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THE IMPACT OF SOCIAL COMPARISONS ON RECIPROCITY

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Abstract:

This paper investigates how social comparison information about referent others (i.e. learning what similar others do and how they are treated) affects reciprocal relationships. Using a three-person gift-exchange game we study how employees' reciprocity towards an employer is affected by exposure to pay comparison information (what co-workers earn) and effort comparison information (how co-workers perform). We find that pay comparison information does not affect reciprocity. Effort comparison information, however, influences reciprocal relationships in important ways: the ability to observe reciprocal behavior on the part of others strongly affects employees' reciprocity towards the employer. While our data show that social information in principle may either erode or amplify reciprocal relationships, we find that, on average, social comparisons have a detrimental impact on reciprocity.

Keywords: Reciprocity, gift-exchange, social information, social comparisons, pay comparisons.

JEL: A13, C92, J31.

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1. Introduction

Reciprocity can have an important influence on economic behavior, as demonstrated in a wide range of experiments where many individuals forgo some of their own earnings to reward the generosity of others.[1] Much of this experimental evidence, however, comes from bilateral interactions within stylized social environments. Naturally occurring interactions, on the other hand, take place in social environments where individuals are typically exposed to considerable amounts of social information about similar others, which can ultimately affect their attitudes and behavior. In this paper we investigate experimentally how exposure to *social comparison information about referent others* (i.e. learning what similar others do and how they are treated) influences reciprocal behavior.

The next section discusses the related literatures in detail. We note that in many natural social situations individuals can observe how similar others behave in similar circumstances, and this may provide valuable guidance in understanding how one is expected to behave. Also, in many natural social environments information about others' material well-being is available and may influence the way individuals evaluate their own well-being (Fliessbach et al., 2007; Tricomi et al., 2010), and hence their behavior. For example, in many workplaces a worker can observe the relationship between other workers and the employer, i.e. a worker can observe how similar others are rewarded by the employer (*pay comparison information*) and how they behave and perform (*effort comparison information*). The availability of such pieces of social information may affect a worker's attitude and behavior towards the employer.

Section 3 describes our experimental design. Our paradigm for studying how social comparisons influence reciprocal behavior is the gift-exchange game. In a standard bilateral gift-exchange game an "Employer" decides on the wage to pay to an "Employee", who can in turn reciprocate by choosing costly effort that rewards the Employer. In standard gift-exchange game experiments many employees are willing to eschew their private interests to reciprocate employers' wage offers. In particular, the higher the wage, the higher is the employees' effort. In this paper we extend the standard bilateral setting to a three-person gift-exchange game. In our experiment subjects are grouped in firms composed of one Employer and two employees, labeled "Employee 1" and "Employee 2". The game begins with the Employer choosing wages for each employee, which are then publicly observed. A key feature of the game is that the two employees then choose costly efforts sequentially: thus,

[1] For reviews and discussions of the relevance of reciprocity in economics see Fehr and Gächter (2000) and Fehr and Fischbacher (2002). For general overviews of the importance of reciprocity in social interactions, see Cialdini (2001) and Gintis et al. (2005).

while both have full information about relative wages at the time they make effort choices, only Employee 2, who moves last, has access to information about the co-worker's effort. Hence, while both Employee 1's and Employee 2's behavior reveals how pay comparison information influences effort choices and reciprocity, from Employee 2's decisions we can also study the effects of effort comparison information.

We report our results in Section 4. The four main findings from our study are as follows. 1) As in many other gift-exchange game experiments we also observe a strong, positive own wage-effort relationship: employees reciprocate higher own wages with higher effort. 2) Exposure to pay comparison information has on average little impact on the observed wage-effort relationship: while own wage is a powerful determinant of own effort, co-workers' wages have virtually no effect. 3) When the wage for both employees is high, the effort level for Employees 2 is sensitive to the effort provided by Employee 1: if their co-worker chooses low effort they tend to expend low effort, while if their co-worker expends high effort they also expend high effort. 4) On average the Employer does worse when both pay and effort information are provided, suggesting that social comparisons have an overall detrimental impact on reciprocity.

We discuss these results in Section 5. Our finding that, on average, social comparison information undermines reciprocity is related to other recent findings which suggest that individuals tend to evaluate the social information available in the environment in a way beneficial to their self-interest. However, we also find that social information sometimes has beneficial effects, and we suggest that group composition may be an important tool for harnessing the positive effects of social comparisons.

2. Related Literature

Numerous studies have shown the importance of positive reciprocity for economic behavior. Using simple bilateral games such as investment (Berg et al., 1995), sequential prisoner's dilemma (Clark and Sefton, 2001) and gift-exchange games (Fehr et al., 1993), many experimental studies have shown that people are willing to incur costs to reward kind actions, even in anonymous interactions where there are no positive future consequences associated with reciprocal behavior.

A particularly suitable framework for our research question is the gift-exchange game (GEG). This game reproduces a contractually incomplete labor relation where an "employer" makes a wage offer to an "employee" who, upon acceptance, chooses how much costly effort to supply. GEG experiments have been extensively used to examine the "fair wage-effort

hypothesis" formulated in the seminal work by Akerlof and Yellen (1990). According to this hypothesis labor relations can be described as a reciprocal "gift exchange": employees are willing to "gift" harder work effort to their employers in exchange for a fair wage. Consistent with the fair wage-effort hypothesis, many GEG laboratory experiments, including some with one-shot situations where decisions are made anonymously and pure self-interest would lead employees to shirk, have shown that employees systematically choose to reciprocate generous wage offers with higher effort (e.g., Fehr et al., 1993; Fehr et al., 1997; Gächter and Falk, 2002; Brandts and Charness, 2004; Charness, 2004; Maximiano et al., 2007 - for a recent review of the experimental literature see Fehr et al., 2009; Charness and Kuhn, *forthcoming*). Thus, positive reciprocity has been extensively documented in many simple GEG studies, providing support for the relevance of the norm of reciprocity in these social situations.[2]

Maximiano et al. (2007) stress that organizations are complex social systems where employers typically interact with many employees at the same time, hardly resembling the stylized work environments studied in standard GEG experiments where employers bilaterally interact with single employees. Maximiano et al. conduct an experiment where, in their "1-4" treatment, an employer offers (the same) wage to four employees who then (simultaneously) choose efforts. They find that reciprocal responses are not substantially different from those observed in a "1-1" treatment where an employer is matched with one employee. Thus they find that vertical reciprocity (i.e. employer-employee gift exchange) is robust to increases in the size of the workforce. However, the presence of co-workers can create other differences between multi-worker and single-worker firms beyond the pure number effects studied by Maximiano et al.. In particular, in Maximiano et al. all workers are paid the same and do not observe each others' behavior, whereas in general information about what co-workers earn (*pay comparison information*) and how they perform (*effort comparison information*) may be available and may in turn influence vertical reciprocity.

The relevance of pay comparison information in the workplace is suggested by abundant survey and case-study evidence pointing to the importance of horizontal fairness concerns (i.e. fairness between employees) in labor relations (e.g., Agell and Lundborg, 1995; Campbell III and Kamlani, 1997; Bewley, 1999). Furthermore, pay comparisons constitute a central component in a number of theoretical approaches which build on equity theory (Adams, 1965) to improve the understanding of labor relations. In fact, the "fair wage" in

[2] Evidence of varying degrees of reciprocal gift-exchange has been also found in numerous field studies and real effort experiments, see, e.g., Fehr and List (2004), Gneezy and List (2006), Falk (2007), Maréchal and Thöni (2007), Cohn et al. (2008), Bellemare and Shearer (2009), Hennig-Schmidt et al. (2010), Kube et al. (2010).

Akerlof and Yellen's model is defined in relative terms, as employees compare their own pay with their peers' to judge how fairly they are being treated by the employer. Nevertheless, empirical support for the notion that pay comparisons systematically influence employees' behavior remains weak at best, both in the field and in the lab. Field studies exploring the relation between pay dispersion within an organization and its performance have produced mixed results (see, e.g., Cowherd and Levine, 1992; Main et al., 1993; Eriksson, 1999; Hibbs and Locking, 2000). The empirical evidence from laboratory experiments is scarce and equally inconclusive, as some experiments report that horizontal fairness concerns can have a negative impact on work effort (Gächter and Thöni, 2009; Clark et al., 2010; Güth et al., 2010; Nosenzo, 2010, Abeler et al., *forthcoming*), while in others such effects are weak or absent (Güth et al., 2001; Charness and Kuhn, 2007).[3]

Effort comparison information may also have an important influence on behavior: the ability to observe how similar others behave in a given situation may provide informative cues about how one is expected to behave (see, e.g., Cialdini et al., 1990; Keizer et al., 2008). A number of recent field studies and real effort experiments have shown that individual effort behavior can be systematically affected by information about the effort behavior of others (see, e.g., Falk and Ichino, 2006; Mas and Moretti, 2009; Bellemare et al., 2010).

In summary, while there is a large body of evidence on the importance of reciprocity in a variety of settings and social situations, there is also some evidence that individuals' behavior can be systematically affected by social information about the behavior and treatment of others. We argue that exposure to social comparison information is typical in natural environments, such as workplaces, and hence we believe that studying the behavioral effects of social comparisons can add in important ways to understanding how reciprocity works in many natural social situations. In this study we focus on two pieces of social information that may be particularly salient: pay and effort comparison information. We study the impact of pay comparison information on effort behavior by examining how employees respond to a given wage offer when they are paid the same, more or less than an equally productive co-worker. While both Employees 1 and Employees 2 are exposed to information about co-worker's pay, Employees 2 also receive information about the co-worker's effort. Effort comparison information may also have important effects on behavior as it has been shown by a number of field and real effort studies reporting that individual effort behavior is systematically affected by

[3] Relatedly, a number of studies report that informing responders of offers made to other responders can affect acceptance rates in ultimatum games (e.g., Knez and Camerer, 1995; Bohnet and Zeckhauser, 2004; Alewell and Nicklisch, 2009; Ho and Su, 2009).

the effort behavior of similar others. A potential difficulty with the use of field or real effort data is that it is generally hard to strip down the mechanics of effort comparison processes because a number of different forces (e.g. social pressure, learning, social preferences, self-motivation considerations) may simultaneously operate in these settings, potentially confounding the interpretation of results. Our laboratory experiment is based on a tightly controlled abstract setting where subjects interact once and anonymously, and make decisions that lead to quantifiable payoff consequences. Thus, our design allows us to isolate a pure, preference-based form of effort comparisons, separately from the (potentially confounding) effects of social pressure, self-motivation considerations and knowledge spillovers.

3. Experimental Design & Procedures

3.1 The Experimental Game

Our aim is to set up a GEG where we can study how the combination of pay and effort comparison information affects employees' reciprocal behavior. To achieve this aim, we build on the bilateral GEG used in Fehr et al. (1998) and use a payoff structure similar to that used in Fehr et al. (1997). In our underlying game there are three players: Employer, Employee 1 and Employee 2. All players move sequentially: the Employer moves first and chooses a wage $w_i \in \{16, 32\}$ for each Employee $i \in \{1, 2\}$. The Employer can (but does not have to) choose different wages for different employees. Employee 1 observes both wages and then chooses an effort level $e_1 \in \{1,2,3,4\}$. Employee 2 observes both wages *and* the effort chosen by Employee 1 and then chooses an effort level $e_2 \in \{1,2,3,4\}$. After Employee 2's choice, the game ends and the Employer's earnings are computed as:

$$\pi_{ER} = 10 \cdot (e_1 + e_2) - w_1 - w_2$$

and employee *i*'s earnings are computed as:

$$\pi_i = w_i - 5 \cdot (e_i - 1).$$

For our experiment, we implement this game using the strategy method (Selten, 1967), i.e. subjects had to specify complete strategies in the game-theoretic sense. Thus, participants in the role of Employee 1 specified four effort choices, one for each wage combination that could possibly be chosen by the Employer, and participants in the role of Employee 2 specified sixteen effort choices, one for each of the sixteen possible combinations of wages and effort chosen by the Employer and Employee 1.

We implemented a one-shot version of this experimental game. The game was described to subjects using the same labor market frame that we use throughout the text.

3.2 Discussion of the Design

There are a number of reasons why we use the GEG to address the questions we are interested in. First, as discussed in the previous section, positive reciprocity has been documented extensively in many GEG experiments, providing support for the relevance of the norm of reciprocity in these social situations. Second, also as argued earlier, individuals are typically exposed to considerable amounts of social information about similar others in naturally occurring organizations, and hence our three-person GEG provides the minimal environment to study how social comparisons influence behavior. Lastly, the particular GEG we use in our experiment, as compared to other experimental settings, provides a cleaner environment for studying the "pure" effects of social comparison information on reciprocity. On this last point, while some environments are simply not suitable to study positive reciprocity (e.g. the dictator game), in others (e.g. public good games) actions of other players have a direct impact on one's own monetary payoffs and hence on reciprocal considerations: thus, reactions to information about others' contributions to a public good may reflect direct reciprocation (i.e., a reaction to a kind or unkind act by another) rather than the effect of social information *per se*.[4] In our three-person GEG, on the other hand, the wage the employer pays to the co-worker and the co-worker's effort do not directly affect an employee's payoff and hence cannot be used to develop pure reciprocal considerations.

The trilateral game used in this paper allows us to observe two different types of effort decision. Subjects in the role of Employee 1 move after the Employer and before subjects in the role of Employee 2: thus they can condition their effort on both the level of the own wage and the level of the co-worker's wage, but not on the co-worker's effort. Hence, they have access to pay comparison information, but not effort comparison information, and their effort choices can be represented by an effort function $e_1 = f(w_1, w_2)$. Subjects in the role of Employee 2 move last and are fully informed about the co-worker's effort as well as about relative wages, and their effort choices can be represented by an augmented effort function $e_2 = g(w_2, w_1, e_1)$, which describes how social information affects reciprocity when both pay and effort comparison information are available.

We are interested in observing how employees choose effort across situations that differ in the wage paid to the co-worker and in the effort expended by the co-worker. In order to study how the same person behaves across different situations one could have subjects repeatedly play the sequential game with a direct response method. This procedure has the

[4] Brandts and Fatas (2004) and Bardsley and Sausgruber (2005) propose experimental designs that allow to overcome this identification problem in voluntary contribution games.

drawback that the identification of social comparison effects may be confounded by learning effects (since a person's behavior in different contingencies would necessarily be observed at different points in time) as well as strategic effects. Moreover, repeated play might not guarantee the collection of a sufficient number of observations in all the different wage and/or effort combinations for all employees.

For these reasons we adopt the strategy method approach to identify social comparison effects in our setting. This enables us to observe the complete effort functions $e_1 = f(w_1, w_2)$ for each Employee 1 and $e_2 = g(w_2, w_1, e_1)$ for each Employee 2, while eliminating any possible learning or strategic confounds associated with repeated play. Evidence from laboratory experiments comparing decisions elicited with the strategy method and the direct response method suggests that the strategy method does not introduce systematic biases in behavior (see Brandts and Charness, 2009 for a review of the experimental literature). In particular, Gächter and Thöni (2009) report a trilateral gift-exchange game experiment where choices were elicited both with the direct response method and with the strategy method and show the two elicitation methods produce consistent results in this sort of experimental setting.[5] Moreover, Cason and Mui (1998) compare the use of the strategy method and the direct response method for eliciting choices in the presence of social comparison information and conclude that the use of the strategy method in this setting does not significantly alter choices.

Given that our main interest is to isolate the impact of social information on reciprocal behavior, we kept the structure of the decision situation as simple as possible. In particular our setting involves no productivity differences or technological interdependences between employees. One could argue that the absence of productivity differences might reduce the scope for observing wage differences between employees, thus posing a threat to the interpretability of subjects' responses to seemingly arbitrary unequal wage offers. Although productivity differences between employees constitute an important reason why employers may want to introduce pay differentials, there also exist other rationales for unequal wage offers. For example, employers may find it optimal to choose unequal wages if they believe workers will supply high effort only if they are paid more than co-workers, or if employers think that some employees will respond reciprocally whereas others will not and employers therefore try their luck by using a "mixed payment strategy" (see also Gächter and Thöni, 2009).

[5] Note, however, that their direct response method does not allow observation of the complete effort function at the individual level while the strategy method does. Their strategy method data allows them to show that there is substantial heterogeneity in the way people react to pay comparisons.

3.3 Experimental Procedures

The experiment was conducted at the University of Nottingham using the software z-Tree (Fischbacher, 2007). Subjects were students from a wide range of disciplines recruited through the online recruitment system ORSEE (Greiner, 2004). Six sessions were conducted with a total of 84 participants, 28 in each role. The average age was 20 years and 58 percent were male. No subject took part in more than one session.

Upon arrival, subjects were welcomed and randomly seated at visually separated computer terminals. Subjects were given 15 minutes to read through the instructions, and then the experimenter read aloud a briefer précis outlining the most important points contained in the instructions. The instructions and the précis are reproduced in the Appendix. Subjects were then randomly assigned to a group and a role. All decisions were made anonymously, and neither during nor after the experiment were subjects informed about the identity of the other members of their firm. Before proceeding to the decision stage, subjects were guided through two role-specific video presentations which carefully illustrated the main features of the decision screens they were going to use during the experiment.[6] The first video presentation explained the functioning of an on-screen electronic calculator (the *What-if-calculator*) that subjects could use to compute their and other players' payoffs. At the end of the first video presentation, subjects were asked to solve a set of control questions and they could not enter the decision stage unless they had solved all the questions correctly. The second video presentation showed subjects how to enter their choices in a Decision Table and explained once again the structure of the game and the strategy method.

On average the experimental sessions lasted about one hour, including the reading of the instructions and of the précis and the completion of a post-experimental questionnaire. All participants were endowed with an initial amount of 95 points, and earnings from the decision task (which could be negative) were added to this initial amount.[7] At the end of the session, the final point earnings were converted into British Pounds at a rate of £0.10 per point. Subjects were paid in private and in cash at the end of each session. Subject earnings ranged from £5.10 to £12.70, averaging £10.30 (approximately $21 at the time of the experiment).

[6] Video presentations were shown to subjects individually in z-Tree. Video presentations and the software are available upon request.

[7] Note that subjects in the role of the Employer could incur losses from the decision task. The initial endowment outweighed any possible losses.

4. Results

In our experiment employers can choose from four possible wage combinations. Of the 28 employers, 6 (21 percent) paid the high wage to both employees, 7 (25 percent) paid different wages, and 15 (54 percent) paid the low wage to both employees. In the rest of this section we examine how employees reacted to the different wage combinations. We start by exploring whether pay comparison information affects effort behavior among Employees 1. We then turn to Employees 2 and explore the impact on effort of both pay and effort comparison information. Lastly, we compare behavior in the two environments to assess the overall impact of social comparisons on reciprocity.

4.1 Social Comparisons and Effort among Employees 1

Figure 1 displays the average effort expended by the 28 Employees 1 who participated in our experiment. The two bars in the front row represent the wage combinations where the employee gets a low (16 points) own wage, while the bars at the back correspond to the two cases where the own wage is high (32 points). Darker bars represent wage combinations where the co-worker gets a low wage, while lighter bars correspond to the two cases where the co-worker is paid a high wage.

Figure 1: Average Effort - Employees 1

An immediately apparent feature of Figure 1 is that Employees 1 expend more effort when they are paid a high wage. In fact, employees' average effort when the own wage is high exceeds the effort exerted when the own wage is low by around 0.714 when the co-worker's wage is low, and by 0.750 when the co-worker's wage is high. Both differences are highly significant ($p < 0.001$ in both cases).[8] This pattern reproduces the standard "reciprocity result" documented in the GEG literature: employees reciprocate higher wages with higher effort.

[8] All p-values are based on two-sided Wilcoxon matched-pairs signed-ranks tests, unless reported otherwise.

Another noticeable feature of Figure 1 is that social information has on average no effect on Employee 1's effort choices: for a given own wage, they expend roughly the same effort irrespective of the wage the Employer pays to the co-worker ($p = 1.000$ when the own wage is low, and $p = 0.739$ when the own wage is high). As in Gächter and Thöni (2009), this average result masks some heterogeneity in employees' responses to changes in the co-worker's wage, *ceteris paribus*. Of the 28 Employees 1 in the experiment, 12 chose minimal effort irrespective of the wages paid to themselves or the co-worker. These subjects act as 'selfish' monetary payoff maximizers and thus do not change their effort depending on the wage paid to the co-worker as this is irrelevant to their payoff maximization problem. Among the 16 'non-selfish' employees who made at least one non-minimal effort choice in the experiment, 7 expended the same effort for a given own wage irrespective of the co-worker's wage, 4 expended more effort when the co-worker's wage was high, 4 expended more effort when the co-worker's wage was low, and 1 exhibited mixed responses to changes in the co-worker's wage as he or she expended more effort when the co-worker's wage was low if his or her own wage was low, but he or she expended more effort when the co-worker's wage was high if his or her own wage was high.

Overall, we conclude that Employees 1 reciprocate high wages with higher effort, but pay comparison information has *on average* no impact on effort decisions (because heterogeneous reactions happen to cancel each other out).

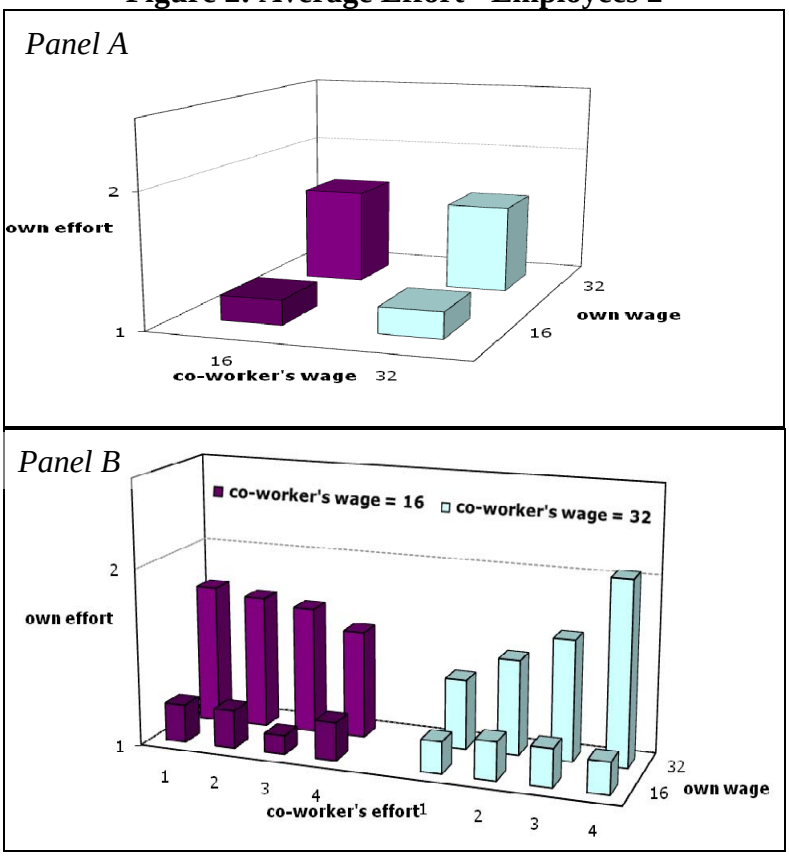
4.2 Social Comparisons and Effort among Employees 2

We now turn the attention to the 28 Employees 2 who participated in the experiment. Figure 2 shows Employee 2's average effort and is divided in two panels. Panel A has the same structure of Figure 1 above and shows average effort per wage combination, aggregating across different levels of the co-worker's effort. Panel B disaggregates the average efforts of Panel A by the four different levels of the co-worker's effort.

A first feature which is apparent in both panels of Figure 2 is that also Employees 2 increase their effort when they are paid the high wage. Ignoring for a moment the effects of social information and averaging across contingencies where the own wage is the same, we note that Employee 2's effort increases on average by about 0.495 and the effect is highly significant ($p < 0.001$). In fact, for each combination of the co-worker's wage and effort shown in Panel B of Figure 2, the mean increase in effort of Employee 2 after an increase in the own wage differs

from zero at $p < 0.058$.[9] A natural question is how Employees 2's effort reaction compares to those of Employees 1's. We will address this question in detail in Section 4.3 below.

Figure 2: Average Effort - Employees 2



Panel A shows average effort per wage combination, aggregating across different levels of the co-worker's effort. Panel B disaggregates effort choices by different levels of the co-worker's effort.

A second notable feature of Figure 2 is that, as with Employees 1, information about the co-worker's wage has on average no effect on Employee 2's effort. This is particularly evident in Panel A of Figure 2: for a given own wage, Employees 2 expend roughly the same effort irrespective of the wage the Employer pays to the co-worker ($p = 0.740$ when the own wage is low, and $p = 0.639$ when the own wage is high). Thus, on average, pay comparisons do not seem to affect effort decisions among Employees 2. Again, this average result masks some heterogeneity in effort responses: comparing the average effort expended by the 16 'non-selfish' Employees 2 across wage combinations where the own wage is the same and the co-worker's wage is either high or low we find that 4 expended the same effort irrespective of the co-worker's wage, 4 expended more effort when the co-worker wage is low, 5 expended

[9] The p-values range from 0.0578 for the case where the co-worker is paid a high wage and supplies minimal effort to 0.0004 for the case where the co-worker is paid a high wage and supplies maximal effort.

more effort when the co-worker wage is high, and 3 exhibited mixed responses to changes in the co-worker's wages.

Moreover, as it is apparent from Panel B of Figure 2, there exists substantial heterogeneity in effort responses with respect to effort comparison information: for a given wage combination, the magnitude of employees' effort crucially depends on the co-worker's effort decision. The way in which effort comparison information affects Employee 2's effort seems to depend on relative pay conditions. In the wage combination where the Employer pays a high wage to both employees the magnitude of Employees 2's effort crucially depends on the co-worker's effort: employees strongly increase their effort as the co-workers expend higher effort. When Employee 2 is paid a high wage and the co-worker's wage is low information about the co-worker's effort seems to have a slightly negative effect on Employee 2's effort. When Employee 2's wage is low there is no clear relation between Employee 2's effort and the co-worker's effort.

We examined the impact of effort comparison information on Employee 2's effort decisions using the regression model

$$e_2 = \alpha_0 + \alpha_1 * high\ wage + \alpha_2 * e_1 + \alpha_3 * high\ wage * e_1 + \varepsilon$$

where the explanatory variable "*high wage*" is a dummy variable which assumes the value 1 when the own wage is high and 0 otherwise. Note that this models e_2 as a linear function of e_1, where the marginal impact of e_1 on e_2 is α_2 (when own wage is low) or $\alpha_2 + \alpha_3$ (when own wage is high). We used OLS to estimate separate models for the cases where the co-worker's wage is low or high and report the results in Table 1.

In both models the estimate of α_2 is very close to, and not significantly different from, zero, showing that no relation between employees' effort exists when the Employer pays a low wage to Employee 2. When the co-worker is paid a low wage the estimate of $\alpha_2 + \alpha_3$ is negative. This reflects the decline in effort that is apparent in Panel B of Figure 2 (bars corresponding to own wage = 32, co-worker's wage = 16). However, the estimate is low and not significantly different from zero ($F(1,27) = 0.73$; $p = 0.401$). In contrast, when the co-worker is paid a high wage the estimate of $\alpha_2 + \alpha_3$ is positive and statistically significant ($F(1,27) = 7.24$; $p = 0.012$). Thus, when the Employer pays a high wage to both workers, Employees 2 systematically increase their effort when the co-worker also does so. The impact of this effect on effort is remarkable. When the co-worker receives a high wage and chooses minimal effort, the Employer elicits only a small amount of extra effort (0.207 – 0.054 =

0.153) from Employees 2 by increasing their wage from 16 to 32. On the other hand, if the co-worker chooses maximum effort Employees 2's reciprocal response is about five times this (0.828 – 0.054 = 0.774). Thus, the own wage-effort relationship is significantly affected by effort comparison information.

Table 1: Employee 2's Effort Regressions

	co-worker's wage is LOW	co-worker's wage is HIGH
high wage	0.643***	-0.054
	(0.169)	(0.147)
e_1	-0.011	0.000
	(0.052)	(0.037)
e_1 * high wage	-0.046	0.207***
	(0.049)	(0.067)
constant	1.214***	1.196***
	(0.145)	(0.122)
N.	*224*	*224*
F-statistic	*F(3,27) = 5.48*	*F(3,27) = 6.69*
Prob > F	*0.004*	*0.002*
R^2:	*0.110*	*0.134*

Dependent variable is Employee 2's effort. Robust standard errors in parentheses adjusted for intragroup correlation (subjects are used as independent clustering units). *** $p < .01$.

4.3 The Impact of Social Comparisons on Reciprocity

Our results show that social comparisons can shape the intensity of employees' reciprocal responses towards the employer in important ways. In particular, whereas information about the co-worker's wage has on average little impact on effort choices, we find that the availability of information about the co-worker's effort can be a crucial piece of social information in our setting: when the Employer offers a high wage to both Employees, Employees 2's reciprocal behavior depends on the reciprocal behavior of the co-worker.

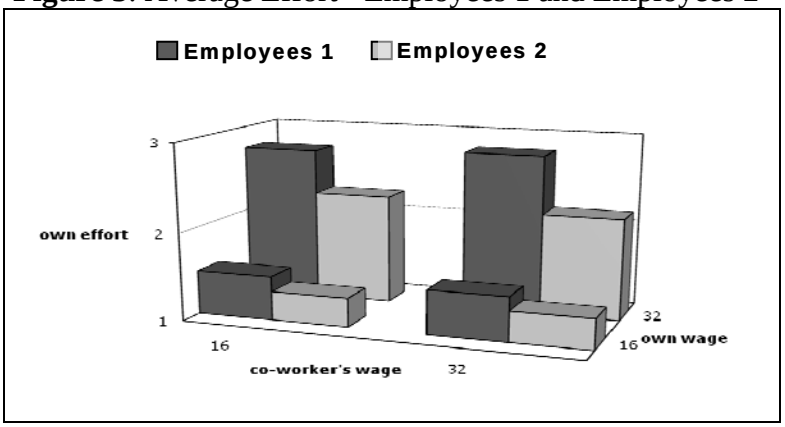
A natural question is then whether an employer could in principle exploit this dependency in employees' reciprocal responses, by adopting a policy of paying equally generous wages *and* making information on co-workers' efforts available. Would such a policy make the employer better off on average, strengthening the reciprocity of those employees who observe reciprocal behavior on the part of others? Or would any positive effect of social information be rather outweighed by the negative effects which may occur when reciprocally motivated employees observe that others do not comply with norms of reciprocity?

To answer these questions, we investigate whether the availability of effort comparison information had on average a beneficial or detrimental effect on employees' reciprocity in our experiment. We do so by comparing the average reciprocal response of Employees 1, who

were just exposed to pay comparison information, with the reciprocal response of Employees 2, who had access to both pay and effort comparison information. As we are interested in the impact of effort comparison information on reciprocity, we focus on the 16 Employees 1 and 16 Employees 2 "non-selfish" employees, i.e. those employees who made at least one non-minimal effort choice in the experiment. Figure 3 and Table 2 restrict attention to these employees. The figure shows the effort expended on average by non-selfish Employees 1 (dark bars) and Employees 2 (light bars) in the four possibly wage combinations.[10]

On average, Employees 1's effort exceeds Employees 2's effort in each given wage combination. Moreover, Employees 1 appear to be decidedly more responsive to own wage increases than Employees 2, irrespective of the co-worker's wage. Thus, on average the availability of effort comparison information seems to have a *detrimental* effect on effort behavior and employees' reciprocal response.

Figure 3: Average Effort - Employees 1 and Employees 2



The figure shows average effort by non-selfish Employees 1 (n=16, dark bars) and non-selfish Employees 2 (n=16, light bars).

How much "reciprocal effort" does the Employer lose on average when effort comparison information is made available? Table 2 answers this question and reports the magnitude of Employee 1's and Employee 2's average reciprocal responses for the various co-worker's wages and (where applicable) effort levels. Reciprocal responses are computed as the change in own effort after an own wage rise *ceteris paribus*, i.e. holding constant the co-worker's wage and (for Employees 2) effort.[11]

[10] As in Panel A of Figure 2, an Employee 2's average effort in each wage combination is simply the average effort choice across the four co-worker's effort contingencies.

[11] More formally, we compute Employee 1's reciprocal responses as $\Delta e_1 = f(w_1 = 32, w_2) - f(w_1 = 16, w_2)$ and evaluate them for different values (low or high) of the co-worker's wage. Employee 2's reciprocal response is computed as $\Delta e_2 = g(w_2 = 32, w_1, e_1) - g(w_2 = 16, w_1, e_1)$ and evaluated for different values of the co-worker's wage and effort.

Table 2: Social Comparisons and Reciprocity

		Average Reciprocal Response	
		co-worker's wage is LOW	co-worker's wage is HIGH
Employees 1		1.250 (0.856)	1.312 (0.704)
Employees 2	when e_1 is 1	1.000 (0.816)	0.375 (0.719)
	when e_1 is 2	0.937 (0.929)	0.562 (0.727)
	when e_1 is 3	1.062 (0.929)	0.812 (0.910)
	when e_1 is 4	0.687 (1.138)	1.500 (0.966)
	overall	0.922 (0.780)	0.812 (0.574)

The table shows average reciprocal responses of Employees 1 and Employees 2 with standard deviations in parentheses.

Aggregating across the four co-worker's effort contingencies, Employees 2's average reciprocal response is substantially lower than Employees 1's, both when the co-worker's wage is high (0.812 vs. 1.312), and when the co-worker's wage is low (0.922 vs. 1.25). A Wilcoxon rank-sum test detects a significant difference in both cases: $p = 0.055$ when the co-worker's wage is high, and $p = 0.025$ when the co-worker's wage is low. While reciprocal responses are generally lower among Employees 2 than among Employees 1 when the co-worker's wage is low, Employees 2's reciprocity in the contingencies where the co-worker's wage is high clearly depends on the co-worker's effort. Employees 2 respond to an own wage increase by expending only 0.375 additional units of effort if they observe that the co-worker expends minimal effort, but they increase effort by 1.5 units when the co-worker expends maximum effort. Thus, the Employer could in principle extract more effort from Employees 2 than from Employees 1, provided that Employees 2 are paired with a sufficiently reciprocal co-worker. Nevertheless, our data suggest that on average reciprocity towards the employer is weakened by exposure to both pay and effort comparison information relative to the case when only pay comparison information is available.

5. Discussion & Conclusions

We have designed an experimental situation to study reciprocal behavior in an environment where subjects can observe the treatment and behavior of similar others before deciding on their reciprocal response. We argue that exposure to these pieces of social information is typical in naturally occurring social environments (e.g. in the workplace) and

hence we believe that studying the behavioral effects of social comparison information can add in important ways to the understanding of individual decisions in social situations.

In our experiment we find strong evidence of reciprocity: employees expend higher effort when they are offered higher wages. However, the strength of the own wage-effort relationship is significantly affected by social comparison information, although a distinction has to be made between the effects of pay and effort comparison information. On the one hand, as in some previous studies (e.g., Charness and Kuhn, 2007), exposure to pay comparison information does not seem to have *on average* a significant impact on individual behavior: effort choices respond strongly to own wage considerations, but not to information about the co-worker's wage. On the other hand, we find that the own wage-effort relationship is significantly affected by effort comparison information, in a way which is dependent on relative pay conditions. When the employer pays equal and generous wages to both employees, employees are reluctant to increase their effort in response to a generous wage offer if their co-worker does not increase effort as well. On the other hand, employees strongly respond to generous wage offers if the co-worker is also willing to do so. The magnitude of the effect is considerable: relative to the case where the co-worker chooses minimal effort, effort responses are five times stronger when the co-worker chooses maximum effort. Effort behavior appears instead less sensitive to social information when the employer pays unequal wages to the employees, or when the own wage is low: in these circumstances effort choices do not depend significantly on the effort of the co-worker.

These findings are in line with those of several other recent studies that suggest that social information about others' behavior can systematically affect individual behavior in a variety of settings. For example, a number of dictator game experiments have shown that dictators tend to behave more (less) generously towards recipients when they are informed about generous (selfish) choices made by other participants (e.g., Bicchieri and Xiao, 2009; Krupka and Weber, 2009). Analogous evidence on this type of social comparison effects comes from public goods game experiments (e.g., Carpenter, 2004; Bardsley and Sausgruber, 2005), gift-exchange games (Thöni and Gächter, 2010) and investment games (Mittone and Ploner, 2009). Relatedly, in public goods game laboratory experiments many people are 'conditional cooperators' who are willing to contribute in proportion to what others contribute (e.g., Falk et al., 2010; Fischbacher and Gächter, 2010). The importance of conditional cooperation has also been documented in a number of recent field experiments (Frey and Meier, 2004; Alpizar et al., 2008; Croson and Shang, 2008; Martin and Randal, 2008; Shang and Croson, 2009; Chen et al., *forthcoming*).

Previous studies have typically interpreted these social comparison effects by referring to one of two different behavioral mechanisms. On the one hand, there is the view that pro-social behavior originates from pressures to comply with norms of 'socially acceptable' behavior in a given context. Here observing what others do can affect individuals' actions by influencing what they perceive to constitute appropriate behavior in a given situation as well as by modulating the extent to which individuals feel compelled to comply with existing norms. The alternative approach emphasizes the role individuals with stable social preferences, i.e. individuals who are not exclusively interested to their own material payoff, but also care about the well-being of others, about how outcomes are distributed among others, etc. (for a review of social preferences models see, e.g., Fehr and Schmidt, 2006). Within such a framework, social comparison effects reflect the extent to which individuals with social preferences adapt their behavior to different conditions of the social environment. For example, Thöni and Gächter (2010) derive the predictions of a number of models of social preferences for a trilateral gift-exchange game closely related to the one studied here. They show that, differently from the other models they consider, the Fehr and Schmidt (1999) model of inequity aversion can account for a positive relation between employees' efforts when the Employer pays equal wages to the two employees. Thus, both approaches can in principle explain the positive correlation between employees' efforts documented in our trilateral gift-exchange game for the wage combination where both wages are high. An interesting avenue for further research would be to disentangle these two leading explanations for pro-social behavior and social comparison effects.

Overall, our results show that the strength of reciprocal relations can be substantially eroded, or amplified by the ability to observe reciprocal behavior on the part of others. What is then the average impact of social comparisons on reciprocity? Our data suggest that, although social information can have a positive effect on reciprocity in some circumstances, this positive impact tends to be outweighed by its negative effects: on average Employee 2's reciprocal responses are less intense that Employee 1's. Nevertheless, our finding that there exist circumstances where social comparisons have beneficial effects on reciprocity points to the importance of devising mechanisms that can reshape the social environment such that social information may end up fostering reciprocal behavior. We propose that selective group composition may be one such mechanism. We see considerable heterogeneity across players: some appear reciprocally motivated whereas others choose uniformly low effort. An employer choosing employees should avoid low effort providers for two reasons. First, such employees cannot be motivated to supply high levels of effort, since they respond to high wages by

shirking. Second, as we have stressed, they also undermine the employer's ability to induce gift exchange from reciprocally motivated employees. In fact, social information within heterogeneous groups tends to undermine performance, as observation of shirkers tends to induce conditionally-cooperative players to adopt more selfish behaviors. This happens despite the fact that there are no payoff interdependencies between Employees[12].

Similarly, employers should find reciprocally motivated employees attractive for two reasons. They can be motivated to supply high levels of effort, and as our study shows, they induce higher levels of reciprocity from other employees. Thus homogeneous groups of reciprocally motivated employees may provide the best environment for harnessing the positive effects of social comparisons. This argument is complementary to those made by the business executives interviewed by Bewley (1999, p. 16): in their view layoffs do less damage to work morale and performance than pay cuts, because layoffs "get the misery out the door" while pushing the remaining workers to work harder in order to avoid future dismissal, whereas pay cuts have a negative impact on all workers' motivation. In addition, our results suggest that if layoffs target less productive workers this has the further advantage of reducing the heterogeneity of the workforce thus strengthening the effort responses of reciprocally motivated employees.

[12] A similar process has been observed in public goods experiments. However, in public goods situations the breakdown of cooperation occurs because cooperators – unlike in our game – are materially affected by free riders and they want avoid being the "sucker" (e.g., Fischbacher and Gächter, 2010). In these type of situations selective group composition may also foster cooperation, see for example Burlando and Guala (2005); Gächter and Thöni (2005); Gunnthorsdottir et al. (2007); and Ones and Putterman (2007).

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Appendix

Instructions

You are now taking part in an economic experiment on decision-making that has been financed by various foundations for research promotion.

If you read the following instructions carefully, you can – depending on your decisions – earn a considerable amount of money. It is therefore very important to read these instructions with care.

During this experiment you are not allowed to communicate with the other participants in any way. If you have any questions, please raise your hand and the experimenter will come to your desk. If you violate this rule, you will be excluded from the experiment and from all payments.

During the experiment your earnings will be calculated in points. You will receive an initial endowment of 95 points, which will be enough to cover any loss that might occur during the experiment. The points you lose will be subtracted from your endowment.

At the end of the experiment we will convert your point earnings into money at the following rate:

1 Point = 10 Pence

Your total money earnings will be paid out to you in private and **in cash** at the end of the experiment.

1. Introduction

In this experiment you will be randomly matched with two other participants to form a group of three persons. We will refer to **each group as a firm, and to the three group members as Employer, Employee 1 and Employee 2**. You will be assigned to a firm and a role entirely at random, and the computer will inform you of your role before the decision-making part of the experiment begins. You will not be informed about who of the other participants are in your firm, either during or after the experiment. Therefore, all decisions are made anonymously.

2. Decisions within a Firm

The structure of the decision-making within each firm is as follows.

- ✓ First, **the Employer** chooses the wages to pay to Employee 1 (**$Wage_1$**) and Employee 2 (**$Wage_2$**). The Employer can choose between two wage levels, 16 or 32. If he or she wants to, the Employer can choose different wages for different Employees.
- ✓ Next, **Employee 1** learns the wages the Employer pays to each Employee, and then chooses an effort level (**$Effort_1$**), either 1, 2, 3 or 4.
- ✓ Finally, **Employee 2** learns the wages the Employer pays to each Employee, and also the effort decision of Employee 1. Employee 2 then chooses an effort level (**$Effort_2$**), either 1, 2, 3 or 4.

3. Distribution of earnings within a Firm

Earnings within the Firm are determined according to the following rules:

Employer

The Employer receives revenue from the effort chosen by the two Employees, and incurs costs from the wages paid to the two Employees. The revenue produced by each Employee equals 10 times the effort he or she chooses. The costs are simply the sum of the two wages the Employer pays to the Employees. The Employer's earnings are therefore:

$$\textbf{Employer's Earnings} = 10 * (Effort_1 + Effort_2) - Wage_1 - Wage_2$$

The Employer's earnings increase with higher effort levels. The higher the wages the Employer pays to the two Employees, the lower are the Employer's earnings. Note that the Employer's earnings could be negative.

Employee 1

Employee 1 receives the wage from the Employer as revenue, and may incur an effort cost. The minimum effort choice of 1 is costless. Each additional unit of effort costs 5 points to the Employee. Therefore the effort cost is calculated as: 5 * (Effort – 1). The earnings of Employee 1 are therefore:

Employee 1's Earnings = $Wage_1 – 5 * (Effort_1 – 1)$

The earnings of Employee 1 only depend on his or her own wage and effort. The higher the wage, the higher are the earnings. The higher the effort he or she chooses, the lower are the earnings.

Employee 2

The earnings of Employee 2 are calculated in the same way as those of Employee 1, except, of course, that Employee 2's earnings depend on his or her own wage ($Wage_2$) and his or her own effort choice ($Effort_2$):

Employee 2's Earnings = $Wage_2 – 5 * (Effort_2 – 1)$

HYPOTHETICAL EXAMPLE FOR DEMONSTRATION PURPOSES

ASSUME THAT THE EMPLOYER CHOOSES THE FOLLOWING WAGES FOR HIS OR HER EMPLOYEES:

WAGE FOR EMPLOYEE 1 = 32

WAGE FOR EMPLOYEE 2 = 16

THE EMPLOYEES CHOOSE THE FOLLOWING EFFORT:

EFFORT EMPLOYEE 1 = 2

EFFORT EMPLOYEE 2 = 3

THIS SITUATION RESULTS IN THE FOLLOWING EARNINGS:

EMPLOYER'S EARNINGS: THE EMPLOYER RECEIVES REVENUE FROM THE EFFORT OF THE TWO EMPLOYEES, I.E.: 10*(2 + 3) = 50. THE EMPLOYER PAYS A TOTAL OF 48 POINTS TO THE EMPLOYEES.

THE EARNINGS OF THE EMPLOYER ARE: 50 – 48 = **2**.

EMPLOYEE 1'S EARNINGS: EMPLOYEE 1 RECEIVES A WAGE OF 32. THE EFFORT CHOICE OF 2 HAS A COST OF 5*(2 – 1) = 5.

THE EARNINGS OF EMPLOYEE 1 ARE: 32 – 5 = **27**.

EMPLOYEE 2'S EARNINGS: EMPLOYEE 2 RECEIVES A WAGE OF 16. THE EFFORT CHOICE OF 3 HAS A COST OF 5*(3 – 1) = 10.

THE EARNINGS OF EMPLOYEE 2 ARE: 16 – 10 = **6**.

4. The Decision Task

Although the structure of the decision-making within each firm is the one described above, in this experiment we ask you to take a decision for each possible situation that may arise. Please note that one of these situations will be actually relevant, so make your choices carefully.

The situations you face when making your decisions will depend on your role.

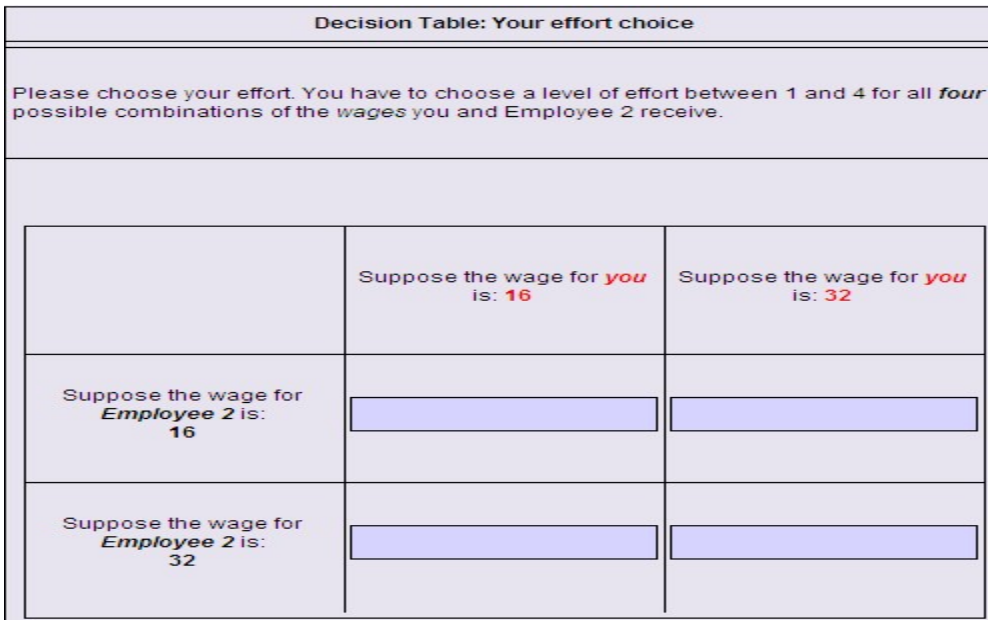
If you are an **Employer you must choose two wage**s, one for each Employee within the Firm. The Employer can choose between:

- $Wage_1 = 16$ and $Wage_2 = 16$;
- $Wage_1 = 16$ and $Wage_2 = 32$;
- $Wage_1 = 32$ and $Wage_2 = 16$;
- $Wage_1 = 32$ and $Wage_2 = 32$.

Depending on the choice of the Employer one of four situations will arise:

- Employee 1 and Employee 2 could both have a wage of 16;
- Employee 1 could have a wage of 16 while Employee 2 has a wage of 32;
- Employee 1 could have a wage of 32 while Employee 2 has a wage of 16;
- Employee 1 and Employee 2 could both have a wage of 32.

If you are **Employee 1** you will be in one of these four situations. However, before knowing which of these situations you are actually in, you will be asked to **indicate what you would do for each of the four possible situations** you may be in. You will see a decision screen like the one below:



Each box represents one of the four possible situations you may be in. In each of these boxes, you must enter an effort choice, either 1, 2, 3 or 4. Your actual effort choice will depend on which of these four possible situations will actually realise, i.e. on the wage combination actually chosen by the Employer.

Depending on the choices of the Employer and Employee 1 one of sixteen situations may arise:

- Employer could choose $Wage_1 = 16$ and $Wage_2 = 16$ while Employee 1 chooses 1 unit of effort;
- Employer could choose $Wage_1 = 16$ and $Wage_2 = 16$ while Employee 1 chooses 2 units of effort;
- ….and so on.

If you are **Employee 2** you will be in one of these sixteen situations. However, before knowing which of these situations you are actually in, you will be asked to **indicate what you would do for each of the sixteen possible situations** you may be in. You will see a decision screen like the one below:

Decision Table: Your effort choice

Please choose your effort. You have to choose a level of effort between 1 and 4 for all ***sixteen*** possible combinations of the *wages* you receive and the *wages* and *effort* of Employee 1.

	Suppose the wage for ***you*** is: **16** Suppose the wage for ***Employee 1*** is: **16**	Suppose the wage for ***you*** is: **16** Suppose the wage for ***Employee 1*** is: **32**	Suppose the wage for ***you*** is: **32** Suppose the wage for ***Employee 1*** is: **16**	Suppose the wage for ***you*** is: **32** Suppose the wage for ***Employee 1*** is: **32**
Suppose ***Employee 1*** chooses effort: **1**				
Suppose ***Employee 1*** chooses effort: **2**				
Suppose ***Employee 1*** chooses effort: **3**				
Suppose ***Employee 1*** chooses effort: **4**				

Each box represents one of the sixteen possible situations you may be in. In each of these boxes, you must enter an effort choice, either 1, 2, 3 or 4. Your actual effort choice will depend on which of these sixteen possible situations will actually realise, i.e. on the wage combination actually chosen by the Employer and on the effort actually chosen by Employee 1.

More information about how to solve your specific Decision task will be provided to you via computer later on during the experiment, once your role has been determined.

You have to perform this task **only once**.

5. How do we determine your actual earnings?

Although Employee 1 will take four effort decisions, **only one** will be relevant in determining the earnings of members of the Firm. Similarly, only one of the sixteen effort decisions made by Employee 2 will be actually used in the earnings' computation.

Which decision is actually relevant will be determined at the end of the experiment, once everyone in the firm has taken his or her decisions: the actual wage combination chosen by the Employer will determine which of the four possible situations is relevant for Employee 1. Employee 1's choice in this relevant situation will determine which of the sixteen possible situations is relevant for Employee 2.

6. What happens next?

I. When the experiment starts you will be informed about whether you are an Employer or an Employee in this experiment. In case you are an Employee, it will be specified whether you are Employee 1 or Employee 2.

II. When you press the "Continue" button, a screen with a brief video-presentation about the main features of the experiment will appear. In this video-presentation you will receive some information about the "*What-*

if-calculator", a tool you can use during the experiment to facilitate your computations. It is important to note that no other participant will be informed about your calculations and that these calculations do not have any effect on your earnings.

III. After this brief video-presentation, you will access a new screen where you will be asked to answer a few questions. You will have to calculate the earnings of all members of your Firm for five hypothetical scenarios, with the help of the "*What-if-calculator*". Press "Check" when you have answered all the questions. You will be informed about whether your answers are correct.

IV. Once you have answered all the questions correctly, you will be guided to a new short video-presentation that will give you specific information about how to enter your decisions into the Decision Table.

V. After that, you will finally enter the Decision Task screen. Depending on whether you are an Employer or an Employee you will have to choose wages or effort levels. In this screen, you will again have the possibility to use the "*What-if-calculator*".

Please, raise your hand if you have any questions.

Précis

I will now briefly summarize the content of the instructions you have just read.

At the beginning of the experiment you will be randomly matched with two other participants to form a group of three people and you will be randomly assigned a role within this group, which we will call "firm". You will be either the Employer or Employee 1 or Employee 2.

The structure of the decision-making within each firm is as follows.

First, **the Employer** chooses one wage to pay to Employee 1 (**$Wage_1$**) and one wage to pay to Employee 2 (**$Wage_2$**).

Next, **Employee 1** learns the wages the Employer pays to each Employee, and then chooses an effort level (**$Effort_1$**).

Finally, **Employee 2** learns the wages the Employer pays to each Employee and also the effort decision of Employee 1, and then chooses an effort level (**$Effort_2$**).

The Employer's earnings increase with higher effort levels and decrease with higher wages.

The Employees' earnings increase in the wage they receive and decrease with higher effort. The earnings of each Employee only depend on his or her own wage and effort.

Although the structure of the decision-making within each firm is the one I have just described, in this experiment we ask you to take a decision for each possible situation that may arise. This is a crucial point, so make sure you have understood it correctly.

The possible situations you will face when making your decisions will depend on your role.

If you are an **Employer you must choose two wage**s, one for each Employee within the Firm. Thus, depending on the choice of the Employer one of four situations will arise:

- Both Employees could get a wage of 16;
- Both Employees could get a wage of 32;
- And the two situations where one Employee gets a wage of 16 while the other Employee gets a wage of 32;

If you are **Employee 1** you must indicate an effort choice for each of these four possible situations, before knowing which one you are actually in. Remember, one of these four decisions will be the one that is actually relevant, so make your choice carefully.

Depending on the choices of the Employer and Employee 1 one of sixteen situations may arise:

- Both Employees get a wage of 16 and Employee 1 chooses 1 unit of effort

- Both Employees get a wage of 16 and Employee 1 chooses 2 units of effort;
- ….and so on…

Since there are 4 possible levels of effort and 4 possible wage combinations, 16 situations in all may arise.

If you are **Employee 2** you must indicate an effort choice for each of the sixteen possible situations. Remember, one of these sixteen decisions will be the one that is actually relevant, so make your choice carefully.

Which decision is actually relevant will be determined at the end of the experiment, once everyone in the firm has taken his or her decisions: the actual wage combination chosen by the Employer will determine which of the four possible situations is relevant for Employee 1. Employee 1's choice in this relevant situation will determine which of the sixteen possible situations is relevant for Employee 2.

Please, raise your hand if you have any questions.