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Social Comparison and Peer effects with Heterogeneous Ability

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Social Comparison and Peer effects with Heterogeneous Ability *

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Abstract

Whether and how the observability of a coworker's effort influences an employer's wage decisions and workers' effort decisions is a central issue for labor organizations. We conduct an experiment using a three-person gift-exchange game to investigate this matter in the context of wage transparency and heterogeneous abilities. We find that showing a coworker's effort increases both wages and the difference in wages between two heterogeneously skilled workers when the more able worker is observed. The knowledge of a coworker's effort increases the level of reciprocity exhibited by observed workers (peer effects), whereas it reduces that exhibited by workers who are observers. Overall, displaying coworker's effort has a beneficial effect on reciprocity. Regardless of their ability, workers exert levels of effort that are positively related to those of their coworkers. This strategic complementarity of efforts is partially explained by inequity aversion.

Keywords: Heterogeneous ability, Gift-exchange game, Social comparison, Peer effect, Reciprocity
JEL Classification: C91, D03, J24, J31, J82

1 Introduction

When workers' effort is not enforceable, how are workers incentivized within firms? Even when workers and firms have opposing interests - because expending effort is costly for workers and beneficial for the firm - there can be gains if workers' efforts are valuable enough for the firm to compensate workers for the cost of their efforts. Thus, encouraging workers to expend a certain level of effort is a central issue for labor organizations. Although there may be certain exceptions to the positive relationship between wage and effort, financial incentives affect workers' behavior.[1] However, the notion that workers' efforts are driven by more than financial rewards is an idea that has received close scrutiny in recent experimental studies. It has been shown that social pressure might also be an incentive in labor organizations (see Kandel and Lazear, 1992). In addition, social comparisons among workers may have important implications in labor market (see Cohn et al., 2014 for a recent discussion).

Social comparison may arise in multi-worker settings in which workers frequently interact with one another, and such interactions may generate additional information regarding coworkers' wages and/or efforts. This information may ultimately affect both employers' and workers' behaviors, particularly when workers' effort levels cannot be enforced. Because it is impossible to prevent these interactions or the dissemination of information within firms, employers must assess what impact knowledge of coworkers' efforts has on wage and effort decisions. Does this information increase or decrease the workers' effort levels? Until now, the few studies that have examined these questions have assumed that workers are identical. The purpose of this paper is to extend this research literature by examining whether and how social comparisons - generated through the observable efforts of coworkers - affects wage and effort decisions in the context of heterogeneous abilities. Answering this research question is of interest to labor organizations for at least two reasons. First, most workers differ from one another in terms of their abilities. This heterogeneity may result from differences in length of employment, skills, qualifications, or (more broadly) their personal backgrounds. For instance, analyses conducted in 2012 by the Directorate for Research, Studies and Statistics (DARES) highlight the substantial heterogeneity in the backgrounds and educational attainment of workers in a given profession. Such differences subsequently lead to heterogeneous ability levels.[2] Second, as shown by Hamilton et al. (2003) in their experimental study, teams with more heterogeneous worker abilities may be more productive.[3]

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[1]See Gneezy et al. (2011) and Gneezy and Rey-Biel (2014) for a discussion of monetary incentives.

[2]To illustrate this purpose, consider the profession that employs the most employees in the green sector of the economy, i.e., technicians involved in the production and distribution of energy, water and heating. In a typical firm, 11% of the workers had no degree in or knowledge about their profession when they began their employment, 36% had at most a high school diploma and little knowledge about their profession, 29% had a professional baccalaureate, and 24% had in-depth knowledge. DARES Analyses, Mars 2012. "Les professions de l'économie verte: typologie et caractéristiques", n°018.

[3]There is nonetheless no consensus about the dominance of maximally homogeneous teams (Prat, 2002)

It is obviously difficult to determine whether displaying a coworker's effort influences both wage and effort decisions using real-world data. Similarly, many of the key variables at work in the present study, such as effort and ability levels, might be unmeasured in surveys, or the measurements might contain errors. In this context, experimental economics has proven to be a useful tool, and a laboratory experiment appeared to be the best approach to address the issue in the present study.[4] For instance, laboratory experiments make it possible to control for firm composition and worker ability when the latter is exogenously fixed.

More precisely, the purpose of the present study is to explore the following research questions: Despite their differences in ability, are workers affected by their coworkers' effort levels? If so, is the influence similar regardless of the ability of the worker who chooses his level of effort first? In addition, what is the impact of the observability of effort on (i) wage decisions and (ii) the strength of reciprocity?[5] To that end, we conduct an experiment based on the gift-exchange game that was first developed by Fehr et al. (1993) to study labor relationships under contractual incompleteness in a laboratory setting. Their pioneering model was next modified and expanded by Fehr et al. (1998). Typically, the employer first offers a wage to a worker, and the worker responds by exerting a certain effort. There is by now a large body of experimental evidence that demonstrates workers' willingness to exert a high level of effort - and thus to incur costs - with the aim of rewarding employers for their wage offer (see Fehr et al., 2009 for a recent review).[6] In our experiment, we introduce minor changes to the original game to account for the multi-worker setting and heterogeneity in workers' abilities. Each experimental firm consists of an employer and two workers; there is one high-ability and one low-ability worker per firm. Employers and workers are equally well-informed about each worker's ability. In the first stage of the game, the employer selects the wage he offers to each worker. In the second stage, each worker chooses his level of effort. Depending on the experimental treatment, workers have different information when they choose their effort levels. In the baseline treatment, workers are unable to observe the effort exerted by their coworker. In the second treatment, the more able worker observes the effort decision of the less able worker in his firm before selecting his own effort level.

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or maximally heterogeneous teams (Hong et al., 2004). In a recent study, Hoogendoorn et al. (2014) show that team performance exhibits an inverse U-shaped relationship with ability dispersion. However, analyzing the optimal distribution of abilities within firms is beyond the scope of this paper. See Papps et al., 2011 for a discussion of this issue, for instance.

[4]See List and Rasul (2011) and Charness and Kuhn (2011) for an overview of the use of field and laboratory experiments in labor economics.

[5]It is worth briefly noting that this paper does not discuss issues regarding the selection of workers on the basis of their ability (see Bandiera et al. 2007, for example) or the effects of introducing high- or low-skilled workers on productivity (see, for instance, Paserman, 2012 and 2013 and Pallais 2014).

[6]There is now conflicting evidence on the efficacy of a gift exchange in real-effort situations (Gneezy and List, 2006; Hennig-Schmidt et al., 2010) that opens fruitful avenues for research. Englmaier and Leider (2012) find that a gift exchange is more effective when workers are aware of the importance of the task for the employer, whereas Cohn et al. (forthcoming) stress that those individuals who display positive reciprocity (i.e., gift-exchange) in a laboratory experiment also show reciprocal responses in the field.

The order of workers' decisions is reversed in the third treatment. Recently, Gächter et al. (2013) highlight the role of inequity aversion in explaining the observer worker's effort decision in a laboratory experiment that resembles our study in certain respects. As a consequence, our participants take part in a second experiment to elicit their individual estimates of inequity aversion that allows us to control for it thereafter.

We find that enabling social comparisons among heterogeneously skilled workers affects wage decisions. Most employers favor the more able worker, and displaying a coworker's effort induces employers to increase both the wages and the difference between the two workers' wages. This increase is even stronger when the effort exerted by the more able worker is displayed. This finding is consistent with the targeting effect highlighted by Bandiera et al. (2007). One explanation of this result is that the employer provides strong incentives to the more able worker to induce him to exert a high level of effort, particularly when the worker cannot be influenced by his coworker's effort. Regarding worker behaviors, we observe strong evidence of positive reciprocity: workers who are offered a high wage by employers tend to reciprocate with high effort levels. However, displaying the coworker's effort has mixed effects on the levels of effort exerted and the degree of reciprocity. If we distinguish the observed worker from the observer worker, we note that the observability of a coworker's effort has a beneficial effect on the level of reciprocity exhibited by those who are observed (peer pressure effect), whereas it has a detrimental effect on the level of reciprocity exhibited by those observing their coworkers. Overall, displaying coworker effort increases the strength of reciprocity. What is more striking is the strategic complementarity of efforts, regardless of the ability level of the worker whose efforts are displayed. Finally, we find that both advantageous and disadvantageous inequity aversion explains a significant part of the effort levels chosen by the observer worker.

Our paper is related to two strands of literature. The first strand consists of experimental studies that address the issue of workers' incentives under contractual incompleteness. In moral hazard situations, the issue of incentivizing workers to exert an expected effort is an important challenge for both employers and for firm performance. Akerlof (1982) and Akerlof and Yellen (1990) highlight that one of the key determinants of the effort exerted by workers is the wage received. They demonstrate a positive relationship between the wage received and the effort exerted by a worker as long as the worker's wage falls below the "fair' wage (the fair wage-effort hypothesis). In a later study, Bewley (1999) emphasizes the importance of the fairness of a wage offer and argues that employers seem to believe that workers' perception of fairness affects their productivity. The fairness of a wage offer depends not only on the level of the received wage but also on coworkers' wages, which raises the prospect of the influence of wage comparisons among workers on wage assignment, on the effort exerted and ultimately on firm performance (see Charness et al., 2014 for a recent experiment and a dedicated

literature review).

Further, a horizontal dimension generated by peer effects must be considered in a multi-worker setting. It has been well-established in the literature that individuals change their behaviors when they are observed (Hawthorne effect). Thus, the second strand of literature refers to the effects of peer pressure on productivity (Kandel and Lazear, 1992). Preliminary experiments in the laboratory (Falk and Ichino, 2006) and in the field (Mas and Moretti, 2009) have found that individuals strongly enhance their efforts based on concerns about how peers will view their efforts. Since these pioneering studies, some detrimental effects of peer pressure on productivity have also been noted (see Eriksson et al., 2009 for a laboratory experiment and Bellemare et al., 2010 for a field experiment, for instance). In general, it seems that the benefits of peer effects depend on the nature of the preferences that yield such effects and the context in which peer effects apply (see Sausgruber, 2009 for a review).

This paper sheds light on the interplay between these strands of the literature because, in labor organizations, peer effects may be added to the vertical relationship between workers and employers and to subsequent social comparisons. Workers frequently have the opportunity to observe not only the relationships between the employer and their coworkers but also their coworkers' behavior, and both may impact their own behavior. There are few experiments that extend the bilateral gift-exchange game to a multi-worker setting. Among those that do, some experiments have analyzed how effort decisions are influenced by a coworker's wage (Charness and Kuhn, 2007; Nosenzo, 2010; Gächter and Thöni, 2010; Abeler et al., 2010; Gächter et al., 2012; Cohn et al., 2014; Greiner et al., 2011), but the results of these studies are not clear-cut. For instance, Charness and Kuhn (2007) find that workers are not influenced by coworkers' wages, whereas Nosenzo (2010) observes that knowledge of coworkers' wages has a detrimental effect on the effort exerted. One possible explanation for this discrepancy is based on workers' abilities. Whereas in the experiment conducted by Charness and Kuhn (2007) workers have heterogeneous abilities, workers are identical in the experiment developed by Nosenzo (2010). Moreover, although only a handful of studies have focused on the effects of the observability of a coworker's effort on the effort decision, striking lessons can be drawn from these studies. Gächter et al. (2012) observe that reciprocity declines when effort is displayed. Gächter and Thöni (2014) also note that efforts are strategic complements (i.e., the effort exerted by a worker is positively related to the effort exerted by his coworker), although after the revision stage of effort decisions, conformity in effort tends toward low effort rather than high effort. Finally, Gächter et al. (2013) show that the complementarity of efforts is primarily explained by inequity aversion. A last point to note refers to the elicitation procedure employed. Whereas Gächter et al. (2012) and Gächter et al. (2013) use the strategy method to elicit workers' efforts, Gächter and Thöni (2014) resort to the direct method response, as in our experiment.

Evidence regarding the behavioral effects of coworker's effort on effort decision re-

mains scarce in this context. In addition, all studies conducted thus far assume that workers have similar abilities. Our experiment contributes to this literature by introducing a key element found in labor organizations: heterogeneous abilities among workers within the same firm. Considering differences in ability seems to be a crucial point not only because workers within the same firm typically differ in ability but also because introducing heterogeneous abilities into a firm may increase its overall performance (see Hamilton et al., 2003). Our main contributions are twofold. First, we show that the strategic complementarity in efforts holds when we introduce heterogeneous abilities. Second, displaying information about coworker's efforts increases the overall strength of reciprocity.

The remainder of the paper is organized as follows. We describe the details of the experimental design in Section 2 and present the results in Section 3. Section 4 summarizes and concludes. Some proofs and robustness checks can be found in the Appendix.

2   Experimental design

In this section, we first present the gift-exchange game that we implemented along with the experimental parameters and experimental treatments. Next, we state some behavioral hypotheses that are derived from the gift-exchange game that we employ. Finally, we describe the experimental procedure.

2.1   The three-person gift-exchange game

As is customary, we employ a labor market framework and create a small-scale laboratory replica of the interactions between employers and workers. This rich context also has the advantage of facilitating participants' understanding of the game.[7] The aim of our study is to analyze whether displaying coworker's effort influences the employer's wage decision and how heterogeneous skilled workers respond to a coworker's effort. To that end, we implement a three-person gift-exchange game, which is the minimal setup that allows for comparisons of wage and effort levels. From a methodological perspective, three points of the three-person gift-exchange game that we employ here are notable. First, we do not offer the worker the possibility of rejecting the wage offer and to put forth no effort thereafter. Second, to introduce heterogeneity among workers in a simple manner, we assume that the heterogeneity among workers stems from their ability: there is a high-ability worker (the H-worker) and a low-ability worker (the L-worker) in each firm and ability is fixed throughout the entire game. Furthermore, to limit spurious bias during the experiment, the H-worker was called the "type A worker" and the L-worker

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[7]Although it remains an open question as to whether framing matters, some recent studies, such as Abbink and Hennig-Schmidt (2006), emphasize that framing does not matter.

was called the "type B worker". Third, there is no competition between workers, and wage offers and effort decisions are private information within the firm.

Considering all the above, the game proceeds in two stages. In the first stage, the employer determines the wage to offer each worker; he can offer the same wage to both workers or offer them different wages. To account for differences in ability, we adapt the payoff functions and modify the gift-exchange game used in Fehr et al. (1998). As a result, the payoff structures most closely resemble those in Gächter et al. (2012). The employer's payoff function is given by the following:

$$\pi_E = v \cdot (e_l + e_h) - w_l - w_h \tag{1}$$

where v denotes the marginal value product of effort that is positive and fixed per unit of exerted effort and e_l and e_h represent the effort levels selected by the L-worker and the H-worker, respectively. Similarly, w_l and w_h represent the wages offered to the L-worker and the H-worker, respectively. The employer's payoff function is linear and strictly increasing in efforts and decreasing in wages.

In the second stage, workers learn the wages they receive and their coworker's wage and choose the amount of effort to supply.[8] Their payoff functions are given by the following:

$$\pi_l = w_l - c(e_l) \tag{2}$$

for the L-worker and

$$\pi_h = w_h - c(e_h) \tag{3}$$

for the H-worker

where $c(e_l)$ and $c(e_h)$ denote the cost associated with the efforts exerted by the L-worker and by the H-worker, respectively. Regardless of ability, the worker's payoff is strictly increasing in his own wage but decreasing in the cost of his effort. The function $c(e_i)$ is strictly increasing and convex, and the minimum effort is costless. Therefore, the worker's payoff function is decreasing and concave with respect to the cost of effort. It is noteworthy that the effort produced by the worker costs him less than it benefits the employer (*i.e.*, $c(e_i) < v \cdot e_i, \forall i = \{l, h\}$). This means that the marginal value product of effort is always higher than the marginal cost of effort, which makes maximum effort levels socially efficient. Finally, the payoff function of a worker is independent of the wage offered to his coworker and the level of effort his coworker exerts; thus, there are no earnings interdependency among workers.

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[8]The term "effort" is used throughout this paper, but in the experiment, the expression "quantity of work" was employed, which refers to the quantity of work the worker chooses to exert to provide the employer a certain level of output.

2.2 Experimental parameters

In the experiment, players' decisions are restricted in the following manner. The wage the employer offers to each worker must be an integer between 0 and 100. He can offer the same wage to both workers or offer them different wages. The workers must choose an effort level from those displayed in Table 1.[9] The effort level chosen by a H-worker will be an integer between 1 and 10, whereas the effort level chosen by a L-worker will be a multiple of 0.5 between 0.5 and 5. The marginal value product of effort (v) is set equal to 10, regardless of the worker's ability. The difference in abilities means that effort is less costly for H-workers and more costly for L-workers. As we can see from Table 1, for a given cost, the H-worker's effort is twice that of the L-worker. Finally, it is notable that this cost-effort relationship is slightly modified compared with that introduced by Fehr et al. (1998) to account for heterogeneous ability and payoff structures. In this sense, the cost-effort relationship used here is more similar to that employed by Maximiano et al. (2007) in their multi-worker firm.

Table 1: Effort levels and associated costs for workers according to their ability

Effort levels for H-workers	1	2	3	4	5	6	7	8	9	10
Effort levels for L-workers	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Cost of efforts	0	1	2	4	6	8	10	12	15	18

Overall, there are 10 periods of the game described above. At the end of each period, the employer receives information regarding the effort level chosen by each worker in his firm, and both the employer and workers learn their respective payoffs in the current period, which minimizes potential confounding interaction effects between the two workers. Next, a new period begins in which the employers and workers are randomly reshuffled under the constraint that each player (employers and workers) is matched exactly once with the same two opponents. This stranger design is common information and allows for social preferences to be isolated from reputational concerns by ruling out the possibility of future interactions.

Because losses are possible for the employer (through the proposal of high wages and workers responding through low levels of effort, i.e., $w_l + w_h > v(e_l + e_h)$), all players are endowed with 400 points at the beginning of the experiment with a conversion rate of 50 points = 1.2 Euros.[10] Finally, to avoid wealth effects and to mitigate boredom in later periods, 4 out of 10 periods are randomly selected at the end of the game for payment.

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[9]Whereas stated efforts may reduce the degree of realism, they are used rather than real efforts to induce, control and manipulate differences in ability, regardless of other personal characteristics that might affect real efforts. As noted by Charness and Kuhn (2011), a clear advantage of this method is that it makes it possible to know the cost of effort and therefore to precisely calculate what the equilibrium effort level should be under different behavioral hypotheses.

[10]The methodology is similar to that adopted by Abeler et al. (2010) and Gächter and Thöni (2014).

The randomly selected periods are the same for all participants in a given experimental session. To avoid income effects, the periods selected for payment and the corresponding payoffs are only known at the end of the experimental session. The remuneration scheme used and the stranger design employed allow material payoff spillovers and strategic incentives to be controlled.

2.3 Experimental conditions

The game is implemented using a between-subjects design with three experimental conditions. The experimental treatments vary along a single dimension: the observability of the coworker's effort decision. In all treatments, wages are public information within the firm, which means that workers have full information about their coworker's wage at the time they select their effort levels. In the first treatment, workers have no information about their coworker's effort choice, i.e., effort decisions are secret (*S* treatment). In the second treatment, the L-worker selects his effort level first; then, the H-worker observes his coworker's effort choice and selects his effort level thereafter (*L-H* treatment). The order of moves is reversed in the third treatment (*H-L* treatment). A major problem that could occur in our study is the reflection problem (Manski, 1993) that arises from the mutual influence of workers' efforts. With our stranger design, we take great care to distinguish between observed and observer workers. Those who are observed never receive any information about the effort exerted by anybody else. Similarly, the behavior of those who observe is never revealed, which allows us to avoid any reflection problem in our design.

2.4 Hypotheses

In this subsection, we state the specific behavioral hypotheses derived from the gift-exchange game we developed.

Prior to stating our hypotheses, we must establish the sub-game perfect Nash equilibrium. Standard economic theory disregards social comparisons and fairness motives and thereby assumes that individuals are motivated exclusively by their own material interests. As a consequence, the level of a coworker's wage or effort does not impact effort decisions because material work incentives are not related to the coworker's parameters. The standard economic prediction for this game is thus straightforward. Given that selfish workers receive a guaranteed wage that is not contingent upon their effort decisions, they put forth the minimum amount of effort, which is costless. Foreseeing this, the employer will offer the minimum wage, i.e., 0, to both workers. The sub-game perfect Nash equilibrium is thus $\{w_i = 0, \forall i = \{l, h\}; e_l = 0.5; e_h = 1\}$. It is notable here that the ability level of the workforce has no effect on the predicted wages.

In addition to this equilibrium, discrimination among workers may affect both wages and effort decisions, depending on their abilities and social preferences.

As shown by Kölle et al. (2011) in a public goods game experiment, allocating agents of different abilities with the same initial endowment can lead to highly unfair situations and cause detrimental effects regarding the provision of public goods thereafter. This outcome can easily be transposed to our experiment: assuming inequity-averse workers, providing the same wage to both workers can demotivate the more able worker, which is detrimental to overall performance because his effort is more valuable. Because employer payoff is positively linked to worker effort, employers may be inclined to provide higher wages to the more able worker, which is consistent with what Charness et al. (2014) call *merit pay*, although abilities are here randomly assigned.

*Hypothesis 1 – **Targeting effect**: Employers offer a higher wage to the H-workers than to the L-workers, i.e., $w_h > w_l$.*

The last three assumptions focus on workers' behavior.

As noted by Mittone and Ploner (2011) in a similar context, two roles must be distinguished: the observed worker and the worker who observes. Regarding the former, following the seminal paper of Kandel and Lazear (1992), one might expect some impacts of peer pressure on his effort decision. By supposing that the observed workers are influenced by the awareness that their effort will be revealed to their coworker, a framework of observable efforts should favor an increase in the average level of effort supplied by the observed workers, regardless of their ability.

*Hypothesis 2 – **Peer pressure effect**: Higher levels of effort are chosen by observed workers compared with those selected in the S treatment.*

Observing the effort of coworkers may affect workers' effort decisions by influencing what they perceive to constitute appropriate behavior even if there are no material spillovers between workers. Some social spillover effects in effort, the cost of effort, or their relative values (i.e., e_i/w_i or $c(e_i)/w_i$, $\forall i = \{l, h\}$) may arise. If efforts are positively correlated, efforts are strategic complements. Conversely, a negative relationship between workers' efforts is consistent with the responsibility alleviation effect underlined by Owens (2012). In this case, the higher the effort exerted by the observed worker, the less the observer worker feels obliged to provide a high effort to allow the employer to get a high final payoff.

*Hypothesis 3 – **Social spillover effect**: The behaviors of observer workers are influenced by their coworker's effort decision.*

Alternatively, players' choices may reflect social preferences. In the following, we are particularly interested in the inequity aversion model developed by Fehr and Schmidt (1999). This model has the clear advantage of being tractable. Furthermore, as recently

noted by Gächter et al. (2013), inequity aversion may explain workers' effort decisions.[11] The model developed by Fehr and Schmidt (1999) assumes that individuals are concerned about fairness with respect to final payoffs distribution, in addition to concerns regarding their own material payoffs. The utility function of firm member i is given by the following:

$$U_i(\pi) = \pi_i - \alpha_i \frac{1}{2} \left[max(\pi_j - \pi_i, 0) + max(\pi_k - \pi_i, 0) \right]$$
$$- \beta_i \frac{1}{2} \left[max(\pi_i - \pi_j, 0) + max(\pi_i - \pi_k, 0) \right] \quad (4)$$

where π represents the vector of payoffs, j and k the two other firm members, α_i measures how much member i dislikes disadvantageous inequity and β_i measures how much he dislikes advantageous inequity. Fehr and Schmidt (1999) assume $\alpha_i \geq \beta_i$ so that member i suffers more from disadvantageous inequity than advantageous inequity. Second, they assume $0 \leq \beta_i < 1$. The constraint $0 \leq \beta_i$ excludes individuals who prefer being better off than others, while $\beta_i < 1$ rules out individuals who are willing to "burn" their own money to reduce advantageous inequity.

In the three-person gift-exchange game, each member can be concerned with two dimensions of fairness: vertical fairness, which refers to the relationship between the employer and each worker, and horizontal fairness, which involves the relationship among workers. Before advancing, it should be noted that even when the difference in ability provides a justification for the employer to offer different wages, this does not mitigate social comparisons among workers when coworkers' efforts are displayed. For instance, workers are able to compare themselves to their coworkers by matching the ratio of the cost of effort (i.e., a proxy for worker ability) to wages. Whereas standard economic theory predicts that the observability of a coworker's effort will not change the outcome, a Fehr Schmidt worker will be induced to put forth the level of effort that allows him to decrease payoffs inequity. Considering horizontal fairness alone, a Fehr Schmidt worker will select the effort level that equalizes - or at least approaches - his own final payoff and that of his coworker. By considering both vertical and horizontal fairness, four cases are conceivable (formal predictions are derived in Appendix 1). First, worker i is better off than the other members of his firm. Because an increase in his effort induces a decrease in his payoff and enriches the employer, a Fehr Schmidt worker will be induced to put forth a high level of effort to reduce payoff inequities. In the symmetric situation (worker i is worse off than the others), a Fehr Schmidt worker will supply a low level of effort to minimize inequities. Finally, two hybrid scenarios might occur. When worker i experiences advantageous inequity with his coworker but disadvantageous inequity with the employer, he will decrease his effort level to reduce disadvantageous inequity (assuming, as Fehr and Schmidt do, that worker i is more concerned with being behind than

being ahead). Conversely, if worker i experiences advantageous inequity with the employer and disadvantageous inequity with his coworker, a worker experiencing sufficient advantageous inequity aversion will increase his effort, whereas a worker experiencing weak aversion toward advantageous inequity will reduce his effort. Finally, we note that inequity concerns may also affect the employer's wage decision. A Fehr Schmidt employer will thus be induced to reduce the disparity in final payoffs between himself and his workers. To this end, he will not offer a null wage that would necessarily imply unfair final payoffs.

*Hypothesis 4 – **Inequity aversion**: Fehr Schmidt employers do not offer null wages, and Fehr Schmidt workers adjust their levels of effort up or down to minimize payoff inequities.*

To examine whether inequity aversion explains the decisions observed, after the three-person gift-exchange game experiment, we conduct a second experiment to elicit individual estimates of inequity aversion to thereby control for it. To this end, we follow the experimental design of Blanco et al. (2011).[12]

2.5 Procedure

Experimental sessions were conducted at the LABEX-EM, University Rennes 1. Participants were students with different educational backgrounds. The experiment was programmed and conducted using the Z-tree software (Fischbacher, 2007). Participants were invited using Orsee (Greiner, 2004).

A total of 11 sessions were conducted, 3 for the S treatment and 4 for each of the two other treatments, with 18 participants per session. No subject had previously participated in a similar experiment, and nobody participated in more than one session, resulting in 198 participants. Before the experimental session started, participants were told the following: (i) there would be two independent experiments,[13] (ii) money earned in the experiments would depend on their decisions and the decisions of others in their experimental group, and (iii) they would be paid the earnings they accrued in the two experiments. It was clarified that information about the earnings obtained in each experiment would be given only at the end of the experimental session. We set this condition to reduce the potential spillover effects of earnings from one experiment to the next.

Upon arrival, the subjects were randomly seated at visually separated boxes numbered from 1 to 18. For the gift-exchange game experiment, two groups of nine participants each were constructed (from box numbers 1-9 and from box numbers 10-18), with three employers, three L-workers and three H-workers per matching group. We thus took great care to ensure that the strategies and the history experienced by each participant were never contaminated nor did they contaminate the decision-making within the

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[12]See Appendix 2 for details.

[13]The two experiments refer to the gift-exchange game experiment and the experiment dedicated to eliciting inequity aversion estimates.

other matching group. A total of two independent observations per session were guaranteed by the fact that no information passed between the two matching groups. Data from each matching group would be further treated independently. Participants were randomly allocated to one of the two nine-person matching groups. The computer then randomly allocated the role of participants, who were informed of their role at the beginning of the first period and retained this role throughout all 10 periods. To ensure comparability across sessions and treatments, pairings within each matching group were randomly formed prior to the first session, and we used the same pairings in all the sessions.[14] Neither during nor after the experiment were subjects informed about the identity of the other participants in the room with whom they were matched.

To guarantee public knowledge, instructions regarding the gift-exchange game experiment were distributed and read aloud (see supplementary materials). All participants were required to answer several control questions to ensure that they understood the experimental procedures. In particular, they were required to calculate both the employers' and workers' payoffs in hypothetical exercises. Of course, this procedure may introduce some bias, but to limit this possibility, the exercises reflected representative contingencies. Answers were privately checked and, if necessary, explained to the participants, and the experiment did not begin until all participants had answered all questions correctly. Once the gift-exchange game experiment was completed, the instructions for the experiment dedicated to eliciting inequity aversion estimates appeared on their screens, followed by control questions (see supplementary materials). At the end of the two experiments, the subjects learned their earnings and completed a brief post-experimental questionnaire to collect personal characteristics (i.e., gender, field of study, etc.). Each session lasted up to 80 minutes, and average earnings were 17 Euros.

3 Results

The results are presented in three steps. First, we analyze employers' wage decisions and whether they are influenced by the subsequent display of coworkers' efforts. Second, we focus on workers' behaviors and examine whether being observed by or observing a coworker affects the level of effort chosen. Finally, we consider inequity aversion as a possible explanation for follower workers' effort decisions.[15] The following analysis pools all data because no significant learning effect was found.

3.1 Employers' behavior

Observations of wage decisions reveal substantial heterogeneity in employers' strategies. From Table 2, we note that a significant share of the employers exhibit selfish behavior

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[14]Matching grids are available from the author upon request.

[15]Because the main purpose of our experiment involves decisions observed in the three-person gift-exchange game, the results regarding Experiment 2 are reported for exposition purposes in Appendix 2.

because they offer null wages to both workers. Moreover, between 16.11% and 24.17% of the employers' decisions involve treating workers equally, although the workers differ in ability. Promotions of L-workers are mainly made when coworker efforts are not displayed. This high frequency sharply contrasts with previous studies that have found few occurrences of such wage assignment, even under public wage setting (see, for instance, Charness and Kuhn, 2007). However, the vast majority of employers' decisions favor H-workers, particularly when coworker efforts are observable. This last result is consistent with Hypothesis 1 (i.e., a targeting effect).

Table 2: Classification of employers' wage decisions
by treatment (in %)

Treatments	S	L-H	H-L
Selfishness: $w_h = w_l = 0$	30.00	26.25	23.75
Equality of wages: $w_h = w_l \neq 0$	16.11	22.50	24.17
Targeting effect: $w_h > w_l$	33.33	40.42	37.50
Favor L-worker: $w_h < w_l$	20.56	10.83	14.58

Table 3 reports the mean wage of each type of worker and wage differentials by experimental treatment. Although a non-negligible number of employers offer the same wage to both workers, we note a clear difference between w_h and w_l across the three treatments (Wilcoxon sign rank tests: $z = 3.929$, $p = 0.0034$ in the *S* treatment; $z = 6.417$, $p < 0.0001$ in the *L-H* treatment; $z = 5.464$, $p < 0.0001$ in the *H-L* treatment).

Table 3: Descriptive statistics for employers' wage offers by
treatment (in experimental points)

Treatments	S	L-H	H-L
Mean H-worker wage	18.07 (20.45)	22.90 (25.08)	25.97 (27.17)
Mean L-worker wage	14.05 (17.72)	17.89 (20.26)	18.65 (20.27)
Mean Wages difference	4.02 (15.10)	5.01 (14.62)	7.32 (19.57)

Note: Standard deviation in parentheses.

Such wage differentials result, in part, from different distributions of wages based on worker abilities. Fig. 1 depicts the distribution of wages for each type of worker in the three treatments. We note that L-workers are more likely to receive a null wage, whereas H-workers receive rather high wages (i.e., $w_h > 50$), and this result is stronger when coworker efforts are displayed. This observation is corroborated by the computation of the Kolmogorov-Smirnov test of the equality of the wage distributions: there is no significant difference in the *S* treatment ($d = 0.10$, $p = 0.285$), whereas the two distributions differ significantly when coworker efforts are observable ($d = 0.1167$, $p = 0.062$ in the *L-H* treatment and $d = 0.1458$, $p = 0.009$ in the *H-L* treatment). Although a significant share of the employers offer the same wage to both workers (see Table 2), these latter findings suggest that, on average, the observability of a coworker's efforts induces employers to

treat workers even more differently according to their abilities.

Figure 1: Distribution of wages by treatment
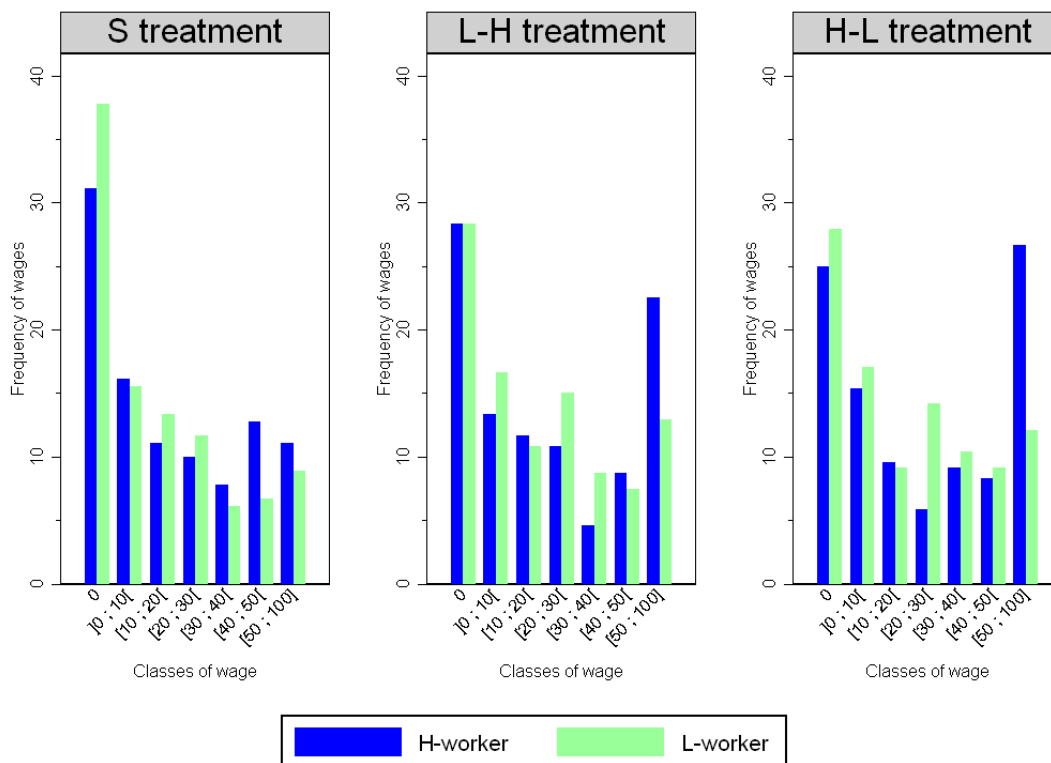
We now turn to the influence of the observability of coworker efforts. The results reported in Table 2 suggest that the observability of coworker efforts tends to decrease the frequency of selfish employers and the proportion of employers who promote L-workers. Conversely, revealing a coworker's effort causes a larger number of employers to favor H-workers and to propose an identical and non-null wage to both workers in an even proportion. A closer examination of Table 3 adds two notable observations. First, displaying coworkers' efforts leads to an increase in both wages: H-workers receive higher wages when their effort decisions are observed than when both workers' efforts are hidden (T-test: $p = 0.0012$). Similarly, H-workers receive higher wages when they observe the effort decisions of their coworkers compared with the S treatment (T-test: $p = 0.0354$). We find the same for L-workers both when they observe their coworkers (T-test: $p = 0.0158$) and when they are observed (T-test: $p = 0.0433$). Even if both wages increase in the H-L treatment compared with the S treatment, the increase in the H-worker's wage is stronger than that of the L-worker, which increases the difference in the two workers' wages (T-test: $p = 0.0607$). Although the targeting effect is not the most prominent in this setting, this result implies that the wage difference is even more pronounced when the H-worker's efforts are observed. However, this finding no longer

14

holds when the L-worker acts as the leader (T-test: $p = 0.4981$). It can be concluded that the observability of the H-workers' efforts induces employers to target their wages toward the more valuable workers (i.e., the H-workers) to urge them to exert high effort levels. This result might ensue because H-workers supplying a high level of effort may induce L-workers to provide a high level of effort thereafter and thus increase the employer's final payoff. The second notable feature from Table 3 involves the comparison of wages between the two treatments in which the coworker's efforts are observable (i.e., *L-H* and *H-L*). In this case, neither the wage received by either type of worker (T-test: $p = 0.2001$ for H-workers and $p = 0.6837$ for L-workers) nor the wage difference (T-test: $p = 0.1440$) differs across treatments. We summarize our findings in Result 1.

Result 1. Hypothesis 1 is verified: most employers promote the most valuable worker. On average, the observability of a coworker's effort leads to an increase in (i) the wages of both workers and (ii) the wage difference only when the more able worker's effort is displayed.

3.2   Workers' behavior

We now turn to the examination of workers' behaviors. For this purpose, Table 4 reports some descriptive statistics, and Fig. 2 displays the average effort exerted as well as the associated cost by each type of worker in response to a wage within a certain interval. The wage intervals are selected such that at least 5% of the observations are within each interval. Despite the fact that workers have immediate incentives to free-ride and avoid the cost of effort, we observe that workers nonetheless exert costly efforts. Further, H-workers provide higher levels of effort on average than L-workers, but these efforts are not necessarily more costly, particularly when H-workers observe their coworkers.

Table 4: Summary statistics for workers
(in experimental points)

Treatments	S	L-H	H-L
w_h	18.07(20.45)	22.90(25.08)	25.96(27.17)
w_l	14.05(17.72)	17.89(20.26)	18.65(20.27)
e_h	1.99(1.63)	1.83(1.85)	2.65(2.54)
e_l	0.93(0.87)	1.26(1.13)	1.22(1.15)
$c(e_h)$	1.38(2.49)	1.26(3.13)	2.63(4.49)
$c(e_l)$	1.23(2.92)	2.30(3.92)	2.26(4.06)

Note: Standard deviation in parentheses.

However, as is typically observed in gift-exchange laboratory experiments, Fig. 2 exhibits an upward-sloping wage-effort relationship, regardless of worker ability. Therefore, gift-exchange occurs because higher wages lead to higher average effort decisions and decrease the frequency of low effort levels. This basic result holds for all treatments.

15

Figure 2: Average effort and cost for a given wage by treatment
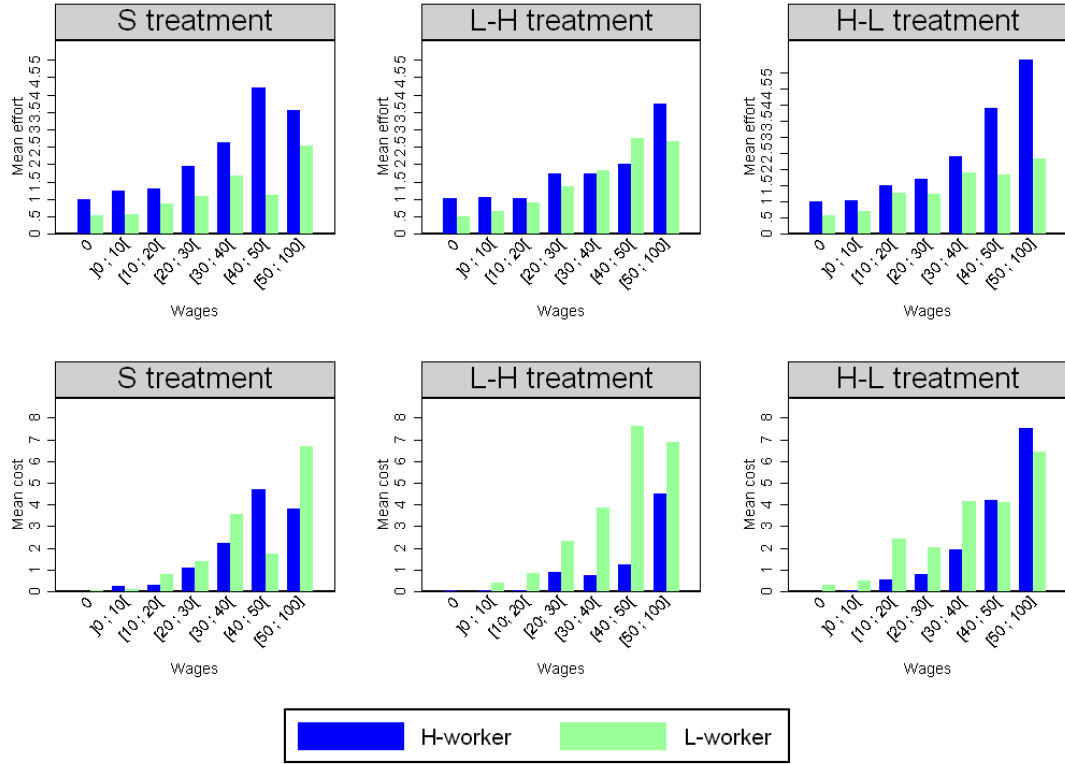
Result 2: There is strong evidence of positive reciprocity between workers and employers.

The study of individual strategy profiles strengthens this result. From the results reported in Table 5, we observe the following: (i) a large share of the subject pool exhibits reciprocal behavior across the three experimental treatments, and (ii) the positive correlation between wages and efforts is equally strong for both H- and L-workers when we account for the order of moves. Regardless of the workers ability, we note that the strength of reciprocity appears to be the lowest for workers who act as the follower and the strongest for those acting as the leader, according to the Spearman rank correlation coefficients reported in Table 5. This finding is supported by performing Chi-square tests. The proportion of reciprocal workers is significantly lower for workers who observe their teammates compared with the S treatment ($\chi^2 = 18.2069, p = 0.001$ for H-workers and $\chi^2 = 25.5611, p = 0.001$ for L-workers). Conversely, when workers act as leaders, the proportion of reciprocal workers increases ($\chi^2 = 42.2400, p = 0.001$ for H-workers and $\chi^2 = 86.5906, p = 0.001$ for L-workers). Thus, it follows that the proportion of reciprocal workers is significantly larger when they act as leaders rather than followers ($\chi^2 = 29.1310, p = 0.001$ for H-workers and $\chi^2 = 55.7405, p = 0.001$ for L-workers). These observations are consistent with peer pressure effects (Hypothesis 2) that postulate

a higher level of reciprocity for workers whose efforts are observed. Our main findings are summarized in Result 3.

Table 5: Relationship between the wage received and
the effort exerted

Treatments	S	L-H	H-L
Overall			
ρ	0.5661	0.6211	0.6091
Prob	< 0.001	< 0.001	< 0.001
% of reciprocal workers	66.66	64.58	52.08
H-workers			
ρ	0.6657	0.5400	0.7440
Prob	< 0.001	< 0.001	< 0.001
% of reciprocal workers	61.11	33.33	66.66
L-workers			
ρ	0.6456	0.7643	0.5979
Prob	< 0.001	< 0.001	< 0.001
% of reciprocal workers	72.22	95.83	37.50

Notes: ρ is the Spearman correlation coefficient and Prob the associated probability. Reciprocal players are those for whom the Spearman rank correlation coefficient is significant at the 5% level.

Result 3: The observability of coworker's efforts has a beneficial effect on reciprocity for those who are observed (Hypothesis 2 - Peer pressure effect), whereas it has a detrimental effect on the reciprocity exhibited by those observing their teammates. Overall, displaying coworker's effort increases the strength of reciprocity.

Finally, because the increase in reciprocity for observed workers exceeds the decrease in reciprocity for those who observe their teammates, the observability of effort has an overall beneficial effect on the strength of reciprocity, although the proportion of reciprocal workers diminishes. This result contrasts with those reported by Gächter and Thöni (2014) and Gächter et al. (2012, 2013). An explanation for this discrepancy might stem from the different settings employed; the setting of those studies considers workers with identical abilities, whereas heterogeneous abilities are introduced in the present study. Besides, it is worth noting from Table 5 that the increase in the proportion of observed reciprocal workers and the increase in the strength of their reciprocity are higher for L-workers than for H-workers compared with the *S* treatment. This result agrees with that of Falk and Ichino (2006), according to which low-ability workers are more sensitive to the pressure arising from their peers than high-ability workers.

We also find differences based on workers' abilities when we examine the levels of exerted effort *per se*. The effort levels are higher in experimental treatments with observable efforts, regardless of the order of moves.[16] One exception is for H-workers who put forth significantly lower levels of effort that lead them to experience lower costs than L-workers, regardless of the level of the wage received (see the middle panel at the bottom

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[16]All Mann-Whitney U tests are significant at the 5% level.

of Fig. 2).[17] We also observe that workers provide a higher level of effort when acting as leaders than when acting as followers, regardless of the ability of workers. This finding is consistent with Result 3.

Figure 3: Relation between workers' effort and that of their team-mates
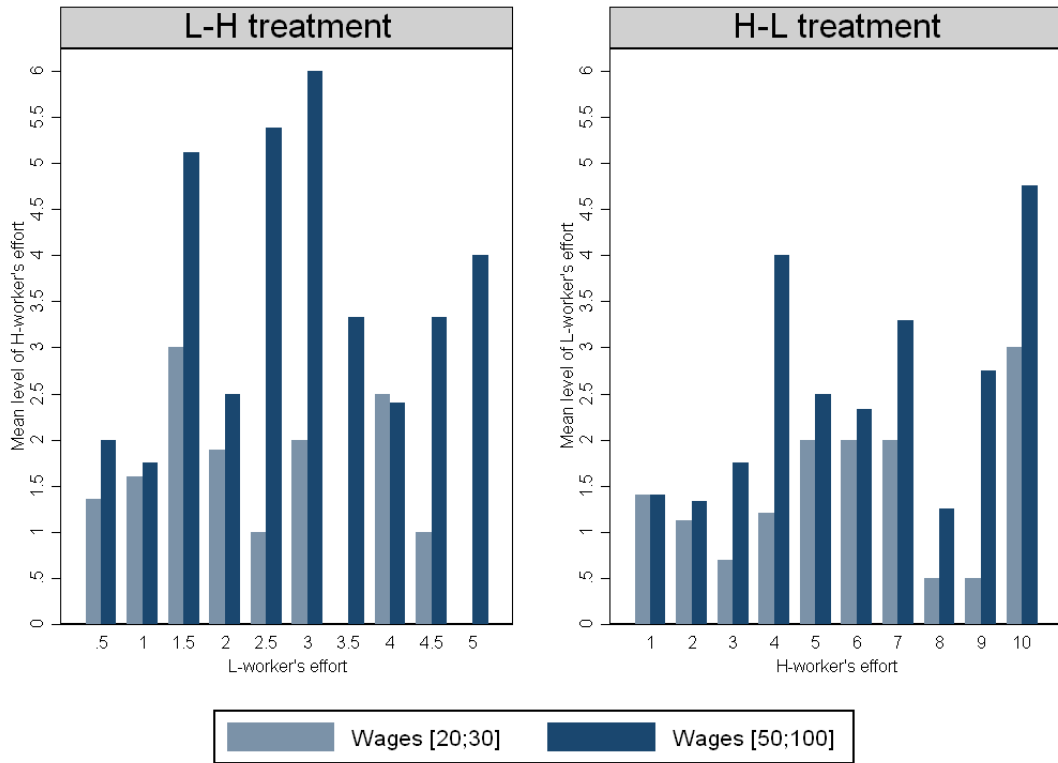
Whereas mixed results have been obtained regarding the effort exerted by the observer workers, the strength of the reciprocity they exhibit is unambiguously lower in comparison with the *S* treatment. A key question remains: What is the impact of the observed coworker's effort and reciprocity on the observer worker's behavior? To answer these questions, the relationship between a worker's effort and that of his teammate is depicted in Fig. 3. This figure is depicted for two wage ranges to account for the positive relationship between a worker's wage and the level of effort he exerts. From Fig. 3, we note that the worker's effort seems positively related to his coworker's effort for both H-workers (left panel of Fig. 3) and L-workers (right panel of Fig. 3). The Spearman rank correlation coefficients corroborate these observations ($\rho = 0.4412$, $p < 0.001$ in the *L-H* treatment and $\rho = 0.3886$, $p < 0.001$ in the *H-L* treatment).

To strengthen these observations, we conduct econometric regressions. First, we perform double-censored Tobit regressions on effort decisions to examine whether workers

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[17]The distributions of $c(e_h)$ and $c(e_l)$ differ significantly; Kolmogorov-Smirnov test: $d = 0.2000$, $p < 0.0001$ in the *L-H* treatment.

are influenced by their coworkers' effort decisions by controlling for the wages of both workers and the sociodemographic characteristics of participants. The Tobit estimates account for the efforts being left-censored by the minimum effort and right-censored by the maximum effort. Standard errors are clustered at the individual level and account for intra-individual correlation in the error term over the 10 periods. The results are reported in columns (1) and (2) in Table 6. Consistent with the positive reciprocity between the wage received and the effort exerted that was found above (see Result 2), we naturally observe that the wage is a strong predictor of the effort exerted for both types of workers. Moreover, the results are also clear regarding the link between efforts. We note that the coworker's effort has a positive impact on the effort decision. Therefore, the efforts are strategic complements. This finding holds, regardless of worker ability. There are positive social spillover effects (Hypothesis 3). Moreover, the level of significance of a coworker's effort in the first two regressions suggests that L-workers are substantially more sensitive than H-workers to their coworkers' efforts. Several explanations can be advanced for this result, including the wish to appear to be productive as a high-ability worker despite the cost it might involve. The observation of a H-worker's effort can be understood as a non-pecuniary incentive to motivate a L-worker. This incentive may explain why efforts exerted by L-workers are higher when they observe their teammates than when efforts are hidden. Another striking result is the impact of the L-worker's wage on the H-worker's effort. The reported estimate highlights the feelings of jealousy experienced by H-workers regarding their coworkers' wages that tend to discourage them from supplying high levels of effort, all else being equal. These feelings of jealousy that are associated with relatively low efforts exerted by the L-workers may explain why observer H-workers exert lower levels of effort compared with those exerted in the *S* treatment.

Finally, we extend our analysis by examining the relationship between the reciprocity exhibited by the leader worker and that of the follower worker. To approximate the degree of reciprocity, we use relative effort, that is, we examine the e_i/w_i function. We run OLS regressions on the relative effort levels. From the results reported in columns (3) and (4) in Table 6, we note a strong and positive relationship between relative efforts for both types of workers. This result means that the follower worker considers both the wage and the level of effort supplied by his coworker before making his choice. Moreover, the level of reciprocity exhibited by the follower worker is positively related to that of the leader worker. This last finding provides additional support for the strategic complementarity of efforts and the positive social spillover effect.[18] The main finding is summarized in Result 4.

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[18]Robustness checks are provided in Appendix 3, Tables 8 and 9.

Table 6: Estimates for the worker's effort and relative effort

Dependent variables	H-worker's effort	L-worker's effort	H-worker's relative effort	L-worker's relative effort
	(1)	(2)	(3)	(4)
Wage	0.132***	0.040***		
	(0.020)	(0.015)		
Partner's wage	-0.047**	0.006		
	(0.018)	(0.012)		
Partner's effort	0.595*	0.190***		
	(0.344)	(0.079)		
Partner's relative effort			0.826**	0.482***
			(0.356)	(0.112)
Constant	-8.198**	1.480*	0.095	0.112***
	(3.794)	(0.847)	(0.109)	(0.031)
Socio-demographic controls	Yes	Yes	Yes	Yes
F-test ($\omega_i = 0$)	4.99	2.68	0.76	4,64
p-value	(0.0007)	(0.0620)	(0.5607)	(0.0068)
Group fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Prob > F	0.000	0.000	–	–
Log pseudolikelihood	-172.770	-231.4988	–	–
R-square	–	–	0.642	0.535
N	240	240	167	170
Left-censored observations	185	146	–	–
Right-censored observations	2	6	–	–

Notes: Clustering errors at the individual level in parentheses. Socio-demographic controls include dummies for gender, first year student or not, economic studies or not and whether participant has a job activity. ***, **, * denote statistical significance at the 1%, 5% and 10% level, respectively.

Result 4: Hypothesis 3 is satisfied. Both H-workers and L-workers tend to exert levels of effort that are positively related to those of their coworkers. Efforts are strategic complements.

3.3 Inequity aversion concerns

We focus our analysis on the sub-game beginning when the observer worker chooses his effort. The level of his effort might reflect inequity aversion concerns. By selecting his effort and the associated cost, the follower worker has the opportunity to increase or decrease the gap in final payoffs.[19] To illustrate the prominence of such behavior, Fig. 4 displays the relationship between a worker's payoff and that of his coworker in treatments in which the coworker's efforts are observable. The size of the dots is proportional to the number of underlying observations. The dashed line is the 45-degree line. Observations on this line mean that a worker matches his coworker's payoff exactly. From Fig.

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[19]Note that we only focus on the equality of the workers' final payoffs because few observations are characterized by equal final payoffs for each member of the firm.

4, we note that 36.66% of workers' choices in the *L-H* treatment and 36.25% in the *H-L* treatment aim to equalize the final payoffs, while the vast majority of decisions maintain the advantage of the H-worker.[20]

Figure 4: Relation between workers' final payoffs
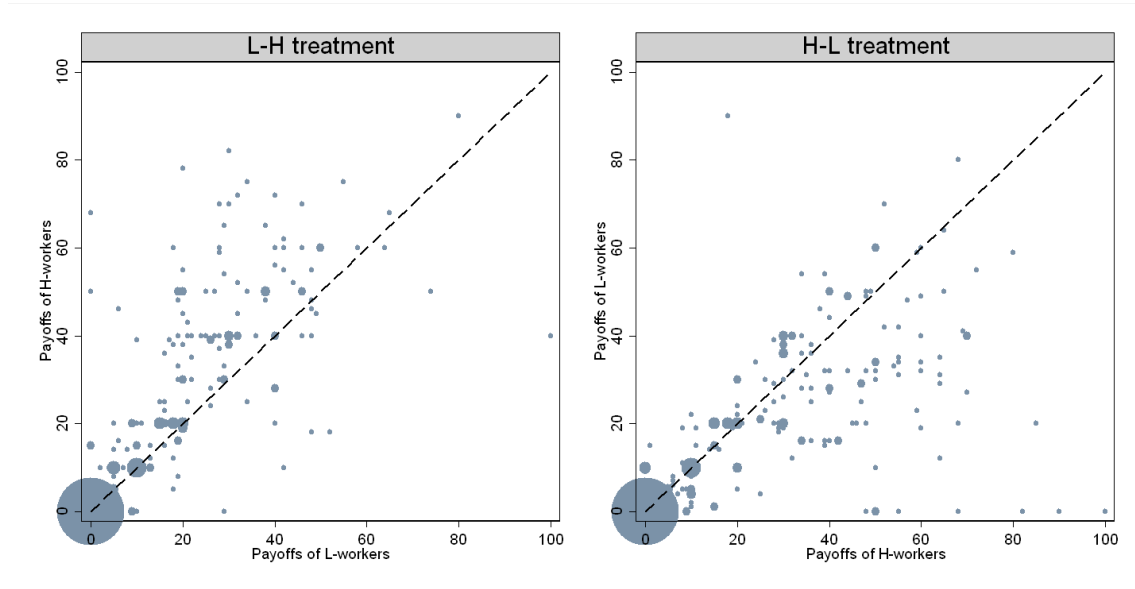
Eliciting individual inequity aversion parameters from the decisions made in Experiment 2 allows us to explore in greater depth the relationship between the degree of inequity aversion and the level of effort exerted. To this end, two situations must be considered.

First, the follower worker, j, receives a lower wage than the final payoff obtained by the leader worker i, (i.e., $w_j < \pi_i = w_i - c(e_i)$). In this case, the follower worker is worse off than his coworker, and the disadvantageous inequity cannot be suppressed. Therefore, the more workers are averse to such inequity (i.e., high α), the lower the level of effort they exert to avoid widening the final payoffs gap. This negative relationship is confirmed by the Spearman rank correlation coefficient: $\rho = -0.5836$, $p = 0.0765$ for L-workers.[21]

Second, the follower worker, j, receives a higher wage than the final payoff obtained by the leader worker i, (i.e., $w_j > \pi_i = w_i - c(e_i)$). Here, the follower worker is better off than his coworker and has the opportunity to close this gap by exerting a high and costly level of effort. In this case, the more sensitive the follower worker is to advantageous inequity (i.e., high β), the higher the level of effort. The Spearman rank correlation coefficients corroborate this strong and positive relationship for both types of workers

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[20]The results from Mann-Whitney U tests confirm that the final payoffs of workers differ significantly depending on their ability: $z = -1.796$, $p = 0.0725$ in the *S* treatment, $z = -2.068$, $p = 0.0386$ in the *L-H* treatment and $z = -2.780$, $p = 0.0054$ in the *H-L* treatment.

[21]We only have three effort levels for H-workers in this situation; therefore, we cannot perform this test.

($\rho = 0.7857$, $p = 0.0362$ for L-workers and $\rho = 0.8167$, $p = 0.0072$ for H-workers). These results suggest that the degree of inequity aversion exhibited by follower workers may explain - at least in part - the level of efforts they exert and thus the strategic complementarity of efforts. We conclude with the following result.

Result 5: A significant portion of workers choose their effort to minimize the inequity of workers' final payoffs.

4 Conclusion

Despite the inescapable difference in ability among workers within a firm and the opportunity for a worker to observe how his teammate behaves before exerting his own effort, we are unaware of other attempts to experimentally study how the observability of coworkers' efforts affects both employers' and workers' decisions in this context. In this paper, we investigate this issue in a laboratory experiment.

Our results reveal that the display of a coworker's effort leads to an increase in both wages and wage differentials, particularly when the more able worker is observed. This result may indicate that the high-ability worker who receives a high wage will be prone to exert high effort and, in turn, may induce the low-ability worker to act similarly. In addition, this order of moves prevents the high-ability worker from being discouraged by his coworker's behavior. However, this explanation suggests that workers are not sensitive to their coworker's wage, which is questionable insofar as we cannot test for this issue and the evidence in the literature is inconclusive. For example, in an experiment that includes homogeneous ability among workers and unobservable efforts, Nosenzo (2010) finds that knowing coworker's wage affects effort decisions. Conversely, under heterogeneous productivity, Charness and Kuhn (2007) do not find support for this result. The observability of coworkers' efforts generates mixed responses from workers. Compared with situations in which the coworker's effort is unknown, those whose behavior is observed supply a level of effort that reflects greater reciprocity, which is consistent with the peer-effects hypothesis. Conversely, observer workers exhibit a lower strength of reciprocity. However, overall, displaying coworker's effort increases the strength of reciprocity. Further, the level of effort exerted by the observer worker reflects a strategic complementarity between efforts, i.e., workers' efforts are positively correlated with those exerted by their coworkers. One explanation of the strategic complementarity of efforts underlined here relates to inequity aversion: more than one-third of workers adjust their effort levels up or down to equalize the workers' final payoffs, whose strength is directly related to the individual parameters of inequity aversion.

An alternative explanation for the follower worker's effort decision might be related to compliance with social norms, as suggested by Gächter and Thöni (2014). If the observed worker's effort is perceived as a norm to follow, then a higher level of effort ex-

hibited by the observed worker will result in higher effort from the observer worker. This explanation is consistent with Mittone and Ploner (2011), who emphasize that the positive relationship between efforts may originate either from pure preferences for conformity among workers or from a combination of learning about social norms and a desire to comply with these social norms. Thus, compliance with social norms may explain the positive relationship among workers' efforts. A fruitful avenue for future research would be to investigate in more detail the role of social norms in this setting by applying the elicitation procedure of Krupka and Weber (2013), for example. For this purpose, some adjustments should be made to our experimental design, in which the large set of possible wages offered to each worker and the large set of workers' efforts lead to too many combinations to apply the procedure developed in Krupka and Weber (2013). To elicit individual compliance with social norms, it would be necessary to restrict the set of wage and effort decisions or to use the strategy method with restricted choice sets, in the same vein as Gächter et al. (2012) and Gächter et al. (2013). Further, to increase the external validity of our results and to thereby inform human resource policy, another interesting extension would be to address the attribution of ability to workers. In our experiment, workers were randomly selected to be high- or low-ability workers. Being a low-ability worker may be perceived as unfair by participants, which may subsequently affect their decisions. An extension would consist of introducing a first stage with a real effort task whose results would determine who would be the high- and low-ability workers in the experiment, such as the task used in Charness et al. (2014), which would open up additional avenues for future research.

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Appendix

Appendix 1. Predictions derived from the inequity aversion model of Fehr and Schmidt (1999) in the three-person gift-exchange game case

In a three-person gift-exchange game, a Fehr Schmidt H-worker maximizes the following utility function:

$$U_h(\pi) = \pi_h - \alpha_h \frac{1}{2} \left[max(\pi_E - \pi_h, 0) + max(\pi_l - \pi_h, 0) \right]$$
$$- \beta_h \frac{1}{2} \left[max(\pi_h - \pi_E, 0) + max(\pi_h - \pi_l, 0) \right] \tag{5}$$

with h denoting the H-worker, l the L-worker and E the employer.

Recalling that the employer's payoff function is:

$$\pi_E = v(e_l + e_h) - w_l - w_h \tag{6}$$

and those of workers:

$$\pi_l = w_l - c(e_l) \tag{7}$$
$$\pi_h = w_h - c(e_h) \tag{8}$$

for the L-worker and the H-worker, respectively.

The derivative of $U_h(\pi)$ with respect to the level of effort exerted e_h is:[22]

$$\frac{\partial U_h}{\partial e_h} = \begin{cases} -\frac{\partial c(e_h)}{\partial e_h} - 0.5\beta_h(-10 - 2\left(\frac{\partial c(e_h)}{\partial e_h}\right)) & \text{if } \pi_h > \pi_l \text{ and } \pi_h > \pi_E \quad (A) \\ -\frac{\partial c(e_h)}{\partial e_h} - 0.5\alpha_h(10 + 2\left(\frac{\partial c(e_h)}{\partial e_h}\right)) & \text{if } \pi_h < \pi_l \text{ and } \pi_h < \pi_E \quad (B) \\ -\frac{\partial c(e_h)}{\partial e_h} + 0.5\beta_h\left(\frac{\partial c(e_h)}{\partial e_h}\right) - 0.5\alpha_h\left(10 + \left(\frac{\partial c(e_h)}{\partial e_h}\right)\right) & \text{if } \pi_h > \pi_l \text{ and } \pi_h < \pi_E \quad (C) \\ -\frac{\partial c(e_h)}{\partial e_h} - 0.5\alpha_h\left(\frac{\partial c(e_h)}{\partial e_h}\right) - 0.5\beta_h\left(-10 - \left(\frac{\partial c(e_h)}{\partial e_h}\right)\right) & \text{if } \pi_h < \pi_l \text{ and } \pi_h > \pi_E \quad (D) \end{cases} \tag{9}$$

The above expressions (eq. 9) are directly related to the marginal cost of the exerted effort and the sensitivity to the difference in payoffs. Thus, according to the payoff inequity and the degree of sensitivity, the H-worker is induced to increase or decrease his effort. The four situations are depicted in Fig. 5. To plot Fig. 5, we approximate the effort-cost functions as follows:

$$c(e_h) = 0.1061e_h^2 + 0.8333e_h - 1.0667 \tag{10}$$

$$c(e_l) = 0.4242e_l^2 + 1.6667e_l - 1.0667 \tag{11}$$

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[22]The results are symmetric if we consider the L-worker.

27

with eq. (10) for the H-worker and eq. (11) for the L-worker. For exposition purpose, we set $w_h = w_l = 25$.[23]

Figure 5: Location of equal payoffs in the three-person gift-exchange game
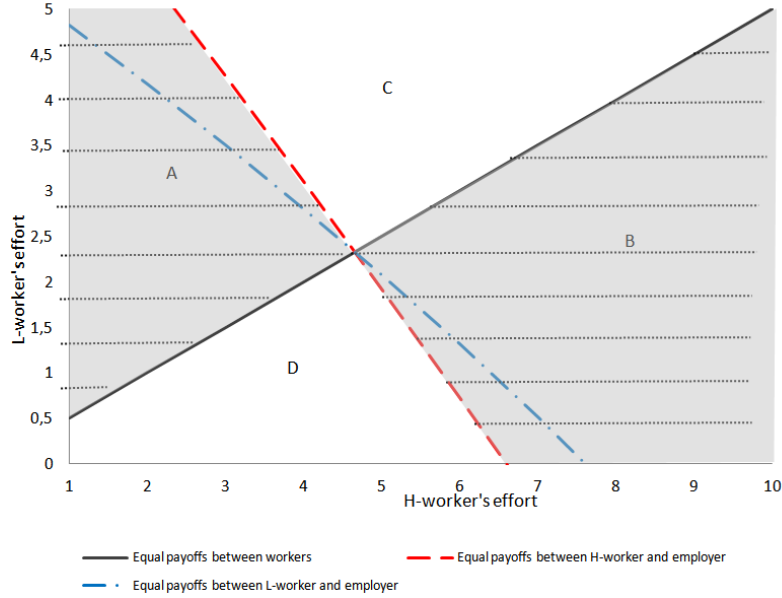
From Fig. 5, above the line $\pi_E = \pi_h$, the H-worker obtains a higher final payoff than the employer. Similarly, to the left of the line $\pi_l = \pi_h$, the H-worker obtains a higher final payoff than the L-worker. The intersection of these two lines creates four conceivable cases.

In the first case (A), the H-worker has a higher final payoff than the other two players. In this case, the derivative is positive ($\partial U_h / \partial e_h > 0$) if $\beta_h > \frac{\partial c(e_h)/\partial e_h}{(\partial c(e_h)/\partial e_h) + 5}$. This means that a H-worker with a sufficiently high β will increase his effort to be closer to the employer's payoff (an increase in effort leads to an increase in the employer's payoff and a decrease in the H-worker's payoff so that the payoffs difference diminishes) and to the low-ability worker's payoff. Regarding the case of both disadvantageous inequities (B), the derivative is unambiguously negative ($\partial U_h / \partial e_h < 0, \forall \alpha_i$). Thus, the H-worker will reduce his effort to reduce the gap between his payoff and the payoffs of other members of his firm. While conclusions drawn from the first two cases (i.e., A and B) seem natural, it is more difficult without calculations to postulate the change in exerted effort when both advantageous and disadvantageous inequities are at work. When the H-worker has the potential to earn more than his co-worker but his payoff is lower than that of the employer (case C), the H-worker will unequivocally decrease his effort ($\partial U_h / \partial e_h < 0, \forall \alpha_i \geq \beta_i$). Finally, when the H-worker has an advantageous inequity with respect to the employer and a disadvantageous inequity with respect to his co-worker (case D), a worker with a low β (i.e., $\beta_h < \frac{(\partial c(e_h)/\partial e_h)(2+\alpha_h)}{(\partial c(e_h)/\partial e_h) + 10}, \forall \alpha_i \geq \beta_i$) will supply the minimum effort ($\partial U_h / \partial e_h < 0$). This

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[23]The same figure holds for $w_h \neq w_l$.

28

result holds for a marginal cost of effort ranged from 0 to 10. Alternatively, a sufficiently advantageous inequity averse worker (i.e., $\beta_h > \frac{\partial(c(e_h)/\partial e_h)(2+\alpha_h)}{(\partial c(e_h)/\partial e_h)+10}$, $\forall \alpha_i \geq \beta_i$) will exert high effort ($\partial U_h / \partial e_h > 0$).

Appendix 2. Experiment 2: Inequity aversion

1. Elicitation

After the first experiment, we conducted a second experiment that aimed at estimating the individual parameters of inequity aversion, following Fehr and Schmidt (1999)'s model. This model assumes that the utility of player i may be written as:

$$U_i = x_i - \alpha_i \max\left(x_j - x_i, 0\right) - \beta_i \max\left(x_i - x_j, 0\right) \tag{12}$$

where x_i is the monetary payoff of player i, x_j is the monetary payoff of player j, α_i is the parameter for disadvantageous inequity of player i and β_i is the parameter for advantageous inequity of player i. It is assumed that $\alpha_i \geq \beta_i$.

We followed the procedure of Blanco et al. (2011), whereby subjects make decisions in two different games: an ultimatum game using the strategy method and a modified dictator game. In each game, subjects do not learn their role (for example, proposer or responder in the ultimatum game) until the end of the game.

More precisely, the ultimatum game is used to elicit the individual parameter of disadvantageous inequity, α_i. In this game, the proposer must divide 20 points between himself and the responder. Next, the responder must decide whether to accept or reject the proposition. Note that all subjects decided first as a proposer and second as a responder. To avoid any feedback and to elicit the complete strategy of responders, we used the strategy method; that is, responders must decide whether to accept or reject any of the 21 possible distributions (ranging from $(20, 0)$ to $(0, 20)$; see Fig. 6). The estimation of α_i is obtained through the decisions of the responder i and corresponds to the switch point between rejecting and accepting the distribution.

Figure 6: Table for responder's choices in the ultimatum game

Regarding the individual parameter of advantageous inequity, β_i, we used a modified version of the dictator game. In this game, each subject must make decisions as a proposer by choosing between two distributions: a non-egalitarian one $(20, 0)$ and an egalitarian one (x_i, x_i), for 21 possibilities (ranging from $(0, 0)$ to $(20, 20)$; see Fig. 7). The estimate of the advantageous inequity parameter, β_i, corresponds to the switch point from the unfair distribution $(20, 0)$ to the egalitarian one (x_i, x_i).

Figure 7: Table for proposer's choices in the modified dictator game

To avoid any order effects, in half of the experimental sessions, the ultimatum game was played before the modified dictator game, and we reversed the order in the other half. We applied this setting to each experimental treatment. Outcomes of these two games are known at the end of Experiment 2. Moreover, subjects knew that they would be paired with a different participant in these two games, a participant who was also dif-

ferent from their partner in the gift-exchange game, to rule out reputation and retaliation (or acknowledgment) effects.

2. Results of Experiment 2

Decisions made in the two games of Experiment 2 enable the selection of subjects with consistent preferences, i.e., subjects switch at some point (if at all) from choosing the left column to choosing the right column but they do not switch back. Overall, out of 198 participants, 176 (88.88%) behave consistently in both games. This result is in accordance with Blanco et al. (2011) who find 84.72%. In Table 7, we summarize the distribution of the advantageous and disadvantageous inequity parameters of all consistent subjects. Next, we present these distributions depending on (1) the role of players in the gift-exchange game and (2) the experimental treatment.

Table 7: Distribution of inequity aversion parameters

|	All	By role			By treatment		
		Employers	H-workers	L-workers	Secret	L-H	H-L
$\alpha < 0.4$	40.34%	37.88%	44.44%	39.29%	37.78%	38.46%	43.94%
$0.4 \leq \alpha < 0.92$	26.14%	28.79%	20.37%	28.57%	22.22%	29.23%	25.76%
$0.92 \leq \alpha < 4.5$	25.00%	22.73%	27.78%	25.00%	28.89%	24.62%	22.73%
$4.5 \leq \alpha$	8.52%	10.61%	7.41%	7.14%	11.11%	7.69%	7.58%
$\beta < 0.235$	27.27%	25.97%	20.29%	19.72%	22.22%	18.46%	39.39%
$0.235 \leq \beta < 0.5$	15.34%	15.58%	10.14%	11.27%	22.22%	12.31%	13.64%
$0.5 \leq \beta$	57.39%	44.16%	47.83%	47.89%	55.56%	69.23%	46.97%

Note: The theoretical distribution of Fehr and Schmidt (1999) is 30%, 30%, 30%, 10% for α and 30%, 30%, 40% for β. The empirical distribution found by Blanco et al. (2011) is 31%, 33%, 23%, 13% for α and 29%, 15%, 56% for β in their experiment.

Because this experiment replicates the one of Blanco et al. (2011), it is interesting to compare our results with theirs and with the theoretical distribution assumed by Fehr and Schmidt (1999). Computation of Chi-square goodness-of-fit tests indicate no significant differences between our distributions and that assumed by Fehr and Schmidt (1999) and that observed by Blanco et al. (2011), for both advantageous and disadvantageous inequities. More importantly, because this experiment was conducted after the gift-exchange game, and the elicited parameters of inequity aversion were used in the data analysis of results obtained in the gift-exchange game, we need to check whether the type of players or the information provided has not biased the results of Experiment 2. Again, from the Chi-square tests, we note that all comparisons (i.e., between experimental treatments and between roles of players) fail to be significantly different from each other. We conclude that the information provided and the roles in the gift-exchange game had no impact on the choices made in Experiment 2.

Finally, the implementation of the two games (i.e., the modified dictator game and the ultimatum game) makes it possible to elicit the joint distribution of the α and β pa-

rameters. Fig. 8 depicts both individual parameters that are widely distributed in the subject pool. The assumption of a positive correlation between α_i and β_i, as assumed by Fehr and Schmidt (1999), is confirmed (Spearman rank correlation coefficient: $\rho = 0.3045$, $p < 0.0001$), while it contradicts that found by Blanco et al. (2011) ($\rho = -0.03$, $p = 0.820$). Moreover, 53.41% of subjects' decisions confirm the hypothesis of $\alpha_i \geq \beta_i$, which is close to the findings of Blanco et al. (2011) who observe 62.29%. The corresponding data points lie above the $\alpha = \beta$ line in Fig. 8.

Figure 8: Distribution of inequity aversion parameters for consistent choices
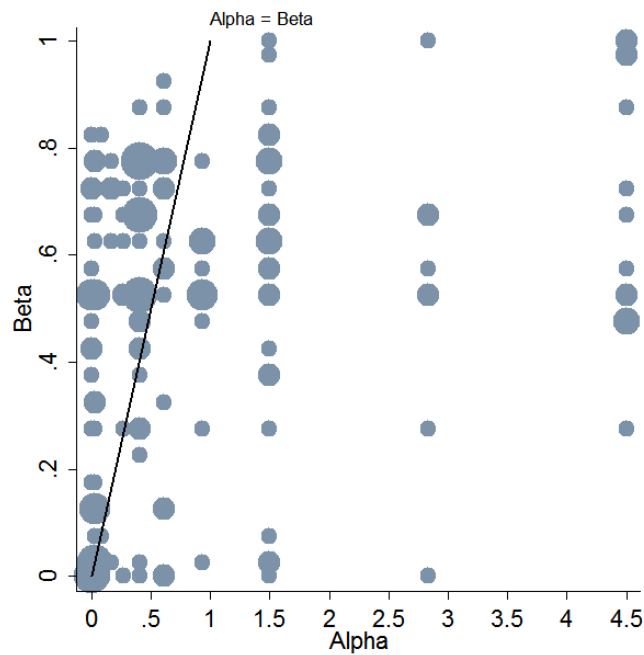
Result. Subjects exhibit various degrees of inequity aversion. The positive relationship between both inequity aversion parameters is corroborated and a little more than half of the subjects' decisions confirm the assumption of $\alpha_i \geq \beta_i$.

Appendix 3. Supplementary analyses - Robustness checks for the relationship between workers efforts

As emphasized by Gächter and Thöni (2014), the strong correlation between the wage received and the exerted effort may biased the estimates. To test the robustness of our results reported in Table 6, we provide additional regressions (1) without the worker's wage, (2) without his co-worker's wage, and (3) without both of them. We do this for each type of worker's ability. We perform double censored Tobit regressions to account for the efforts being left-censored by the minimum effort and right-censored by the maximum effort. The set of socio-demographic variables remains the same. Results are reported in Table 8. We observe that, in all regressions, the co-worker's effort is a strong and positive determinant of the effort exerted by the follower worker. The strategic complementarity of efforts appears as a robust finding. It is notable that, compared to previous studies that have pointed out the strategic complementarity in efforts (see for instance Gächter and Thöni, 2014), the magnitude of the estimates for co-worker's effort are larger in our experiment, especially regarding the influence of L-worker's efforts on H-worker's efforts.

Table 8: Tobit estimations for the relationship between workers efforts, without wages

Dependent variables	H-worker's effort			L-worker's effort		
	(1)	(2)	(3)	(1)	(2)	(3)
Wage		0.112***			0.043***	
		(0.019)			(0.013)	
Partner's wage	0.065***			0.026***		
	(0.024)			(0.009)		
Partner's effort	0.796**	0.605**	1.526***	0.184**	0.219***	0.345***
	(0.385)	(0.293)	(0.351)	(0.081)	(0.074)	(0.076)
Constant	-5.860	-7.805**	-6.065	1.959**	1.529*	2.405***
	(3.838)	(3.804)	(3.807)	(0.874)	(0.825)	(0.796)
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
F-test ($\omega_i = 0$)	5.73	4.99	6.37	2.37	2.25	2.32
p-value	(0.0002)	(0.0007)	(0.0001)	(0.0537)	(0.0650)	(0.0578)
Group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Log pseudolikelihood	-194.886	-174.521	-198.413	-239.427	-231.687	-243.366
N	240	240	240	240	240	240
Left-censored observations	185	185	185	146	146	146
Right-censored observations	2	2	2	6	6	6

Notes: ***, **, * denote significance at the 1%, 5% and 10% level, respectively. Robust standard errors adjusted for clustering at the individual level in parentheses. Socio-demographic controls include dummies for gender, first year student or not, economic studies or not and whether participant has a job activity.

Another robustness check of results reported in Tables 6 and 8 consists of removing observations for which the received wage is null, because in this case, the exerted effort corresponds necessarily to the minimum effort. To that purpose, we conduct Tobit regres-

sions without (1) the worker's wage when this latter is null, (2) without his co-worker's wage when it is null, and (3) without both wages when these latter are equal to 0. We do this for each type of worker's ability. As previously pointed out, the Tobit estimates account for the efforts being left-censored by the minimum effort and right-censored by the maximum effort. Results are reported in Table 9. As expected, in all regressions, the co-worker's effort has a positive and significant impact on the effort exerted by the follower worker. It is noteworthy that the magnitude and significance of the co-worker's effort estimates are similar in the three specifications, and this remark holds regardless of worker's ability. The strategic complementarity of efforts is a robust finding. Another point to note is the negative and significant impact of L-worker's wage on H-worker's effort: the feelings of jealousy of H-worker's regarding their co-worker's wage is also a robust result.

Table 9: Tobit estimations for the relationship between workers efforts, without null wage

Dependent variables	H-worker's effort			L-worker's effort		
	(1)	(2)	(3)	(1)	(2)	(3)
Wage	0.123***	0.131***	0.130***	0.027**	0.034**	0.027**
	(0.022)	(0.025)	(0.025)	(0.013)	(0.014)	(0.013)
Partner's wage	-0.055***	-0.065***	-0.066***	0.009	0.005	0.010
	(0.018)	(0.021)	(0.021)	(0.010)	(0.010)	(0.010)
Partner's effort	0.622*	0.599*	0.605*	0.209***	0.195**	0.203***
	(0.345)	(0.336)	(0.338)	(0.078)	(0.076)	(0.078)
Constant	-8.065**	-8.019**	-8.078**	1.607**	1.457*	1.489*
	(3.693)	(3.725)	(3.697)	(0.802)	(0.825)	(0.828)
Socio-demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
F-test ($\omega_i = 0$)	5.37	5.15	5.16	2.11	2.26	2.20
p-value	(0.0005)	(0.0007)	(0.0006)	(0.0828)	(0.0653)	(0.0720)
Group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Log pseudolikelihood	-166.883	-165.299	-165.055	-208.393	-206.525	-204.719
N	172	172	167	173	180	170
Left-censored observations	118	118	113	81	90	80
Right-censored observations	2	2	2	5	5	5

Notes: ***, **, * denote significance at the 1%, 5% and 10% level, respectively. Robust standard errors adjusted for clustering at the individual level in parentheses. Socio-demographic controls include dummies for gender, first year student or not, economic studies or not and whether participant has a job activity.