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Team production and gift exchange

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Abstract

We report on a laboratory experiment on team production when a principal decides, before contributions are made, how the team output will be allocated between himself and the team members. The allocation determines the marginal per capita rate of contributions. Despite free-riding being the dominant strategy, if workers perceive more generous allocations as a gift by the employer, reciprocity motives may increase contributions. We also explore the impact of communication on the employer's side. Our results show the presence of reciprocity, evidencing that the "gift-exchange" phenomenon is robust to team production. Regarding communication, we find that messages with a positive connotation significantly increase contributions to the common project.

Keywords: public goods game, gift exchange game, communication, experiments.

JEL Codes: C92; H41; D91; M52

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1 Introduction

Team production faces the free-rider problem, where individual incentives are at odds with efficient outcomes (Holmström, 1982). The linear voluntary contribution mechanism (VCM) setting (Isaac and Walker, 1988) has spurred a large experimental literature on how to promote cooperation in groups, with many different mechanisms being used (for example, punishment (Fehr and Gächter, 2000; Kosfeld et al. 2009; Traulsen et al. 2012; Alventosa et al., 2021); feedback (Nikiforakis, 2010; Bigoni and Suetens, 2012; Faillo et al., 2013); exclusion (Croson et al., 2015), among others).

In this paper, we use the VCM to study experimentally team production settings when the principal -the employer- is an active player who chooses the marginal per capita rate that team members will face. He does it by deciding how much of the team output he keeps for himself and how much will be equally distributed among the workers. This feature is reminiscent of the agency problem, where the principal incentivizes agents by linking their wages to the firm's output (Mirrlees, 1999).

The active role of the principal also places our research in the experimental gift-exchange literature, where a principal offers a wage, and the worker can reciprocate by exerting higher efforts associated with higher salaries. The experimental literature documents the existence of reciprocity in the labor market (see Fehr et al., 1997 or Hannan et al., 2002) with long-run effects (Fehr et al, 1998; Gächter and Fehr, 2002).

The novelty in our setting is that the"gift" is given to a team rather than to a single worker, so we deal with a "poisoned" gift, since it embeds a free-riding problem. Our experimental design features groups composed of one employer and three workers, and the employer can choose between offering a high share, which results in equal sharing of the production among the four group members, and offering a low share, which makes the team indifferent between fully contributing or not contributing at all to the public good. Our results show that high offers by the employers result in significantly higher contributions on the side of the workers, although their choices are still distant from full contribution. Hence, we find evidence that the gift exchange phenomenon is robust to "poisoned" gifts.

The existence of reciprocity leads to further investigation of mechanisms that could reinforce the effects on efficiency. To this end, we include the possibility of non-binding communication from employers to workers when offering the contract by means of pre-specified messages. One message has a "positive" nature, in which employers anticipate their gratitude for high contributions, another one has a"negative" connotation, in which employers express their disappointment from receiving low contributions, and the third

one expresses an "expectation" of high contributions.

Communication might play a role in our setting as there is experimental evidence that reports that non-binding communication enhances reciprocity (Charness and Dufwenberg, 2006), reduce free-riding behavior (Isaac and Walker, 1988), or solves coordination failures (Brandts et al., 2007). With regard to communication in labour markets, non-binding communication has been shown to work in Cooper and Lightle (2013), that allowed employers and employees to freely communicate about their wage and effort decisions. In this case, communication was shown to be effective from employees to employers, who demanded higher wages in order to exert greater levels of effort.

We find in our communication treatment that only positive messages have a significant effect on the workers' contributions. They do it both through a direct channel (by increasing workers' contributions in those cases in which they receive the low offer) and by indirect channel, since positive messages enhance the probability of making the high offer by the employers themselves.

The closest paper to ours within the experimental literature is Cason et al. (2020), which features a combination of a gift-exchange game and a social dilemma, although in their case, there exists a social dilemma among principals. They find that the desired level of effort is mostly ignored by workers and that the combination of conditional wage contracts and discretionary bonuses is effective in overcoming the agency problem.

The remainder of the paper is organized as follows. In Section 2, we present the theoretical model, the experimental design, and our main hypotheses. Section 3 presents our results. In Section 4 we conclude.

2 The experiment

In this section, we present the theoretical model of team production with an active principal. Then, we discuss the experimental design and state the main hypotheses.

2.1 The game

We consider a group of four: One employer ($i = 0$) and three workers ($i = 1, 2, 3$). The four members participate in a common project with the structure of a VCM. The employer's task is to decide how the team output is allocated, whilst the workers decide with how much of their initial endowment they contribute to the common project.

This sequential game has two stages:

- *The distribution stage* - The employer decides how to allocate the team output between him and the workers. He does so by choosing the proportion $\gamma \in [\frac{1}{2}, 1]$ of the project that the workers will receive evenly, being $(1 - \gamma)$ the proportion that the employer keeps for himself.

- *The contribution stage* - Workers are informed about the value of γ chosen and each decides unilaterally how much of their individual endowment ω to contribute to the common project (c_i) and how much to keep for himself/herself ($\omega - c_i$). The size of the common project is the sum of the worker's contributions multiplied by a technological parameter of size 2.

The employer's payoff is:

$$\pi_0(c_i, \gamma) = (1 - \gamma) \cdot 2 \cdot \sum_{i=1}^{3} c_i \tag{1}$$

Each worker's payoff is:

$$\pi_i(c_i, \gamma) = \omega - c_i + \frac{\gamma}{3} \cdot 2 \cdot \sum_{i=1}^{3} c_i \tag{2}$$

Note that for any value of γ chosen by the employer, no contribution is the dominant strategy for workers, because the individual return from contributing to the team project $2\gamma/3$ is smaller than 1, which is the return from the private good. However, the social dilemma occurs only when the total payoff of the group $3\omega + (2\gamma - 1) \cdot \sum_{i=1}^{3} c_i$ is maximized when workers contribute fully to the project of the team, and this requires $1/2 \leq \gamma$. This is the reason why we restrict the values of γ to the interval $[\frac{1}{2}, 1]$.

Using backward induction arguments, individual workers' incentives are to contribute $c_i = 0$ to the common project. Anticipating this, the employer is indifferent about which fraction γ to offer to workers in the distribution stage.

2.2 The experimental design and procedures

We take this game to the lab, where participants were randomly assigned the role of employer (Type A participants) and workers (Type B participants). They were also randomly assigned to groups of four, composed of one type A participant (employer, with no endowment) and three type B participants (workers, with an individual endowment $\omega = 20$

in each period). Roles and groups were fixed for the duration of the experiment. Groups were independent.

Groups played a total of 30 periods, divided in six blocks of five periods. At the beginning of each block, the group's employer chose the proportion γ between two possible offers: $\gamma = 1/2$ or $\gamma = 3/4$. Then the three workers were informed about this value and played the VCM for 5 periods with the value of γ chosen by the employer. We opted for this block design for allowing workers to experience how the structure of the social dilemma -and their payoffs- were affected by the value of γ. We chose the high value $\gamma = 3/4$ because it divides equally the team product between the four members of the group. At the end of each period, workers were informed about the group contribution, their individual payoffs and their accumulated payoffs in the block.

We implemented two different treatments. The *Baseline* treatment -just outlined- and a *Communication* treatment where in addition, employers could send, along with their choice of γ, non-binding messages to their workers in the distribution stage employers. We opted for three pre-designed messages:

- "I am grateful for high contributions" (Positive)
- "I am disappointed by low contributions" (Negative)
- "I expect high contributions" (Expectation)
- "No message" (Empty)

The experiment was implemented in the Laboratory for Research in Experimental Economics (LINEEX) from the University of Valencia. We ran two sessions, one session with the *Baseline* treatment and one session with the *Communication* treatment (between-subjects design). Each session had 40 experimental subjects participating, i.e. 10 groups of 4 subjects each. Each session lasted, on average 65 minutes, and participants earned, on average, 12 euros.

In the Appendix the reader may find a translated version of the instructions.

2.3 Hypotheses

Our goal is to explore the impact of two variables on contributions. On the one hand, we analyse the effect of the offer, γ, on contributions, in order to detect a potential reciprocity (gift exchange) between employers and workers. On the other hand, we study the effect that the non-binding communication from the employer to the workers has on

contributions. With this end, we present null hypotheses based on the standard selfish preferences theory, and alternative hypotheses based on behavioral models.

2.3.1 Hypotheses on gift exchange and reciprocity

As previously anticipated, no contribution is a dominant strategy for any value of γ, what makes the employer indifferent between offering $\gamma = 1/2$ or $\gamma = 3/4$. Hence, our first hypothesis comes.

H_0 : *Null contributions to the group project independently of the offer,* γ.

Literature on reciprocity in the labour market is vast using diverse methodologies. There are theoretical models (Akerlof, 1982; Akerlof and Yellen, 1990), laboratory experiments (Fehr et al. 1997, 1998; Gächter and Fehr, 2002; Hannan et al. 2002; Brandts and Charness, 2004; Falk and Kosfeld, 2014; Kube et al. 2012; Englmaier et al. 2014), and field experiments (Gneezy and List, 2006). These works have shown the rise of profitable labour interactions under reciprocity norms. Such reciprocity makes employers offer wages that are greater than the competitive wage, and makes employees exert levels of effort that surpass the minimum effort. Both parties, employers and employees, seem to understand the long-run benefits of this reciprocal interactions, which makes the effect prevail over time.

Previous experimental findings in VCM show that a significant proportion of subjects display social preferences, such as reciprocity. This leads to positive average contributions, specially in the first rounds of the game. However, the presence of free riders makes contributors end up free-riding as well. These results suggest a combination of selfish individuals and conditional cooperators in the lab.

A reciprocal employer could find optimal to offer $\gamma = 3/4$ at the beginning of each block expecting this to rise contributions from which he can benefit. This, in turn, could be understood as a gift from the employer to the reciprocal workers, which could potentially make contributions increase.

In this line, we propose the following alternative hypothesis:

H_1 : Average contributions to the group project are greater when $\gamma = 3/4$ than when $\gamma = 1/2$.

2.3.2 Hypotheses on Communication

In the *Communication* treatment, the message sent by the employer is independent from the offer, γ, and non-binding for the following blocks. For instance, a positive message of *"I am grateful for high contributions"* could be followed with a low γ in the next block even if workers fully contributed. Thus, selfish workers should ignore these messages. Anticipating this, employers would be indifferent between which message to send, if any.

HC_0 : *Communication does not have an effect on workers' contributions and workers contribute zero to the group project independently of the message sent by the employer.*

Nevertheless, there is extensive literature about communication in the lab indicating that messages are indeed taken into account. For instance, previous results support the "carrot or stick" metaphor where the promise of rewards in case of cooperation work better than the threat of punishment in case on non-cooperation (see Dickinson, 2001; for an application in teamwork).

Focusing on the labour market, free communication has been shown to generate a bilateral gift exchange in the employer-employee relationship (Cooper and Lightle, 2013), specially when messages have a positive connotation (Bolton and Werner, 2016). However, according to Cason et al. (2020) expressing a desired level of effort is not enough to enhance effort, but a combination of conditional wages and promises of (ex-post) bonuses is.

In this regard, we could predict that, if subjects are not selfish, positive or expectation messages may induce greater contributions than negative or empty messages.

HC_1 : *Communication has a positive effect on workers' contributions, specially when the employer sends a positive or an expectation message.*

3 Experimental Results

In this section we present the experimental results for our experiment. We start by presenting preliminary descriptive results to have a general overview of subjects' behaviour. Next, we proceed to examine the two dimensions of our analysis: (i) the effect of the offer on contributions, and (ii) the effect of communication on contributions.

3.1 Descriptive statistics

In Table 1 we present the frequency of each offer in each treatment, along with the average contributions.

	Baseline		**Communication**	
	Frequency	Avg. Contr.	Frequency	Avg. Contr.
Low offer ($\gamma = 1/2$)	58.33%	5.22	51.67%	5.55
High offer ($\gamma = 3/4$)	41.67%	7.88	48.33%	8.08
Total	100%	6.33	100%	6.78

Table 1: Frequency of offers and average contributions in ECUs, by offer and treatment.

We observe that average contributions are positive for both levels of offer in the two treatments, t-tests reject equality to zero contributions in all cases (p-value=0.000 for Low offer in *Baseline*, High offer in *Baseline*, Low offer in *Communication* and High offer in *Communication*). Moreover, contributions are significantly greater when the offer is high than when the offer is low (Wilcoxon signed rank test, p-value=0.0166 for *Baseline* and p-value=0.0077 for *Communication*). However, average contributions are not significantly different between the treatments (Mann-Whitney-Wilcoxon test, p-value=0.4963 for Low offer, p-value=0.5134 for High offer).

In Figures 1 and 2, we can also observe how contributions evolve over time.

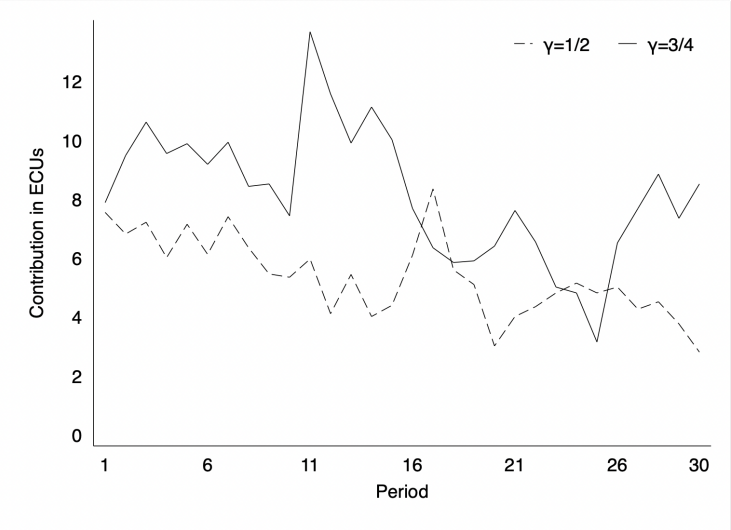

Figure 1: Dynamics of average contributions in the *Baseline* treatment according to offer.

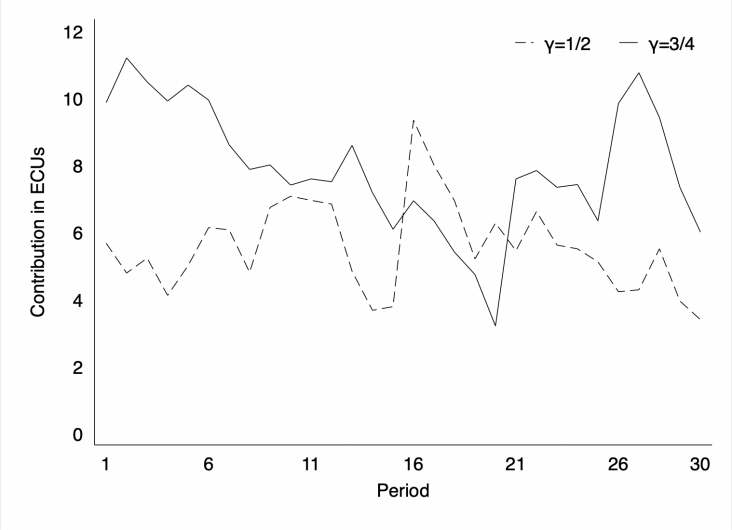

Figure 2: Dynamics of average contributions in the *Communication* treatment according to offer.

Average contributions display a decreasing trend, common in PGG in the lab. In some cases, a slight restart effect at the beginning of each block (periods 1, 6, 11, 16, 21 and 26) can be observed. In the *Baseline* treatment, contributions are greater under high offers than under low offers for most of the rounds, except between the fourth and the fifth block. In the last block, contributions diverge. Something similar can be observed in the *Communication* treatment, where contributions under $\gamma = 1/2$ are only higher than contributions under $\gamma = 3/4$ in the fourth block. In the latter treatment, contributions display a greater volatility, possibly due to the different dynamics that different messages sent generate.

Finally, Table 2 presents the frequency with which each message was sent in the *Communication* treatment, the frequency of low and high offers, and the average contributions in each case.

	Frequency	**Low offer** ($\gamma = 1/2$)	**High offer** ($\gamma = 3/4$)	**Avg. Contribution**
Positive	26.67%	25%	75%	7.95
Negative	26.67%	75%	25%	6.18
Expectation	23.33%	57.14%	42.86%	7.13
Empty	23.33%	50%	50%	5.76

Table 2: Frequency of messages and average contributions in ECUs in the *Communication* treatment.

All types of messages were roughly equally offered, but there was a strong correlation between positive messages and high offers, and between negative messages and low offers.

3.2 What is the effect of the offer on contributions?

To test the effect of the offer that the employer makes on workers' contributions, we propose two random-effects panel data models using Generalised Least Squares clustered at the group level in Table 3.

In these models, the dependent variable is the contribution and the explanatory variables are: whether the offer is high (dummy variable *High Offer* takes value 1 when $\gamma = 3/4$ in that block and takes value 0 when $\gamma = 1/2$ in that block); whether we are in the Communication treatment (dummy variable *Communication* takes value 1 in this treatment and value 0 in the *Baseline* treatment); the interaction between *High Offer* and *Communication* (dummy *High Offer* $\times$ *Communication* takes value 1 when $\gamma = 3/4$ in the *Communication* treatment and 0 otherwise); a time variable indicating the period (*Period*)[1]; the individual's previous contribution (*Previous Contribution*); the previous group contribution excluding the individual's contribution (*Previous group contribution*$_{-i}$); and whether the offer in the previous block was high (dummy variable *Previous high offer* takes value 1 if in the previous block $\gamma = 3/4$ and 0 if in the previous block $\gamma = 1/2$).

While Model 1 focuses on the offer, the treatment and its interaction, in Model 2, we add the three lagged variables: the previous own contribution, the previous group contribution (excluding own contribution) and the previous offer. Both models include the time variable, *Period*.[2]

When employers give high offers, $\gamma = 3/4$, contributions are significantly greater than when employers give low offers, $\gamma = 1/2$. This result is robust when controlling for past behaviour in Model 2. In fact, the margin of the coefficient of *High Offer* in Model 1 is 2.8797 (p-value=0.000) and in Model 2 is 1.0058 (p-value=0.014). Thus, we reject our first null hypothesis that claimed that the offer has no impact on contributions and we do not reject our alternative behavioural hypothesis.

Result 1. *When the employer gives high offers, workers contribute more than when the employer gives them low offers.*

[1] We also run complementary regressions including alternative time variables such as the block (from 1 to 6), or the subperiod within the block (from 1 to 5). These alternatives do not vary the results qualitatively.

[2] Note that when we introduce the variable *Previous offer*, we discard the first block of the experiment, as there is no previous offer in this block. Thus, there is a lower number of observations in Model 2.

	(1) Contribution	(2) Contribution
Constant	6.9305***	1.9457***
	(0.7203)	(0.3065)
High Offer	2.2831***	1.0921***
	(0.7741)	(0.3274)
Communication	-0.2822	0.1839
	(1.0126)	(0.3409)
High Offer × Communication	1.1932	-0.1726
	(1.1705)	(0.7973)
Period	-0.1002***	-0.0276**
	(0.0260)	(0.0121)
Previous contribution		0.5764***
		(0.0524)
Previous group contribution$_{-i}$		0.0490
		(0.0320)
Previous high offer		-0.1515
		(0.3544)
Number observations	1800	1500

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Panel data linear model with random effects clustered at the group level, explaining workers' contributions.

Moreover, there is a decreasing trend in contributions, that is, as time goes by, contributions fall. Nevertheless, the chance to communicate or receiving high offers in the communication treatment seem to have no direct significant impact on contributions. Concerning past behaviour, the previous contribution has a positive significant effect on present contributions. However, the previous group contribution or the previous offer do not.

3.3 What is the effect of communication on contributions?

Despite the possibility of communicating does not have an impact on contributions *per se*, the specific messages sent in the *Communication* treatment could. With this end, we present two random-effects panel data models using Generalised Least Squares clustered at the group level in Table 4.

In these models, the dependent variable is the contribution and the explanatory variables are the ones of Table 3, but instead of introducing the variable *Communication*, we substitute it by 4 dummy variables, one for each message (*Positive, Negative, Expecta-*

	(1) Contribution	(2) Contribution
Constant	7.0407***	2.0987***
	(0.7293)	(0.3284)
High Offer	2.2712***	1.1127***
	(0.7629)	(0.3297)
Positive	-0.8385	1.0886**
	(0.8853)	(0.4636)
Negative	0.2900	0.4153
	(1.1527)	(0.3338)
Expectation	-0.7948	0.2401
	(1.5723)	(0.7817)
Empty	-0.4580	-0.4755
	(0.8897)	(0.3318)
Positive × High Offer	1.4899	-1.0551
	(1.2435)	(1.0163)
Negative × High Offer	0.9333	-0.1727
	(2.3824)	(1.4812)
Expectation × High Offer	2.5835	-0.0363
	(1.6239)	(1.1467)
Empty × High Offer	0.9882	0.0966
	(0.9834)	(0.6759)
Period	-0.1070***	-0.0345**
	(0.0269)	(0.0135)
Previous contribution		0.5731***
		(0.0524)
Previous group contribution$_{-i}$		0.0457
		(0.0321)
Previous high offer		-0.0989
		(0.3713)
Number observations	1800	1500

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Panel data linear model with random effects clustered at the group level, explaining workers' contributions disaggregating communication.

tion, Empty)[3] , and their interaction with the variable *High offer* (*Positive* × *High Offer, Negative* × *High Offer, Expectation* × *High Offer, Empty* × *High Offer*).

Following the same structure as in Table 3, Model 1 focuses on the impact of the offer, the treatment and its interaction, while Model 2 we introduce the lagged variables collecting previous behaviour. Both models include the time variable.

The results show that only the positive message is significant in explaining contributions, and only in Model 2. Furthermore, its impact is positive. That is, receiving a positive message significantly increases contributions only if we control for previous behaviour, i.e. previous contribution, previous group contribution and previous offer.

We analyse the impact of the positive message a little bit further by obtaining the margin of this variable for the different offers. The margin of the coefficient of *Positive* in Model 2 is 1.089 (p-value=0.019) if the offer is low ($\gamma = 1/2$) and 0.0335 (p-value=0.969) if the offer is high (γ=3/4). Hence, the positive message has a significantly positive effect only when the offer is low. Therefore, we reject the null hypothesis on communication that claimed that communication was completely irrelevant on contributions, and we partially accept the alternative behavioural hypothesis.

Result 2. *Positive messages have a direct positive impact on contributions. When the employer sends a positive message, the workers' contributions are greater than when the employer sends no message at all.*

Noticing the strong impact that the offer has on contributions, we finally analyse the probability that the employer makes a high offer. To this end, we propose two random-effects logit models in Table 5.

In these models, the dependent variable is the probability of the employer making high offers ($\gamma = 3/4$) and the explanatory variables are: the type of message (dummy variables *Positive*, *Negative*, *Expectation* and *Empty*; a time variable indicating the block (*Block*); the previous group contribution (*Previous group contribution*); and whether the offer in the previous block was high (dummy variable *Previous high offer* taking value 1 if in the previous block $\gamma = 3/4$ and 0 otherwise). In this case, we restrict the analysis to the first contribution of each block as it is when the message was sent.

We find that the only message that has a significant impact on the probability of employers making a high offer is the positive message. Furthermore, this impact is positive, which implies that when employers send a message saying *"I am grateful for high*

[3]Recall that there were 4 possible message types: *Positive*, *Negative*, *Expectation*, *Empty* and the base is no communication at all (*Baseline* treatment). Thus, results are interpreted with respect to the *Baseline* treatment.

	(1) Pr(High Offer)	(2) Pr(High Offer)
Constant	-0.0258	0.7243
	(0.4967)	(0.9701)
Positive	1.3907**	1.9407**
	(0.6696)	(0.9812)
Negative	-0.6880	-0.6647
	(0.6716)	(0.6991)
Expectation	0.0521	0.2164
	(0.6349)	(0.7142)
Empty	0.3371	-0.0195
	(0.6320)	(0.7286)
Block	-0.0920	-0.1733
	(0.1174)	(0.1715)
Previous group contribution		-0.032
		(0.0214)
Previous high offer		0.2373
		(0.5226)
Number observations	120	100

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Panel data logit model with random effects explaining employers' offers.

contributions", the probability of making a high offer ($\gamma = 3/4$) along such a message increases.

In particular, the marginal effect of the coefficient for *Positive* in Model 1 is 0.3161 (p-value=0.018) and in Model 2 it is 0.4024 (p-value=0.007), which implies that positive messages increase the probability of high offers, approximately, 30-40% with respect to the case without communication.[4]

Recall that a positive message has a direct positive impact on contributions. We now find that there is also an indirect effect of the positive message on contributions via the employer's offer. If the employer sends a positive message, this increases the probability that he/she also gives the group workers a high offer ($\gamma = 3/4$). Moreover, according to Result 1, under high offers workers contribute more.

Result 3. *Positive messages have an indirect positive impact on contributions as well. Positive messages induce high offers, which in turn, increase contributions.*

[4]If we examine whether the differences between the coefficients of the different types of messages are significant, we find that only the difference between *Positive* and *Negative* is significant (p-value=0.015 in Model 1 and p-value=0.018 in Model 2).

4 Conclusions

In this paper we have experimentally studied whether reciprocity and communication are effective to meliorate social dilemmas in the firm. Our results suggest that there is a "gift-exchange" between employers and workers, since high offers by the former ones induce higher contributions by the later ones, even if they have incentives to free-ride on others. Communication seems to help in this "gift-exchange", although not all messages have the same effect. We find that messages with a positive (gratitude) content by the employers have an effect on the workers choices (raising their contribution), and also induce higher offers on the side of the employers. However, messages with negative (disappointment) connotations or expressing the employers expectations do not seem to be effective.

Our results have direct implications for firms that aim to provide the proper incentives to their workers. When workers' wages are linked to the firm income, providing them with a sufficiently high share of it can be effective to activate high efforts, thus, subsequently increasing the employer's payoff. Moreover, when designing a communication strategy on the side of the employer, not all messages are useful to enforce high efforts. In this case, messages including positive (gratitude) connotations can trigger reciprocity concerns and better align the workers' incentives to those of the firm.

Thus, our results suggest that when there exist social dilemma problems derived from team production in a firm, it may be beneficial for employers to offer "efficiency wages" to their employees in order to trigger reciprocity on their side. Also, when designing an effective communication strategy, it is advisable for employers to focus on messages that express positive concerns, like gratitude. In any case, we believe that this paper is just a first step in a broad research agenda that explores the links between gift-exchange and public goods games. For example, among other interesting aspects of the problem at hand, further research can study the effects of cheap-talk communication (like, e.g., promises) on the side of employees, or also two-way free-form (chat) communication.

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Appendix. Instructions

Instructions for the Baseline treatment. Between square brackets [ ] additions made in the Communication treatment.

Welcome and thank you for participating in this experiment. Please, read these instructions carefully. During the experiment, you will have the opportunity of earning money. How much money you earn depends on your decisions and the decisions made by other participants during the experiment. All payments will be expressed in ECUs (Experimental Currency Unit), will be exchanged to Euros at the end of the experiment and will be given to you in a sealed envelope. Any communication between you is expressly forbidden and subject to immediate expulsion from the experiment. In case of having any doubt, please raise your hand. Doubts will be solved privately.

The Experiment

At the beginning of this experiment, you will be randomly assorted into groups of 4 participants. Within each group, 1 participant will be randomly assigned the **Type A** role and the other 3 participants will be randomly assigned the **Type B** role. Both groups and roles will be fixed during the whole experiment.

You will play 6 blocks with 5 rounds each one.

- What decisions does each type make?

In each round, each Type B participant of the group will receive an endowment of 20 ECUs and will decide how many of these ECUs to contribute to a common project (c) and how many ECUs to keep for himself/herself ($20 - c$).

The return of the common project (R) will be the sum of the contributions of the 3 Type B participants multiplied by 2.

Return of the common project (R) = 2·*(Sum of the contributions of Type B participants)*

The Type A participant, who does not receive an initial endowment, must decide how to distribute the return of the common project between him/her and the 3 Type B participants. To do so, he/she will choose which proportion of R to allocate to the Type B participants (p) and which proportion to keep for himself/herself ($1 - p$). The Type A participant will have two options about how much to allocate to Type B participants: $p = 0.5$ or $p = 0.75$.

The proportion allocated to Type B participants will be equally shared among the 3. That is, each Type B participant will receive $p/3$ of the return of the common project.

- If the Type A participant chooses $p = 0.5$, Type B participants receive 50% of the return of the common project, which will be equally shared among the 3 participants. The Type A participant will keep the remaining 50%.
- If the Type A participant chooses $p = 0.75$, Type B participants receive 75% of the return of the common project, which will be equally shared among the 3 participants. The Type A participant will keep the remaining 25%.

Therefore, the payoff for the Type A participant will be the proportion of the return of the common project that he/she has decided to keep for himself/herself:

Payoff of Type A participant: $(1 - p) \cdot R$

For each Type B participant, his/her payoff will be the amount of ECUs that he/she has decided to keep for himself/herself, $20 - c$, plus the proportion of the return of the common project that the Type A participant has decided to allocate to him/her, $\frac{p}{3} \cdot R$:

Payoff of Type B participant: $20 - c + \frac{p}{3}R$

- When are decisions made?

The experiment is divided into 6 blocks of 5 rounds each.

At the beginning of each block, the Type A participant will choose the proportion of return of the common project to allocate to the Type B participants during the whole block: $p = 0.5$ or $p = 0.75$.

[*Communication:* Then, the Type A participant will be able to send a message to the Type B participants in his/her group. Once the share of the return of the common project has been decided, a list of predefined messages will appear, from which he/she will be able to choose one for the three Type B participants. He/she will also be able to choose not to send any message.]

Next, Type B participants will observe the share chosen by the Type A participant for that block [*Communication:* along with the message sent by the Type A participant].

In each of the 5 rounds of each block, Type B participants will simultaneously decide how much to contribute to the common project, c. In each round, the share will

be done according to the decision that the Type A participant made at the beginning of the block.

At the end of each round, all participants will observe the sum of the contributions made to the common project, their own payoff for that round and the accumulated payoff in the block until that round.

While participants of one type are making a decision, participants of the other type will be asked to answer some questions that they will observe on their screen.

- How is the final payment determined?

At the end of the experiment, one of the 6 blocks will be randomly chosen. Your final payment will be the sum of the earnings in ECUs made in that block converted to Euros according to the following ratio:

10 ECUs = 1 €

The minimum payment will be of 5 €.

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