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Experimental Evidence**

Gary Charness  
David Masclet  
Marie Claire Villeval

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**Gary Charness**

*University of California, Santa Barbara*

**David Masclet**

*CREM, CNRS, University of Rennes  
and CIRANO*

**Marie Claire Villeval**

*University of Lyon, CNRS-GATE,  
CCP Aarhus and IZA*

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IZA

P.O. Box 7240  
53072 Bonn  
Germany

Phone: +49-228-3894-0  
Fax: +49-228-3894-180  
E-mail: [iza@iza.org](mailto:iza@iza.org)

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## ABSTRACT

### **Competitive Preferences and Status as an Incentive: Experimental Evidence<sup>\*</sup>**

In this paper, we investigate individuals' investment in status in an environment where no monetary return can possibly be derived from reaching a better relative position. We use a real-effort experiment in which we permit individuals to learn and potentially improve their status (rank). We find that people express both intrinsic motivation and a taste for status. Indeed, people increase their effort when they are simply informed about their relative performance, and people pay both to sabotage others' output and to artificially increase their own relative performance. In addition, stronger group identity favors positive rivalry and discourages sabotage among peers.

#### NON-TECHNICAL SUMMARY

In many workplace environments, people invest resources in status-seeking activities. In this paper, we investigate individuals' investment in status in an environment where no monetary return can possibly be derived from reaching a better relative position. We use a real-effort experiment in which people are paid a flat rate and can also freely engage in leisure activities. We permit individuals to improve their status; depending on the treatment, they can spend money to either sabotage others' performance or artificially increase their own performance. We find that people express both intrinsic motivation and a taste for status. Indeed although they are paid a flat wage, i) relative to an environment with no information, people increase their effort when they are simply informed about their relative performance, ii) people pay both to sabotage others' output and to artificially increase their own performance to potentially upgrade their rank in their group; iii) stronger group identity favors positive rivalry and discourages sabotage among peers. Overall, these findings can be explained by competitive preferences, which lead to one's status functioning as an incentive.

JEL Classification: C91, C92, M54, D63, J28, J31

Keywords: status seeking, rank, competitive preferences, experiment

Corresponding author:

Marie Claire Villeval  
GATE (Groupe d'Analyse et de Théorie Economique)  
CNRS - University of Lyon  
93, Chemin des Mouilles  
69130 Ecully  
France  
E-mail: [villeval@gate.cnrs.fr](mailto:villeval@gate.cnrs.fr)

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## 1. INTRODUCTION

While standard economic theory assumes that individuals only care about their individual payoffs, there are many situations in which people exhibit a strong concern for social comparisons and status. In economics, social comparisons have been shown to influence both behavior (see for example Glaeser *et al.*, 1996, on criminal activity; Duflo and Saez, 2002, on investment plans; Güth *et al.* 2001, Charness and Kuhn, 2007, Gächter and Thöni, 2009, and Clark *et al.*, 2010, on effort in employer-employee relationships) and subjective well-being (Clark and Oswald, 1996; Clark *et al.*, 2008; Brown *et al.*, 2008; Ferrer-i-Carbonell, 2005; Luttmer, 2005; Azmat and Iriberry, 2010). Social comparisons are especially important when people care about their status in their reference group. Theoretical models have shown that the willingness to pay for status influences efficiency and income redistribution (see for example Allgood, 2006, Hopkins and Kornienko, 2009). A few experimental studies in economics demonstrate both the importance given by individuals to status and how it affects behavior in negotiations (Ball and Eckel, 1996), markets (Ball and Eckel, 1998; Ball *et al.*, 2001), coordination games (Eckel and Wilson, 2007), and organizations either in cooperative settings (Kumru and Vesterlund, 2008; Eckel *et al.*, 2009) or in competitive settings (Huberman *et al.*, 2004; Rustichini and Vostroknutov, 2008).

However, none of these studies investigates people's investment in status seeking in an environment without any expected monetary return from such activity. Indeed, in most of the experimental studies cited above, status is given exogenously and it is provided without any cost (with the exception of Ball and Eckel, 1998; Huberman *et al.*, 2004; Rustichini and Vostroknutov, 2008). In this paper, we define status as the individuals' relative standing in their group and we isolate the pure willingness of individuals to invest in status-seeking activities and

its impact on real effort. Everyday life provides numerous examples in which people invest resources in status seeking to be at the top of the social scale. Human-resource managers also take advantage of this concern for social position through policies such as assigning symbolic rewards to the employee of the month. Status seeking seems to be strongly related to competition among individuals. The study of evolution in biology and anthropology has shown how competition involves status and how status structures societies.<sup>1</sup>

In the same vein, the existence of competitive preferences identified in economics (Charness and Grosskopf, 2001; Charness and Rabin, 2002) may motivate people to engage in such status-seeking activities.<sup>2</sup> Status seeking may be related to the desire for dominance in competition. This has been documented both in animals and in humans, as dominance better secures the access to food or to mates. However, we would like to be clear that status-seeking and competitive preferences are not isomorphic. Status-seeking typically involves some form of public recognition, while a taste for competitive preferences does not depend on such recognition. Of course, receiving a symbolic reward may matter even in the absence of observability by others if it affects self-esteem. In this study, however, we are chiefly interested in social status and we do not aim at disentangling these two dimensions.

While one motivation for costly status seeking is the expectation of (eventual) monetary benefits, this behavior is also observed when no immediate or delayed monetary return can be

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<sup>1</sup> Status seeking may be also related to matching among individuals. For example, if social status signals non-observable abilities, it may help people to match with people of similar ability, which will be payoff-maximizing in case of complementary interactions (Rege, 2008). We do not investigate this dimension in our paper.

<sup>2</sup> In one allocation task in Charness and Grosskopf (2001), a person could choose any amount between 300 and 1200 for the other person while receiving 600 for herself regardless of her choice. A number of people choose to allocate less than 600. One example was the individual who chose 599 for the paired participant.

derived from the competition.<sup>3</sup> Indeed, many people engage in behavior such as investing in costly status symbols and conspicuous consumption of positional goods (Duesenberry, 1949; Veblen, 1949; Frank, 1985), or striving for status and public display of status as a goal in itself (Huberman *et al.*, 2004).

As shown in Rustichini (2008), humans may be willing to make costly decisions when engaged in a contest if the outcome of the competition says something about the underlying factors of the ranking, i.e. if a higher (lower) rank in terms of performance means a higher (lower) rank in the social scale. Individuals may therefore make costly choices to improve their status if they believe that others will interpret the outcomes of past contests as a signal of their intrinsic value and their status in the society.

It is difficult if not impossible to use field data to determine the extent to which individuals are willing to invest in resources to improve their status aside from potential (eventual) financial remuneration, and how this behavior is affected by the conditions in which status can be improved. Survey data have trouble identifying status-seeking activities and since they cannot precisely delineate reference groups, it is difficult to know to whom individuals compare themselves. By controlling the environment and the composition of the reference group, experimental methods offer the possibility of directly evaluating the individual's willingness to invest in status seeking.

Our aims in this study are three-fold. First, we study whether individuals care about their status in a setting where status derives from receiving more or less salient information about their relative position in their group (in the case of more salient information, we assign positive or

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<sup>3</sup> The initial observation behind our study was that although the pay for French academics is completely fixed (with some rare exceptions), people nevertheless compete for prestige or for trying to signal their unobservable ability, even sometimes by sabotaging others.

negative symbols for the highest or lowest rank, respectively). Relative position is here determined by work performance in a real-effort task. Status seeking may motivate people to perform better (Frank, 1988). In our environment, people can compete to accumulate positive symbols or to avoid negative symbols, but not in order to receive better pay. Second, we study the degree to which individuals are willing to pay to increase their relative position in their reference group in order to improve their status. And third, we analyze how any such investment is affected by the feasible mechanism for status improvement.

Indeed, one can improve one's relative position not only by exerting higher effort to outperform others (see Azmat and Iriberry, 2010a, and Blanes i Vidal and Nossol, 2009 for field data, and Azmat and Iriberry, 2010b and Eriksson *et al.*, 2009, for experimental evidence), but also by using other strategies. Examples of own artificial performance improvement include doping (see Preston and Szymanski, 2003), forgery, use of ghost-writers and plagiarism. Competition has been shown to favor unethical behavior (Shleifer, 2004), and Schwierien and Weichselbaumer (2009) show experimentally that a competitive environment encourages people to cheat to improve their own performance.

Alternatively, people may also improve their relative position in a group by sabotaging the performance of others. In economics, sabotage is usually motivated by the agent's willingness to increase the probability of receiving the winner's prize in tournaments (Lazear, 1989; Chen, 2003; Harbring *et al.*, 2007); this is also true in our environment, except the prize is purely symbolic. In social psychology, sabotage is more broadly related to the analysis of interpersonal destructive deviance at work that causes harm to others (Berry *et al.*, 2007; Tziner *et al.*, 2006). Here, while sabotage harms others by destroying their output, it reduces the

earnings of the agent who chooses sabotage (this is in contrast with Rustichini and Vostroknutov, 2008, in which rank can improve by subtracting money from another player's earnings).

To preview our results, our data show that even when wages are fixed, many subjects exhibit intrinsic motivation for working, and also adopt competitive behavior. A striking result is that individual performance is influenced by feedback on one's relative position in the group, as people tend to exert significantly more effort when they receive information about their rank. We also find that some people are willing to pay for status improvement without any instrumental monetary considerations, sacrificing money to potentially improve their rank.

In addition, there is evidence of bonding: if people from the same school are more likely to buy redemption points, they are less likely to sabotage than when matched with people from other schools. This indicates that group identity favors positive rivalry but discourages destructive competition. Overall, our findings provide evidence of the importance of competitive preferences in non-monetary competitive settings. Some people value status *per se*, perhaps because they believe that their relative position in a group serves as a signal to others about their intrinsic competence and value.

The remainder of the paper is organized as follows. Section 2 describes the experimental design and experimental protocol. Section 3 presents theoretical predictions and behavioral conjectures about the expected treatment effects. The results of the study are presented in section 4, and section 5 contains a discussion and our concluding remarks.

## 2. EXPERIMENTAL DESIGN

### 2.1. Treatments

Our experiment consists of four different treatments with ten periods each and is based on a between-subject design. In our *baseline treatment*, each person is matched with two other people. We use a stranger matching protocol, so that groups are randomly reformed at the beginning of each new period. Participants are informed that they will be paid a flat wage of 10 Experimental Currency Units (with 10 ECU equal to one Euro) at the beginning of each of 10 periods, so that it is common information that wage is uncorrelated to performance. They have the option of performing a task during a fixed time of two minutes; this task consists of decoding sets of one-digit numbers into letters from a grid of letters that is displayed on the computer screen (see the screenshots in Appendix A, where sample instructions are presented). In each new period, a different grid of letters and different decoding numbers appear.

Participants must press a button to start a new period (and immediately receive the wage for the period). Once this is done, they can stop working at any time during the course of the period and can resume work at will; they can also choose not to perform the task at all. We provide the participants with alternative leisure activities on the job. Two magazines are provided in each cubicle and the instructions clearly indicate that people are allowed to read these magazines or any personal documents they have brought in their bags.<sup>4</sup> The participants are continuously informed of their current number of correct answers. If a submitted answer is not correct, the individual is informed that her response was not correct and the same letter is displayed until the correct answer is provided. Once the two minutes have elapsed, a vertical bar

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<sup>4</sup> Dickinson (1999) is the notable experimental study regarding on-the-job leisure. In the field, leisure at work takes multiple forms: surfing the net, long coffee breaks, office gossiping, etc. Several studies have shown how the expansion in use of the Internet is affecting labor productivity (Gordon, 2000).

is displayed on the screen; its height indicates the total number of correct answers. In this treatment, people receive no feedback about the performances of the other two group members.

The *ranking treatment* is identical to the baseline except that the computer displays three vertical bars corresponding to the performance of each of the three group members at the end of each period on the screens of the group members. Each person is therefore able to see her relative performance. In one ranking sub-treatment, people also received positive or negative symbols to materialize this ranking. Precisely the worker who has performed the best in her group receives a “gold medal” while the lowest performer gets a “donkey hat”. At the beginning of each period, each player can see the profile of her two co-workers and this is made common information in the instructions. The profile of each subject includes a historical record of all symbols assigned throughout the previous periods, in order to emphasize the social image associated with status. In order to separate the effects of these devices, we also conducted a variant called the *ranking treatment without symbols*. This treatment is identical to the ranking sub-treatment described above except that highest and lowest relative positions are not assigned visual symbols. In the profile box displayed at the beginning of each period, we indicate for each person the number of times he or she has been ranked first and last in previous periods.

The subjects’ profile also includes their gender and their school like in the baseline treatment. This also allows us to investigate the importance of in-group effects and whether knowing that one shares similar characteristics with the other members of one’s group influences decisions. Indeed we know the potential importance of group identity and bonding from the literature in both social psychology and economics (Tajfel *et al.*, 1971; Brewer, 1999; Akerlof and Kranton (2000), Halevy *et al.*, 2007; Charness *et al.*, 2007; Chen and Li, 2009). Our

expectation is that if people are biased in favor of their group, they should sabotage less when matched with participants from the same school, same status or same gender.

The *redemption treatment* is identical to the ranking treatment, except that the participants are informed in the instructions that we add a second stage in which they can modify their performance. Indeed in this stage, people have the opportunity to (simultaneously) purchase extra units of ‘output’ to artificially increase their performance and possibly their rank in the performance distribution. They can buy from 0 to 20 units of output that will be added to their original performance; the cost of each unit is 0.5 ECU and this cost is deducted from the person’s payoff. At the end of this stage, the computer program computes and displays the net performance of each group member, and the symbols associated with this net performance (the donkey hat for the lowest performer and the medal for the best performer).

The *sabotage treatment* is identical to the redemption treatment except that in the second stage participants are informed in the instructions that they can pay to reduce the performance of their co-workers rather than to improve their own performance. They can assign from 0 to 20 costly points to each of the other members of their group ‘*to reduce their score*’. Each point assigned by player  $i$  to player  $j$  reduces player  $j$ ’s performance by one unit of output and this may modify the provisional ranking resulting from performing the task in stage one. Assigning points is equivalent to sabotage (although the term is not used in the instructions). While player  $j$ ’s earnings are unaffected by receiving sabotage points, a participant who chooses sabotage incurs a direct cost of 0.5 ECU per point of sabotage that is subtracted from the flat wage to determine the final earnings for the period. We chose the same cost for each unit purchased in the two treatments. While each sabotage or redemption point costs the same, it should be acknowledged that in some cases, one redemption point allows the subject to improve her position relative to

the two other group members, whereas one sabotage point targets only one person. This brings up the issue of relative cost.<sup>5</sup> Note that our results do not seem to support a cost-efficiency hypothesis since we should expect more redemption points than sabotage, which sharply contrasts with what we observe.

As in the redemption treatment, people can observe any change in the performance of the three group members at the end of the second stage. However, while people can see directly if their group members have artificially increased their own score in the redemption treatment, they are not informed about who has sabotaged their output.<sup>6</sup> Like in the ranking treatment, participants in the redemption and sabotage treatments are informed in the instructions that at the beginning of each new period the profile of each group member will be displayed on their screen, including the number of donkey hats and gold medals earned in the previous periods.<sup>7</sup>

## *2.2. Experimental procedures*

The experiment consists of 24 sessions of ten periods each. Twelve sessions were conducted at the CREM-CNRS (LABEX) institute of the University of Rennes 1 and 12 others were

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<sup>5</sup> Some studies have investigated, in the context of public-good games, the extent to which the decision to punish is influenced not only by the cost of punishment but also by its impact on the target (Nikiforakis and Normann, 2008; Masclet and Villeval, 2008; Carpenter, 2007; Anderson and Putterman, 2006; Egas and Riedl, 2005; Falk, Fehr and Fischbacher, 2005). The evidence is mixed. Carpenter (2005) and Anderson and Putterman (2006) find that the demand for punishment is decreasing in its price. In Nikiforakis and Normann (2008), the contributions to the public good increase monotonically in the effectiveness of punishment. In contrast, Masclet and Villeval (2008) find that people will to pay more to increase the harm imposed on targets when punishment has a lower impact, to compensate for the fact that the monetary consequences of each punishment point on the target are lower. In Falk, Fehr and Fischbacher (2005) cooperators in cooperation games also increase their punishment expenditures if the impact of punishment on the targets is reduced.

<sup>6</sup> We note that the second stage of both the redemption and sabotage treatments involves a strategic decision if people care about their status in the group; in this case, if one believes that others will be spending money for redemption or sabotage, this may well increase the likelihood that one also spends money on redemption or sabotage (in order to at least preserve status). While we cannot know whether the motivation for engaging in redemption or sabotage reflects strategic concerns, in any case the underlying motive for purchasing points is that people care about status.

<sup>7</sup> Under the assumption that people can perfectly observe each other in peer groups, we deliberately allowed individuals to observe any change in the performance of the three group members. We would most likely observe

conducted at the GATE-CNRS institute of the University of Lyon, France. Between nine and 15 individuals took part in each session, for a total of 345 participants who were invited via the ORSEE software (Greiner, 2004); no individual participated in more than one session. The participants were undergraduate students from a variety of majors including business, economics, law, engineering, medicine and literature. Table 1 displays summary information about the sessions and includes the session number, the location, the number of people and 3-person groups in the session, and the treatment.

[Table 1 about here]

The experiment was computerized and the scripts were programmed using the Z-tree platform (Fischbacher, 2007). The experiment lasted on average 90 minutes and each subject earned an average of 14.74 Euros, including a show-up fee of 5 Euros.

### 3. THEORETICAL PREDICTIONS

After presenting the standard theoretical predictions for this game, this section develops a behavioral model in which we include the individual's concern for status and social ranking.

#### 3.1. Standard predictions

Consider first the baseline treatment. To keep matters simple, we adopt a simple setting of a team consisting of two identical members, agent 1 and 2. Each player is paid a flat wage,  $\bar{w}$  such that wage is independent of the work effort of agents 1 and 2,  $e_1$  and  $e_2$ , respectively. Let  $c(e_i)$  denote each agent  $i$ 's cost function for effort,  $i=1,2$ . It is assumed that  $c_1 > 0$  and  $c_{11} > 0$ , where subscripts denote partial derivatives.

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more sabotage (redemption) with some degree of anonymity, so that our results may represent a lower bound for

We assume for exposition that utility is additive in wage and work such that each agent's utility is given by:

$$U = \bar{w} - c(e_i) \quad i, j = 1, 2; j \neq i. \quad (1)$$

The theoretical prediction is straightforward: assuming that an individual is only interested in maximizing her own payoff, no effort is exerted. The same prediction applies to both the baseline and the ranking treatments (with or without symbols). Turning next to the redemption and sabotage treatments, we can easily see by backward induction that the only subgame-perfect equilibrium of the game, whether played once or finitely repeated, is for no participant to either work or purchase any redemption or sabotage points.

### *3.2 Behavioral predictions*

A possible objection against these standard predictions is that players may be influenced by the performances of others and by their status in the group. Observing others' effort in the ranking treatment may influence individual decisions. People may enjoy outperforming others and desire even the modest symbols of status offered in our experiment. Indeed, there is strong evidence that people care not only about their own payoffs but also about social comparisons and status (Ball and Eckel, 1998; Huberman *et al.*, 2004; Kumru and Vesterlund, 2008; Rustichini, 2008; Eckel *et al.*, 2009; Gächter and Thoeni, 2009; Clark *et al.*, 2010).

Clark and Oswald (1998) provides a model of distributional preferences that offers a rationale to the search for status by appealing to competitive preferences, whereby individuals enjoy outperforming others (i.e. seeking status). In keeping with this seminal paper, we represent competitive preferences in a simple linear form:

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sabotage (redemption) in the laboratory.

$$U = \theta v(a_i - a^*) + (1 - \theta)u(a_i) - c(a_i) \quad (2)$$

where  $a_i$  is an economic action that gives utility both directly and indirectly through status.  $a^*$  is the mean of others' choice. The parameter  $\theta \in [0,1]$  indicates the relative importance of status concerns. The function  $u$  is the direct utility that is increasing and concave in  $a_i$ . The function  $v$  captures the indirect utility from comparisons. Let us assume that the first derivative of  $v$  is positive, so that people enjoy outperforming others' actions. Finally,  $c(a_i)$  is a cost function that is increasing and convex in  $a_i$ .

The action we consider here is effort expended at work  $e_i$ ,  $i = 1,2$ . In our framework, the agents derive no direct utility from their work effort since each agent  $i$ ,  $i = 1,2$ , is paid a flat wage,  $\bar{w}$ , irrespective of her effort at work. However, each agent  $i$  may derive an indirect utility from comparisons. Then, equation (1) can be rewritten as follows:

$$U = \bar{w} - c(e_i) + \theta v(e_i - e_j), \quad i, j = 1,2; j \neq i \quad (3)$$

Individual  $i$  chooses the level of effort  $e_i^*$  that maximizes expression (3). The Nash equilibrium requires that each agent's work effort maximizes utility as given by equation (3). Assuming an interior solution, the following first-order condition defines the optimal work effort choices of agent 1 and 2:

$$\theta v_1(e_i - e_j) - c_1(e_i) = 0, \quad i, j = 1,2; j \neq i \quad (4)$$

The first term expresses the marginal benefit from status induced by an increase in effort; the second term represents the marginal disutility of work. The following proposition characterizes the equilibrium outcome of this model.

PROPOSITION 1. *Agents with comparison-concave utility should exert a positive effort level in the ranking treatment. As a consequence, the average effort level should be higher in the ranking than in the baseline treatment.*

The formal proof of Proposition 1 is presented in Appendix B.

Now consider the sabotage game. In stage one, each agent  $i$  chooses her work effort,  $e_i$ . In the second stage, each agent can reduce the other agent's performance by exerting additional effort of sabotage  $a_i$  that artificially increases her status. It is assumed that sabotage effort is costly, such that  $c(e_i, a_i) > 0$ ,  $i=1,2$ , with  $c_2 > 0$  and  $c_{22} > 0$ . We re-write (3) as follows:

$$U = \bar{w} - c(e_i, a_i) + \theta v(e_i - e_j, a_i, a_j) \quad i, j = 1, 2; j \neq i \quad (5)$$

where  $v(e_i - e_j, a_i, a_j)$  denotes the utility from comparisons that is assumed to be increasing in agent  $i$ 's own sabotage effort  $a_i$ , ( $v_2 > 0$ ) and decreasing in the other agent's sabotage effort  $a_j$ , ( $v_3 < 0$ )  $i=1,2$ . We use backward induction to solve the game. In the second stage, the Nash equilibrium requires that the action  $a_i$  maximizes utility as given by equation (5). In the first stage, production efforts are chosen. The prediction of the sabotage model is summarized in the following proposition.

PROPOSITION 2. *For sufficient concern for status, there exists a subgame-perfect equilibrium in which players both sabotage and exert positive work effort. Work effort is lower in the sabotage treatment than in the ranking treatment.*

The formal proof of Proposition 2 is presented in Appendix B.

Consider now the redemption treatment.<sup>8</sup> Each agent  $i$ 's utility can be re-written as:

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<sup>8</sup> The fact that the sabotage points are less cost-effective than redemption points is not modeled here for the reasons we mentioned above. This could constitute an extension of this work.

$$U = \bar{w} - c(e_i, r_i) + \theta v(e_i - e_j, r_i, r_j) \quad i, j = 1, 2; j \neq i \quad (6)$$

As in the sabotage game, redemption effort  $r_i$  is assumed to be costly, such that  $c(e_i, r_i)$ ,  $i=1,2$ , is characterized by  $c_2 > 0$  and  $c_{22} > 0$ .  $v(e_i - e_j, r_i, r_j)$  is the indirect utility from comparisons. The first derivative of  $v$  with respect to  $(e_i - e_j)$  is positive such that each agent likes outperforming the other agent. Its first derivative with respect to  $r_i$  is positive such that  $v$  is increasing in agent  $i$ 's own redemption effort  $r_i$ , ( $v_2 > 0$ ). Finally,  $v$  is decreasing in the other agent's redemption effort  $r_j$ , ( $v_3 < 0$ )  $i=1,2$ . The following proposition characterizes the theoretical predictions of our redemption game:

*PROPOSITION 3. Work effort is lower in the redemption treatment than in the ranking treatment. People should, however, exert more work effort in the redemption treatment than in the sabotage treatment if the loss of indirect utility associated with the other agent's increased sabotage effort is higher than the loss induced by the increased redemption effort in response to an increase in one's own work effort.*

The formal proof of Proposition 3 is presented in Appendix B.

## 4. EXPERIMENTAL RESULTS

This section presents a comparative analysis of performance across treatments, before analyzing the individuals' willingness-to-pay for status in the redemption and sabotage treatments. Last, we examine the overall impact of status-seeking activities on individual effort decisions.

### *4.1. Performance*

Table 2 provides some summary statistics on average performance in each treatment and Figure 1 displays the distribution of effort by treatment.

(Table 2 and Figure 1 about here)

Interestingly, Table 2 indicates first that in all treatments, people show intrinsic motivation for the task, as they exert positive work effort even though they receive a flat wage at the beginning of each period. The average frequency of the no-effort choice is 7.77% in the baseline treatment, 2.36% in the ranking treatment (pooling both variants of this treatment), 5.73% in the redemption treatment, and 8.20% in the sabotage treatment.<sup>9</sup>

On average people score 23.15 correct answers per period in the baseline, 27.65 in the ranking treatment (pooling both variants of this treatment), 24.19 in the sabotage and 25.86 in the redemption treatments (in the last two treatments, these values correspond to the first-stage performance).

A Mann-Whitney pairwise statistical test comparing average performance in the two variants of the ranking treatment (with and without the assignment of symbols) indicates no significant difference ( $z = -1.492$ ,  $p = 0.136$ ).<sup>10,11</sup> This finding suggests that status symbols *per se* have little effect on performance compared with simple feedback about relative performance. In the remaining of the section we therefore pool data of both ranking treatments. Table 2 indicates that informing participants about their relative performance produces a positive incentive on work effort in both the ranking and redemption treatments. On average people

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<sup>9</sup> A Mann-Whitney pairwise statistical test comparing average frequencies of no-effort choice in the two variants of the ranking treatment (with and without the assignment of symbols), maintaining the conservative assumption that each session's activity is a unit of observation, indicates no significant difference ( $z = -1.103$ ,  $p = 0.269$ , two tailed). In the remaining of the paper we therefore pool data of both variants of the ranking treatment. A similar test indicates that the average frequency of no-effort choice is significantly lower in the ranking treatment than in the baseline treatment ( $z = -2.078$ ,  $p = 0.037$ , two-tailed). The average frequency of the no-effort choice is also lower in the redemption treatment (5.73%) compared to the baseline, although this difference is not significant ( $z = -0.741$ ,  $p > 0.1$ , two-tailed). Finally the average frequency of the no-effort choice is 8.20% in the sabotage treatment ( $z = -0.245$ ,  $p > 0.1$ ).

<sup>10</sup> On average people score 28.73 correct answers per period in the ranking treatment without symbols and 26.03 correct tasks in the ranking treatment with symbols.

perform 4.5 units of output more in the ranking treatment than in the baseline. A Mann-Whitney pairwise statistical test indicates that this difference is significant ( $z = -2.263, p = 0.024$ ).

People actually produce 2.71 units more in the redemption treatment than in the baseline (the difference amounts to 3.49 units after the use of redemption points). However, no significant difference in actual performance is found between these treatments with the Mann-Whitney test, using session-level data ( $z = -1.347, p = 0.178$ ). The difference between the actual performance in the baseline and in the sabotage treatment is only 1.04 units (with no difference at all after the use of sabotage). No significant difference is found between these treatments either ( $z = -0.980, p = 0.327$ ). Finally, a similar test indicates that people actually produce significantly less in the sabotage treatment than in the ranking treatment ( $z = -1.900, p = 0.057$ ). This result supports the prediction of Proposition 2.

Figure 2 shows the time path of average performance by period in all treatments. It indicates that the evolution of performance over time differs also across treatments.

*(Figure 2 about here)*

Figure 2 indicates that the average performance is very similar across treatments in the first period of the game. The sharp increase in the average performance between period 1 and period 2, observed in all treatments, may simply reflect a learning effect. After period 5, however, average performance decreases in both the baseline and the sabotage treatments while it remains rather stable over time in the ranking and redemption treatments. This evolution suggests that status-seeking prevents performance from declining over time in the ranking and redemption treatments. The decline of performance in the sabotage treatment might be due to

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<sup>11</sup> All the non-parametric tests reported in this section maintain the conservative assumption that each session is a unit of observation and are two-tailed.

the fact that the positive effect of status concern on performance is more than offset by the discouragement produced in some players by this destructive environment.

Figure 3 provides complementary information about the evolution of the differences of performance across the first and the second half of the sessions, relative to the baseline.

*(Figure 3 about here)*

Figure 3 shows that there is little difference in performance between treatments in the first half of the game. In sharp contrast, strong differences across treatments emerge after period 5. These findings are confirmed by Mann-Whitney tests. While the difference between the ranking and the baseline treatments in the first five periods is marginally significant, none of the other differences are significant. In contrast, almost all differences are statistically significant in the last five periods. Compared with the baseline, people work harder both in the ranking treatment ( $z = -2.546, p = 0.011$ ) and in the redemption treatment ( $z = -2.091, p = 0.036$ ). The first comparison supports the prediction of Proposition 1. No significant difference is found between the sabotage and the baseline treatments ( $z = -0.980, p = 0.327$ ).

Taken together, these findings reveal that the differences observed between the baseline and the ranking or the redemption treatments are mainly due to a decline in performance over time in the baseline treatment or when sabotage is allowed. This may be explained by a decline of intrinsic motivation in these two environments. In contrast, status concerns in the ranking and redemption treatments prevent this decline.

The econometric analysis reported in Table 3 provides more formal support for these results. The dependent variable is the actual individual performance. Since there are 10 observations for each participant, we estimate econometric models with random effects. Model

(1) is a Generalized Least Squares model with robust standard errors clustered at the session level to control for serial correlation within each session. The independent variables include treatment dummies, with the baseline as the reference category, and a dummy variable equal to 1 if the observation belongs to periods 6 to 10, and 0 otherwise. Model (2) reports similar estimates with a control for usual demographic variables (gender, being a student at the University versus being in another school, studying economics or not). To check the robustness of our results, we have also estimated two random-effects Tobit models (models (3) and (4)), since a number of observations are left-censored (see the distribution of performances by treatment in Figure 1. In model (4), we add several interaction variables to the previous independent variables to control for trend differences across treatments in the second half of the game.

*[Table 3 about here]*

Model (1) shows that providing information on one's own relative performance has a positive and significant effect on absolute performance. All else equal, players' effort is predicted to increase by 4.51 units (19.71% of the coefficient of the constant term) in the ranking treatment compared to the baseline. The dummy variable "redemption" also captures a positive and significant coefficient, indicating that people also provide more effort in this treatment than in the baseline. Performance is 2.71 units higher (11.84% of the coefficient of the constant term) than in the baseline. A  $t$ -test indicates that there is no significant difference between the ranking and redemption treatments ( $p = 0.184$ ), suggesting that introducing the opportunity to artificially increase one's own performance does not lead to an improvement in average performance. Introducing the opportunity to sabotage leaves unchanged the average performance obtained in the baseline, suggesting that the positive effects of ranking are offset by the introduction of

sabotage activities. Model (2) reports similar results, indicating that these effects are robust to the introduction of demographics; similar results are also found with model (3), a Tobit model.

Model (4) indicates that the coefficients associated with the interaction variables *ranking\*periods 6-10* and *redemption\*periods 6-10* are positive and significant at the 1% level. These results confirm the fact that status concern mitigates the decline of performance observed in the baseline treatment in the second half of the game. The interaction variable *sabotage\*periods 6-10* is only marginally significant, probably because a large part of the impact of status concern is offset by the refusal of some subjects to work in such an environment. These findings support the predictions of our Propositions.

#### *4.2. Investment in status-seeking activities*

People are willing to pay to improve their performance artificially or for reducing the performance of others. On average in a period, the subjects buy 1.08 sabotage points (S.D. = 2.94) and 0.77 redemption points (S.D. = 2.15). A Mann-Whitney pairwise test indicates no significant difference in the number of points assigned between the sabotage and the redemption treatments across all periods ( $z = 0.733$ ,  $p = 0.460$ ) or in the final period alone ( $z = 1.155$ ,  $p = 0.248$ ). The high standard deviation indicates, however, a great deal of heterogeneity among individuals. In fact, only a modest proportion of participants (14.20%) purchase sabotage points in a period, but those who do so buy an average of 5.25 points; this represents 26.25% of their income for the period. Similarly, 11.90% of the subjects pay to increase their performance, purchasing 4.58 points on average (22.90% of their income for the period). Figure 4 illustrates the evolution of the number of redemption and sabotage points purchased over time.

[Figure 4 about here]

Figure 4 shows that the level of sabotage is quite stable, while people purchase fewer redemption points over time. To better understand the willingness-to-pay for status, we examine successively the determinants of sabotage and redemption behavior.

### *Status-seeking and sabotage*

Table 4 provides information on the determinants of sabotage points by reporting the estimates from random-effects Tobit models. The dependent variable is the total number of sabotage points assigned by player  $i$  to player  $j$ . The independent variables include the subject's actual performance that corresponds to the score of player  $i$  in the first stage of the game. It also includes the squared value of the actual performance to test for potential non-linearity in the relationship between sabotage and performance. We add several variables capturing the subject's position in the performance distribution, and include a dummy variable for periods 6 to 10.<sup>12</sup> We also control for demographics variables and the characteristics of the two co-workers to identify the presence of in-group effects.<sup>13</sup>

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<sup>12</sup> The  $rank_i$  variable corresponds to the relative position of subject  $i$  in the performance distribution at the end of the first stage of each period; it is equal to 1 for the highest position, 2 for the intermediate position, and 3 for the lowest position in the distribution. The  $rank_i^x$  variable is equal to 1 if the individual is in relative position  $x$  in the distribution, and 0 otherwise (with  $x = 1, 2$  or  $3$  for the highest, intermediate and lowest position, respectively). The interaction variable  $rank_i^2 * rank_j^1$  captures the situation where  $i$  occupies the intermediate position while the  $j$  has the highest rank. The difference in performance between  $i$  and  $j$  is also included. *Equal performance* is equal to 1 if the performance of both subjects is equal, and 0 otherwise. The *negative difference* variable corresponds to the absolute value of the difference between the performance of  $i$  and  $j$  if  $i$ 's initial performance is lower than  $j$ 's performance, and 0 otherwise. The interaction variable *low negative difference* takes the absolute value of the difference between  $i$  and  $j$  when this difference is less than 5 units.

<sup>13</sup> We also controlled for demographics variables and for the characteristics of the two other co-workers. More precisely, *same school* is equal to 1 if group members belong to the same school or university, and 0 otherwise. *Same gender* takes the value 1 if all group members are either males or females, and 0 otherwise. Last, *average medals<sub>i</sub>* (*average hats<sub>i</sub>*) indicates the current average number of gold medals (donkey hats) received by the two other group members in the previous periods. This variable is included to test whether being in a group of winners or losers influences the decision to sabotage others.

[Table 4 about here]

Table 4 illustrates the relationship between own performance and the decision to sabotage others. The *initial performance* variable captures a positive and significant coefficient, suggesting that the harder one works, the more one sabotages. This indicates that the subjects who sabotage are also those who are competitive and care about their rank. However, this relationship between performance and the decision to sabotage is non-linear. The reason is that the agents who exert a high performance need less sabotage to improve their rank. This is confirmed by the positive coefficient associated with the rank of the subject. After controlling for performance, this positive effect of rank indicates that the subjects who are not the best performers at the end of the first stage are more likely to pay to sabotage. Similarly model (2) in Table 4 indicates that being in the intermediate position ( $rank^2_i$ ) or in the lowest position ( $rank^3_i$ ) induces people to assign significantly more sabotage points than if they have attained the highest performance in their group. No significant difference is found between these two coefficients ( $p = 0.523$ ). Including demographic variables leave these results unchanged (see model (3)).

Do people sabotage to reach the highest position or to avoid getting the lowest one? The  $rank^2_i$  variable is no longer significant when the interaction variable  $rank^2_i * rank^1_j$  is included; the coefficient of this variable is positive and significant. This suggests that those who are in the intermediate position assign points only to those who are in the highest position in order to replace them in the highest position. Additionally, we find a positive and significant effect of the interaction variable “ $rank^3_i * rank^2_j$ ” in estimate (4). Controlling for this variable,  $rank^3_i$  is no longer significant, suggesting that those who are in the lowest position only assign points to those who are in intermediate position in order to avoid keeping the lowest position. Results

from model (5) also support these findings. People assign more sabotage points when a co-worker's performance is equal or slightly higher.

Belonging to the same school as the other group members reduces the willingness to sabotage. A possible interpretation is that people are reluctant to sabotage their peers because of in-group preferences. However, belonging to the same gender does not generate the same behavior, suggesting that being of the same gender confers only a weaker sense of group identity. *Average cum hat<sub>i</sub>* has a significant and negative coefficient, indicating that the presence of low-status co-workers reduces the subjects' willingness to pay for sabotage, probably because it is easier to outperform them naturally. Finally, having received sabotage points in previous period has no significant impact, indicating that sabotage is not motivated by revenge (which is not surprising since groups are re-matched after each period).

To summarize, these findings indicate that subjects who pay to sabotage co-workers are also those who work hard and are highly competitive. However, this relationship is non-linear since the agents with the highest performance need not sabotage to improve their rank. Another interesting finding is that agents sabotage only those whose performance is close to theirs while they tend to give up when the difference in performance relative to the co-worker is too large. Finally, our data suggests the presence of an in-group bias, as belonging to the same school reduces the subjects' willingness to sabotage.

### *Status-seeking and redemption*

Table 5 reports the results from random-effect Tobit regressions on the determinants of redemption decisions. The dependent variable is the total number of redemption points subject  $i$  buys to artificially increase her performance. The independent variables include most of the

variables presented in Table 4. The *negative difference* variable is the absolute value of the difference in performance between person  $i$  and the person with the next-higher performance, and is 0 otherwise. The *equal performance* variable is equal to 1 if subject  $i$ 's actual performance is identical to the actual performance of at least one other group member. It is intended to capture the effect of the willingness to differentiate oneself from equals.

Table 5 reports very similar results to those obtained in Table 4. The higher is the actual performance, the higher is the willingness-to-pay for redemption points. We also find an inverted U-shaped relationship between actual performance and the number of purchased redemption points. The  $rank^2_i$  and  $rank^3_i$  variables have a significant and positive coefficient, indicating that people buy more redemption points when they occupy the intermediate or the lowest position in the performance distribution compared with the people who occupy the highest position. Column (4) of Table 5 also shows that people buy redemption points to differentiate themselves from others, when they have equal actual performance; the time trend is negative. Last, belonging to the same school has a positive and significant impact on the willingness of people to increase their performance artificially. As we observed the opposite regarding the willingness to sabotage others, one interpretation is that in a group of peers people are particularly competitive, provided that it does not harm others.

#### *4.3. The impact of status-seeking on effort*

The rank in the distribution of performance and status-seeking activities in the group in the previous period may be important determinants of subsequent performance. We did not include these variables in the regressions reported above to avoid any endogeneity bias. We now estimate the determinants of changes in individual performance between period  $t$  and period  $t+1$

in separate random-effects Generalized Least Squares regressions. The independent variables include the same controls for the individual's rank in the distribution as in the regressions reported above. In addition, we include several variables to test for the influence of changes in the relative position of a subject in the distribution of performance due to status-seeking activities in the previous period. In particular,  $rank_i^3$  in  $(t-1)*change$  is equal to 1 if the subject has ended up in the lowest rank in period  $t-1$  while she had a higher rank at the end of the first stage of the previous period, and 0 otherwise. We also include the number of sabotage points received by the subject in the previous period and the number of redemption points purchased by the subject in  $t-1$ . In addition, we control for the standard demographic variables. Table 6 reports the results of these regressions.

[Table 6 about here]

Table 6 indicates that having the lowest rank in the distribution in period  $t-1$  leads people to increase their effort in the next period. This is interesting since effort is increased without any additional monetary incentive, which suggests that performance comparisons support intrinsic motivation. In contrast, being a victim of sabotage activities has a significant negative impact on future effort. Finally, Table 6 indicates that those who sabotage and those who purchase redemption points tend to exert more effort in subsequent periods. This suggests that competitive preferences motivate the people who are willing to reach the highest rank in their group both to exert productive effort even when paid a flat wage and to use artificial and costly means to improve their relative position in their group even when unfair to others.

## 5. DISCUSSION AND CONCLUSION

There are many examples in everyday life at work in which people invest resources in wasteful activities to improve their own relative position in their reference group or to decrease the relative position of others. This may lead to interpersonal or organizational deviance and to illegal or unethical practices like plagiarism, forgery, and sabotage. Our experiment investigates the existence of such behavior in the laboratory. We pay subjects a flat wage to perform a repetitive task, and even provide alternative leisure activities. Although a standard economic model would predict that people should not exert any effort at all under such a compensation scheme, we observe that subjects do work in this environment, showing evidence of intrinsic motivation for work. Interestingly, in the presence of intrinsic motivation, they work even harder when they receive information about their relative position in their group. This provides evidence that people care about their status, and that social comparisons can increase motivation.

Another striking result is that some people are willing to incur a cost to artificially increase their relative position in their group without any expectation of monetary return of any sort, either by sabotaging the work of others or by increasing their own output artificially. In both redemption and sabotage treatments, agents buy points when their performance is close to that of others, either to reach the highest rank or to avoid the lowest one. The sabotage treatment provides clear evidence that some people are willing to engage in wasteful status-seeking activities. Overall, we find support for our behavioral theoretical predictions, as there is significantly higher performance in the ranking treatment than in the baseline treatment, and significantly higher performance in both the ranking and redemption treatments than in the sabotage treatment.

We also find some evidence of an in-group bias and bonding. Indeed, when people are matched with peers from the same school, they are more likely to increase their own performance artificially by buying redemption points, but they are less likely to sabotage their group members. Group identity seems to favor positive rivalry but it discourages destructive competition among peers.

Our interpretation is that competitive preferences and a desire for dominance (Rustichini, 2008) help to explain why people care so much about their relative position that they are willing to pay to improve it. Our intuition is that paying people a flat wage leads those individuals who have competitive preferences to express them through status-seeking activities, including sabotaging the work of others. A natural extension is to investigate whether using a competitive payment scheme would reduce or increase this costly status-seeking behavior by focusing competitive behavior on increasing earnings.

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**Table 1. Characteristics of the experimental sessions**

<i>Session number</i>	<i>Number of subjects</i>	<i>Number of groups</i>	<i>Treatment</i>	<i>Location</i>
1	15	5	Baseline	Rennes
2	15	5	Baseline	Rennes
3	15	5	Baseline	Lyon
4	9	3	Baseline	Lyon
5	15	5	Ranking	Rennes
6	15	5	Ranking	Rennes
7	15	5	Ranking	Lyon
8	15	5	Ranking	Lyon
9	12	4	Sabotage	Rennes
10	15	5	Sabotage	Rennes
11	15	5	Sabotage	Rennes
12	15	5	Sabotage	Lyon
13	15	5	Sabotage	Lyon
14	15	5	Redemption	Rennes
15	15	5	Redemption	Lyon
16	15	5	Redemption	Lyon
17	15	5	Redemption	Lyon
18	15	5	Redemption	Lyon
19	15	5	Ranking <sup>‡</sup>	Rennes
20	15	5	Ranking <sup>‡</sup>	Rennes
21	15	5	Ranking <sup>‡</sup>	Rennes
22	15	5	Ranking <sup>‡</sup>	Rennes
23	12	4	Ranking <sup>‡</sup>	Lyon
24	12	4	Ranking <sup>‡</sup>	Lyon

<sup>‡</sup>: ranking treatment without symbol

**Table 2. Average performance by session in each treatment**

<i>Baseline</i>	<i>Ranking</i>	<i>Ranking (cdt)</i>	<i>Sabotage First stage</i>	<i>Sabotage Final</i>	<i>Redemption First stage</i>	<i>Redemption Final</i>
23.54 (11.60)	27.51 (8.41)	27.91 (9.41)	27.00 (6.17)	25.55 (7.28)	29.56 (5.73)	30.95 (5.82)
22.19 (9.98)	30.08 (8.13)	26.9 <sup>#</sup> (9.06)	25.21 (12.03)	23.87 (11.86)	24.26 (8.46)	25.04 (9.06)
22.6 (11.81)	29.96 (5.36)	21.65 <sup>#</sup> (11.28)	27.52 (7.30)	26.54 (7.11)	27.43 (7.56)	28.82 (8.10)
25.04 (12.12)	30.28 (7.42)	27.12 <sup>#</sup> (7.47)	18.66 (14.57)	18.08 (14.22)	25.34 (11.33)	25.58 (11.47)
	26.67 (8.72)	28.44 <sup>#</sup> (4.71)	23.13 (13.21)	22.13 (12.93)	22.72 (13.10)	22.82 (13.15)
23.15 (11.35)	...	27.65 (8.00)	24.19 (11.76)	23.13 (11.51)	25.86 (9.89)	26.64 (10.26)

Note: Numbers in parentheses are standard deviations. <sup>#</sup>: Variant of the ranking treatment with symbols

**Table 3. Determinants of effort**

<i>Dependent variable</i>	<i>Initial perf.</i>	<i>Initial perf.</i>	<i>Initial perf.</i>	<i>Initial perf.</i>
<i>Models</i>	<i>RE GLS<sup>a</sup></i>	<i>RE GLS<sup>a</sup></i>	<i>RE Tobit<sup>b</sup></i>	<i>RE Tobit<sup>b</sup></i>
	(1)	(2)	(3)	(4)
Baseline	<i>Ref.</i>	<i>Ref.</i>	<i>Ref.</i>	<i>Ref.</i>
Ranking	4.512*** (0.924)	4.528*** (1.0280)	4.780*** (1.467)	3.310** (1.495)
Sabotage	1.038 (1.560)	1.144 (1.298)	1.116 (1.663)	0.5288 (1.694)
Redemption	2.711** (1.192)	2.923** (1.143)	3.012* (1.652)	1.460 (1.683)
Ranking* periods 6-10				2.960*** (0.578)
Sabotage* periods 6-10				1.188* (0.654)
Redemption* periods 6-10				3.126*** (0.647)
Periods 6-10	0.558 (0.431)	0.558 (0.431)	0.459** (0.240)	-1.711*** (0.495)
Demographics	<i>no</i>	<i>yes</i>	<i>yes</i>	<i>yes</i>
Constant	22.878*** (0.535)	21.693*** (0.872)	21.420*** (1.545)	22.496*** (1.562)
Observations	3450	3450	3450	3450
Left-censored obs.	-	-	178	178
Log likelihood	-	-	-11034.217	-11015.973
Wald $\chi^2$	4588.26	8293.61	26.51	63.24
$p > \chi^2$	0.000	0.000	0.000	0.000

Notes: RE GLS <sup>a</sup> = Random Effects Generalized Least Squares; RE Tobit <sup>b</sup> = Random Effects Tobit.  
 \*\*\* Significant at the 0.01 level; \*\* at the 0.05 level; \* at the 0.1 level. Since observations within a session may be dependent, estimates are conducted with robust standard errors clustered on sessions. Robust standard errors are in parentheses.

**Table 4. Determinants of sabotage (random-effects Tobit models)**

<i>Dependent variable</i>	<i>Total number of points assigned by subject i to subject j</i>				
	<i>Models</i>	(1)	(2)	(3)	(4)
Actual performance	0.684*** (0.201)	0.630*** (0.199)	0.588*** (0.199)	0.573*** (0.206)	0.544** (0.230)
Actual perf. Squared	-0.009** (0.004)	-0.008** (0.004)	-0.007* (0.004)	-0.006* (0.004)	-0.007 (0.004)
Rank <sub>i</sub>	1.573*** (0.510)				
Rank <sub>i</sub> <sup>1</sup>		<i>Ref.</i>	<i>Ref.</i>	<i>Ref.</i>	<i>Ref.</i>
Rank <sub>i</sub> <sup>2</sup>		2.483*** (0.746)	2.504*** (0.744)	-0.076 (0.913)	0.334 (0.928)
Rank <sub>i</sub> <sup>3</sup>		2.971*** (1.028)	2.877*** (1.026)	0.636 (1.203)	-0.451 (1.412)
Rank <sub>i</sub> <sup>2</sup> * Rank <sub>j</sub> <sup>1</sup>				4.037*** (0.821)	
Rank <sub>i</sub> <sup>3</sup> * Rank <sub>j</sub> <sup>2</sup>				3.145*** (1.143)	
Points of sabotage received in ( <i>t</i> -1)					0.160 (0.102)
Positive difference Equal performance					<i>Ref.</i> 6.403*** (1.278)
Negative difference					-0.034 (0.100)
Low Negative difference					1.147*** (0.313)
Periods 6-10	-0.637 (0.580)	-0.677 (0.578)	-0.697 (0.575)	-0.193 (0.620)	0.112 (0.653)
Same gender				0.443 (0.643)	0.363 (0.714)
Same school				-2.385** (1.011)	-3.161*** (1.104)
Average medals <sub>i</sub>				0.068 (1.997)	-0.232 (2.541)
Average hats <sub>i</sub>				-5.833*** (1.974)	-7.141** (2.544)
Demographics					
Constant	<i>no</i> -16.467*** (2.847)	<i>no</i> -20.755*** (2.920)	<i>yes</i> -22.137*** (3.039)	<i>yes</i> -21.205*** (3.203)	<i>yes</i> -21.898*** (3.604)
Observations	1440	1440	1440	1440	1440
Left-censored obs.	1232	1232	1232	1232	1232
Log likelihood	-959.092	-957.661	-954.703	-931.046	-822.414
Wald $\chi^2$	24.51	27.98	33.27	69.28	71.17
$p > \chi^2$	0.000	0.000	0.000	0.000	0.000

Notes: \*\*\* Significant at the 0.01 level; \*\* at the 0.05 level; \* at the 0.1 level. Standard errors are in parentheses.

**Table 5. Determinants of the purchase of redemption points  
(random-effects tobit models)**

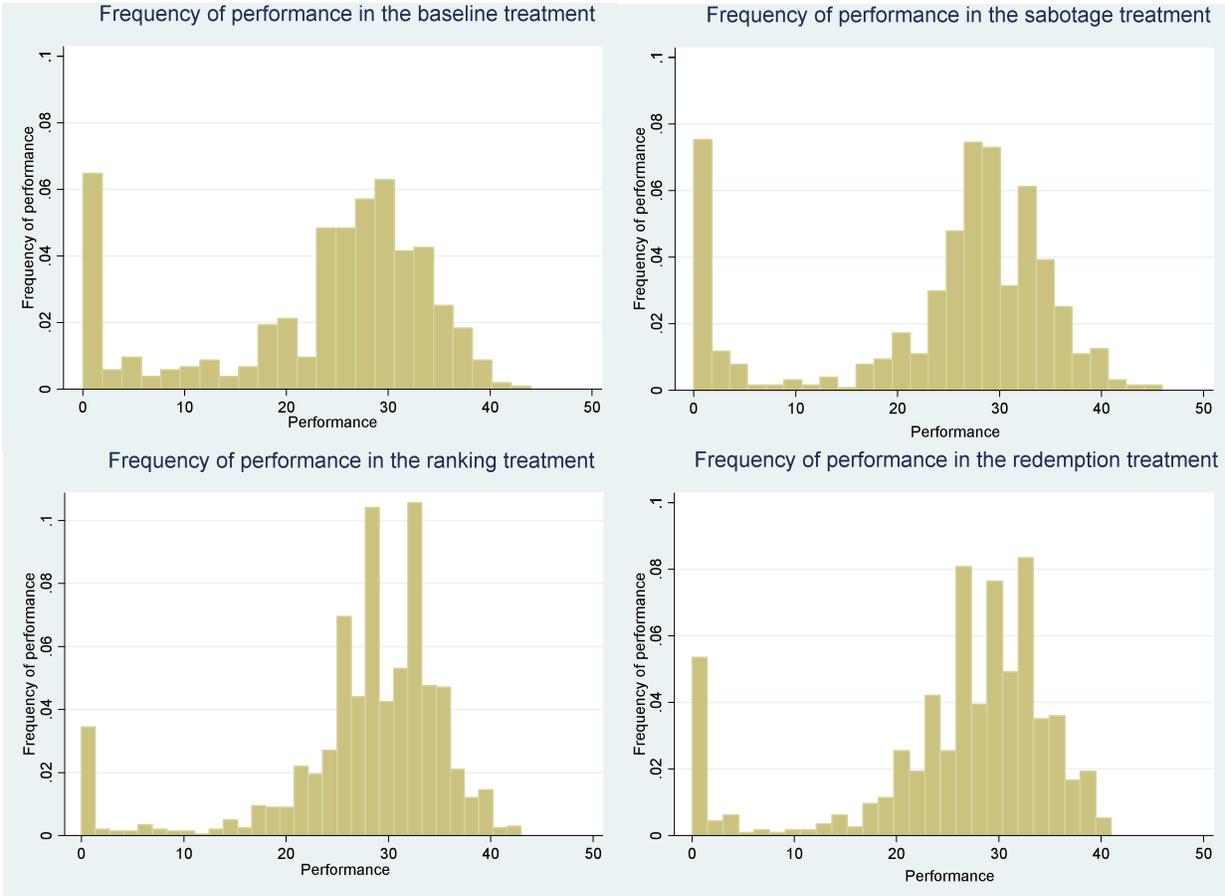
<i>Dependent Variable: Number of redemption points purchased by i</i>				
<i>Models</i>	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>
Actual performance	0.826*** (0.303)	0.797*** (0.304)	0.740** (0.309)	0.588* (0.345)
Actual performance Squared	-0.018*** (0.006)	-0.018*** (0.006)	-0.017** (0.007)	-0.015** (0.007)
Rank <sub>i</sub>	1.917** (0.768)			
Rank <sub>i</sub> <sup>1</sup>	<i>Ref.</i>	<i>Ref.</i>	<i>Ref.</i>	<i>Ref.</i>
Rank <sub>i</sub> <sup>2</sup>		2.442** (1.137)	2.058* (1.149)	1.456 (1.345)
Rank <sub>i</sub> <sup>3</sup>		3.750** (1.543)	2.892* (1.611)	2.928* (1.627)
Positive difference				<i>Ref.</i>
Equal performance				2.469* (1.468)
Negative difference				-0.138 (0.167)
Periods 6-10	-3.044*** (0.946)	-3.053*** (0.944)	-2.654*** (0.964)	-2.606*** (0.970)
Same school			3.637*** (1.398)	3.901*** (1.419)
Same gender			1.236 (0.968)	1.191 (0.973)
Average medals <sub>i</sub>			0.543 (2.947)	1552 (3.075)
Average hats <sub>i</sub>			-4.446 (2.744)	-3.869 (2.763)
Demographics	<i>no</i>	<i>no</i>	<i>yes</i>	<i>Yes</i>
Constant	-13.927*** (4.067)	-19.494*** (4.358)	-21.592*** (5.023)	-18.893** (5.687)
Observations	750	750	750	750
Left-censored obs.	636	636	636	636
Log likelihood	-521.240	-521.041	-509.297	-507.138
Wald $\chi^2$	32.80	33.17	48.70	51.28
$p > \chi^2$	0.000	0.000	0.000	0.000

Notes: \*\*\* Significant at the 0.01 level; \*\* at the 0.05 level; \* at the 0.1 level. Standard errors are in parentheses.

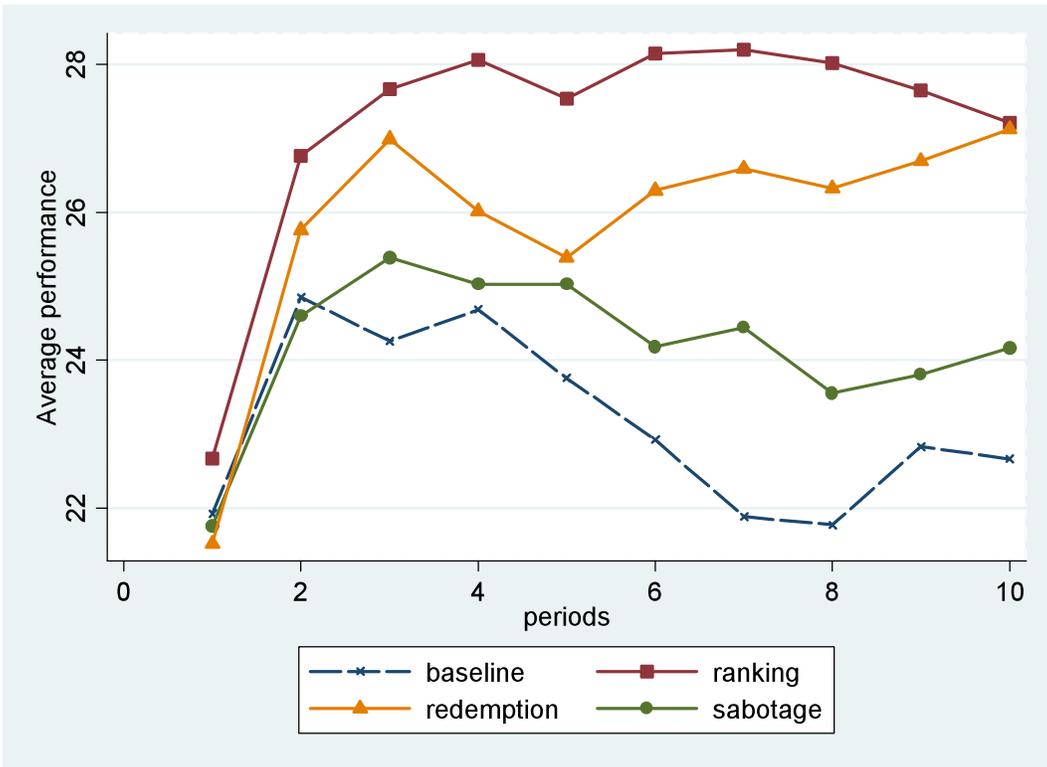
**Table 6. First differences in work effort by treatment (Random-Effects GLS models)**

<i>Treatments Models</i>	<i>Ranking (1)</i>	<i>Sabotage (2)</i>	<i>Redemption (3)</i>	<i>Ranking (4)</i>	<i>Sabotage (5)</i>	<i>Redemption (6)</i>
Rank <sub>i</sub> in ( <i>t</i> -1)	1.047*** (0.134)	1.137*** (0.251)	1.447*** (0.339)			
Rank <sub>i</sub> <sup>1</sup> in ( <i>t</i> -1)				<i>Ref.</i> 471 (0.354)	<i>Ref.</i> 0.579 (0.590)	<i>Ref.</i> 1.731*** (0.576)
Rank <sub>i</sub> <sup>2</sup> in ( <i>t</i> -1)				1.157*** (0.247)	1.951*** (0.565)	3.195*** (0.591)
Rank <sub>i</sub> <sup>3</sup> in ( <i>t</i> -1)					3.283 (2.883)	-2.292*** (0.486)
Rank <sub>i</sub> <sup>3</sup> in ( <i>t</i> -1)* Change						
Points of sabotage received in ( <i>t</i> -1)		-0.239 ** (0.105)			-0.321 ** (0.142)	
Points of sabotage assigned in ( <i>t</i> -1)		0.137*** (0.032)			0.140*** (0.024)	
Points of redemption purchased in ( <i>t</i> -1)			0.304*** (0.071)			0.309*** (0.079)
Constant	-1.611*** (0.250)	-1.837*** (0.511)	-2.518*** (0.723)	268* (0.162)	-0.474 (0.380)	-1.182** (0.514)
Observations	1296	648	675	1296	648	675
Wald $\chi^2$	71.00	371.08	53.22	199.85		177.16
$p > \chi^2$	0.000	0.000	0.000	0.000	0.000	0.000

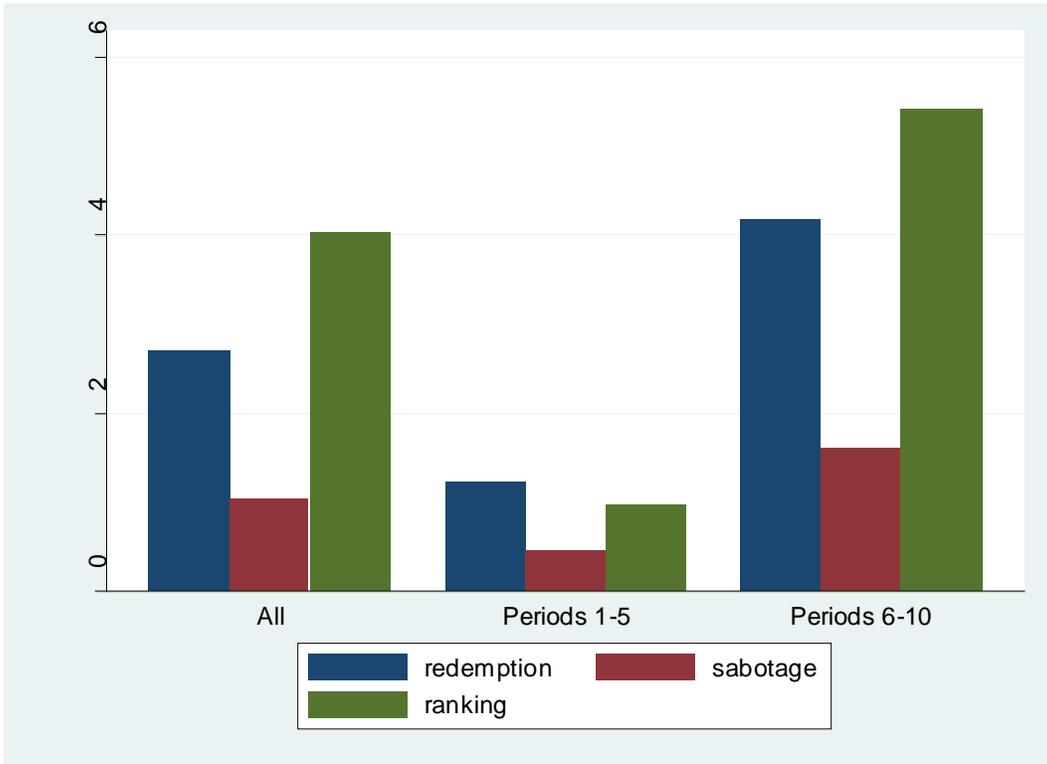
Notes: \*\*\* Significant at the 0.01 level; \*\* at the 0.05 level; \* at the 0.1 level.  
Robust standard errors are in parentheses, clustered at the session level.



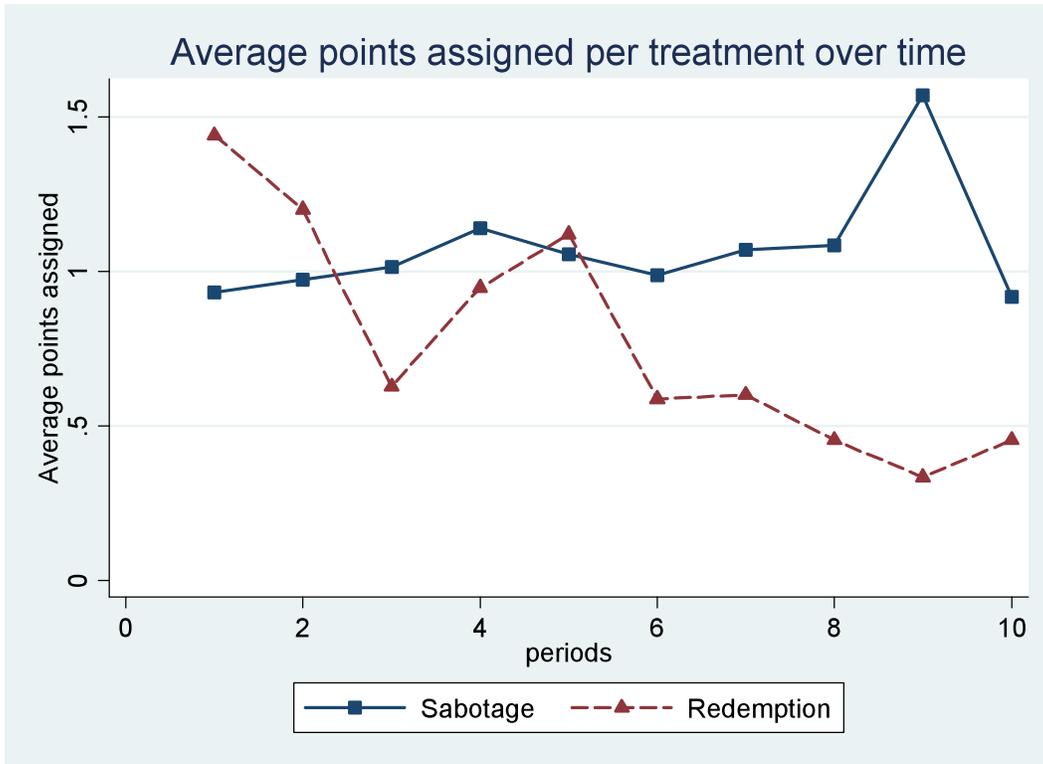
**Figure 1. Frequency of performance per treatment**



**Fig.2. Evolution of the average performance over time by treatment**



**Fig. 3. Average difference in performance between each treatment and the baseline**



**Fig. 4. Evolution of the average number of points purchased over time**

## **APPENDIX A: Instructions**

### **Instructions for the sabotage treatment**

The instructions for the other treatments are available from the authors upon request.

We thank you for participating in this experiment in economics during which you can earn money. You will receive a show-up fee of 5 Euros. In addition, you will receive additional earnings to perform a task. These earnings are given in ECU (*experimental currency units*). The conversion rate is:

$$10 \text{ ECU} = 1 \text{ Euro}$$

At the end of the session, your earnings in ECU will be added, converted into Euros and added to your show-up fee. The total amount of your payoff will be paid to you in private.

This session consists of 10 rounds that will start as soon as you have answered to some preliminary questions on your gender and your school. The successive parts start automatically. At the beginning of each part, all the participants are randomly matched in groups of three. Groups are rematched automatically at each new part. The identity of these co-participants will remain unknown.

#### **Description of each part**

At the beginning of each part, you receive 10 ECU to perform a task. This payoff is independent of your performance at the task.

Each part consists of two stages: in the first stage, you perform a task, then you are informed on your score and the scores of your two other group members; in the second stage, you can modify the score of your group members.

#### **Description of the first stage**

##### **The task**

The task consists of converting letters into numbers during two minutes. Your screen displays a table with two columns. The first column indicates letters and the second column indicates their correspondence in numbers. You are given a letter and you must enter the corresponding number in the box on your screen. You must validate your answer by pressing the 'OK' button.

Once you have validated your answer, you are immediately informed whether your answer is correct or not. If your answer is incorrect, you must enter a new number until the answer is correct. A new letter appears only after you have submitted a correct answer for the current letter.

As soon you have validated a correct answer, the conversion table of letters and numbers is modified and a new letter to convert is displayed on your screen. You can convert as many letters as you like during the two-minute period of time.

#### **Information on your screen at the beginning of a part**

At the very beginning of the first part, a table indicates for each group member his attributes in terms of gender and school.

During each part, you are continuously informed of the remaining time until the end of the part (at the top right of the screenshot: 'remaining time') and of your score (the number of correct answers).

Please find below a copy of the screenshot that will be displayed.

Période 1 de 10 Temps restant [sec]: 167

Vous êtes J3

Joueur	J1	J2	J3
Médaille d'or			
Bonnet d'âne			
Genre	♂	♀	♀
Ecole	Ecole de commerce Sciences Politiques	Autre Sciences Economiques	<b>Ecole d'ingénieur Chimie</b>

Lettre	Chiffre
A	10
B	21
C	19
D	12
E	13
F	14
G	4
H	9
I	7
J	17
K	8
L	20
M	18
N	15
O	2
P	1
Q	23
R	24
S	22
T	11
U	3
V	26
W	6
X	25
Y	16
Z	5

Lettre : W

Chiffre correspondant :

Nombre de bonnes réponses : 0

### Information on your screen at the end of the first stage

After the two minutes have elapsed, a graph represents your score and the scores of your two group members as bars which height is proportional to the number of correct answers provided.

### Description of the second stage

During the second stage, you can modify the score of each of the other group members. You can reduce the score of each of your group members in the limit of 20 units each. You cannot increase their score.

To modify the score of another member, you can use a slider as indicated on the figure below. By moving this scrollbar, you decide on the number of points that will reduce the scores of the other group members. Each point reduces the score by one unit. While moving the slider, you can see on the figure the score of the group member and the height of his bar decreasing. Since there are two other members in your group, you have two sliders.

Next, you must validate your choice by pressing the 'validate' button. If you modify the score of another group member, it costs you 0.5 ECU for each unit reduced.

Similarly, your group members can modify your score by during the second stage. You ignore who has modified your score, if any.

Please find below a copy of the screenshot that will be displayed.



At the end of the second stage, a new graph indicates your final score and the final score of your two group members for this part.

If you have performed the highest score in your group at the end of the second stage, you receive a 'gold medal' on your computer screen. If you have performed the lowest score in your group at the end of the second stage, you receive a 'donkey hat' on your computer screen. If you perform the intermediate score, you receive neither gold medal nor donkey hat. If two group members perform the same score and this score is higher than that of the third member, the first two members do not receive any medal and the third member receives the donkey hat. If their score is lower than that of the third member, the latter receives the gold medal and the two other members do not receive anything.

These gold medals and donkey hats are cumulated across parts.

**Beware: the assignment of gold medals and/or donkey hats depends on the final score, i.e. after a possible change of the initial score by the group members.**

At the beginning of each new part, the groups of three members are rematched randomly. Therefore, you are matched with two other participants than in the previous part. You are informed at the beginning of each new part of the attributes of the two other group members. These attributes include for each group member his gender, his school, and from the second part on, the number of his gold medals and donkey hats accumulated during the previous parts.

\*\*\*

During the experiment, you are allowed to read a book or a magazine that you have brought with you or the magazine that is placed on your desk. You must remain seated and keep silent until the end of the session. You must also press the "Next" button at the beginning of each new part to receive the 10 ECU for this part.

It is forbidden to communicate with the other participants; otherwise, you will be excluded from the session.

If you have any question regarding these instructions, please raise your hand. We will answer to your questions in private.

## APPENDIX B: Proofs

**Proof of proposition 1.** From equation (4), we can easily see that the model with standard preferences holds in the absence of information on others' choices. This should be the case in our baseline treatment in which people are not informed about others' performances. In contrast, depending on the value of parameter  $\theta$ , which measures how much they enjoy outperforming others, individuals may derive utility from effort in the ranking treatment.

From (4), using the implicit function theorem, each individual's response to the other agent's effort is given by:

$$\left. \frac{\partial e_i}{\partial e_j} \right|_{(4)} = \frac{\theta v_{11}(e_i - e_j)}{\theta v_{11}(e_i - e_j) - c_{11}(e_i)} \quad \text{with } i, j = 1, 2; j \neq i \quad (\text{B1})$$

The denominator of Eq. (B1) is negative by the requirement that the maximization problem be concave. The sign of the expression is therefore opposite the sign of  $v_{11}(e_i - e_j)$ . Provided  $v$  is concave, a rise in player  $j$ 's effort  $e_j$  leads the other agent to increase her own effort  $e_i$ ,  $i, j = 1, 2; i \neq j$ .

**Proof of proposition 2.** Let's solve the game by backward induction. In stage 2, players choose their sabotage effort. Assuming an interior solution, the following first-order condition defines the optimal sabotage choice of each agent  $i$ ,  $i = 1, 2$ , given the prior determination of work effort:

$$\theta v_2(e_i - e_j, a_i, a_j) - c_2(e_i, a_i) = 0 \quad i, j = 1, 2; i \neq j \quad (\text{B2})$$

The first term of equation (B2) expresses the marginal benefit from status induced by an increase in agent's sabotage activity, while the second term represents the marginal cost of

exerting sabotage. From (B2) it can be seen that for non-null values of  $\theta$ , individuals may choose a positive level of sabotage to artificially increase their performance. The intensity of sabotage depends on the form of both the utility  $v$  and the cost function  $c$ .

Solving the first-order condition for  $i, i=1,2$ , yields the following Nash equilibrium for the sabotage activity:

$$a_1^* = g(e_1, e_2) \text{ and } a_2^* = h(e_1, e_2) \quad (\text{B3})$$

Given identical agents, a symmetric equilibrium implies that  $g_1=h_2, g_2=h_1$ . Eq. (B2) yields<sup>14</sup>:

$$g_1 = h_2 = \frac{c_{21} - \theta v_{21}}{\theta v_{22} - c_{22}} \quad (\text{B4a})$$

and

$$g_2 = h_1 = \frac{\theta v_{21}}{\theta v_{22} - c_{22}} \quad (\text{B4b})$$

The denominator of both (B4a) and (B4b) is unambiguously negative. Sufficient conditions for  $g_1 < 0$  and  $g_2 > 0$  are that sabotage and work are substitutes such that not only greater work effort increases the marginal cost of sabotage ( $c_{21} > 0$ ) but also that sabotage and work be substitutes in the comparison utility such that  $v_{21} < 0$ .<sup>15</sup>

Next consider the first stage in which work effort is chosen. The subgame-perfect Nash equilibrium with respect to the choice of work effort implies that agent  $i$  solves:

---

<sup>14</sup> We also assume that increased sabotage effort by one agent leaves unchanged the marginal gain to increased sabotage effort on the part of the other agent in terms of indirect utility such that  $v_{23} = 0$ .

<sup>15</sup> Note that our conditions also hold if effort and sabotage are independent in disutility ( $c_{21} = 0$ ) or if they are complements in disutility ( $c_{21} < 0$ ) provided that  $|c_{21}| < |\theta v_{21}|$ . Nevertheless, assuming that people have a time constraint, it seems more natural to consider that work effort and sabotage are substitute in disutility.

$$\max_{e_i} \bar{w} - c(e_i, g(\cdot)) + \theta v(e_i - e_j, g(\cdot), h(\cdot)) \quad (\text{B5})$$

To solve this, we substitute (B3) for the constraint that determines the equilibrium level of the two agents' sabotage effort. Given a symmetric solution, we obtain the following first-order conditions with respect to agent 1's and 2's work efforts  $e_1$  and  $e_2$ , respectively:

$$\theta v_1 - c_1 + v_3 h_1 = 0 \quad (\text{B6a})$$

$$\text{and } \theta v_1 - c_1 + v_3 g_2 = 0 \quad (\text{B6b})$$

By comparison with the first order-conditions in the absence of sabotage (see Eq. 4), new terms appear in Eq. (B6a) and (B6b), i.e.  $v_3 h_1$  and  $v_3 g_2$ , respectively. Given our prior assumptions,  $v_3$  is negative and  $h_1 = g_2 > 0$ . This implies that  $v_3 h_1 < 0$  and  $v_3 g_2 < 0$ . These terms can be interpreted as the reduced comparison-utility due to the reaction of player  $j$  in terms of increased sabotage effort in response to an increase in agent  $i$ 's work effort. The optimal level of effort  $e^{**}$  that solves (B6a) and (B6b) should be therefore lower than the level  $e^*$  that solves (4).

Intuitively, the reason for lower effort in the sabotage treatment than in the ranking treatment is that by choosing her work effort each player internalizes the negative externality induced by the sabotage activity of the other agent. Precisely each agent anticipates the negative reaction of player  $j$  in terms of increased sabotage in response to her work effort that leads to a reduction of indirect comparison-utility  $v$ .

**Proof of proposition 3.** We use backward induction to solve the redemption game. First-order conditions defining the optimal redemption effort of each agent  $i$ ,  $i=1,2$ , given the prior

determination of work effort, are given by:

$$\theta v_2(e_i - e_j, r_i, r_j) - c_2(e_i, r_i) = 0 \quad i, j = 1, 2; i \neq j \quad (\text{B7})$$

The first term of equation (B7) is the marginal benefit from status induced by an increase in agent  $i$ 's redemption effort; the second term is the marginal cost of this effort. We can solve this first-order condition to obtain the following Nash equilibrium for redemption effort:

$$r_1^* = k(e_1, e_2) \quad \text{and} \quad r_2^* = l(e_1, e_2) \quad (\text{B8})$$

In the first stage, each agent chooses her work effort by solving the following maximization problem:

$$\max_{e_i} w - c(e_i, k(\cdot)) + \theta v(e_i - e_j, k(\cdot), l(\cdot)) \quad (\text{B9})$$

We obtain first-order conditions with respect to agent 1's and 2's work efforts  $e_1$  and  $e_2$  by substituting (B7) for the constraint that determines the subgame Nash equilibrium level of two agents' redemption effort:

$$\theta v_1 - c_1 + v_3 l_1 = 0 \quad (\text{B10a})$$

$$\text{and} \quad \theta v_1 - c_1 + v_3 k_2 = 0 \quad (\text{B10b})$$

It is instructive to compare agents' optimal choices of work effort  $e^{***}$  that solves the set of Eq. (B10) with the optimal choice of effort  $e^{**}$  that solves the set of Eq. (B6). Note that potential differences of work effort in redemption and sabotage treatment may stem only from differences between the final terms:  $v_3 l_1$  and  $v_3 h_1$ , respectively in Eq. (B10a) and (B6a). Similar comparison can be done between  $v_3 k_2$  and  $v_3 g_2$ . A sufficient condition for  $e^{***} > e^{**}$  is that  $|v_3 h_1| < |v_3 l_1|$ . According to the following condition  $|v_3 h_1| < |v_3 l_1|$ , agents would incur higher losses

in term of indirect utility  $v$  when the other agent increase her sabotage activity compared to the redemption case where the other agent increases her redemption effort.

Intuitively the reason for higher effort in the redemption treatment compared to the sabotage treatment is that agents incur a higher cost of received sabotage than redemption effort by the other agent. This might be the case either if the indirect disutility of receiving sabotage is higher than the disutility of the other player acquiring redemption or if the other player is more prone to engage in sabotage than redemption in response to an increase in the agent's work effort.