Self-selection and the power of incentive schemes: An experimental study*

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Abstract

We examine how self-selection of workers into firms depends on the power of the firms' incentive schemes and how it affects the performance of firms that increase the power of the incentive schemes. In a laboratory experiment, we let subjects choose between (low-powered) team incentives and (high-powered) individual incentives. We observe that subjects exhibiting high trust or reciprocity in the trust game are more likely to choose team incentives. When exposed to individual incentives, workers who chose team incentives perform worse if both the unobservable interdependency between workers and their incentive to cooperate under team incentives are high.

JEL Classification: C91, J3, M52, M55

Key words: Self-selection; Incentive schemes; Laboratory experiment

1 Introduction

A reorganization in a firm or the restructuring of the public sector often involves proposals to increase the power of employees' incentive schemes. Recent examples of such proposals in the public sector are with respect to teachers, employment offices, and medical practices (see Burgess and Ratto (2003) for a survey). Indeed, there is some empirical evidence

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that high-powered incentive schemes improve workers' performance. For instance, Lazear (2000) studies the behavior of 3,000 employees of a car glass company that changed the compensation method from an hourly wage to piece-rate pay. This shift could be interpreted as a move from a low-powered incentive scheme to a high-powered one. Lazear observes that the average output per worker increases by 44%. Nalbantian and Schotter (1997) find similar evidence in laboratory experiments. They compare payment schemes based on team performance (i.e. low-powered incentives) and individualistic performance (i.e. high-powered incentives). They document that the team performance schemes perform much worse.

However, the literature also offers mechanisms which explain why low-powered incentive schemes may perform well. These include intrinsic motivation, positive reinforcement, mutual monitoring among team members, and opportunities for subjects to reciprocate among each other within a team (Kandel and Lazear, 1992, Minkler, 2002). In questionnaires, workers indicate that they very much appreciate non-pecuniary motivations like intrinsic incentives to perform the job (Frey and Jegen, 2001) as well as a fair relationship with the employer (Fehr and Schmidt, 2004). Indeed, Ittner et al. (2003) (physicians), Lavy (2002) (teachers), and Knez and Simester (2001) (airlines) all provide evidence on teams in which (low-powered) team incentives do perform well. Low-powered incentive schemes may even outperform high-powered ones when the latter crowd out intrinsic motivation (Frey and Jegen, 2001).

In this paper, we study one effect of incentive schemes that has been hardly addressed in the literature so far: self-selection of worker types into firms. Indeed, crowding-out of intrinsic motivation may be amplified if intrinsically motivated workers self-select into firms with low-powered incentives (Delfgaauw and Dur, 2007). We examine how self-selection of workers into firms depends on the power of the firms' incentive schemes and how it affects the performance of firms that increase the power of the incentive schemes.

We answer these questions using a laboratory experiment in which subjects perform two tasks in a simple production game. In Task 1, they produce their own output, while in Task 2, they increase the output of the colleague in their team. Before they perform the tasks, subjects have to choose between two payment schemes: a low-powered one and a

high-powered one. Subjects choosing the same scheme are matched together. Under either scheme, their payment is based on both team performance and individual performance. In the high-powered one, individual performance has a higher weight in the payment. For 10 rounds, subjects participate under the scheme they have chosen. Next, all subjects play 10 more rounds in which they are paid according to the high-powered payment scheme. A priori, it is not clear whether the performance will improve for those who had chosen the low-powered incentive scheme. The higher power of the scheme may induce workers to expend more effort in Task 1 because they obtain a higher payment for their own output. However, this effect may be counterbalanced because workers no longer have the incentive to reward their colleague for high effort in Task 1 with high effort in Task 2. In other words, reciprocal behavior is not triggered by the high-powered incentive scheme because money-maximizing workers exert high effort in Task 1 in the subgame perfect Nash equilibrium. The latter effect may be strong because in the self-selection process, reciprocators may be more likely to choose to work for a low-powered incentive scheme than money-maximizers. However, also money-maximizers who have trust in others to cooperate in both tasks may choose the low-powered incentive scheme so that they can choose to free-ride in Task 2. To analyze the role of trust and reciprocity, we let subjects submit strategies in the trust game and use these as measures for these characteristics.

We use a laboratory experiment to answer our research questions because field data are likely to suffer from measurement and identification problems. Measurement problems may, for instance, arise in connection to workers' output and even if output is measurable, the researcher has no information on an individual's effort and preferences. Identification problems occur because it is not straightforward to isolate the effect of the power of the incentive scheme on a worker's performance from other effects. In contrast, in the laboratory we can observe each subject's effort and measure their preferences, and we can expose the same individual to different payment schemes and observe her reaction, while keeping the rest of the environment constant.

Self-selection of employees in firms is hardly explored in existing empirical literature. Notable exceptions are Lazear (2000) (in a field study) and Keser and Montmarquette (2004) and Dohmen and Falk (2006) (in laboratory experiments). In his field experiment

in a car glass company, Lazear (2000) not only observes that the average output per worker went up when the company increased the power of its workers' incentive scheme, he also finds that the firm was increasingly able to attract productive workers. In other words: there is a clear self-selection effect.

Like us, Dohmen and Falk (2006) and Keser and Montmarquette (2004) study self-selection in a laboratory experiment. Dohmen and Falk (2006) let subjects choose between a fixed and a variable payment scheme in a real effort experiment (the task is to correctly multiply one- and two- digit numbers). They observe strong self-selection: the more productive a subject is the more likely she is to opt for a variable payment scheme. In contrast to us, Dohmen and Falk do not examine the effect of increasing the power of the incentive scheme for those who choose the low-powered one (i.e. a fixed payment). Keser and Montmarquette (2004) have a similar set-up as ours, with the differences that (1) they let each subject stay in the same two-player team for the duration of the experiment and (2) by construction, the maximum payoff is higher under team incentives than under individualistic incentives, while in our set-up it is the same. Keser and Montmarquette observe that team incentives are popular, and frequently lead to high output. In our experiment, subjects are randomly rematched after each production game so that trigger strategies cannot explain the instances of cooperation we observe.

Our experimental findings show that trust and reciprocity (as measured in the trust game) are important determinants of subjects' sorting behavior. The more a subject trusts and the higher her propensity to reciprocate the more likely she is to choose the low-powered payment scheme. Indeed, we observe reciprocal behavior in the low-powered incentive scheme in the sense that a subject is more likely to expend high effort in Task 2 if both she and her colleague exert high effort in Task 1. We also find that increasing the power of the incentive scheme has ambiguous effects: subjects who choose the low-powered incentive scheme increase output when confronted with high-powered incentives if and only if the benefits from (unobservable) cooperation are high, from both the individual's and the team's viewpoint. Self-selection partly explains why workers may perform worse if the power of their incentive scheme is increased.

The remainder of the paper is organized as follows. Section 2 contains the theoretical

analysis of the production game. In section 3, we discuss the design of the experiment and our hypotheses. Section 4 includes the experimental observations. Section 5 concludes.

2 Theory

We study a production game in which a principal lets agents choose between a low-powered incentive scheme and a high-powered one. Two agents who opt for the same scheme form a team and play a simple production game. After describing the rules of the game, we study its properties under the assumption that agents are only interested in their own monetary pay-off.

The rules of the production game are as follows. The two agents (labeled 1 and 2) provide input in two subsequent tasks. In Task 1, each agent i independently chooses effort $e_i \in \{L, H\}$, where $0 \leq L < H$. The costs of effort are $c(e_i)$, with $c(L) = 0 < c(H) < H - L$. In Task 2, after observing the effort of the other agent, each agent i chooses a reward $r_i \in \{0, R\}$, with $0 < R$. The higher effort and reward the higher the agent's costs. Cost of reward are $k(r_i)$ where $k(0) = 0$ and $0 < k(R) < R$. An agent's effort raises her own output, while her reward raises the output of her team member (which could be interpreted as helping the other person or being cooperative with her). More precisely, the relationship between the efforts and the rewards of players i and j forming one team and the output o_i of player i is the following:

$$o_i = e_i + r_j$$

$\{i, j\} = \{1, 2\}$. We assume that individual output is observable by the principal, while the input is observable only by the agents and unverifiable vis-a-vis the court.

A parameter $\alpha \in \left[\frac{1}{2}, 1\right]$ characterizes the environment in which the production team operates. Player i receives the following payment as a function of her output and the output of the other player:

$$p_i = \alpha o_i + (1 - \alpha)\, o_j$$

$\{i, j\} = \{1, 2\}$. In other words, α is a measure of the extent to which an agent's output determines her payment. In the extreme case $\alpha = 1$, only her own output determines what she gets, while the other extreme $\alpha = \frac{1}{2}$ indicates that the payments are only

based on total team performance. Note that there is a one-to-one relationship between a team's total output and the total payment to the team members. So, we assume that the principal and the agents proportionally share the gains from the agents' output. Table 1 summarizes the resulting two-stage game.

Task 1	H	L
H	$H - c(H)$, $H - c(H)$	$\alpha H + (1-\alpha)L - c(H)$, $\alpha L + (1-\alpha)H$
L	$\alpha L + (1-\alpha)H$, $\alpha H + (1-\alpha)L - c(H)$	L, L

Task 2	R	0
R	$R - k(R)$, $R - k(R)$	$(1-\alpha)R - k(R)$, αR
0	αR, $(1-\alpha)R - k(R)$	0, 0

Table 1: Payoff matrices of the production game.

Proposition 1 characterizes the subgame perfect Nash equilibrium (SPNE) of the production game.

Proposition 1 *The production game has an SPNE in weakly dominant strategies in which both agents choose effort $e = H$ [$e = L$] in the first task if*

$$\alpha \geq [\leq] \frac{c(H)}{H - L} \equiv \alpha_1.$$

In the second task, both choose reward $r = R$ [$r = 0$] if

$$\alpha \leq [\geq] 1 - \frac{k(R)}{R} \equiv \alpha_2.$$

Proof. Straightforward. ■

This proposition implies that the output in the first [second] task is higher [lower] the higher α. Observe that the players reach the Pareto optimum if and only if both play $e = H$ and $r = R$. If $\alpha_1 \leq \alpha_2$, this is an equilibrium outcome for $\alpha \in [\alpha_1, \alpha_2]$.

Before the agents produce, the principal has them choose between two payment schemes. We let INDI [TEAM] denote the high- [low-]powered payment scheme, because it as the larger weight on individual [team] performance. We wish to focus on

the nontrivial case in which there is no α for which the Pareto efficient outcome can be achieved in an SPNE, that is: $\alpha_1 > \alpha_2$.

If α_{INDI} [α_{TEAM}] denotes the high- [low-]powered scheme's α, we assume that

$$\alpha_2 < \alpha_{TEAM} < \alpha_1 < \alpha_{INDI}.$$

The following proposition implies that a principal who wants to maximize total output prefers to confront the agents with INDI.

Proposition 2 *In the SPNE, in INDI [TEAM], both agents in the production team choose effort $e = H$ [$e = L$] and reward $r = 0$. Total output is higher in INDI than in TEAM and so is each agent's payment.*

Proof. Follows immediately from Proposition 1. ■

However, TEAM may yield a better outcome than INDI for both the principal and the agents if the population contains sufficiently many reciprocal agents, i.e. agents who wish to cooperate as long as their team mate does so as well. A reciprocator plays the following "tit-for-tat" strategy in TEAM: she starts off by choosing effort $e = H$ in Task 1, and she continues to cooperate by submitting reward $r = R$ in Task 2 if and only if the other team member chooses the high effort $e = H$ in Task 1 as well. Note that money maximizing agents may "free-ride" on a reciprocal agent's effort by choosing effort $e = H$ in Task 1 submitting reward $r = 0$ in Task 2. Observe that the money maximizer obtains a higher pay-off in TEAM than in INDI if he meets a reciprocator who plays the above "tit-for-tat" strategy.

3 The experiment

In this section, we describe the design of our experiment and the hypotheses that we wish to test based on the results from the theory.

3.1 Design

In the year 2004, we ran 9 experimental sessions using two parametrizations of the production game (see Tables 2 and 3 below). Altogether, 172 students from Tilburg University

participated in the experiment. Participants were paid for all points they earned in the experiment (on average 13 Euro including a 5 Euro participation fee for a session lasting approximately 1.5 hours). The experiments took place in English. The experiments were fully computerized, programmed, and conducted using z-Tree (Fischbacher, 1999). Upon arrival at a session, participants were randomly seated at computer cubicles which were separated by blinds. During the experiment, communication other than via computer was prohibited.

Of the 172 subjects, 134 participated in the main design, while 38 entered control sessions (see further below). In each experimental session of the main design, subjects had to make decisions at four subsequent stages:

1. the trust game;
2. a "labor market" in which subjects chose between TEAM and INDI;
3. the production game (10 rounds) in the chosen incentive scheme TEAM or INDI;
4. the production game (10 rounds) in INDI.

Subjects only received instructions for the stage that they were on, and were not informed about the stages to follow. Moreover, no feedback on the trust game was given before the end of the experiment so as not to contaminate further decision making in the main part of the experiment.

Let us discuss the experiment in detail. We used the trust game to measure subjects' reciprocity and trust (i.e. their belief in others' reciprocity). Berg et al. (1995) designed the trust game to mimic a situation in which two players, a sender and a receiver, can profit if trust exists between them. The sender has to decide how much of her 10 point endowment to transfer to the receiver. This money is then tripled and the receiver has to decide how much money (if any) to return to the sender. In the unique SPNE of the trust game, a money maximizing receiver will return zero, so that a money-maximizing sender will transfer zero. However, senders who expect receivers to be sufficiently reciprocal have the incentive to transfer a strictly positive amount of money. We, therefore, use a

subject's action in the role of sender to evaluate her level of trust, and her strategy in the role of receiver to measure her level of reciprocity.

In order to obtain a measure of both trust and reciprocity for each subject, we used a strategy method behind the veil of ignorance.[1] We asked subjects to submit strategies for both roles of the trust game, i.e. they first decided how much to transfer to the receiver in the role of sender, and then how much to return to the sender for every level of transfer the sender could make. At the very end of the experimental session, we let the computer decide at random which role each subject would play and to whom she would be matched. We paid them according to the strategies they submitted for the role that was assigned by the computer. A measure of a subject's trust is how much she transfers in the role of sender (which is an integer between 0 and 10).[2] A measure of a subject's reciprocity is the average fraction she returns in the role of receiver (a number between 0 and 1).

In the second stage of the experiment, we present subjects with a choice between the production games INDI and TEAM. Four sessions used parametrization P1 and three sessions parametrization P2, see Table 2. These parametrizations result in the pay-off matrices depicted in Table 3. The intuition behind the choice of parametrizations P1 and P2 is that in P2, subjects lose more points ($6-0=6$) when they fail to initiate cooperation than in P1 (where they lose $6-2=4$ points). At the same time, the incentives to free-ride on a cooperator are higher in P1 than in P2 (2 points vs. 1 point). As a result, reciprocal subjects are expected to be less successful in sustaining cooperation in P1 than in P2.

In each round, a subject was assigned to another anonymous co-player from among the subjects who chose the same scheme.[3] This matching procedure was known to the subjects. Of the 134 subjects in the main design, 6 could not continue into the production game because an odd number of subjects entered either of the two schemes.

After 10 rounds, we informed subjects that they would play 10 more rounds in which

[1] Vyrastekova and Onderstal (2005) discuss this design and observe that subjects behave similarly as in the standard trust game design.

[2] We are aware of the fact that the sender's motivation to transfer money in the trust game may go beyond the belief in positive reciprocity (Charness, 2004). For instance, risk and betrayal aversion might affect sender's decision to send money in the trust game (see Schechter, 2007 and Bohnet and Zeckhauser, 2004 respectively). However, Vyrastekova and Garikipati (2005) provide evidence that transfers are a reasonable measure of belief in positive reciprocity.

[3] When an odd number of subjects chose either scheme, one or two subjects were randomly excluded from continuing in the experiment, so that we could match the subjects into pairs.

	Parametrization P1	Parametrization P2
Number of sessions	4	3
Number of subjects	78	56
H	18	14
L	2	0
$c(H)$	12	8
R	16	14
$k(R)$	8	8
α_{INDI}	$\frac{7}{8}$	$\frac{6}{7}$
α_{TEAM}	$\frac{5}{8}$	$\frac{1}{2}$

Table 2: Experiment parametrizations of the production game

Parametrization P1						Parametrization P2					
INDI			TEAM			INDI			TEAM		
Task 1	H	L	Task 1	H	L	Task 1	H	L	Task 1	H	L
H	6,6	4,4	H	6,6	0,8	H	6,6	4,2	H	6,6	-1,-1
L	4,4	2,2	L	8,0	2,2	L	2,4	0,0	L	7,7	0,0
Task 2	R	0	Task 2	R	0	Task 2	R	0	Task 2	R	0
R	8,8	-6,14	R	8,8	-2,10	R	6,6	-6,12	R	6,6	-1,7
0	14,-6	0,0	0	10,-2	0,0	0	12,-6	0,0	0	7,-1	0,0

Table 3: Experiment payoff matrices of the production games

all participated in INDI. We rematched them after each round, but only among those who chose the same scheme in the labor market. Having also finished these 10 rounds, the subjects learned the results of the trust game and their accumulated earnings for the whole experiment, and were paid by us in cash.

In order to evaluate how self-selection affects our results, we ran a control session where we forced all subjects to start with TEAM. We did so with 18 and 20 subjects in P1 and P2 respectively. In both control sessions, the procedures were kept as similar to the other sessions as possible. Subjects submitted the trust game strategies, and then played 10 rounds of the production game under TEAM incentives in the given parametrization. Afterwards, we informed subjects that they would participate in 10 more rounds and we exposed them to the TEAM scheme in the other parametrization. We chose this approach so as to let subjects earn approximately the same amount of income as in the other sessions. In our analysis, we only compare TEAM without self-selection in rounds

1 to 10 to TEAM with self-selection (rounds 1 to 10 as well).

3.2 Hypotheses

The theoretical results of section 2 provide a set of testable hypotheses concerning the payment scheme subjects choose and their behavior under these schemes. In this subsection, we formulate the three hypotheses that we test using experimental data. Under the hypotheses, we maintain the assumption of money-maximizing subjects. All hypotheses may be rejected if the population contains sufficiently many reciprocal agents.

Hypothesis 1a: Labor market. All subjects select INDI.

Hypothesis 1b: Production. In INDI [TEAM] subjects choose $e = H$ $[e = L]$ in Task 1 and $r = 0$ in Task 2.

Hypotheses 1a and 1b may be rejected if subjects with high trust and/or high reciprocity select TEAM. As said, subjects may earn more in TEAM than in INDI if they choose $e = H$ in Task 1 and $r = R$ in task 2 if they observe history (H, H) in Task 1, and $r = 0$ otherwise. Such a strategy could be typical for a reciprocal subject: she cooperates in Task 2 if and only if her colleague cooperates in Task 1. If all subjects were sufficiently reciprocal, all would choose TEAM and play the above strategy. Moreover, a non-reciprocal subject may also choose TEAM if she believes that reciprocators enter TEAM as well. She could play $e = H$ in Task 1, hoping that her team mate cooperates in both task, so that she could free ride in Task 2 by opting for $r = 0$.

Next, we spell out the hypothesis most relevant for policy: does a team perform better if the principal increases the power of the incentive scheme?

Hypothesis 2: The power of incentives. Subjects who choose to play TEAM in rounds 1-10 produce less in rounds 1-10 than in rounds 11-20 (in which they play INDI).

We may not find support for hypothesis 2 if reciprocal subjects self-selected in TEAM. Indeed, if sufficiently many subjects choose $e = H$ in Task 1 and $r = R$ in task 2, they perform worse in INDI.

Finally, we address the question to which extent self-selection contributes to TEAM outperforming INDI - if it does. Subjects may select TEAM to express their willingness to provide high effort without explicit monetary incentives. It is especially relevant when we think of firms operating under team-based incentives. The incentive scheme is usually known to the workers entering the firm beforehand, i.e. it is one of the factors upon which they select the firm. If self-selection matters then it generates a reason for the firm to stick to TEAM incentives. We can evaluate the role of self-selection for the success of team-based incentives by comparing the behavior of subjects in TEAM who self-selected this scheme, to subjects who were forced to play TEAM. If more cooperation is found in the former group, then self-selection is responsible for at least part of the success of TEAM.

Hypothesis 3: Self-selection. Subjects who select TEAM in the main design (in which they can choose between TEAM and INDI) produce the same output as those who participate in the control design (in which all play TEAM).

Hypothesis 3 will be rejected if the initial sorting of subjects into TEAM and INDI results in higher payoffs for subjects in TEAM. The driving force may be that those who choose TEAM trust more and are more reciprocal than those choosing INDI. If all subjects are forced to play TEAM, less reciprocity may be realized, so that the output in TEAM ends up being lower than it would be under sorting.

4 Data analysis

In this section, we address the results from our experiment in the light of the three hypotheses formulated above. We reject the first hypothesis for parametrization P1, and all hypotheses for P2. Before discussing these observations in more detail, we wish to note that the findings in our trust game set-up do no differ substantially from the observations in Berg et al.'s (1995) standard trust game (quoted in brackets). In our experiment, senders transfer, on average, 51% (52%) of their endowment to receivers, while 9% (6%) of them send nothing. Receivers return on average 36% (30%) of the sender's transfer.

4.1 Labor market and production

A substantial fraction of subjects chooses TEAM in both parametrizations: 34% in P1 and 44% in P2. This finding allows us to reject the hypothesis that all select INDI. Figures 1 and 2 present subjects' choices in the trust game conditional on the payment scheme they selected. From these figures, it becomes clear that those who choose TEAM have both more trust and higher reciprocity. Subjects selecting INDI send on average 4.6 points while those selecting TEAM send significantly more, 5.5 points (Mann-Whitney U test, $p = 0.049$). Subjects selecting TEAM return a fraction that leaves senders' investment profitable (i.e. more than one third of the received number of points), unlike subjects selecting INDI who return less than senders sent to them.

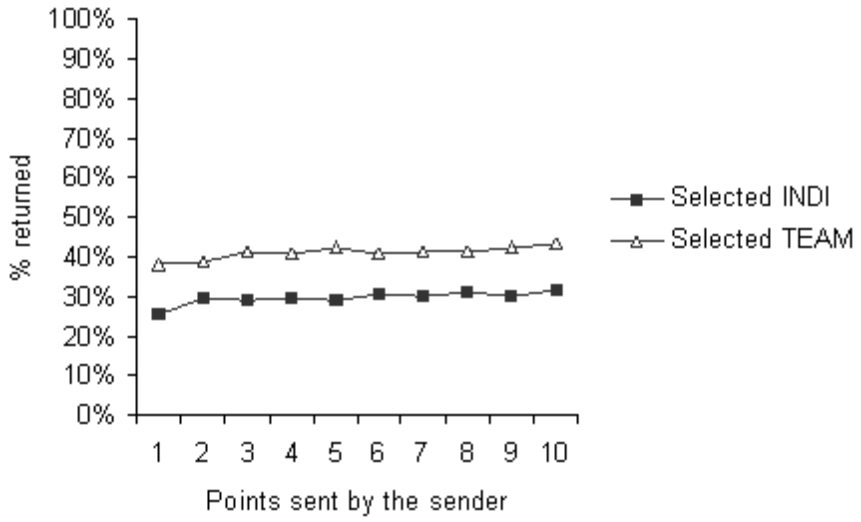

Figure 1: Reciprocity by subjects who selected INDI and TEAM.

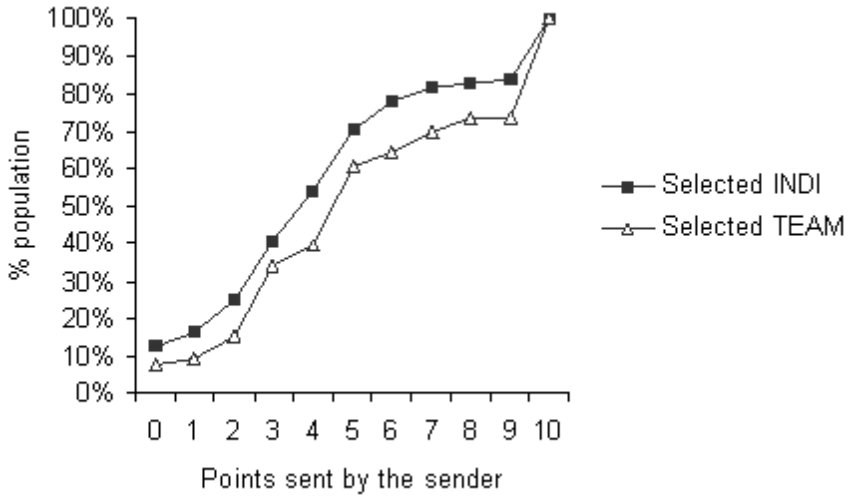

Figure 2: Distribution of "trust" by subjects who selected INDI and TEAM.

Table 4 includes Probit estimates for the choice of TEAM. The outcomes show that there is a non-linear relationship between trust and reciprocity on one hand, and the choice of the payment scheme on the other. Both trust and reciprocity have a positive effect on the choice of TEAM (in line with the above non-parametric tests). However, the interaction term is negative and (weakly) significant. Its parameter estimate implies that given values of reciprocity below 0.57, higher trust makes entry into TEAM more likely.

Variable	Coefficient estimate	Standard error
Trust	0.057**	(0.024)
Reciprocity	0.74**	(0.33)
Trust * reciprocity	- 0.10*	(0.052)
P2-dummy	- 0.059	(0.089)
# observations	134	
Log Likelihood	- 85.44	
* [**] indicates significance at the 10% [5%] level.		

Table 4: Probit estimates of choice of TEAM. The coefficients are expressed as marginal effects.

These observations have two implications. First, the reason that we must reject hypothesis 1a is that subjects who exhibit high trust are likely to enter TEAM. Second, TEAM may attract "free-riders": people who believe that sufficiently many other are reciprocators, without having the attention to reciprocate themselves. In other words,

these subjects may imitate behavior of reciprocators in Task 1, but free-ride on them in Task 2. Consequently, the TEAM scheme attracts reciprocal as well as money-maximizing subjects, as long as their trust is sufficiently high.

Observation 1a (Labor market): A nonnegligible fraction of subjects (more than one third in both parametrizations) selects TEAM. On average, subjects who do so trust more and are more reciprocal than subjects who opt for INDI. However, money-maximizers (subjects with low reciprocity levels) also enter TEAM if their trust-level is sufficiently high.

We now turn to analyzing subjects' strategies under the payment scheme of their choice. From Figure 3, we derive that in Task 1, subjects in INDI choose nearly exclusively $e = H$ (which is a dominant strategy). Also in TEAM, we observe $e = H$: in parametrization P1 [P2] on average 31% [69%] of subjects choose $e = H$. This observation is somewhat surprising: we expect someone who enters TEAM to always play $e = H$, hoping that her team mate will choose $r = R$ in Task 2. One explanation for this discrepancy is that subjects entered TEAM by mistake. There is indeed support for this suggestion. Subjects choosing $e = L$ in TEAM send significantly less points in the trust game than subjects choosing $e = H$ in the same scheme (5.2 points vs. 6.1 points in P1 and 4.1 points vs. 6.4 points in P2 with p-values of the Mann-Whitney U tests being $p = 0.059$ and $p = 0.000$, respectively). This means that their trust is lower than for subjects entering TEAM who choose $e = H$. However, low trust implies that they should prefer INDI.

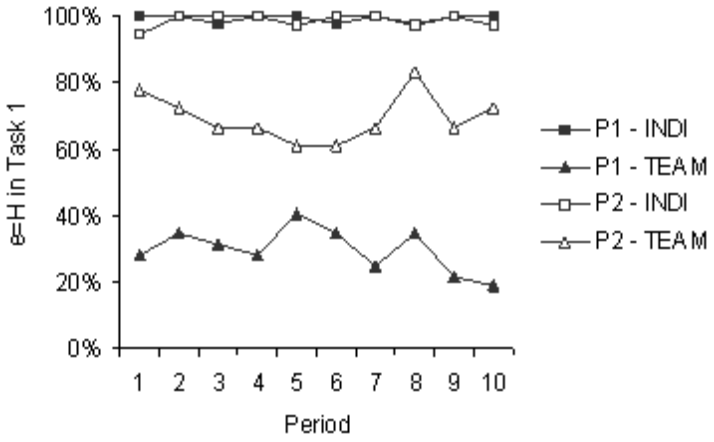

Figure 3: Action $e = H$ in Task 1 for P1 and P2.

Figure 4 indicates that high effort in Task 2 is much more likely in TEAM than in INDI, especially if both subjects gave high effort in Task 1. We use a conditional Logit model to investigate whether subjects employ the above "tit-for-tat strategy" in Task 2 (see Table 5 for the estimates). This specification accounts for subject-specific effects because a subject's choices in Tasks 1 and 2 may depend on her individual characteristics. For both P1 and P2, it is apparent that the probability of choosing $r = R$ is highest when both players chose $e = H$ in Task 1 (the coefficients on any other history observed are significant and negative). Moreover, we observe that those who choose $r = R$ in TEAM are more likely to be reciprocators than those who choose $r = 0$. In the trust game, the former return on average 51% [39%] of the sent amount in P1 [P2], while the latter return on average 39% [25%]. The difference is significant in both cases (Mann–Whitney U test, $p = 0.090$ [$p = 0.008$]). So, reciprocators are less inclined to "free ride" in Task 2.

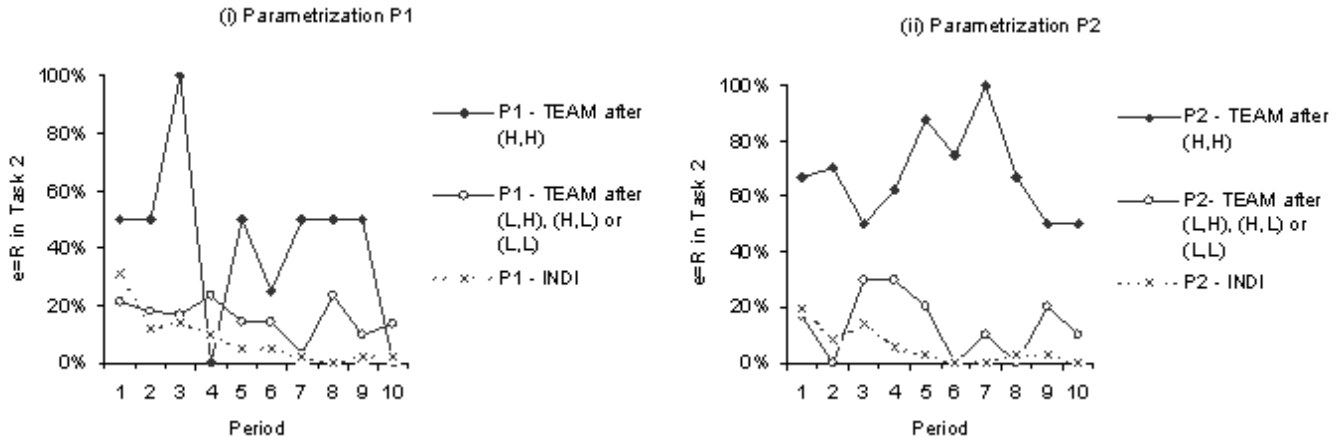

Figure 4: Action $r = R$ in Task 2 for P1 and P2.

Task 1 action $e \in \{L, H\}$		Parametrization	
Player	Co-player	P1	P2
H	H	reference group	
H	L	- 1.54 (0.637)***	-3.41 (0.851)***
L	H	- 1.63 (0.678)***	- 3.13 (0.885)***
L	L	- 1.91 (0.607)***	- 1.98 (0.957)**
Number of observations		190	120
Dropped (no variation)		130	60
Log likelihood		-70.809	-32.249
** [***] indicates significance at the 5% [1%] level.			

Table 5: Conditional Logit model estimates for the probability of $r = R$ in Stage 2 (standard errors between brackets).

Observation 1b (Production): In INDI, in the far majority of cases, subjects choose $e = H$ and $r = 0$, which is the SPNE. In TEAM, many subjects deviate from the SPNE by choosing $e = H$ or $r = R$. Those who select TEAM are more likely to choose $r = R$ in Task 2 if they observe history H, H in Task 1 than another history. In TEAM, a subject is more likely to opt for $r = R$ the more reciprocal she is.

4.2 The power of incentives

Is it profitable for the principal to increase the power of the incentive scheme? Table 6 summarizes the performance of INDI and TEAM. It contains the average profits per subject and per round in the self-selected scheme in rounds 1-10 for both parametrizations. In P1 [P2], INDI is significantly more [less] profitable than TEAM for both the principal and the agents. Moreover, in both parametrizations, individuals who self-select into TEAM earn significantly more than the payoff predicted by the Nash equilibrium for this scheme.

	Payoff in SPNE		Average payoff		Mann-Whitney U test
Parametrization	INDI	TEAM	INDI	TEAM	INDI-TEAM
P1	6	2	6.6 (0.2)	4.6 (0.28)	p = 0.000
P2	6	0	6.3 (0.16)	6.6 (0.39)	p = 0.002

Table 6: Average and Nash equilibrium payoffs per subject per round in the self-selected scheme (rounds 1 to 10) and Mann-Whitney U test (standard errors between brackets).

These observations suggest that the principal can increase output by switching from TEAM to INDI in parametrization P1, but not in P2. This is indeed what we find. Figures 5 and 6 display actions chosen in rounds 11 to 20 in Task 1 and Task 2, respectively. They correspond closely to the SPNE.

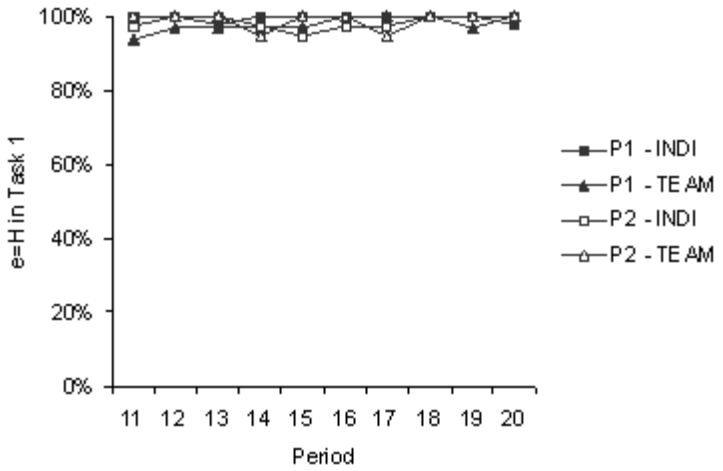

Figure 5: Action $e = H$ in Task 1 for P1 and P2.

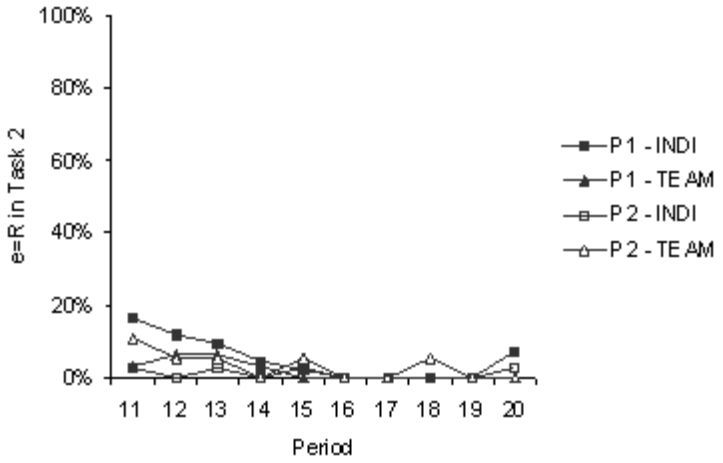

Figure 6: Action $r = R$ in Task 2 for P1 and P2.

Table 7 presents the average payoffs for subjects who chose TEAM in periods 1 to 10 (in which they play TEAM) and periods 11 to 20 (in which they play INDI). The economic performance of the subjects who chose TEAM significantly changes when they are forced to play INDI. However, the change is not unidirectional. In parametrization P1, we observe a significant increase in output. The opposite is found in parametrization P2: performance is worse in INDI than in TEAM. Therefore, increasing the power of the incentive scheme is not profitable in P2. Note that these observations cannot be related to the subject pool composition, because subjects are matched in the same subset of the pool as when they play according to the self-selected scheme.

	Payoff in SPNE		Avg. payoff of those choosing TEAM		Wilcoxon Signed Ranks test
Parametrization	INDI	TEAM	TEAM (rounds 1-10)	INDI (rounds 11-20)	
P1	6	2	4.6 (0.28)	6.1 (0.11)	p=0.001
P2	6	0	6.6 (0.39)	6.1 (0.18)	p=0.044

Table 7: Average and Nash equilibrium payoffs for 10 rounds in the forced payment scheme COMP only for subjects who previously self-selected into COOP.

Observation 2 (The power of incentives): Subjects who choose TEAM, when exposed to INDI, improve performance in parametrization P1, but not in P2, in which performance is worse.

As said, the difference between P1 and P2 is that in P2, the additional gains from cooperation are higher than in P1, both for the individual and the team. Therefore, in the case of strong (unobservable) interdependency between workers and strong incentives to cooperate under team incentives, switching from team incentives to individual incentives does not improve performance.

4.3 Self-selection

We have observed that in P2, subject who self-select in TEAM perform worse once they are forced to play INDI. Is the success of TEAM explained by the fact that reciprocal subjects choose TEAM in the labor market? We compare the actions in the production game in Figure 7 (Task 1) and Figure 8 (Task 2) with the control group which was forced to play TEAM. We find that in P1, self-selection has no effect ($p = 0.909$ Mann-Whitney U test). However, in parametrization P2, subjects earn significantly more in the sessions when they sort themselves into TEAM than when we force them to do so ($p = 0.016$ Mann-Whitney U test). More specifically, those who self-select are significantly more likely to choose $e = H$ in Task 1 (Mann-Whitney U test, $p = 0.012$), and $r = R$ in Task 2 (Mann-Whitney U test, $p = 0.005$).

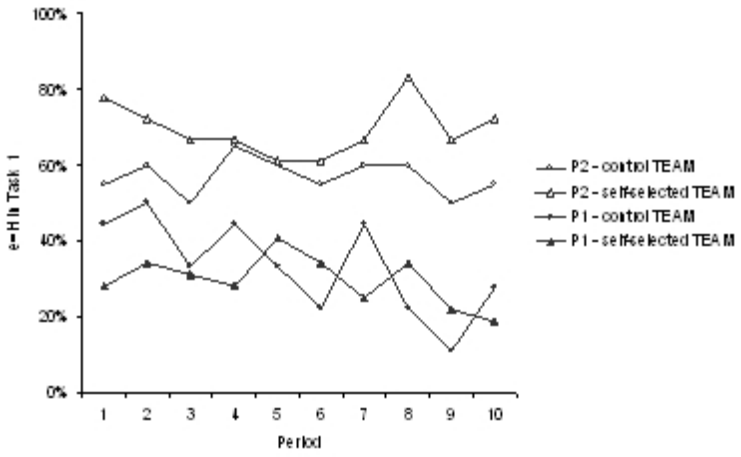

Figure 7: Action $e = H$ in Task 1 for parametrizations P1 and P2 in the self-selected TEAM and in control TEAM sessions.

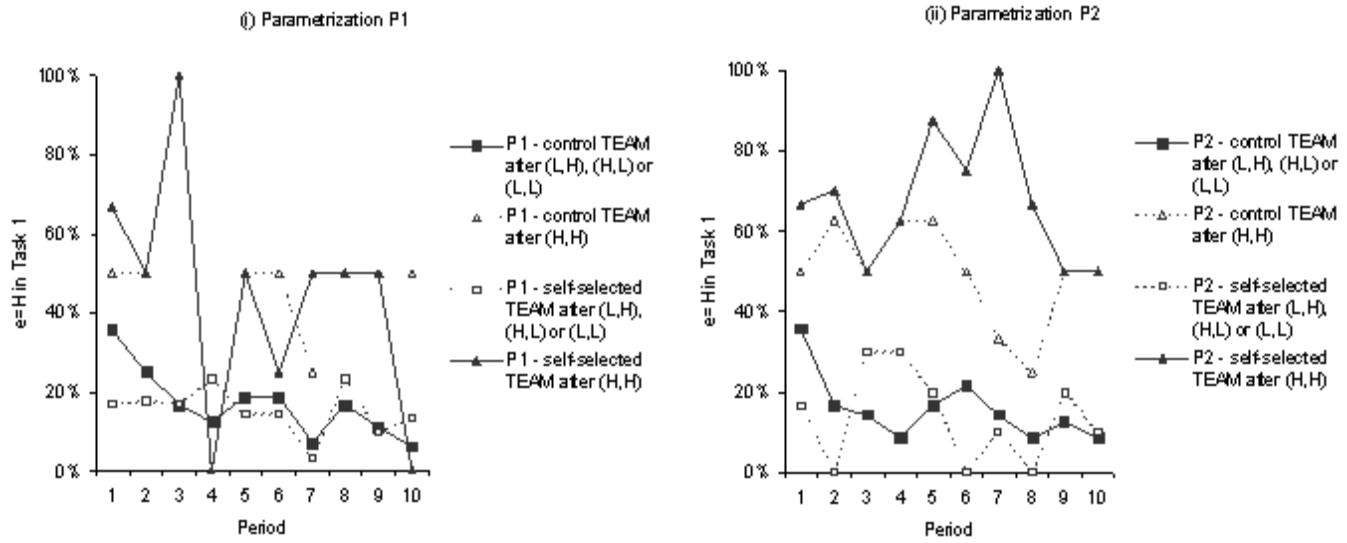

Figure 8: Action $r = R$ in Task 2 for parametrization (i) P1 and (ii) P2 in the self-selected TEAM and in control TEAM sessions.

Observation 3 (Self-selection): The impact of self-selection on subjects' behavior in TEAM is small in parametrization P1. In contrast, in P2, subjects in the control treatment (who are forced to play TEAM) perform worse than those who select TEAM in the main design.

Because in P2, performance in TEAM is better if subjects can self-select in this scheme, self-selection contributes to an explanation why TEAM performs better than INDI in P2. In other words, self-selection partly explains why an increase in the power of the incentive scheme may have counterproductive effects.

5 Conclusions

High-powered incentives stand high on the list of policy instruments that should improve the performance of organizations. In this paper, we have addressed the questions (1) which types of workers self-select in firms with low- or high-powered incentive schemes and (2) whether firms perform better if they increase the power of their workers' incentives in situations where workers can self-select. We have answered these questions using a laboratory experiment. We have observed that the more a subject trusts or the more

reciprocal she is, the more likely she is to opt for a firm with low-powered incentives. Moreover, production decreased once we confronted subjects who chose low-powered incentives with high-powered incentives if the gains from cooperation are high, from the perspective of both the individual and the team. Self-selection partly explains this finding.

The policy implications of our experiment are as follows. A (public) firm may or may not perform better if the power of workers' incentive schemes is increased. If the interdependency between workers is high and difficult to observe, and their incentive to cooperate is high in the case of a low-powered incentive scheme, a higher-powered incentive scheme may imply worse outcomes. For example, one may think of case managers at employment services, who often have to rely on their mutual expertise to find suitable jobs for their clients. Similar interdependencies may exist between medical doctors and police officers. In contrast, if the gains from the unobservable interdependencies is low, then introducing high-powered incentives is the preferred choice. Another policy option is to strengthen the advantages of team pay, that is, develop sorting mechanisms to attract reciprocal workers, or strengthen signalling mechanisms within the organization.

Finally, we wish to note that we used a very cautious design. Our subjects did not have the opportunity to sort themselves into teams endogenously or to build reputation. Free-rider problems could be alleviate if the subjects are able to form groups endogenously on the basis of historical information or repeated interaction. These options remain open for future research.[4]

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