j}^{\gamma}(a_i)^l = \gamma \hat{a}_{i\leftarrow j}^{POS}(a_i)^l + (1-\gamma)\hat{a}_{i\leftarrow j}^{NEG}(a_i)^l. \tag{A3}$$

Without considering the impact of actions on reputation, agent i would maximize $\pi_i + f_i(a_i)$. We denote the solution to this program by a_i^0. It is obvious that this coincides with the optimal decision for (A2) if $\min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^0)^l \geq \bar{a}_i$ yielding a favorable reputation. If not, the agent may consider increasing contributions to achieve the reputational gain. We can define a level $a_i^1 \geq a_i^0$ by

$$\mu_i = (1-h)(a_i^1 - a_i^0) + f_i(a_i^0) - f_i(a_i^1) \tag{A4}$$

as the contribution level for which the additional costs of contributing (the right hand side) equal the possible reputational gain (left hand side). Under high transparency, we, therefore, obtain as the optimal decision

$$a_i^* = \begin{cases} a_i^0 & \text{if } a_i^0 \geq \bar{a}_i \text{ or } a_i^1 < \bar{a}_i \\ \bar{a}_i & \text{if } a_i^1 \geq \bar{a}_i > a_i^0 \end{cases}. \tag{A5}$$

Changing transparency may leave contribution decisions unaffected (e.g., if $\min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^1)^l \geq \bar{a}_i > \min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^0)^l$ and $a_i^1 \geq \bar{a}_i > a_i^0$ (recall that $\min_{j\neq i} \hat{a}_{i\leftarrow j}(a_i)^h = a_i$), but it may impact contribution decisions in different ways: first, if $\min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^0)^l \geq \bar{a}_i > a_i^0$ and $a_i^1 \geq \bar{a}_i$, reputation under low transparency is gained already when contributing a_i^0 while this is not sufficient under high transparency. In this case, we therefore expect increasing transparency to increase contributions. It can occur, however, only if γ is sufficiently large (see (A3)), that is, if other agents take a very positive view onto agent, particularly onto the special agent. Second, if $\min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^1)^l \geq \bar{a}_i > a_i^1$ and $\bar{a}_i > \min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^0)^l$agents under low transparency increase their contributions in order to gain reputation. In this case, we expect transparency to decrease contributions; again, it occurs only if γ is sufficiently high. Third, if $a_i^0 \geq \bar{a}_i > \min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^0)^l$ and $\min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^1)^l \geq \bar{a}_i$ agents under low transparency increase their contributions to gain reputation. In this case, we expect transparency to decrease contributions, while it occurs only if γ is sufficiently small, that is, if agents take a very negative view. Finally, if $a_i^1 \geq \bar{a}_i > a_i^0$ and $\bar{a}_i > \min_{j\neq i} \hat{a}_{i\leftarrow j}^{\gamma}(a_i^1)^l$, the agent may consider to increase contribution to obtain the reputation in high transparency, so that high transparency increases contributions compared to low transparency.

To provide a more specific example, we assume that $\bar{a}^S = \bar{a}^{\sim S} = 0$ and $\gamma = 1$, that is, that the special agent gets the reputation as long as she is not identified as taking from the public account. Finally, we assume for the special agent $a_i^0 = -E$ and $a_i^1 > 0$, so that she is very concerned with her reputation, but not altruistic at all. This very (positive) view of agents onto each other appears to be consistent with findings by Dana et al. (2007) where agent can exploit a moral wiggle room when others cannot definitely identify the intentions behind an action (e.g., the available action space). Given $\bar{a}^{\sim S} = 0$, the reputation of standard agents does not depend on their actions. Hence, under low transparency, the optimal contribution a_i^* for the special agent i is given by the negative sum of contributions of the two least cooperative standard agents ($a_j + a_k \geq |a_i^*|$ for all standard agents j, k). That is, the special agent may try to hide behind the positive contributions of standard agents to avoid being identified as a taker. In general, however, the outlined model implies a qualitatively ambiguous impact of transparency on contributions when no punishment options exist.

Appendix C: Instructions

These are the English translations of the German instructions for the ASYM_L_PUN. The instructions for other treatments are available in German from the authors upon request.

General explanations for participants

You are taking part in an economic experiment. You can earn a significant sum of money, depending on the decisions and the decisions of other participants. It is therefore very important that you pay attention to the following points.

The instructions you have received from us are intended solely for your private information. *During the experiment, you will not be allowed to communicate with anyone***.** Should you have any questions, please direct them directly to us. Not abiding by this rule will lead to exclusion from the experiment and from any payments.

All decisions in the experiment are made anonymously. Only the experimenter knows your identity, while we cannot match your decisions with your identity.

For your participation in this experiment, you receive an initial income of 6 Euros. FYour additional income depends on your decisions. In this experiment, we calculate in Taler, rather than in Euro. Your entire income will therefore initially be calculated in Taler. The total sum of taler will later be calculated in Euro as follows:

1 Taler = 0,30 Euros

You will be paid *in cash* at the end of the experiment.

The experiment is divided into separate periods. It consists of a total of 10 periods. In each period you will play the same game. Each period consists of two steps. Participants are randomly assigned to groups of four. Each group, thus, has three other members, apart from you. During these 10 periods, the constellation of your group of four will remain unaltered. *You will therefore be in the same group for 10 periods.* Please note that you and the other group members decide anonymously. That is, other group members cannot match your decision with your identity.

At the end of the experiment, we will randomly determine one out of the ten periods to be decisive for your payoff. Therefore, the outcome of every period determines potentially your payoff.

The following pages outline the exact procedure of the experiment. As mentioned earlier, each of the ten periods contains two steps.

Exact procedure for step one

At the beginning of each period, each participant faces the same decision problem. Your decision (as well as the decision of all other group members) is to divide Taler between a private account and a group account. At the beginning, each group member is allotted 12 Taler on your private account. Furthermore, there are 32 Taler on the group account.

At the beginning of the experiment, we will randomly determine one member of your group to be player "1". The player will be the same throughout the entire 10 periods. Player 1 has to decide whether to transfer Taler from her private account to the group account **or** from the group account to the private account. Therefore, player 1's transfers range between -32 and 12 (only integers); positive numbers imply transfers from the private to the group account, negative numbers imply transfers from the group account to the private account.

Each of the remaining three players (player "2", "3", and "4") has to decide whether to transfer Taler from her private account to the group account. Transfers range between 0 and 12 (only integers).

Your income in step one consists of two parts, namely:

(1) the Taler you have kept or transferred on your private account,

(2) the˘*income gained from the group account".* Your income from the group account is calculated as follows:

Income from the group account = .4 * total sum of Taler on the group account

Thus your income in step one equals:

(12 – your transfers) + .4*(total sum of Taler on the group account)

The income gained from the group account is calculated using the same formula for each member of the group. That is, each group member (irrespectively whether it be "1" or any other group member) gains the same income from the group account.

If, for example, the sum of the transfers from all group members adds up to 28 Taler, that is, the group account holds 32 + 28 = 60 Taler, you and all other members each gains an income from the group account of .4x 60 = 24 Taler. If the sum of your and the transfers from all other group members adds up to 9 Taler, that is, the group account holds 32 + 9 = 41 Taler, you and all other members each gains an income from the group account of .4x 41 = 16.4 Taler. For each Taler you keep on your private account, you earn an income of 1 Taler.

Exact procedure for step two

After all group members have made their decisions in step one, you will proceed to step two.

Here, every group member receives an additional endowment of 5 Taler, which you may use to distribute points. You can decide in every row (in the blue box) on how many points you want to distribute; at most, you can distribute five points. Each point costs you one Taler. For each point, you distribute to another player, three Taler are deduced from her income. While you do not receive information on the specific transfers of players in step one, you will receive information on the sum of

Taler on the group account. All Taler from the additional endowment that is not used for distributing points are added to your total income of this period.
An example: If you assign 2 points to another player in your group, you reduce your additional endowment from 5 to 3 Taler. If you do not assign any other points nor receive any points from other group members, your total income in this period increases by the remaining 3 Taler. The total income of the player who received 2 points from you decreases by 2*3 = 6 Taler.

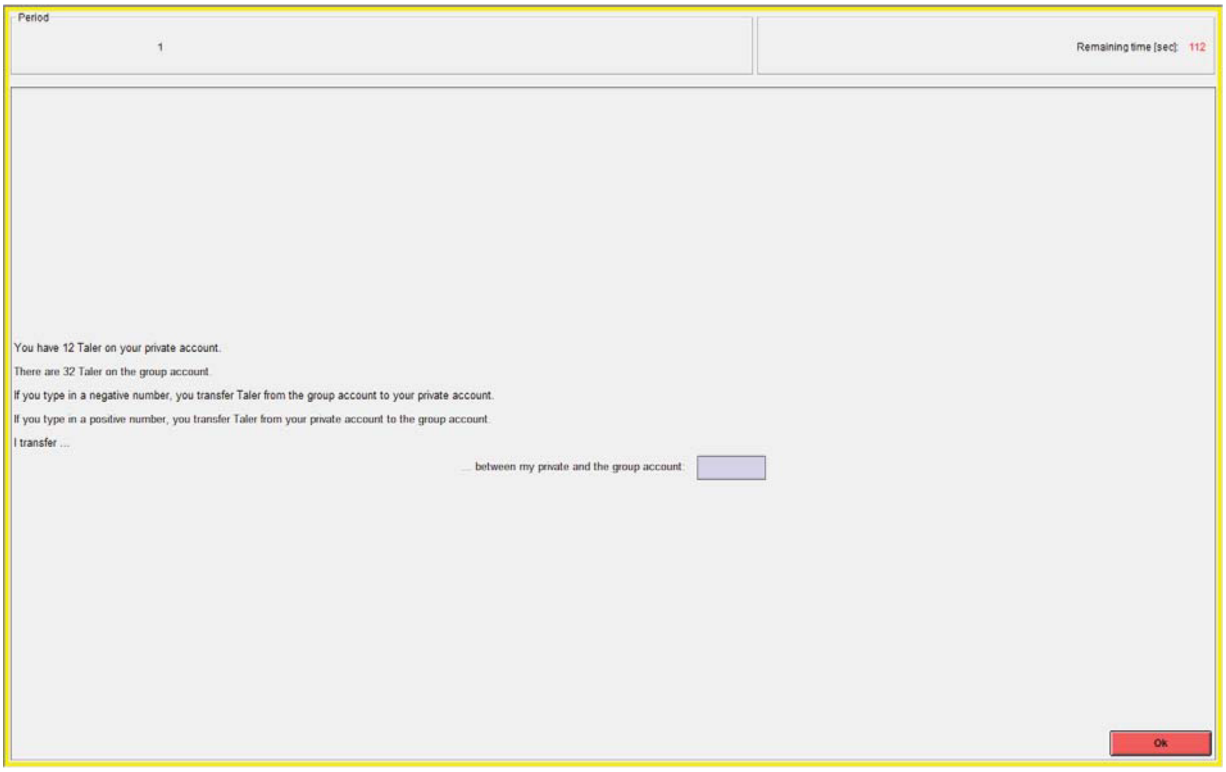
Your total income from step one and two (in Taler) in each period equals

income in step one + 5 – distributed points – 3*received points

Exact procedure for the course of the experiment

You will see the input screen at the beginning of each period. In the left upper corner of the screen you will find the period number. In the right upper corner you will find the remaining time for your decision in seconds.

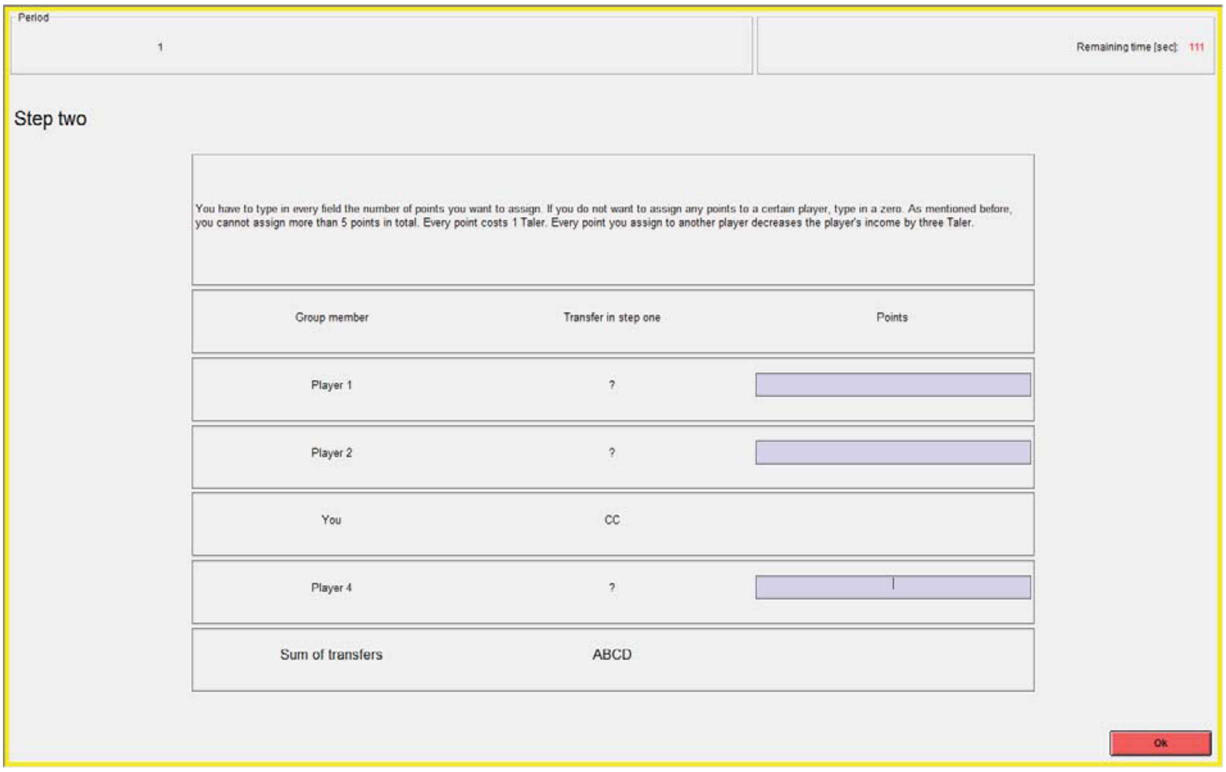
The input screen for player 1 in step one look like this:



The input screen for players 2, 3, and 4 in step one looks like this:

There are 32 Taler on the group account in every period. You make a decision on your transfers on the group account by typing any one whole number between 0 and 12 (player 2, 3, and 4), and between -32 and 12 (player 1), respectively, into the appropriate field on your screen. This field can be accessed using the mouse. Once you have typed in your contribution, please click on *OK*, again using the mouse. Once you have done this, your decision for this period is irreversible.

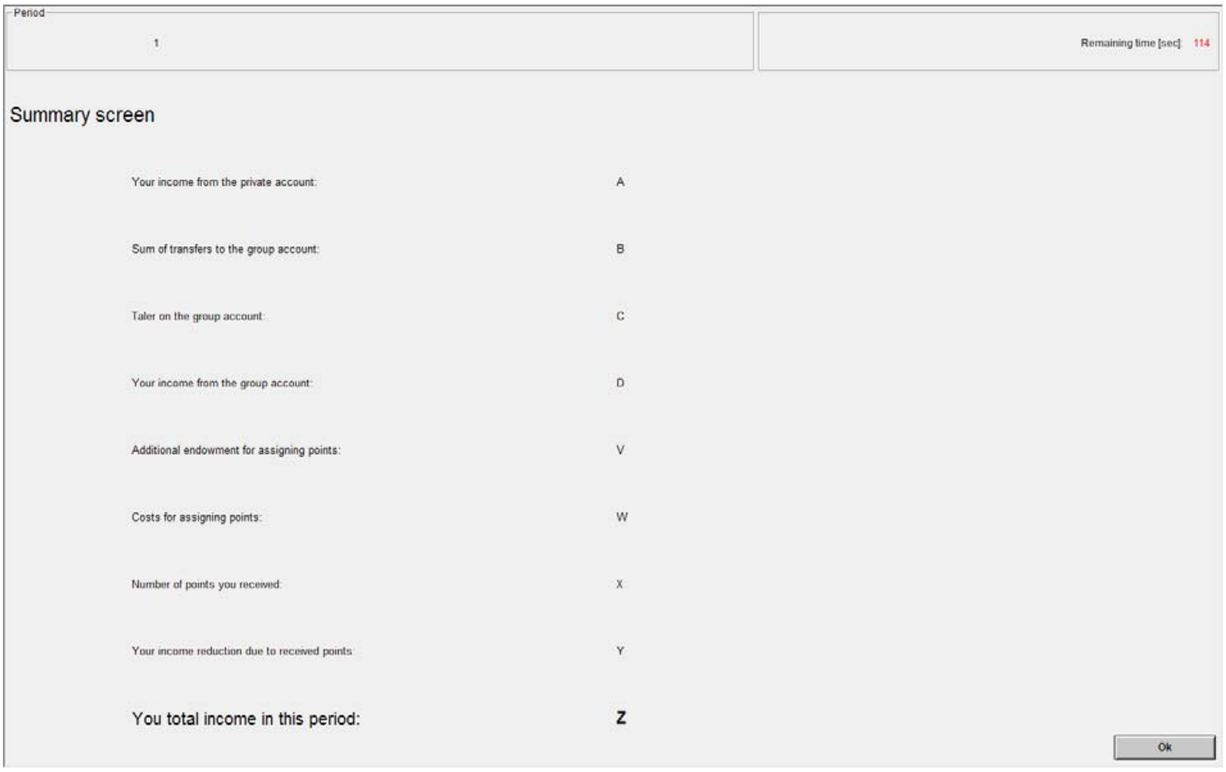
In step two, you will see the sum of all transfers in your group. The input screen on step two looks like this (here for player 3):



Recall: While you do not see the transfers of the other group members (there you will see “?”), you will see in row five the sum of all transfers in the group.

You may assign points you want to distribute. You can operate within the fields by using the mouse. If you do not wish to alter a certain group member’s income, please enter 0. As mentioned earlier, the sum of points distributed cannot exceed 5.

Once all members of the group have made their decisions and have distributed their points, you will be informed about the sum of transfers on the group account, your income from the private account, the number of points you received, as well as the resulting reduction in income. Finally, you will see your period income.



As mentioned earlier, your income (in Taler) in step one is:

(12 – your transfers) + .4*(total sum of Taler on the group account)

And your **total income** equals

income in step one + 5 – distributed points – 3*received points

Before we proceed with the experiment, all participants have to answer some control questions on the computer screen. The control questions will help you to understand the rules of the game.

Do you have any further questions?