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Gift exchange and the separation of ownership and control[☆]

Sandra Maximiano^{a,*}, Randolph Sloof^b, Joep Sonnemans^b

^a Purdue University, Department of Economics, 403 W. State Street, IN 4707-2053, USA

^b Amsterdam School of Economics, University of Amsterdam, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands

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ABSTRACT

Numerous gift-exchange experiments have found a positive wage–effort relationship. In (almost) all these experiments the employer both owns and controls the firm. This paper explores to what extent the separation of ownership and control affects the wage–effort relationship. We compare the standard bilateral gift-exchange game between an owner–manager and a worker with two trilateral ones where the firm is owned by a shareholder and controlled by a manager. The wage–effort relationship is similar in all three situations. Most strikingly, workers reward higher wages with higher effort, even when the manager does not share in the firm's profits.

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1. Introduction

The gift-exchange game has been studied extensively in the laboratory. It represents the interaction between an employer and a worker in an environment where labor contracts are necessarily incomplete. In its most basic version the employer first decides on an unconditional wage transfer. After observing the wage that he will earn, the worker subsequently decides how much effort to supply. Effort increases the profits to the employer, but is also (increasingly) costly to the worker. Therefore, in case the worker is entirely selfish, he will not supply any effort at all, irrespective of the actual wage offered. Anticipating this entirely flat wage–effort schedule, a selfish employer just offers the minimum wage that is sufficient to induce the worker to accept the contract.

Experimental findings are in stark contrast to these theoretical predictions. Workers are typically willing to supply more effort when a higher wage is offered, yielding a significantly positive correlation between wages and effort commonly interpreted as reciprocal behavior (see e.g. Fehr and Gächter, 2000, for an overview). This finding appears rather robust and is found in various variations of the standard gift-exchange game. For example, a number of recent studies still report a significantly positive correlation between wages and effort even with an interior optimal effort level instead of a corner solution (Engelmann and Ortmann, 2009), when high stake levels are considered (Fehr et al., 2002), with different productivity levels among employers (Hannan et al., 2002), and for subject pools different from the standard pool of undergraduate

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* Corresponding author.

E-mail address: maximiano@purdue.edu (S. Maximiano).

students (Hannan et al., 2002). The overall picture that emerges is that fairness and reciprocity considerations play a prominent role in labor relations.¹

However, all the robustness studies referred to above focus on *bilateral*, one-employer–one-worker, relationships (although sometimes embedded in a one-sided or double auction market).² This makes it problematic to directly extend the findings to the real world, because in the presence of social preferences – like fairness, efficiency norms and reciprocity considerations – the actual environment in which the employer–worker relationship is embedded becomes important. In particular, one has to take into account that in reality workers are typically part of a large(r) organization with many employees and multiple hierarchical levels. Fairness and reciprocity considerations are likely to be dependent on this more complex environment, raising the important empirical question to what extent gift-exchange behavior carries over to such settings.

This paper relates to earlier work in which it is investigated how robust the results of bilateral gift-exchange experiments are when the labor relationship is placed in a more complex and more realistic social context. A number of papers extend the standard gift-exchange setting to a situation with two workers and focus on exactly how horizontal fairness between workers matters. Charness and Kuhn (2007), for instance, investigate whether equity concerns compress wages when workers have different productivities. Abeler et al. (2010) explore whether effort decisions of (in principle) equally productive workers are affected by equal versus unequal wages.³ As our focus is on vertical fairness the study of Maximiano et al. (2007) is more closely related to ours. In that experiment the employer has four workers and (by design) pays an equal wage to them. Somewhat surprisingly, findings are that gift exchange is very robust to increases in the size of the workforce. The results also suggest that intention-based reciprocity is an important driving force behind gift exchange beyond outcome-oriented social preferences.

Recent field experiments also explore the robustness of gift-exchange results. Findings here are mixed. Kube et al. (2012) study an actual spot labor market in which the employer's gift takes different forms: either a higher wage than announced, a thermos bottle, or a higher wage where the extra money is presented very nicely in an origami composition. The bottle and the origami have a much stronger impact than sheer money. Also when workers are offered a choice between the money and the bottle, they choose significantly higher effort levels (but predominantly choose the money). Therefore, it seems that "it is the thought that counts". Gneezy and List (2006) explore the duration of the task – an important dimension of labor interactions not yet considered in laboratory experiments. They find that paying more than market-clearing wages has a short-lived effect on workers' effort, both in a library data entry task and in a door-to-door fund raising task.⁴ However, placing the labor relation within a firm instead of in a spot labor market, Bellemare and Shearer (2009) obtain somewhat different results. They conducted a gift-exchange field experiment within a tree-planting firm, where workers received a one-day surprise bonus. Their results suggest that the role of reciprocity is important within this firm, because workers increased average daily productivity by 10 percent. Moreover, high tenure workers continue to reciprocate several days after the gift.

In this paper we explore gift exchange (in the laboratory) within multi-level hierarchies. In reality many firms have a complex hierarchical structure in which ownership and control are separated. The owners of a firm (shareholders) typically delegate authority to managers who are in charge of executive decisions. Part of the manager's job is to determine the firm's compensation structure. Within the context of the gift-exchange game this implies that the owners are not directly responsible for setting a worker's wage. It also implies that the manager who is in charge of wage determination, is not full residual claimant. She does not bear the (full) wage costs but also does not get the (full) benefits generated by the worker's reciprocal attitude. Separation of ownership and control may therefore have important implications for the observed relationship between effort and wages. For example, the worker may not choose a high effort in response to a high wage anymore, because the manager responsible for setting the higher wage does not benefit (sufficiently) from the worker's increased effort herself. Alternatively, the wage–effort relationship may remain largely unaffected, because the worker mainly wants to reward those who pay for the higher wage (i.e. the owners). Our experiment aims at investigating these issues.

We consider four different treatments, in three of which the firm decides on the wage itself. Our first treatment corresponds with the standard bilateral gift-exchange game and serves as baseline. In this treatment ownership and control are vested in a single person, viz. an owner-manager. Two other treatments consider a situation in which the firm is owned by a shareholder but controlled by a manager. In both these treatments the manager chooses the worker's wage, i.e. has full control. As three players are involved, we label these treatments as 'trilateral treatments' (yet note that the number of decision variables just remains two, i.e. wage and effort). The two trilateral treatments differ with respect to how the man-

¹ Despite many studies support the standard gift-exchange result, Charness (2004) reports no significant gift exchange with U.S. undergraduates when a payoff table is provided instead of a payoff function, and Rigdon (2002) shows that gift exchange is negatively affected by an increase in marginal costs of effort.

² Gift exchange appears robust both within and across different market institutions; see Fehr and Falk (2008) for an overview.

³ The setup considered is actually a gift-exchange game in reverse order; workers first decide on effort levels before the employer decides on wages. In the equal wage treatment the employer is obliged to set equal wages, in the individual wage treatment she is not. See Abeler et al. (2011) for a short survey of this and closely related experiments that address the role of communication and of social proximity within the same framework.

⁴ Similar results are obtained by Kube et al. (forthcoming) who replicate (and extend to negative reciprocity) part of Gneezy and List's experiment. Chen and Horton (2009) also explore negative reciprocity in the field. In particular, in their experiment workers performing a data entry task were confronted with a wage cut. Treatments varied in the way the cut was justified. 'Reasonable' justifications, like productivity increases with experience, had little effect on effort, yet a profit motivation increased quits.

Table 1
The cost of effort function.

Effort e	1	2	3	4	5	6	7	8	9	10
Cost $c(e)$	0	1	2	4	6	8	10	12	15	18

ager is rewarded. In one trilateral treatment she receives a fixed wage and ownership and control are fully separated. The shareholder is then full residual claimant of the firm's profits. In the second trilateral treatment the manager is rewarded on the basis of performance pay, earning 25% of the firm's profits. Here ownership is shared between the shareholder and the manager and the separation between ownership and control is more diffuse. In our fourth treatment the firm has no control and nature (i.e. a random device) decides on the actual wage offer (like in Charness, 2004). This bilateral owner-worker treatment is included to explore whether control per se is important for the gift-exchange relationship observed.⁵

Our main finding is perhaps somewhat surprising: the wage–effort relationship does not differ among the three treatments in which the wage is endogenously chosen by (a member of) the firm. Gift exchange is thus also observed in a more complex hierarchical structure and appears to be robust to the firm's separation of ownership and control. This finding is in line with both the hypothesis that workers only care about actions and payoffs of those who pay the wage (i.e. owners) and the hypothesis that they act reciprocal towards the firm as a whole and not towards one of its members in particular. The significantly less steep wage–effort relationship we observe for the treatment in which the wage is exogenously set by nature, however, suggests that the latter is a more likely explanation.

This paper proceeds as follows. In Section 2 we first describe the basic setup that we consider in our experiment and we subsequently derive the theoretical predictions under various behavioral assumptions. These behavioral predictions are derived from selfish preferences, outcome-oriented social preferences (viz. inequality-aversion and quasi-maximin) and intention-based reciprocity. Section 3 presents the details of the experimental design. In Section 4 we report and discuss our main findings. Section 5 discusses and concludes.

2. Setup and behavioral predictions

2.1. Basic setup of the experimental game

The setting we consider concerns a firm which employs a single worker. Participation of the worker is secured, the only issue is to motivate the worker to put in (high) effort. Effort, however, is non-contractible. The firm can just offer an unconditional wage $w \geq 0$. After the wage offer has been made, the worker chooses how much effort $e \geq e_{\min}$ to provide. Effort is increasingly costly, with $c(e)$ denoting the costs of effort in monetary terms. The marginal value product of effort is fixed per unit of effort and equals $v = 40$. The firm's net profits equal:

$$\Pi = 40 \cdot e - w + 360 \quad (1)$$

Here the fixed term of 360 can be interpreted as the net profit the firm makes when the worker only supplies the enforceable effort level e_{\min} . The monetary payoffs for the worker m_W are given by:

$$m_W = w - c(e) + 20 \quad (2)$$

The fixed amount of 20 can be seen as the compensation the worker receives for supplying the enforceable effort level e_{\min} .

We deliberately chose rather high (for the firm) and highly asymmetric fixed payments between the firm and the worker. Like in reality the firm is thus always much richer than the worker. Compared to previous gift-exchange experiments, we also chose a high marginal return to effort. As will be explained in the next section, these choices allow a better identification of the motives underlying workers' reciprocal behavior and thus of the potential impact the separation of ownership and control may have on gift exchange.

In the experiment the firm's wage offer w has to be a multiple of 5 and between 0 and 100. The worker's effort choice is restricted to integer values between 1 ($= e_{\min}$) and 10. The costs of effort are reflected in Table 1. With these parameters both the firm's net profits Π and the worker's monetary payoffs m_W are necessarily positive.

Our main treatment variable concerns the composition of the firm. We compare two different hierarchical structures. The first one is the "Bilateral Condition" (BC) and provides the baseline. In this case the firm consists of a single *owner-manager* who decides on the worker's wage herself. This baseline condition is similar to the common bilateral gift-exchange game between an employer and a worker. The second hierarchical structure we consider is labeled the "Trilateral Condition" (TC). Here ownership and control are separated, resulting in a three-player game. In particular, the owner of the firm is now a shareholder who is not responsible for choosing the worker's wage anymore; this responsibility has been delegated to a

⁵ In our design the manager's pay is exogenously set. This is important to rule out indirect reciprocity and thus disentangle between the importance of ownership and control in worker's reciprocal concerns.

Table 2
Players' monetary payoffs in the four treatments.

Treatment	No. of players	Shareholder	Manager	Worker
BC	$n = 2$	–	$40e - w + 360$	$w - c(e) + 20$
TC0	$n = 3$	$40e - w + 360$	0	$w - c(e) + 20$
TC25	$n = 3$	$30e - 0.75w + 270$	$10e - 0.25w + 90$	$w - c(e) + 20$
BCexo	$n = 2$	$40e - w + 360$	–	$w - c(e) + 20$

manager who has been hired to control the firm. The shareholder thus takes no decision at all. By keeping the firm's total net profits Π constant, we ensure that conditions BC and TC do not differ in terms of efficiency.

Separation of ownership and control implies that the one who decides does not bear the full costs and does not receive the full proceeds generated by her decisions. The characteristic feature of our trilateral condition, therefore, is that the manager is not full residual claimant. Instead, the shareholder claims most of the firm's net profits. To investigate the impact of this distinction between the one who decides and the one who obtains the (net) proceeds in the starkest possible way, we consider one treatment in which the manager does not share in the firm's net profits at all. In this TC0 treatment the manager is just paid a fixed wage (which is normalized to zero). Of course, in reality CEOs and other top-level executives in charge of controlling a firm are typically paid on the basis of performance pay. They thus share in the firm's net profits at least to some extent. The distinction between the one who decides and the one who gets the proceeds is then less extreme. Our TC25 treatment, in which the manager obtains 25% of the firm's net profits and the shareholder gets the remaining 75%, considers such a situation.

In all three treatments described so far the actual wage decision is taken by (a member of) the firm. One potential reason why gift exchange might be robust to the separation of ownership and control is that workers simply do not care about control at all. They only care about the fact that the wage is paid by the firm. In order to explore this we consider another bilateral treatment in which the owner of the firm does not choose the worker's wage herself. Instead, the wage is randomly determined by the experimenter, with each possible wage being equally likely. Because in this treatment the wage is exogenously given to the parties, we label it as BCexo. Table 2 depicts the players' monetary payoffs for the four different treatments that we consider.

The above discussion reveals that, from a more conceptual point of view, an important difference between our treatments is the way in which the wage offer is generated. The wage can either be chosen by an interested party who has a stake in the worker's decision (BC, TC25), chosen by a 'third' party whose payoffs do not depend on the worker's choice (TC0), or determined by a random process (BCexo). Inspired by the ultimatum game experiments of Blount (1995), Charness (2004) studies exactly these three variations for the bilateral gift-exchange game (see also Charness, 2000). His 'Employer' ('Random') treatment is comparable to our BC (BCexo) treatment. However, although his 'Third Party' treatment shares with our TC0 treatment that the wage is chosen by a party with no direct stake in the worker's decision, it differs in an important respect. In Charness (2004) the experimenter performs the role of 'third party' whereas in our case it is a subject with the role of manager. Unlike Charness, our treatment TC0 (and also TC25) thus explicitly considers a trilateral interaction among three subjects.⁶

2.2. Behavioral predictions and hypotheses

Our main interest lies in worker's behavior. When workers are entirely selfish and only interested in maximizing their own monetary payoffs, they will choose the minimum effort level $e^* = e_{\min} = 1$ irrespective of the wage offered. In that case effort will be minimal for all wages in all four treatments. A large number of experimental studies, however, have shown that a substantial fraction of workers make their effort choices according to considerations going beyond material self-interest. A common finding is a positive correlation between effort and wages, providing support for Akerlof (1982)'s efficiency wage theory. His *fair-wage hypothesis* predicts that firms will offer higher than market-clearing wages, expecting that workers will work harder in return. Workers then compare the wage received with a norm they consider fair and choose whether to increase their effort or not. This results in a positive wage–effort relationship.

The gift-exchange relationship between workers and firms may originate from a variety of social norms. Recent theories of social preferences make this explicit and can be roughly classified into two kinds (cf. Camerer, 2003). The first type of theories are *outcome oriented* and assume that workers only care about the final distribution of payoffs. Workers may for instance compare their own payoffs with the average payoffs of others within the firm (Bolton and Ockenfels, 2000) or prefer an equitable distribution of material resources (Fehr and Schmidt, 1999). Alternatively, they may care about social welfare in general and take efficiency into account as well (Charness and Rabin, 2002; Engelmann and Strobel, 2004). A second type of social preference theories assume that people also care about how the distribution of payoffs came about. Workers may then have a preference for rewarding kind intentions of the firm and punishing unkind ones, beyond just caring about the

⁶ A second, related variation between our treatments is whether an inactive, but interested dummy player (the shareholder in TC0 and TC25) is present or not. Such inactive dummy players have been incorporated in ultimatum game experiments by Güth and van Damme (1998), Bereby-Meyer and Niederle (2005), and Fershtman and Gneezy (2001).

final payoff distribution that results (Dufwenberg and Kirchsteiger, 2004). In that case a higher wage is rewarded with a higher level of effort, not (necessarily) because it leads to a more equitable distribution of payoffs but rather because the worker likes to do a favor in return. These theories of *intention-based reciprocity* thus stress the reciprocal nature of the gift-exchange relationship.

We derive the behavioral predictions for both types of theories. Under outcome-oriented social preferences treatments BC and BCexo can be treated as the same. First assume that workers are averse to inequality and have preferences like in Fehr and Schmidt (1999).⁷ In that case a worker is willing to increase (decrease) the other firm members' material payoffs if these are below (above) the worker's own material payoffs. Given our parameter choices for Π and m_W , the owner-manager/owner is always ahead of the worker in both bilateral treatments. The worker therefore chooses $e^* = 1$ in response to any possible wage. In treatment TC0 the manager always earns less than the worker whereas the shareholder always earns more. Choosing higher than minimum effort does not affect the manager's earnings and only increases the shareholder's payoffs, thereby increasing inequality. Therefore, $e^* = 1$. Finally, in treatment TC25 the worker is always behind of the shareholder, but for relatively high wages ahead of the manager. Although choosing $e > 1$ for high wages decreases the payoff difference between manager and worker, it exacerbates the worker-shareholder inequality to a larger extent. Because the worker cares more about being behind than about being ahead, he again chooses $e^* = 1$ after any wage offered. All these predictions do not change if we instead assume that workers compare themselves with the *average* of the other firm members' payoffs, like Bolton and Ockenfels (2000) do.

The predictions obtained from inequality-aversion coincide with the ones based on selfish preferences. The driving force here is the large difference between the fixed amount of 360 appearing in the firm's payoff function (1) and the one of 20 the worker receives. In case these amounts are more equal, as is the case in most gift-exchange experiments, at least in the two bilateral treatments a positive wage-effort relationship is predicted (see e.g. Fig. A1 in Maximiano et al., 2007).

Selfishness/inequality-aversion hypothesis: Effort will be minimal for all wages in all treatments.

Next assume that workers care about overall surplus as well. In particular, let them be motivated by *quasi-maximin preferences* as introduced in Charness and Rabin (2002).⁸ Because in the bilateral treatments the worker is always the worst-off player, efficiency is the single reason that may induce him to exert more than the minimum effort level. Effectively, the worker's utility function can be written as $m_W + \rho_{BC} \cdot \Pi$.⁹ The larger his concern for efficiency, the larger parameter ρ_{BC} is. By putting in one extra unit of effort, the payoffs of the worker decrease by $c'(e) \in \{1, 2, 3\}$ whereas firm net profits increase with 40. The equilibrium effort level thus depends on how $c'(e)/40$ compares to ρ_{BC} . The important thing to note is that this effort level is *independent* of the wage offered; the predicted wage-effort relationship is entirely flat.

The same prediction applies for treatment TC0. Quasi-maximin preferences then correspond to a worker's utility of $m_W + \rho_{TC0} \cdot \Pi$. Because in this treatment the manager is the worst-off player, a higher effort level does not decrease the payoffs of the worst-off player anymore. This effectively increases the worker's concern for efficiency: $\rho_{TC0} \geq \rho_{BC}$.¹⁰ The worker will therefore choose an effort level that weakly exceeds the one in the bilateral treatments, i.e. $e_{TC0} \geq e_{BC}$. But again, the predicted wage-effort relationship is entirely flat. Finally, in treatment TC25 either the worker or the manager is worst-off, depending on the wage and effort levels chosen. For all wages $w \leq 60$ the worker necessarily earns the least and the situation is equivalent to treatment BC. Hence the wage-effort relationship is flat at $e = e_{BC}$ for all $w \leq 60$. In case $w > 60$ the manager earns the least when the worker would put in low effort whereas for high effort levels the worker gets the lowest payoff. The cutoff level of effort that divides the two cases is increasing in the wage. If the worker has a high concern for the worst off player (and thus a relatively low concern for efficiency), he just wants to exert effort up to this cutoff level. An increasing wage-effort relationship may therefore result for relatively high wages. But, for the larger part ($w \leq 60$) the wage-effort relationship will also necessarily be flat in treatment TC25.¹¹

Efficiency hypothesis (quasi-maximin preferences): The wage-effort relationship is entirely flat in all treatments, except (possibly) for wages above 60 in treatment TC25.

From the above it follows that under outcome-oriented social preferences wages and effort are likely to be uncorrelated. The two leading models within this class, viz. inequality-aversion and quasi-maximin preferences, both predict an (al-

⁷ In particular, for a general n -player game with monetary payoffs $m = (m_1, \dots, m_n)$, player i 's utility is given by (for $i = 1, \dots, n$): $U_i(m) = m_i - \frac{1}{k-1} \alpha_i \sum_{j \neq i} \max\{m_j - m_i, 0\} - \frac{1}{k-1} \beta_i \sum_{j \neq i} \max\{m_i - m_j, 0\}$, with $0 \leq \beta_i < 1$ and $\beta_i \leq \alpha_i$.

⁸ For a general n -player game with monetary payoffs $m = (m_1, \dots, m_n)$, player i 's utility is then given by (for $i = 1, \dots, n$): $U_i(m) = (1 - \lambda) \cdot m_i + \lambda \cdot [\delta \cdot \text{Min}\{m_1, \dots, m_n\} + (1 - \delta) \cdot (m_1 + \dots + m_n)]$. Here $\lambda \in [0, 1]$ gives the weight that player i attaches to social welfare, with the latter a weighted (by $\delta \in [0, 1]$) combination of the payoff of the worst-off player and overall surplus.

⁹ In terms of the specification of Charness and Rabin (2002) we have $\rho_{BC} = \lambda \cdot (1 - \delta)$. Recall that under outcome-oriented social preferences treatments BC and BCexo can be treated as equivalent.

¹⁰ It holds that $\rho_{TC0} = \frac{\rho_{BC}}{1 - \lambda \delta}$.

¹¹ For the predicted effort level e_{TC25} it holds that $e_{BC} \leq e_{TC25} \leq \max\{e_{BC}, 5\}$. To see this, note that the worker prefers effort level e_{BC} given that he is the worst-off player. In case the manager is worst-off, effort incentives are (weakly) higher. This yields the lower bound. Similarly so, the upper bound follows because for $e \geq 5$ the worker is necessarily worst-off (i.e. independent of the wage). He will therefore never provide more than his optimal effort given that he is worst-off, i.e. e_{BC} , when this optimal level falls within this range. With $e_{BC} \leq e_{TC25} \leq \max\{e_{BC}, 5\}$ it follows that when $e_{BC} \geq 5$, also in treatment TC25 the wage-effort relationship is entirely flat at $e_{TC25} = e_{BC}$ for all wages. This is the case whenever $\lambda(1 - \delta) \geq 1/5$, i.e. whenever the worker cares sufficiently about efficiency.

most) entirely flat wage–effort relationship.¹² Therefore, if we observe a positive correlation in any of our four treatments, (intention-based) reciprocity is likely to play an important role. When workers have a preference for behaving reciprocally, the *slope* of the wage–effort relationship may differ across treatments though. We next derive intuitively some hypotheses that make these differences explicit. A formal discussion is relegated to [Appendix A](#).

In the baseline BC treatment the owner-manager both chooses the wage and captures the entire net profits Π . A higher wage benefits the worker and thus can be considered kind, also because the owner-manager has to pay the wage from her own pockets. Similarly, a low wage can be seen as unkind. A reciprocal worker then prefers to reward high wages and punish unkind ones. Because the monetary payoffs of the owner-manager are proportionally increasing in the worker's effort, the worker is expected to choose higher effort levels in response to higher wages. Hence a positively sloped wage–effort relationship results.

The owner-manager in the baseline treatment personifies both the one who controls the wage and the one who pays for the wage. Therefore, no matter which (combination) of these two roles the worker prefers to reward, predictions are the same. This does not apply in the other three treatments. First consider treatment TC0 where ownership and control are fully separated. The worker may then still consider higher wages as being more kind (although possibly to a smaller extent because the manager does not pay the wage herself), but he has no opportunity to reward the person responsible for choosing the higher wage. This holds because the manager's payoffs are independent of the worker's effort choice. We may therefore expect that the worker chooses the same (minimum) effort level regardless of the wage. This is actually what the intention-based reciprocity model of [Dufwenberg and Kirchsteiger \(2004\)](#) predicts. The worker will feel neutral towards the shareholder, as she has no choice to make. And because the worker can neither be kind nor unkind to the manager, his effort choice will be guided by monetary payoffs m_W alone. As a result, the wage–effort relationship will be flat and thus less steep than in treatment BC.

Alternatively, the worker may just want to reward (or punish) the person who bears the actual costs of the (un)kind wage offer. If that is the main motivational force, we predict no differences between the slopes of the wage–effort relationship in treatments TC0 and BC. This also holds when the worker perceives the firm as being his employer, independently of its composition. In that case he will feel reciprocally towards the firm as a whole and not towards one of its members, i.e. the one who controls it and/or the one who owns it, in particular.

Predictions for treatment TC25 are related to the ones above. In the model of [Dufwenberg and Kirchsteiger \(2004\)](#) the kindness of a particular wage offer is judged relative to what the firm could offer the worker in principle. The perceived kindness of a given wage is thus the same as in treatments BC and TC0. The effort level the worker chooses in response then depends on the effectiveness of effort as a reciprocation device. The more effective effort is in this regard, the higher actual effort will be. When the worker prefers to reward only the one who controls the wage, we predict that the slope of the wage–effort relationship falls in between the one for BC and the one for TC0 (where it is predicted to be flat). However, in case the worker prefers to reward those who pay for the wage, we expect the same positive slope as in treatments BC and TC0. This follows because in all treatments effort is equally effective in rewarding the group of contributors to the wage. Also when the worker feels reciprocally towards the firm, the predicted slope of the wage–effort relationship is the same in treatments BC, TC0 and TC25.

Finally, consider treatment BCexo in which the wage is selected at random by the experimenter. In this case the controlling role of the firm is entirely absent. Trivially then, a flat wage–effort relationship is predicted when the worker is mainly motivated by reciprocity towards the one who controls the wage. This prediction also follows from the model of [Dufwenberg and Kirchsteiger \(2004\)](#), the reason being the lack of intentions that characterizes the BCexo treatment. If, however, the worker solely feels reciprocally towards the one who pays for the wage, the slope of the wage–effort relationship will be the same as in the other three treatments. A final possibility is that both control and ownership are important for the worker's reciprocal feelings, although he does not care exactly how these two roles are parceled out within the firm. In that case the slope will be less steep in treatment BCexo as compared to the other three treatments.

The above predictions based on reciprocity can be summarized as follows (see also [Fig. 1](#)).¹³

¹² Our predictions for outcome-oriented social preferences rely on both the assumptions that workers adjust their reference group according to the firm's composition and that workers consider the fixed endowment when judging the fairness of the transaction. Alternatively, it might happen that workers exclusively consider the manager's income in all treatments (i.e. ignoring the shareholder), or engage in narrow bracketing and ignore the fixed endowments when making their effort choices. Fundamentally, there is no way to accurately define the proper reference group and the arguments in an individual's utility function without a theory of how they are determined (see [Sobel, 2005, p. 400](#)). Nevertheless, framing has been shown to have a strong influence ([Tversky and Kahneman, 1981; Redelmeier and Tversky, 1992](#)). The framing used in our experiment made the inequality created by the initial endowment very salient. The payoff functions explicitly included the initial endowment and subjects used these functions when making calculations in the control questions. The control questions (among other things) also asked subjects to calculate payoffs for each different role. If subjects nevertheless neglect the fixed payments, outcome-oriented social preferences do predict a positive wage–effort relationship.

¹³ Although we have separated the two motives in the main text, in practice workers may be motivated by both outcome-oriented social preferences and reciprocity. In the theory of [Falk and Fischbacher \(2006\)](#) the (un)kindness a worker experiences from a given wage offer depends on both the intentions and on the payoff (in)equality that results. Their model predicts that $e^* = 1$ for all possible wages in treatments BC, TC0 and BCexo. In the two bilateral treatments this follows because the worker always earns less than the owner(-manager), in treatment TC0 it follows because the worker cannot affect the manager's earnings. Finally, also in treatment TC25 the wage–effort relationship is flat at $e^* = 1$ whenever the manager earns more than the worker, which necessarily happens when $w \leq 60$. For $w > 60$ we may observe a positively sloped wage–effort relationship. The full model of [Charness and Rabin \(2002\)](#) also combines outcome-oriented social preferences and (negative) reciprocity; individuals are motivated by social welfare but withdraw this concern when

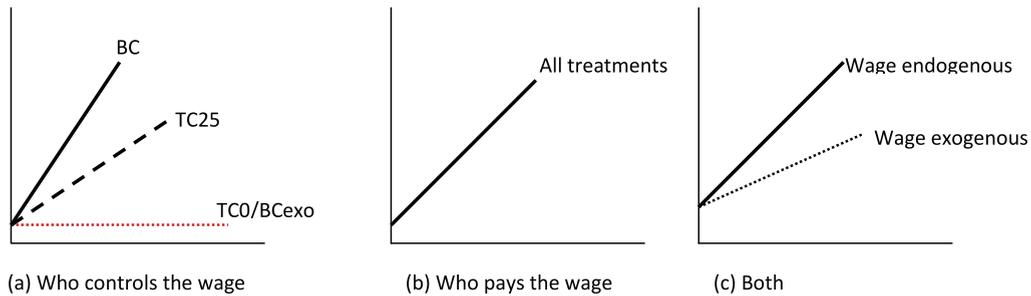


Fig. 1. Predictions based on reciprocity.

Reciprocity hypothesis: Effort levels are increasing in the wage offered in treatment BC. This is consistent with a motivation to reward and/or punish the one who controls the wage, with a motivation to reward and/or punish the one who pays for the wage, or a combination of both. These underlying motives predict differences among treatments though, as follows:

Reciprocity towards who controls the wage: The slope of the wage–effort relationship in treatment TC25 will be less steep than in treatment BC. The wage–effort relationship will be flat in treatments TCO and BCexo.

Reciprocity towards who pays for the wage: The slope of the wage–effort relationship will be the same in all four treatments.

Reciprocity towards the firm as a whole: The slope of the wage–effort relationship will be the same in treatments BC, TCO and TC25, and less steep in treatment BCexo.¹⁴

3. Experimental design and procedures

3.1. Experimental design

Our experiment is inspired by the bilateral gift-exchange game of Fehr et al. (1998). The specifics of our design are more in line with Maximiano et al. (2007) though. Like in that paper we let subjects play the gift-exchange game only once, rather than repeatedly in a row. One-shot interaction has the advantage that subjects' choices cannot be guided by intertemporal considerations. For example, if a worker displays a reciprocal attitude, this cannot be explained by a desire for reputation formation or other repeated game considerations. A second important feature is that we make use of the strategy method. Each worker has to make a contingent effort choice, indicating his/her response to every possible wage offer. Because there are 21 possible wage levels, each worker has to make 21 (contingent) effort choices.

The main advantage of using the strategy method is that it allows us to elicit the wage–effort relationship of every individual worker. Besides that, given that in our experiment subjects interact only once, the use of the strategy method generates a relatively large amount of data at low cost. Theoretically the use of the strategy method should not matter. In practice, however, behavior may be affected because workers have to think about all possible wage offers and not just about the firm's actual wage offer. The literature is still inconclusive about the impact of the elicitation method. A number of experimental studies find that the strategy method does not affect subjects' behavior; e.g. Cason and Mui (1998) for a dictator game, Brandts and Charness (2000) for both a chicken and a prisoners' dilemma game, Oxoby and McLeish (2004) for an ultimatum game, Sonnemans (2000) and Bosch-Domènech and Silvestre (2005) for an individual decision making setting and Falk and Kosfeld (2006) for a simplified principal–agent game. This last experiment is closest to ours with respect to the game studied. Some other studies do find different results; e.g. Güth et al. (2001) for a binary-offer ultimatum game and Brosig et al. (2003) for two different sequential games. Casari and Cason (2009) find the same rates of trust using either the direct or strategy method but lower levels of trustworthiness under the strategy method. Brandts and Charness (2011) survey the literature regarding the elicitation method and, taking all the results together, they conclude that the impact of using the strategy method is rather limited. Results using either the direct response or the strategy method yield similar qualitative results. Moreover, even if the strategy method influences behavior, there is no reason to expect that this influence will differ among our treatments. Treatment comparisons are thus likely to be unaffected.¹⁵

others behave unfair. Charness and Haruvy (2002) present an encompassing approach that nests altruism, equity, and reciprocity and show that all the three social preferences play a role.

¹⁴ Here it is assumed that the worker cares about the fact that the firm both controls and pays the wage, but not about exactly how these two aspects are parceled out within the firm. In Appendix A we elaborate on the changes in predictions if the worker would do so (for which we do not find support, cf. Section 4).

¹⁵ Like Charness and Dufwenberg (2006, p. 1585), we are not aware of any study in which a treatment effect is found when using the strategy method but not when using the direct response method.

Compared to Fehr et al. (1998) and Maximiano et al. (2007) the payoff functions that we use here differ in two notable ways. First, the marginal returns to effort are four times higher, i.e. we have $v = 40$ rather than $v = 10$. This secures that even in treatment TC25 effort is a sufficiently effective instrument to reward the one who controls the wage (i.e. the manager). Second, in all our treatments the worker's payoffs are always substantially below the firm's net profits. This allows a better identification of the motives underlying workers' reciprocal behavior. As discussed in Section 2.2, both inequality-aversion and quasi-maximin cannot explain a positively sloped wage–effort relationship when the worker is always behind. If the two fixed amounts of 360 and 20 appearing in Π and m_W respectively were chosen more equally, these underlying motives would be more difficult to separate. This holds because in that case also under inequality-aversion and quasi-maximin preferences a positive wage–effort relationship may result. For the intention-based reciprocity predictions the inequality between the two fixed endowments is irrelevant. Here, the focus is on the kindness underlying a particular wage offer rather than on the distribution of outcomes. Moreover, as we assume that the worker judges the kindness of a particular wage offer relative to what the firm could give him in principle, the amount of the firm's initial endowment is immaterial.¹⁶

3.2. Experimental procedures

The experiment was run at the University of Amsterdam in November 2005 and February 2006. Overall 293 subjects participated, most of them were undergraduate students in Economics and Business (58%). The average age of participants was 22 years and 42% of them were female. Subjects were (most likely to be) inexperienced with gift-exchange games, as those that previously participated in similar experiments were excluded from participating in the current one. Overall we conducted 14 sessions. Three sessions considered the BC treatment (62 participants in total), another three sessions the BCexo treatment (60 subjects), four sessions the TCO treatment (87 subjects) and another four sessions the TC25 treatment (84 subjects). Subjects earned on average 18.7 euros (including a show-up fee of 12 euros) in less than one hour. Earnings varied substantially, with the minimum earnings equal to 12 euros and a maximum of 35.3 euros.

The experiment was computerized using the z-Tree software developed by Fischbacher (1999). Subjects started with general on-screen instructions. They also received a summary of the instructions on paper (see Appendix B for a sample summary belonging to treatment TC25). To ensure that subjects understood the experiment, in particular how their own payoffs and the payoffs of those with whom they were matched were calculated, all subjects had to answer a number of control questions correctly before the experiment started. As in Maximiano et al. (2007), subjects generated the numerical examples for the control questions themselves, by first making hypothetical choices for both the (owner-)manager's and the worker's role (in treatment BCexo they did so only for the worker's role). They were subsequently asked to calculate the payoffs for each different role. We used this procedure to make sure that all subjects understood how the manager's wage decision affects the owner's payoff and how the worker's effort decision affects the manager and the owner differently.

At the start of the experiment subjects learned their roles. In the bilateral sessions half of the subjects performed the role of owner-manager, owner, the remaining half was assigned the role of worker. In the trilateral sessions, one-third of the subjects were given the role of shareholder, one-third the role of manager and the remaining one-third were assigned the role of worker. In all treatments subjects were randomly and anonymously matched into firms with either two (BC and BCexo) or three (TCO and TC25) firm members.

When making actual choices, workers had to fill in a wage–effort table without knowing the actual wage. In particular, for all 21 possible wage levels (multiples of 5 between 0 and 100) they had to indicate their effort choice, an integer between 1 and 10. In the BCexo treatment, the owner did not take any decision. The wage was randomly drawn individually by the experimenter in front of each worker. This was done after all workers had made their choices. In the BC-treatment the owner-manager had to set the wage without knowing her/his worker's effort choices. In the trilateral treatments the manager did so. Note that in the trilateral treatments shareholders did not take any decision at all. After everyone had made a decision (if any), all subjects were informed about the choices of the other members in the firm. They also learned their own and the other firm members' payoffs. No information was given about choices and payoffs in firms to which the subject did not belong.

At the end of the experiment the number of points a subject had earned were converted into euros, with 30 points corresponding to 1 euro. Each participant learned his/her own earnings in euros, filled in a short background questionnaire and was individually and privately paid.

4. Results

In this section we report the main results of our experiment. Because we are mainly interested in workers' willingness to reciprocate, we first present workers' effort choices and use these to evaluate the hypotheses presented in Section 2.2. After that we turn to (owner-)manager behavior and overall earnings.

¹⁶ Alternatively, if the worker judges the kindness of a particular wage offer relative to what the firm could get in principle, the reciprocity hypothesis would remain the same for all treatments except for TC25 in the case the worker cares about who controls the wage. Here, and compared to the BC treatment, the effectiveness of effort as a reciprocal device is lower but the kindness of a particular wage offer is higher, i.e. $wage/\Pi_{BC}^{manager} < wage/\Pi_{TC25}^{manager}$. So, in this case it would be possible to observe the same wage–effort relationship in both BC and TC25.

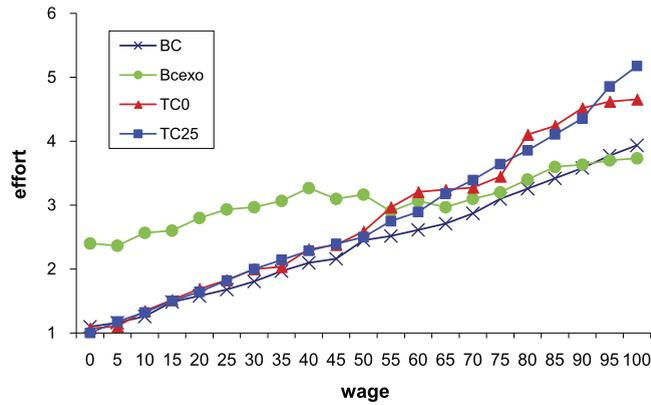


Fig. 2. Average effort by wage.

Table 3
Random effects linear regression with effort as dependent variable.

	Model I		Model II		Model III	
	Coef.	Robust std. err.	Coef.	Robust std. err.	Coef.	Robust std. err.
Constant	0.9560	0.3076***	0.9891	0.1904***	0.9891	0.1904***
Wage	0.0290	0.0035***	0.0283	0.0069***	0.0283	0.0070***
TC0	0.3629	0.5224	-0.1123	0.3160	-0.1123	0.3161
TC25	0.3564	0.5247	-0.1762	0.3049	-0.0276	0.2494
BCexo	0.6675	0.6453	1.4939	0.580***	1.4939	0.5801***
TC0 * wage	-	-	0.0095	0.0102	0.0095	0.0102
TC25 * wage	-	-	0.0107	0.0105	0.0042	0.0101
BCexo * wage	-	-	-0.0165	0.0082**	-0.0165	0.0082**
TC25 * wage * I wage > 60	-	-	-	-	0.0055	0.0035

There are $N = 2478$ observations in total, with 118 clusters (workers) and 21 observations per cluster. The Wald statistic equals $\chi^2 = 74.64$, $p = 0.000$ in Model I, $\chi^2 = 82.37$, $p = 0.000$ in Model II, and $\chi^2 = 84.45$, $p = 0.000$ in Model III.

*** Indicates significance at the 1% level.
** Indicates significance at the 5% level.

4.1. Worker behavior

In all treatments the average effort of the workers over all possible wages is higher than the minimum effort level. In particular, it equals 2.41 in treatment BC, 2.77 in TC0, 2.76 in TC25 and 3.07 in treatment BCexo. This contradicts the predictions based on standard theory and inequality-aversion that the worker will always provide the minimum effort regardless of the wage received. Moreover, also the efficiency hypothesis based on quasi-maximin preferences is rejected. This follows from Fig. 2, which displays the average effort by wage for each treatment separately. The higher the wage offered, the higher the average effort level that is chosen in response. This positively sloped wage–effort relationship holds no matter the firm’s composition and how profits are distributed among firm members. Specifically, the Spearman rank correlation between effort and wages is significant at the 1% level and around 0.29 in the BC treatment, 0.35 in TC0, 0.33 in TC25 and 0.15 in the BCexo treatment. The following result summarizes these findings.

Result 1. In all treatments mean effort levels are above minimum and increasing in the wage.

Fig. 2 also suggests that the wage–effort relationship is less steep when wages are determined exogenously than when wages are chosen by a member of the firm. Moreover, workers’ behavior appears very similar across treatments in which wages are endogenously chosen. To further explore these two observations we regress workers’ effort on the wage level, three treatment dummies and, depending on the specification, up to four interaction terms. To account for the panel structure of our data (we have 21 data points per individual worker), we estimate a random effects model. The results are presented in Table 3.

Model I provides the effects of wage and treatment dummy variables. The highly significant wage coefficient reinforces the reciprocity hypothesis and rejects that only inequality-aversion and/or efficiency considerations are at play. The treatment dummies are insignificant, suggesting that the intercept does not differ across treatments. Sheer inspection of Fig. 2 casts doubt that this is truly the case though. Indeed, this finding changes once we do not impose the a priori restriction of an equal slope, by including the treatment–wage interaction terms. In Model II the intercepts in the BC treatment and in both trilateral treatments are equal and figure around one. The intercept in the BCexo treatment, however, is significantly higher and around 2.5. Moreover, also the average effort provided for low wages is higher in treatment BCexo than in the

other three treatments; (Mann–Whitney) ranksum tests for each wage separately reveal that average effort is significantly higher (at the 10% level) in treatment BCexo for wages of 10 and below.¹⁷ This finding indicates that workers punish wages that are intentionally low. It is in line with previous experiments that investigated the role of intentions for reciprocal behavior (cf. Charness, 2004; Falk et al., 2008).

The interaction terms in Model II reveal that the slopes in both trilateral treatments are steeper than the slope in treatment BC. Increasing the wage by 10 points leads to an estimated increase in effort of 0.39 in treatment TC25 and 0.38 in treatment TC0, as compared to around 0.28 in treatment BC. However, these differences are not statistically significant. The estimated slope of 0.12 for the BCexo treatment is significantly lower though (but still significantly different from zero). Given the efficiency hypothesis for treatment TC25 (see Section 2.2) we include in Model III the interaction term $TC25 * wage * I_{wage > 60}$ to check whether the slope in treatment TC25 is steeper for wages higher than 60. The estimates report a positive but insignificant coefficient.¹⁸

In addition, we can perform non-parametric tests. First, we consider a two-sample ranksum test for each wage separately. It shows that differences in average effort levels between treatments BC and TC0, treatments BC and TC25, and treatments TC0 and TC25 are insignificant for all wage levels. In contrast, differences between BCexo and each of the other treatments are significant for very low wages. Second, in order to check whether the findings at the aggregate level are replicated at the individual level, we fit a linear effort function $e_i = a + b * w_i$ for each individual subject. We subsequently use a two-sample ranksum test to compare differences in individual slopes across treatments.¹⁹ Ranking individual estimates of b 's from low to high we do not find statistical evidence that the average rank in the BC treatment is higher than in each of the other treatments. We also do not find statistical evidence that supports the hypothesis that the average rank in treatment TC25 is higher than in treatment TC0. However, the average rank in TC25 is significantly higher than in BCexo at $p = 0.01$ (one-tailed test) and it can be rejected that the average rank in TC0 equals the average rank in BCexo at $p = 0.01$ (two-tailed test).²⁰ Comparing all the estimates in the three treatments in which the wage is endogenously chosen with the estimates in treatment BCexo, we see that the average rank in BCexo is significantly lower at $p = 0.01$ (one-sided test). Table C.2 in Appendix C reports the average fitted wage coefficients and the test results.

Result 2. The wage–effort relationship is equally steep in all three treatments in which the wage is endogenously chosen.

Result 3. The wage–effort relationship is steeper when the wage is chosen by a member of the firm than when it is exogenously determined.

To further investigate worker behavior in more detail we analyze individual worker's choices and classify all workers into four categories. In particular, we use the estimated wage coefficient b together with the observed monotonicity of the relationship to classify individual workers. The four different categories are defined as follows:

Selfish/inequality-averse behavior: This group consists of those workers who provide the minimum effort level $e = 1$ regardless of the wage.

Efficiency-oriented behavior: This class contains those subjects with an entirely flat wage–effort relationship at some higher than minimum effort $e > 1$, and also those subjects in treatment TC25 whose wage–effort relationship is flat up to a wage of 60 and non-decreasing after 60.

Reciprocal behavior: These subjects increase their effort with wages in a monotonic way. Workers within this category have a significantly positive wage coefficient; $b = \partial e / \partial w > 0$.²¹

Erratic behavior: These subjects do not make monotonic effort choices. This class also contains those subjects with “random” behavior in the BCexo treatment (e.g. to mimic the randomness in the wage).

Note that the first two categories together cover quasi-maximin preferences. Workers who display efficiency-oriented behavior just have a concern for efficiency that is sufficiently strong to make a difference with selfish/inequality-averse behavior (cf. Section 2.2).

¹⁷ This holds for all bilateral comparisons between BCexo and BC, TC0 and TC25, respectively, except for the difference in average effort levels between BCexo and TC25 when $w = 10$.

¹⁸ Essentially the same conclusions are obtained when we estimate a two-sided Tobit model that takes account of the censoring problem; see the estimates reported in Table C.1 in Appendix C.

¹⁹ Charness (2004) performs the same test. He estimates the wage–effort slope for each worker using worker's actual effort choices and corresponding wage offers for a total of 10 periods. Using actual choices might overestimate (underestimate) the impact of wages if very low (high) wages are only rarely observed and if workers behave reciprocal. Additionally, his inferred individual slopes are not independent due to interaction effects. So, our analysis benefits from using the strategy method by which we can better elicit the wage–effort relationship for every individual.

²⁰ We use a one-tailed test whenever the reciprocity hypothesis predicts the direction of the difference in slopes (see Fig. 1), otherwise we use a two-tailed test.

²¹ Here subjects in treatment TC25 whose wage–effort is non-decreasing for wages above 60 are excluded, because they are already included in the class of efficiency-oriented behavior. In the experiment we only have a single subject who behaves this way; s/he chooses $e = 1$ for $w \leq 90$ and $e = 7$ for $w > 90$.

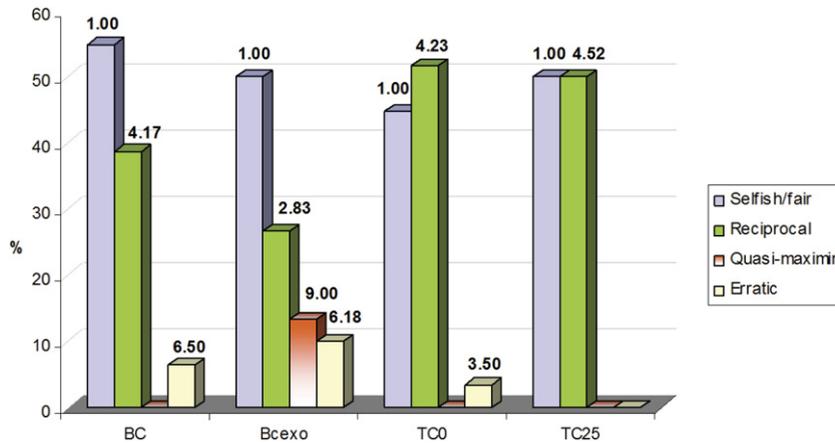


Fig. 3. Classification of workers by treatment and average contribution per worker type.

Fig. 3 shows the distribution of subjects over the four categories by treatment. The figure also indicates the average effort provided by the different worker types. In all treatments a large fraction of workers behaves selfish or according to inequality-averse preferences. However, this does not explain our Result 2 that the wage–effort relationship is equally steep in treatments BC, TC0 and TC25. Estimating a random effects model like in Table 3 for the subsample of reciprocal types only, the wage–effort relationship is still equally steep in the treatments with an endogenously chosen wage.²² Also the distribution of worker types does not differ across these treatments. Although the percentage of selfish/inequality-averse workers is highest in treatment BC, differences with treatments TC0 and TC25 are insignificant. A chi-square test reveals that there are no differences in the frequency distribution of worker types between treatments BC and TC0, between BC and TC25, and between treatments TC0 and TC25.

The type distribution in the BCexo treatment is somewhat different though. In particular, there are fewer subjects acting reciprocally in this treatment, as compared to the three endogenous treatments.²³ Similar results are obtained from comparing the distribution of individual slopes across treatments by means of a Kolmogorov–Smirnov test. There is no difference in the distribution of individual slopes between each pair of treatments in which the wage was endogenously chosen. In contrast, the distribution of individual slopes is significantly different in treatment BCexo (see Fig. 4 and Table C.5, in Appendix C). Apart from fewer reciprocal subjects, the average contribution of these type of workers is also lower in the BCexo treatment. These two observations together explain why the wage–effort relationship is significantly less steep when the wage is exogenously determined (Result 3). Finally, in this treatment we observe some workers that display efficiency-oriented behavior. The typical worker within this class chooses a very high effort level of around $e = 9$, independent of the wage drawn by nature. This can be explained by the very favorable ratio of low marginal costs (3 at most) to high marginal returns (40), which allows for large efficiency gains. Moreover, the fact that efficiency-oriented behavior is almost exclusively observed in the BCexo treatment may indicate that some workers may have a preference for efficiency but withdraw this concern for intentionally low wages.²⁴

The main findings concerning the distribution of worker types are summarized in Results 4, 5 and 6 below.

Result 4. In all treatments there is a large proportion (around 50%) of workers that behave selfish or inequality-averse.

Result 5. The distribution of worker types does not differ across treatments in which the wage is endogenously chosen by a member of the firm.

Result 6. There are fewer workers behaving reciprocally in the BCexo treatment and their average effort contributions is lower as compared to the endogenous treatments, although differences are not always significant.

Taken together, the aggregate results support the reciprocity hypothesis; on average we find a positively sloped wage–effort relationship. However, we also observe large variations in individual worker’s behavior. In all treatments, around half

²² See Table C.3 (random effects linear regressions) and Table C.4 (tobit regressions) in Appendix C.

²³ This follows from making bilateral comparisons between treatment BCexo and treatments BC, TC0 and TC25, respectively, by means of a binomial test. Differences in the fraction of reciprocal workers between BCexo and the two trilateral treatments are significant at the 5% level, differences between BCexo and BC are not. The latter may result from the fact that the binomial test is not very powerful with low numbers. Comparing the complete type distribution over the four categories by means of a chi-square test, significant (10% level) differences are found only between treatments BCexo and TC0.

²⁴ Therefore, in the three endogenous treatments we cannot exclude that some reciprocal workers may behave according to the full model of Charness and Rabin (2002). However, we may exclude efficiency-oriented behavior from reciprocal behavior in treatment BCexo. Here it seems less likely that a worker will withdraw his efficiency concern to punish non-intentionally low wages.

Table 4
Wage distribution measures and Mann–Whitney tests.

	BC (<i>n</i> = 31)	TC0 (<i>n</i> = 29)	TC25 (<i>n</i> = 28)	BCexo (<i>n</i> = 30)
Average	61.45	67.24	49.29	64.5
Percentile 25	35	35	17.5	45
Median	70	90	52.5	65
Percentile 75	100	100	77.5	90
% offers = 0	19.35	13.79	17.86	0
% offers = 100	29.03	44.83	14.29	13.33
BC vs. TC0	0.3858 [†]			
BC vs. TC25	0.1630 [†]			
TC0 vs. TC25	0.0469 [†]			

[†] Remark: *p*-value of a ranksum test comparing wage offers between the two treatments.

of the workers provide the minimum effort regardless of the wage. When the wage is endogenously chosen, the remaining half behaves reciprocally. Comparing these endogenous treatments with other (bilateral) gift-exchange experiments, the percentage of reciprocal workers that we find here is somewhat lower. For example, Maximiano et al. (2007) obtain a fraction of 64% of reciprocal workers and the overall wage–effort relationship found there is also steeper than the one we observe here.²⁵ The explanation for this is straightforward. Because of the highly asymmetric fixed amounts in I and m_W in the present experiment, also inequality-averse subjects should display a flat wage–effort relationship (cf. Section 2). In most previous experiments the initial endowments are much more symmetric and therefore inequality-averse subjects are predicted to choose a positive wage–effort relationship. This explains why we find a significantly lower slope and also around 10% more workers that always choose the minimum effort (resulting in low overall levels of effort). At the same time, we still find that the slope is substantial and significantly different from zero. Like in Maximiano et al. (2007), these findings suggest that reciprocity is an important driving force behind gift-exchange, beyond (exclusively) outcome-oriented social preferences.²⁶

Looking at whom the worker likes to reciprocate, the results for treatment TC0 clearly reject the hypothesis that he is only reciprocal towards the one who controls the wage. The one who pays for it certainly plays a role. Our finding that the wage–effort relationship does not differ among the three endogenous treatments (Result 2) is in fact in line with the worker only caring about the one who pays for the wage. But it also supports the hypothesis that the worker is reciprocal towards the firm as a whole and not particularly sensitive to its exact composition, i.e. to how ownership and control are divided within the firm. The finding that the wage–effort relationship is significant less steep in the BCexo treatment (Result 3) in fact indicates that this is the more plausible explanation. Control per se is thus important for the reciprocal relationship (cf. Charness, 2004 and Falk et al., 2008). At the same time, the significantly positive slope we observe in treatment BCexo reinforces the observation that the worker also prefers to reciprocate the one who pays for the wage. This holds because, unlike in the earlier experiments of Charness (2004), the positive wage–effort relationship in our BCexo treatment cannot be attributed to distributive concerns like inequality-aversion or quasi-maximin. Also note that in the BCexo treatment the intercept is substantially higher relative to the other treatments. Together with the significantly smaller slope this suggests negative reciprocity if a low wage is intentionally chosen.

Overall we conclude that the worker feels reciprocally towards the firm; both the fact that the firm controls the wage and pays for it are important for the gift-exchange relationship. Exactly how ownership and control are subdivided among (potentially) various firm members appears unimportant though.

4.2. Wage offers and earnings

Although our main interest lies in workers' effort choices, we briefly look at (owner-)managers' behavior as well. Standard theory predicts that (owner-)managers should pay the minimum wage in treatments BC and TC25. However, if the (owner-)manager herself is inequality-averse or expects to gain or lose from a positive or negative reciprocal reaction of the worker, she may pay more than the minimum wage. Because in treatment TC0 the manager does not benefit herself from the worker's effort, a higher wage there may reveal the manager's preferences for equality and/or efficiency. But in this treatment any wage offer is consistent with selfish preferences as well. Table 4 presents the average wages (besides some other measures of the wage distribution) for all treatments.

Because wages in BCexo are drawn at random we focus on the endogenous treatments. Only a small percentage of (owner-)managers pays the minimum wage of zero and the average wage is substantially higher in all cases. In the BC treatment the mean wage equals 61.5 points. In treatment TC0 the manager offers on average around 6 points more and

²⁵ Here we use the bilateral 1–1 treatment in Maximiano et al. (2007) as comparison. In this treatment the owner-manager's earnings equal $10e - w + 90$ whereas the worker's earnings are $w - c(e) + 90$. The wage coefficient found for that treatment equals 0.0556 compared to 0.0283 here for the bilateral treatment (cf. Table 3). We acknowledge though that this is not a perfect comparison, given that also the returns on effort differ besides the fixed amounts.

²⁶ See Falk et al. (2005, 2008) for evidence that reciprocity is quantitatively the more important motivational force.

Table 5
Average earnings by treatment and role (in experimental points).

		BC	TC0	TC25	BCexo
Workers	Endowment	20	20	20	20
	Overall earnings	78.71	82.97	65.54	80.5
Managers	Endowment	360	0	90	
	Overall earnings	403.06	0	109.11	
Shareholders (Owners in BCexo)	Endowment		360	270	360
	Overall earnings		432.07	327.32	427.5

Remark: Earnings in points. The conversion rate is 30 points = 1 euro. Apart from these points, subjects received a show up fee of 12 euros.

Table 6
Optimal wage and potential earnings.

	Optimal wage	max Π	min Π	$\Pi_{\{w=0\}}$
BC	100	417.42	401.45	403.87
TC25	90	450.69	399.14	402.76
TC0	100	467.14	383.57	400.00
BCexo	0 [†]	456.00	409.33	456.00

[†] Remark: Optimal random wage.

in treatment TC25 on average 12 points less. These differences between treatments increase when we look at the median wage. Especially in treatment TC0 the median wage is very high and equal to 90. Moreover, a larger percentage of managers (44.8%) offers the maximum wage of 100 when they do not bear (part of) the wage costs. Despite the observed differences between treatments, ranksum tests fail to find significant differences in wages between the BC treatment and the two trilateral ones. But wages are significantly higher (at the 5% level) in treatment TC0 as compared to treatment TC25. These results carry over to the proportions of minimum and maximum wage offers; we find a significant difference (at the 5% level) for the proportion of maximum wage offers between treatments TC0 and TC25. This may indicate that managers are friendly with the money of others. Such an interpretation is in line with the empirical observation of Baker et al. (1988) that in actual practice managers tend to assign mostly good or outstanding performance evaluations to their employees when they do not bear the costs of doing so. Baker et al. (1988, p. 614) also note more generally that when managers are not paid for performance, they have little incentives to structure value-maximizing contracts with subordinates. A potential drawback of the separation of ownership and control is thus that it may lead to an upward pressure on wages. In our experiment, however, the higher wages in TC0 do not come at the expense of firm's profits, see the discussion of Tables 5 and 6 below.

Result 7. Wages in the endogenous treatments are on average substantially higher than minimal. Wages are highest in treatment TC0 and lowest in treatment TC25, although differences among treatments are typically insignificant.

We next turn to the actual earnings subjects obtain in the experiment. Table 5 reports the subjects' average earnings by treatment and by role, excluding the show up fee of 12 euros every participant received for showing up on time. Workers earn slightly more in TC0, which is driven by the higher wages they receive in this treatment. The firm's overall net profits are highest in treatment TC25. Here the wage costs are the lowest and the effort provided the highest. Despite the higher wage costs in TC0, the firm's overall profits are higher in TC0 than in treatment BC.

The disparity between the workers' and the firms' overall earnings is mainly driven by the difference in the fixed amount of 20 for the worker and 360 for the firm. Ignoring these, the average additional earnings the firm makes are smaller than those of the worker in treatment BC. In the two trilateral treatments the additional earnings are higher for the firm than for the worker.

Table 6 reports what firms could have earned by choosing the 'optimal' wage given the (unknown) actual wage–effort schedules of the workers. The profit maximizing wage equals 100 in treatments BC and TC25, 90 in treatment TC0 and zero in BCexo. Comparing Tables 4 and 6 it can be seen that actual earnings are higher than minimal in all treatments. Also, firm's potential earnings are higher when ownership and control are separated, but the difference between the actual and maximal earnings is lower in the BC treatment.

5. Concluding discussion

In this paper we address the following question: does the separation of ownership and control between shareholders and managers that characterizes modern corporations influence workers' reciprocal attitudes? What may seem a trivial extension of the standard bilateral gift-exchange game is in fact a question difficult to answer without empirical evidence. This holds because, although being able to rationalize the positive wage–effort relationship commonly found in many gift-exchange experiments, most of the so called pro-social theories do not generalize in a natural way to more complex organizations (cf. Charness and Kuhn, 2011). For instance, it seems rather unlikely that a worker in a large organization that is

vastly better endowed reciprocates a high wage out of equity reasons. Similarly so, it is a priori not clear whether a higher wage is reciprocated if the person who sets the wage neither bears any costs of doing so, nor receives any monetary benefits from the worker's increased effort. To explore these issues – and thus more generally the fundamental motivations behind gift-exchange behavior – we investigate the robustness of experimental gift exchange in a larger and hierarchical organization. In particular, we consider a three-tier hierarchy in which a manager controls the worker's wage but is not full residual claimant; most of the firm's returns go to a wealthy shareholder.

Our experimental design covers four treatments. The standard bilateral gift-exchange game with a single owner-manager and a worker, serves as a baseline (BC). This treatment is compared with two other treatments in which the firm is owned by a shareholder but controlled by a manager. In these trilateral treatments the manager chooses the worker's wage. The manager herself either receives a fixed wage such that the shareholder is full residual claimant of the firm's profits (treatment TC0), or she is paid on the basis of performance receiving 25% of firm's profits (treatment TC25). In our final fourth treatment (BCexo) the firm has no control and the wage is chosen by a random device. This treatment is again bilateral in nature, as there is only an owner but no manager.

To exclude efficiency as a confounding factor when comparing different treatments, the firm's profit function is kept constant across treatments. It is chosen such that (like in reality) the firm is always much richer than the worker. Compared to previous experiments we also increased the marginal return to effort. Our parameter choices allow us to exclude inequality-aversion and efficiency concerns (quasi-maximin preferences) as possible explanations for a positively sloped wage–effort relationship. Other characteristic features of our design are that we employ the strategy method and that only a single period is played.

We find that workers on average exhibit a reciprocal attitude in all treatments. The higher the wage paid, the higher the effort level the firm receives on average. Somewhat surprisingly, this also holds in treatment TC0 where the manager in charge of choosing the wage does not benefit from the worker's reciprocal behavior at all. The wage–effort relationship does not differ between the baseline treatment and the two trilateral treatments. In our experiment gift exchange thus appears to be robust to the separation of ownership and control. Comparison with the results for the treatment in which the wage is exogenously given indicates that both ownership and control are important for the reciprocal relationship. This suggests that the worker acts reciprocally towards the firm as a whole and not to one of its members in particular.

Another important finding is that we observe a large heterogeneity in workers' reciprocal attitudes. In the treatments where the wage is endogenously chosen the proportion of reciprocal workers figures around 50%. The remaining half of the workers always provides the minimum effort. Given our parameterization, the latter behavior is in line with both selfish and inequality-averse preferences. In the treatment where the wage is exogenously given, the fraction of reciprocal types is lower. Here we also observe that around 12% of the workers are strongly motivated by efficiency concerns. These individual differences are important to keep in mind when interpreting the average wage–effort relationship observed.

We purposely chose our experimental design as to distinguish between possible motivations for gift-exchange behavior, while keeping potential confounding factors at a minimum. Nevertheless, our choices come with some limitations. First, the experiment is highly contextualized. We did so mainly to enhance subjects' understanding (see also Maximiano et al., 2007). Yet it may make them play according to some outside world rules they might be familiar with in similar contexts. For instance, workers in the experiment may reward a high wage out of habit because they expect managers to ultimately benefit somewhere in the future, as it commonly happens in real firms. Re-running our trilateral treatments with a more neutral framing, i.e. with roles labeled as 'player 1', etc., would allow identification of whether importing such rules of thumb into the lab plays a role. Second, and a somewhat related point, the separation of ownership and control is very salient in our case. The shareholder is some other student in the lab, i.e. someone subjects can directly identify themselves with. This contrasts with the anonymous, impersonal group of shareholders that many workers are likely to never think about or relate to in reality. Workers in real firms may simply take their manager as their "boss", not being very conscious of the fact that he or she is not residual claimant. Our robustness check thus seems to provide a particularly strong test. Reassuringly, reciprocal behavior appears to survive even in a setting where the separation of ownership and control is highlighted.

A third limitation concerns the one-shot nature of our game. As there is limited scope for learning in our experiment, it remains an open question whether workers would still be willing to exert high effort in response to a kind wage offer from the manager if they would repeatedly experience that there are no benefits for the manager in doing so (not even long term). A follow up experiment in which subjects play the trilateral games a number of times in a row would shed light on this matter. Note however that our current one-shot setup is particularly conducive to a clean identification of the (individual) wage–effort relationship, as there is no interaction process over time that leads to dependent observations. By employing the strategy method we elicit the entire (individual) wage effort relationship in essentially one decision. As discussed at length in Section 3.1, we have no reasons to believe that the strategy method per se explains our results. Nevertheless, we cannot exclude the possibility that it makes conditioning effort on wages more salient, even when the one choosing the wage does not benefit at all. The strategy method employed thus could induce subjects to think differently about the strategic situation at hand.

A final remark concerns the models chosen to explain observed behavior. In our theory section we derived predictions based on some of the leading theories of social preferences in the field. Our choice of treatments and of parameter values enables us to distinguish these theories from each other. The results obtained favor a reciprocity model in which workers reciprocate both who decides and who pays the wage. Yet that does not necessarily exclude alternative explanations. For

example, our findings for the endogenous treatments are also consistent with a model in which workers are not rewarding a kind act, i.e. rewarding a decision that benefits them, but instead wish to compensate the owner for the involuntary loss of paying the wage. That is, workers may care about the owner's allocation relative to the owner's initial endowment (or simply want to be kind to people who experience a loss). If that would be the underlying explanation, it would make less sense to interpret our findings in terms of reciprocity. The significantly lower correlation between wages and effort when the wage is randomly determined, however, suggests that this alternative explanation is not the driving force. Apparently it is crucial that the wage is intentionally determined by another person. Blount (1995) develops a theoretical framework that identifies two dimensions important for the effect of causal attributions on behavior, viz. perceptions of intentionality and of self-interest. Her experimental findings for the ultimatum game and ours for the gift-exchange game suggest that especially the former dimension is key.²⁷ As soon as human decision makers are involved, people are likely to develop normative expectations about how these decision makers should behave, and respond similarly to the decision taken irrespective of whether the response affects the decision maker or not.

Despite the limitations discussed above, our findings tentatively suggest that a worker's motivation to reciprocate does not vanish (or does not even diminish) in firms with diffuse ownership stock. Workers may reciprocate a kind wage offer with higher effort and/or an unkind wage offer with lower effort, even if a large part (or all) of the benefits goes to a much wealthier shareholder. As a first approximation the standard bilateral gift-exchange game thus seems to provide a good short cut to study more complex, multi-person work environments. Future research should tell us whether this conclusion continues to hold when other realistic elements are added to the labor relation. For instance, the frequent public outrage about the level of CEO pay and the process by which it is determined, suggests that workers will be (much) less willing to reciprocate when managers are endogenously granted a high wage. It thus seems fruitful to explore a setting in which the owner endogenously chooses the manager's compensation. The three-tier hierarchy that we study could also be made more realistic by giving the owner-principal a larger say in the manager's wage offer to the worker. In a first stage the owner-principal could then either explicitly allow the manager to freely set the worker's wage, or alternatively, put bounds on the worker's potential compensation. Workers' inclination to reciprocate is likely to depend in a non-trivial way on both the actual wage offer and the bounds imposed.

Appendix A. Formal justification of the reciprocity hypothesis

First consider treatment BC in which the firm is represented by a single employer. Following Dufwenberg and Kirchsteiger (2004), let the worker's utility be given by:

$$U_W = \pi_W + Y \cdot \kappa_{WE} \cdot \lambda_E \tag{A.1}$$

Here m_W denotes the worker's monetary payoffs as reflected by (2) in the main text, while term $Y \cdot \kappa_{WE} \cdot \lambda_E$ gives his reciprocity payoffs. The non-negative constant Y measures how sensitive the given worker is to reciprocity concerns.²⁸ Factor κ_{WE} represents the worker's kindness towards his employer. Kindness is measured as the difference between what the worker actually gives to the employer by choosing effort level e and the average of the minimum and the maximum monetary payoffs that he could give her in principle. Thus:

$$\kappa_{WE}(e) = v \cdot e - \frac{1}{2}(v \cdot 1 + v \cdot 10) = v \cdot \left(e - 5\frac{1}{2} \right) \tag{A.2}$$

(Recall that in the experiment we have $v = 40$.) Term λ_E reflect the kindness of the employer as perceived by the worker. It is defined as the difference between what the worker believes the employer believes she gives to the worker by choosing w , and the average of the minimum and the maximum payoff that the worker believes the employer believes she could give the worker in principle. To calculate λ_E we thus need the worker's second order beliefs about the employer's beliefs about the worker's choice of effort in reaction to w . Let $e^0(w)$ denote the employer's beliefs about $e(w)$ and $e^{00}(w)$ the worker's beliefs about these beliefs. We get:

$$\lambda_E = w - e^{00}(w) - \frac{1}{2} \left(\min_w(w - e^{00}(w)) + \max_w(w - e^{00}(w)) \right) \equiv \bar{\lambda}(w) \tag{A.3}$$

A key feature of the worker's multiplicative reciprocity payoffs is that he wants to match the sign of his own kindness κ_{WE} with the sign of the perceived kindness λ_E of the employer. As a result, in equilibrium – where beliefs are correct – it necessarily holds that $\bar{\lambda}(w)$ increases with w .²⁹

²⁷ Blount (1995) conducts three ultimatum game studies. In the first two, the third party treatment induces the same response behavior as in the standard interested party condition (both being significantly different from the random condition). In study 3 the payoff consequences for both earning players are highlighted and significant differences between the third party condition and the interested party condition are observed.

²⁸ Throughout this appendix we assume that a given worker is in principle equally sensitive to reciprocity considerations regarding all other players. Differences between reciprocity concerns regarding different other players like e.g. manager and shareholder then follow from differences in perceived kindness λ , see below. An alternative approach leading to similar conclusions would be to let Y vary directly with the identity of the other player considered (see Dufwenberg and Kirchsteiger, 2000). Between workers Y can vary to capture heterogeneity in workers' preferences for reciprocation.

²⁹ The intuition here runs as follows (cf. Dufwenberg and Kirchsteiger, 2000, p. 1075). Let $w_1 < w_2$ and suppose $\bar{\lambda}(w_1) \geq \bar{\lambda}(w_2)$, i.e. the higher wage w_2 is perceived as less kind than the lower wage w_1 . The worker will then be less kind in response to the higher wage, i.e. $e(w_2) \leq e(w_1)$. Because

The worker's effort choice $e(w)$ follows from maximizing U_W . For the continuous analog of our specification with discrete effort choices the first order condition becomes (assuming $c(e)$ to be increasing and convex):

$$\frac{\partial c}{\partial e} = Y \cdot \frac{\partial \kappa_{WE}}{\partial e} \cdot \lambda_E = \delta \cdot [Y \cdot v \cdot \bar{\lambda}(w)] \quad (\text{A.4})$$

where $\delta \in [0, 1]$ is introduced solely for expositional purposes; in the BC treatment we have $\delta_{BC} = 1$. From $\bar{\lambda}(w)$ increasing it follows that $e(w)$ is increasing. The steepness of this wage–effort relationship depends on v , i.e. on the effectiveness of effort as reciprocation device. Similarly so, $e(w)$ is steeper the higher δ is.

The perceived kindness λ_E of the employer's wage choice in treatment BC may originate from either the employer choosing the wage or from the employer actually paying for the wage (or both). Dufwenberg and Kirchsteiger (2004) define perceived kindness in terms of intentional choices that affect the worker's payoffs. A strict interpretation of their theory would therefore entail that $\lambda_E = 0$ in BCexo, because in that treatment the employer takes no decision at all. This corresponds to setting $\delta_{BCexo} = 0$ in (A.4), implying that $e(w) = 0$ for all w . If, however, workers perceive kindness solely in terms of who actually pays for the wage, also $\lambda_E = \bar{\lambda}(w)$ in BCexo and thus $\delta_{BCexo} = 1$. The wage effort relationship is then equally steep as in treatment BC. The case where the worker cares about both the one who controls the wage and the one who pays for the wage can be conceptually represented by postulating $\lambda_E = \mu_C \cdot 0 + (1 - \mu_C) \cdot \bar{\lambda}(w)$ in the BCexo treatment, where $\mu_C \in [0, 1]$ denotes the weight on control concerns and $\mu_P = 1 - \mu_C$ the weight on payment concerns in the perception of kindness.³⁰ This would imply $\delta_{BCexo} = (1 - \mu_C)$, leading to a less steep wage–effort relationship than in BC for $\mu_C > 0$.

In the trilateral conditions the firm is represented by both a manager and a shareholder. If the worker takes these two roles separately in his reciprocity considerations, his utility becomes (cf. Dufwenberg and Kirchsteiger, 2004):

$$U_W = \pi_W + Y \cdot \kappa_{WM} \cdot \lambda_M + Y \cdot \kappa_{WS} \cdot \lambda_S \quad (\text{A.5})$$

The second (third) term on the r.h.s. gives the reciprocity payoffs with respect to the manager (shareholder). Letting $\alpha_M \in [0, 1]$ denote the share of profits the manager obtains, we immediately obtain $\kappa_{WM}(e) = \alpha_M \cdot \kappa_{WE}(e)$ and $\kappa_{WS}(e) = (1 - \alpha_M) \cdot \kappa_{WE}(e)$, with $\kappa_{WE}(e)$ as defined in (A.2).

The determination of λ_M and λ_S is less straightforward. Again, as the shareholder has no decision to take, a strict interpretation of Dufwenberg and Kirchsteiger (2004) would entail $\lambda_S = 0$. Similarly so, in their definitions perceived kindness does not depend on the associated costs of the gift to the gift-giver. Therefore, $\lambda_M = \bar{\lambda}(w)$ as reflected in (A.3). Effectively, the worker only cares about the manager as the person who controls the wage and effort choices are determined by the first order condition:

$$\frac{\partial c}{\partial e} = Y \cdot \frac{\partial \kappa_{WM}}{\partial e} \cdot \lambda_M = \alpha_M \cdot [Y \cdot v \cdot \bar{\lambda}(w)] \quad (\text{A.6})$$

This corresponds with $\delta_{TC} = \alpha_M$ in (A.4). For $\alpha_M < 1$ the wage–effort relationship is then less steep than in treatment BC. In particular, for $\alpha_M = 0$ as in treatment TC0, it is entirely flat. If perceived kindness is envisaged in terms of who pays for the wage, we obtain $\lambda_M = \lambda_S = \bar{\lambda}(w)$. This effectively corresponds to $\delta_{TC} = \alpha_M + (1 - \alpha_M) = 1$ in (A.4), i.e. to the same predictions as for treatment BC.

Finally, consider the trilateral treatments when perceived kindness is both in terms of who controls the wage and who pays for the wage. In the main text we interpret this as the worker feeling reciprocal towards the firm as a whole and not to one of its members in particular. We thus effectively assume that the worker's preferences are represented by (A.1). The predicted wage–effort relationship is then the same as in BC, irrespective of the share α_M the manager gets. Yet an alternative assumption would be that even in this case the worker's reciprocal feelings are member-specific as in (A.5). Because the manager both controls and pays, her kindness as perceived by the worker would then equal $\lambda_M = \mu_C \cdot \bar{\lambda}(w) + (1 - \mu_C) \cdot \bar{\lambda}(w) = \bar{\lambda}(w)$. The shareholder's perceived kindness becomes $\lambda_S = (1 - \mu_C) \cdot \bar{\lambda}(w)$. In that case we would effectively obtain $\delta_{TC} = \alpha_M + (1 - \alpha_M) \cdot (1 - \mu_C)$ in (A.4). For $\mu_C > 0$ the predicted wage–effort relationship is then less steep than in BC. Moreover, it differs between TC0 and TC25 as well. The intuition here is that the effectiveness of effort as reciprocation device of control concerns increases with α_M .

Taken together, the analysis in this appendix shows that a formal model along the lines of Dufwenberg and Kirchsteiger (2004) generates the 'reciprocity hypothesis' informally discussed in the main text. In formulating this hypothesis, 'reciprocity towards the firm as a whole' has been taken literally. It is assumed that the worker cares about the fact that the firm both controls and pays for the wage, but does not care about exactly how these two aspects are parceled out within the firm. If, however, the worker would do so, predictions based on both control and payment concerns being present differ from the ones reflected in Fig. 1(c). In particular, the slopes should satisfy $BCexo = TC0 < TC25 < BC$ in that case. Our experimental results depicted in Fig. 2 do not support this alternative interpretation.

in equilibrium beliefs should be correct this implies $e^{00}(w_2) \leq e^{00}(w_1)$. But for $e^{00}(w_2) \leq e^{00}(w_1)$ and $w_1 < w_2$ necessarily $\bar{\lambda}(w_1) < \bar{\lambda}(w_2)$ from (A.3), contrary to our initial supposition.

³⁰ A similar approach is taken in Falk and Fischbacher (2006), who scale perceived kindness (in their setup measured through interpersonal comparison of payoffs between employer and worker) by a multiplicative *intention factor* $\vartheta \in [0, 1]$. This corresponds to $\vartheta = 1 - \mu_C$ here.

Appendix B. Summary of instructions for treatment TC25

In this experiment you are taking part in a study of the labor market. There are three types of participants: shareholders, managers and workers. One third of the participants will be assigned the role of shareholder; one third the role of manager and the remaining one third will be workers. You will be randomly assigned one of these roles. Which role you have, you will hear at the start of the experiment. Your role will not change during the experiment.

The experiment consists of one period only. In this period you will be randomly and anonymously matched with two other participants. All groups will be composed of three participants: one shareholder, one manager and one worker. (Each group represents a firm.) You will not know with whom you are matched. During the experiment you will earn money based on the choices you and the participants with whom you are matched make. These earnings are calculated in points.

The single period has two stages. These stages have the following setup:

- Stage 1** In this stage you (may) have to make a decision without knowing the choices of those with whom you are matched. If you are a shareholder, you actually do not have to make a decision at all. If you are a manager, you have to set the wage of the worker. This wage should be a multiple of 5 and in between 0 and 100. Each manager is allowed to set only one wage. If you are a worker, you have to decide which effort level you want to provide for each possible wage set by the manager. There are 21 possible wages (ranging from 0 till 100), so each worker has to make 21 effort choices. These effort levels should be integers and in between 1 and 10. Effort is costly for the worker, and the costs (in number of points) belonging to a particular level of effort are reflected in the following cost schedule:

Cost schedule of feasible effort levels.

Effort	1	2	3	4	5	6	7	8	9	10
Cost	0	1	2	4	6	8	10	12	15	18

- Stage 2** In this stage you will be informed about the choices of the others. If you are a shareholder, you will learn the wage chosen by the manager and the corresponding effort level of the worker. If you are a manager, you will learn the worker's effort choice for the wage that you offer. And if you are a worker, you will learn the wage chosen by your manager. You will also be informed about your period earnings and those of the two participants with whom you are matched. These period earnings (in number of points) are calculated as follows:

$$\text{Shareholder's period earnings} = \frac{3}{4} * (40 * \text{Effort level of worker} - \text{Wage offered} + 360)$$

$$\text{Manager's period earnings} = \frac{1}{4} * (40 * \text{Effort level of worker} - \text{Wage offered} + 360)$$

$$\text{Worker's period earnings} = \text{Wage} - \text{Cost of effort provided} + 20$$

Note that the shareholder earns 75% of the firm's total profits, the manager earns 25%.

At the end of the experiment the period earnings will be converted into euros at the rate of 30 points = 1 euro. In addition to the period earnings earned in the experiment you will receive a show up fee of 12 euros.

Appendix C. Robustness checks

Table C.1

Tobit regression with effort as dependent variable (all workers).

	Model I		Model II		Model III	
	Coef.	Robust std. err.	Coef.	Robust std. err.	Coef.	Robust std. err.
Constant	−5.9711	1.4601 ^{***}	−6.2241	1.5453 ^{***}	−6.2276	1.5457 ^{***}
Wage	0.0791	0.0064 ^{***}	0.0847	0.0151 ^{***}	0.0847	0.0151 ^{***}
TC0	0.9232	1.7076	−0.1526	1.7347	−0.1526	1.7353
TC25	0.9670	1.7555	0.3278	1.6845	−0.5969	1.6934
BCexo	1.9017	1.9567	4.4217	2.1901 ^{**}	4.4229	2.1908 ^{**}
TC0 * wage	−	−	0.0193	0.0199	0.0193	0.0199
TC25 * wage	−	−	0.0116	0.0195	0.0460	0.0217 ^{**}
BCexo * wage	−	−	−0.0478	0.0189 ^{**}	−0.0478	0.0189 ^{**}
TC25 * wage * I wage > 60	−	−	−	−	−0.0269	0.0076 ^{***}

There are $N = 2478$ observations in total, with 118 clusters (workers) and 21 observations per cluster. Log PseudoLikelihood is -3641.373 for Model I, -3629.049 for Model II, and -3627.691 for Model III. There are 1538 left-censored observations, 790 uncensored observations, and 150 right-censored observations.

^{***} Indicates significance at the 1% level.

^{**} Indicates significance at the 5% level.

Table C.2Estimated coefficients and rank-sum test tests (p -values).

	Coef. estimates	b_{BC}	b_{TC25}	b_{TC0}	b_{BCexo}
b_{BC}	0.0283	–	0.862 ^a	0.842 ^a	0.109 ^a
b_{TC25}	0.0390	–	–	0.513 ^a	0.013 ^a
b_{TC0}	0.0378	–	–	–	0.014 ^b
b_{BCexo}	0.0118	–	–	–	–
b_{end}	0.0348	–	–	–	0.009 ^a

^a One-tailed test: H1: the average rank of “row treatment” is higher than the average rank of “column treatment”.^b Two-tailed test: H1: average rank of “row treatment” differs from the average rank of “column treatment”.**Table C.3**

Random effects linear regression with effort as dependent variable (only reciprocal types).

	Model I		Model II		Model III	
	Coef.	Robust std. err.	Coef.	Robust std. err.	Coef.	Robust std. err.
Constant	0.8277	0.4500*	0.5368	0.3184*	0.5368	0.3186*
Wage	0.0668	0.0042***	0.0726	0.0073***	0.0726	0.0073***
TC0	0.0619	0.6909	0.2978	0.5812	0.2978	0.5815
TC25	0.3571	0.6408	0.0891	0.5716	0.3863	0.4548
BCexo	–1.3333	0.7387*	0.4751	0.3713	0.4751	0.3715
TC0 * wage	–	–	–0.0047	0.0105	–0.0047	0.0105
TC25 * wage	–	–	0.0054	0.0091	–0.0075	0.0106
BCexo * wage	–	–	–0.0362	0.0122***	–0.0362	0.0122***
TC25 * wage * I wage > 60	–	–	–	–	0.0110	0.0068

There are $N = 1029$ observations in total, with 49 clusters (workers) and 21 observations per cluster. The Wald statistic equals $\chi^2 = 295.31$, $p = 0.000$ in Model I, $\chi^2 = 431.44$, $p = 0.000$ in Model II, and $\chi^2 = 431.12$, $p = 0.000$ in Model III.

*** Indicates significance at the 1% level.

** Indicates significance at the 5% level.

Table C.4

Tobit regression with effort as dependent variable (only reciprocal types).

	Model I		Model II		Model III	
	Coef.	Robust std. err.	Coef.	Robust std. err.	Coef.	Robust std. err.
Constant	–1.1789	0.6847*	–1.6021	0.7842**	–1.6035	0.7846**
Wage	0.0965	0.0053***	0.1044	0.0100***	0.1044	0.0100***
TC0	0.0306	0.9811	0.4817	1.1828	0.4817	1.1831
TC25	0.5036	0.9180	0.4775	1.1422	0.3192	1.0648
TC0 * wage	–	–	–0.0083	0.0136	–0.0083	0.0136
TC25 * wage	–	–	0.0006	0.0123	0.0066	0.0120
BCexo * wage	–	–	–0.0392	0.0125***	–0.0392	0.0125***
TC25 * wage * I wage > 60	–	–	–	–	–0.0048	0.0067

There are $N = 1029$ observations in total, with 49 clusters (workers) and 21 observations per cluster. Log PseudoLikelihood is –1922.277 for Model I, –1913.388 for Model II, and –1913.233 for Model III.

*** Indicates significance at the 1% level.

** Indicates significance at the 5% level.

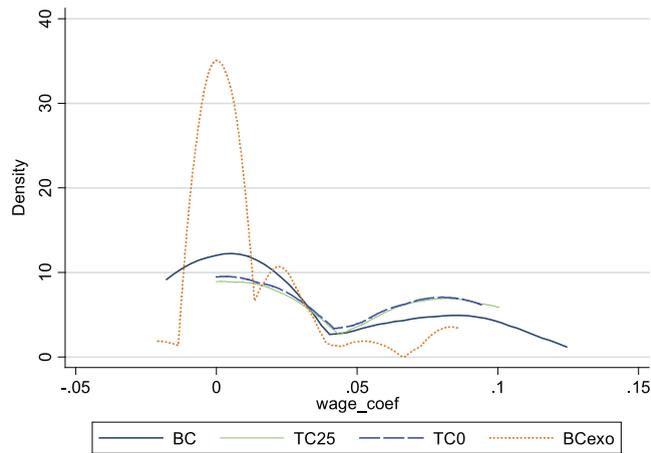


Fig. 4. Kernel density plot of individual wage–effort slopes by treatment.

Table C.5

Distribution of individual slopes, Kolmogorov–Smirnov test (p -values).

	b_{BC}	b_{TC25}	b_{TC0}	b_{BCexo}
b_{BC}	–	0.391	0.493	0.048
b_{TC25}	–	–	0.904	0.001
b_{TC0}	–	–	–	0.000
b_{BCexo}	–	–	–	–
b_{end}	–	–	–	0.020

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