

Abeler, Johannes; Altmann, Steffen; Kube, Sebastian; Wibrals, Matthias

**Working Paper**

## Gift exchange and workers' fairness concerns: When equality is unfair

CeDEX Discussion Paper Series, No. 2009-11

**Provided in Cooperation with:**

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*Suggested Citation:* Abeler, Johannes; Altmann, Steffen; Kube, Sebastian; Wibrals, Matthias (2009) : Gift exchange and workers' fairness concerns: When equality is unfair, CeDEX Discussion Paper Series, No. 2009-11, The University of Nottingham, Centre for Decision Research and Experimental Economics (CeDEX), Nottingham

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CENTRE FOR DECISION RESEARCH & EXPERIMENTAL ECONOMICS



The University of  
Nottingham

Discussion Paper No. 2009-11

Johannes Abeler,  
Steffen Altmann,  
Sebastian Kube and  
Matthias Wibrall  
June 2009

Gift Exchange and Workers'  
Fairness Concerns –  
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CeDEx Discussion Paper Series

ISSN 1749 - 3293



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Karina Terry  
Centre for Decision Research and Experimental Economics  
School of Economics  
University of Nottingham  
University Park  
Nottingham  
NG7 2RD  
Tel: +44 (0) 115 95 15620  
Fax: +44 (0) 115 95 14159  
[karina.terry@nottingham.ac.uk](mailto:karina.terry@nottingham.ac.uk)

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# Gift Exchange and Workers' Fairness Concerns—When Equality Is Unfair<sup>†</sup>

Johannes Abeler\*, Steffen Altmann<sup>‡</sup>,  
Sebastian Kube\*\*, Matthias Wibrals\*

March 10, 2009

(forthcoming: Journal of the European Economic Association)

## Abstract:

We study how different payment modes influence the effectiveness of gift exchange as a contract enforcement device. In particular, we analyze how horizontal fairness concerns affect performance and efficiency in an environment characterized by contractual incompleteness. In our experiment, one principal is matched with two agents. The principal pays equal wages in one treatment and can set individual wages in the other. We find that the use of equal wages elicits substantially lower efforts. This is not caused by monetary incentives per se since under both wage schemes it is profit-maximizing for agents to exert high efforts. The treatment difference instead seems to be driven by the fact that the norm of equity is violated far more frequently in the equal wage treatment. After having suffered from violations of the equity principle, agents withdraw effort. These findings hold even after controlling for the role of intentions, as we show in a third treatment. Our results suggest that adherence to the norm of equity is a necessary prerequisite for successful establishment of gift-exchange relations.

**JEL classification:** J33, D63, M52, C92, J41.

**Keywords:** wage setting, wage equality, equity, gift exchange, reciprocity, incomplete contracts.

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<sup>†</sup> Financial support from the Bonn Graduate School of Economics is gratefully acknowledged. We thank Rachel Croson, Lucie Dörner, Florian Englmaier, Ernst Fehr, Simon Gächter, Uri Gneezy, David Huffman, Michael Kosfeld, Peter Kuhn, Sandra Ludwig, Wolfgang Luhan, Bentley MacLeod, Clemens Puppe, Martin Sefton, Ferdinand von Siemens, Philipp Wichardt, Eyal Winter and especially Armin Falk and Felix Marklein for helpful discussions. Valuable comments were received from seminar and conference participants in Alessandria, Barcelona, Bayreuth, Bonn, Budapest, Jena, Karlsruhe, Paris, Prague, Stockholm (Ratio Colloquium), Tilburg, Vienna, and Zurich. We thank Patrick Bolton and two anonymous referees whose thoughtful comments helped to improve the paper significantly.

\* University of Bonn and IZA, Lennéstr. 43, 53113 Bonn, Germany. email: *lastname*[at]uni-bonn.de

<sup>‡</sup> IZA Bonn and University of Bonn, Schaumburg-Lippe-Str. 5–9, 53113 Bonn, Germany. email: *altmann*[at]iza.org

\*\*Max Planck Institute for Research on Collective Goods and University of Bonn, Kurt-Schumacher-Str. 10, 53113 Bonn, Germany. email: *kube*[at]coll.mpg.de

*“To treat people fairly you have to treat people differently.”*

Roy Roberts, at that time VP of General Motors<sup>1</sup>

## 1 Introduction

In recent years, a vast body of literature has stressed the importance of gift exchange for mitigating moral-hazard problems of incomplete contracts: since many agents repay a gift in the form of higher wages by providing higher efforts, effort can be elicited under incomplete contracts even in one-shot situations where no future gains can be expected (e.g., Akerlof 1982, Fehr et al. 1997, Maximiano et al. 2007). The potential of gift exchange as a contract enforcement device, however, is likely to depend on the institutions that shape the employment relation, above all the mode of payment. Yet little is known about the interaction of different payment modes with gift exchange. Exploring this interaction is crucial in order to understand under which conditions the efficiency-enhancing effects of gift exchange develop their full power. A key question in this context is how to treat agents relative to each other as this affects the perceived fairness of a pay scheme. In this paper, we study this question by focusing on two important fairness principles: horizontal equality and equity.

On the one hand, it has been argued that *horizontal equality* is crucial for a wage scheme to be considered as fair. Differential pay of co-workers could cause resentment and envy within the workforce, and ultimately lower performance (e.g., Pfeffer and Langton 1993, Bewley 1999). Wage equality is also often referred to in employer-union bargaining as being a cornerstone of a fair wage scheme and is one of the most prevalent payment modes (e.g., Medoff and Abraham 1980, Baker et al. 1988). If workers care foremost about equality, a wage scheme that guarantees equal wages for co-workers should lead to an efficiency-enhancing gift-exchange relation. On the other hand, the importance of the *equity principle* has long been discussed in social psychology, personnel management, and economics (e.g., Homans 1961, Konow 2003). In a work environment, the equity principle (or “equity norm”) demands that a person who exerts higher effort should receive a higher wage compared to his co-worker. Only when performance of co-workers is the same, equity and equality coincide. However, in

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<sup>1</sup>Quoted in Baker et al. (1988).

real-life work relations this is likely to be the exception rather than the rule. Whenever workers differ in their performance, horizontal wage equality violates the equity principle since a higher effort is not rewarded with a higher wage. In other words, if equity is important, the often-heard slogan “equal pay for equal work” implies “unequal pay for unequal work”.<sup>2</sup>

Ideally, our research question would be examined in work environments that differ only with respect to the payment mode. To come close to this ideal world, we introduce a simple and parsimonious laboratory experiment that allows us to analyze the interaction between the institution of wage equality and gift exchange. In the experiment, one principal is matched with two agents. In a first stage the agents exert costly effort. After observing their efforts, the principal pays them a wage. In one treatment he can choose the level of the wage but he is obliged to pay the same wage to both agents (*equal wage treatment* or EWT). In our second treatment, the principal can wage discriminate between the two agents (*individual wage treatment* or IWT). In both treatments, neither efforts nor wages are contractible. Note that principals in the individual wage treatment are free to pay the same wage to both agents, i.e., the EWT is a special case of the IWT. If agents care foremost about wage equality, there should thus be no treatment difference; if equity considerations are more important, we should find that the EWT elicits lower effort levels than the IWT.

The main findings of the experiment are as follows. First, performance differs substantially between the EWT and the IWT: agents who are paid equal wages exert significantly lower efforts than agents who are paid individually. Effort levels are nearly twice as high under individual wages and efforts decline over time when equal wages are paid. Second, this strong treatment effect cannot be explained by differences in monetary incentives. The actual wage choices of principals imply that providing high effort levels is profitable for agents in both treatments. From a purely monetary viewpoint agents’ behavior in both treatments should thus be similar. Third, we show

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<sup>2</sup>Lazear (1989) neatly summarizes this discussion (p. 561): “It is common for both management and worker groups such as labor unions to express a desire for homogeneous wage treatment. The desire for similar treatment is frequently articulated as an attempt to preserve worker unity, to maintain good morale, and to create a cooperative work environment. But it is far from obvious that pay equality has these effects.”

that the frequent violation of the equity principle in the equal wage treatment can explain the effort differences between the treatments. In both treatments, agents who exert a higher effort and earn a lower payoff than their co-worker strongly decrease their effort in the next period. However, the norm of equity is violated much more frequently under equal wages. Principals in the IWT seem to understand the mechanisms of equity quite well. When efforts differ they do pay different wages, rewarding the harder-working agent with a higher payoff in most cases. Agents' reactions cause completely different dynamics in the two main treatments. Under equal wages, initially hard-working agents appear to get discouraged and reduce their effort to the level of their low-performing co-workers. By contrast, in the individual wage treatment the high performers keep exerting high efforts while the low performers change their behavior and strongly increase their effort levels.

Note that principals in the IWT can set two wages instead of one in the EWT. This opens the possibility that agents attribute a different degree of intentionality to principals' wage choices. It could be that this additional moment of discretion has a direct impact on the treatment difference. To rule out this potential confound, we conduct an additional control treatment where principals can again choose only one wage as in the EWT. The second wage is set *exogenously* such that the equity principle is always fulfilled. Effort levels in the control treatment are similar to those of the IWT and much higher compared to the EWT. This strongly suggests that the difference between our two main treatments is indeed driven by agents' desire for wages that are in line with the equity principle.

Our results suggest a psychological rationale for using individual wages. Agents perceive equal wages for unequal performance as unfair and reduce their effort subsequently. The traditional literature on incentive provision in groups comes to a similar conclusion though for a different reason. It is usually argued that the inefficiency of equal wages stems from the fact that marginal products and wages are not aligned. This can lead to free-riding among selfish agents (e.g., Holmström 1982, Erev et al. 1993). We enlarge the scope of this critical view on wage equality: interestingly, in our setup it is precisely the presence of fair-minded agents and not their absence that calls for the use of individual rewards.

An earlier literature in social psychology also studies the consequences of equity in social exchanges (Homans 1961, Adams 1963, Adams 1965, Andrews 1967). In his influential equity theory, Adams (1965) operationalizes the general equity principle in an “equity formula”, which states that the ratio of outcomes to inputs should be the same for every individual.<sup>3</sup> If this is not the case an individual experiences distress and seeks to reestablish equity. Our study complements this literature in several ways. As Mowday (1991) notes, interpreting the existing empirical evidence can often be difficult because important aspects such as the cost of effort or the relevant reference group are ambiguous. Our economic laboratory experiment offers a high level of control over these aspects. In addition, violations of the equity norm arise from the interaction of principals and agents in our study whereas they are induced by the experimenter in most earlier experiments, e.g., by making subjects believe they are over- or underqualified for a job (e.g., Adams 1963 or Lawler 1967).

Our results also inform the literature analyzing the influence of relative income on satisfaction and performance. It has been shown that relative income affects people’s well-being (e.g., Clark and Oswald 1996, Easterlin 2001, Fließbach et al. 2007). However, it is less clear how this influences performance, i.e., whether low relative income leads to frustration and reduced performance (as in Clark et al. forthcoming and Torgler et al. 2006) or to an increase in performance due to a “positional arms race” (Neumark and Postlewaite 1998, Layard 2005, Bowles and Park 2005). The controlled laboratory environment of our experiment allows us to reconcile these differing views. Our results indicate that the comparison process goes beyond a one-dimensional comparison of income and also includes a comparison of effort. In particular, they suggest that receiving a lower income while exerting a *higher* effort leads to reduced performance as this conflicts with the equity principle. By contrast, a lower income that is generated by a *lower* effort leads to a (small) increase in performance.

There are only a few experimental studies that analyze the interaction of payment modes and social preferences (e.g., Bandiera et al. 2005, Fehr et al. 2007, Falk et al. 2008b). Most closely related to our paper is the work of Charness and Kuhn (2007). Here, one principal is matched with two agents who differ in their productivity; like in our study, wages and efforts are not contractible. In contrast to our results, they

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<sup>3</sup>The idea of proportionality dates at least back to Aristotle’s *Nicomachean Ethics*.



find that co-workers' wages do *not* matter much for agents' decisions. However, their design differs from ours in several important points. While Charness and Kuhn focus on heterogeneity in productivity, we look at the effect of actual output differences between agents. Furthermore, we allow for richer comparisons between the agents, as in their design agents are not aware of the magnitude and direction of the productivity differences. The different results underline the importance of information for determining the reference group: Charness and Kuhn's results rather apply to groups of workers that are loosely related and know little about each other, while our focus is on close co-workers who have a good understanding about their peers' abilities and efforts.

Regarding compensation practice in firms, our findings highlight the importance of taking the concerns for co-workers' wages into account. However, doing so by paying equal wages to a group of agents may actually do more harm than good. As soon as agents differ in their performance, equal wages which seem to be a fair institution at first sight might be considered very unfair. While the discouraging effect of equal wages on hard-working agents has long been informally discussed (e.g., Milgrom and Roberts 1992, p. 418f) this paper provides controlled evidence in favor of this intuition. Moreover, it suggests that it is the violation of the norm of equity that causes the discouragement and low performance. Our results should not be interpreted as arguments against wage equality in general. They rather point to limits of equal wages.<sup>4</sup> Wage equality is potentially a good choice in occupations where, e.g., due to technological reasons, workers' performance differs only slightly or where performance differences are due to random influences. In addition, the transparency of co-workers' work efforts and wages might have an influence on the optimal choice of the pay scheme.

The remainder of this paper is structured as follows. In the next section we describe the experimental design and discuss theoretical predictions. In Section 3 we present and discuss our results and Section 4 concludes.

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<sup>4</sup>Independent of equity-equality trade-offs, equal wages might be beneficial for the principal because they could increase peer monitoring (Knez and Simester 2001) and lower transaction costs since contracts do not have to be negotiated with every worker individually (e.g., Prendergast 1999).

## 2 Experimental Setup

### 2.1 Design and Procedures

In the experiment, one principal is matched with two agents. The subjects play a two-stage game. In the first stage, agents decide simultaneously and independently how much effort they want to provide. Exerting effort is costly for the agents. Effort choices range from 1 to 10 and are associated with a convex cost function displayed in Table 1. The principal reaps the benefits of production: every unit of effort increases his payoff by 10.

Effort level $e_i$	1	2	3	4	5	6	7	8	9	10
Cost of effort $c(e_i)$	0	1	2	4	6	8	10	13	16	20

**Table 1:** *Cost of effort.*

In the second stage, after observing the effort decisions of his agents, the principal decides on wages for the two agents. The wages have to be between 0 and 100. Neither efforts nor wages are contractible. The only difference between treatments is the mode of payment. In one treatment the principal can only choose one wage  $w$  that is paid to each of the agents (*equal wage treatment* or EWT). In the other treatment he can discriminate between the two agents by choosing wages  $w_1$  and  $w_2$  for agent 1 and 2, respectively (*individual wage treatment* or IWT). The EWT is thus a special case of the IWT. At the end of each period, the two agents and the principal are informed about efforts, wage(s), and the resulting payoffs for all three players. The payoff functions for the players are summarized in Table 2.

Treatment	EWT	IWT
Payoff Principal	$\pi_P = 10(e_1 + e_2) - 2w$	$\pi_P = 10(e_1 + e_2) - (w_1 + w_2)$
Payoff Agent $i$	$\pi_{A_i} = w - c(e_i)$	$\pi_{A_i} = w_i - c(e_i)$

**Table 2:** *Payoffs of players.*

This game is played for twelve periods. We implemented a stranger design to

abstract from confounding reputation effects, i.e., at the beginning of each period principals and agents were rematched anonymously and randomly within a matching group. A matching group consisted of three principals and six agents. The subjects kept their roles throughout the entire experiment. After the last period, subjects answered a short post-experimental questionnaire. The experiment was conducted in a labor market framing, i.e., principals were called “employers” and agents were called “employees”.<sup>5</sup>

Our setup is related to the gift-exchange game introduced by Fehr et al. (1993) but differs in two important aspects. First, in our experiment agents move first while in Fehr et al.’s setup the principal moves first. Our move order allows the principal to base his wage decision on the actually exerted effort. More importantly, a principal in our experiment is matched with two agents instead of one. This is an essential prerequisite to analyze the interaction between gift exchange and payment modes. It allows us to study the impact of relative wages on the perceived fairness of the wage scheme and agents’ behavior.

All participants started the experiment with an initial endowment of 400 points that also served as their show-up fee. Points earned were converted at an exchange rate of 0.01 Euro/point. The experiment was conducted at the BonnEconLab at the University of Bonn in April 2005 using z-Tree (Fischbacher 2007). For each treatment, we ran four sessions with a total of 8 matching groups (144 participants). The experiment lasted approximately 70 minutes. On average subjects earned 8.30 Euro.

## 2.2 Behavioral Predictions

Efficiency is determined by agents’ effort choices. It is maximized if both agents exert the highest possible effort of 10. However, if all players are rational and selfish the principal will not pay anything to the agents since wage payments only reduce his monetary payoff. Anticipating this, both agents will provide the minimal effort of one in the first stage. The finite repetition of the game in randomly rematched groups does not change this prediction. This subgame perfect equilibrium is the same for both payment modes. If all players were selfish we should therefore expect no

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<sup>5</sup>An English translation of the instructions is available from the authors upon request.

difference between treatments.

By contrast, in laboratory experiments studying labor relations with incomplete contracts, one typically observes that efforts and wages exceed the smallest possible value. Moreover, wages and efforts are positively correlated (e.g., Fehr and Gächter 2000). These findings illustrate the potential of reciprocal gift exchange in enforcing incomplete contracts, as postulated in Akerlof and Yellen’s fair wage-effort hypothesis (Akerlof and Yellen 1990). A fundamental prerequisite for the functioning of gift-exchange relations is that workers perceive their wage as fair. The fairness of a wage payment, however, may not only be evaluated in absolute terms, but also *relative* to the wages of other members in a worker’s reference group.<sup>6</sup> This is not important for the special case of bilateral gift-exchange relationships where only one agent interacts with one principal (e.g., Fehr et al. 1997). However, horizontal fairness considerations potentially play a crucial role in our setup where workers can compare to co-workers.

How do the behavioral predictions depend on which horizontal fairness principle is most important? If agents in the experiment care foremost about *wage equality*, the EWT—which guarantees equal wages by design—should lead to efficient gift exchange between firms and workers. Additionally, we should expect no behavioral differences between treatments since firms in the IWT can pay their workers equal wages, too. Given that firms in the IWT recognize workers’ desire for equal treatment, they will decide to do so. Thus, the wage-effort relationship and average effort levels should not differ across treatments. If some firms nevertheless wage discriminate between workers, the IWT should lead to less efficient outcomes than the EWT.

By contrast, if workers consider *equity* to be more important than equality, we should expect differences in behavior between treatments. The equity principle demands that a person who exerts a higher effort than his co-worker should receive a higher wage and payoff. Our experimental treatments differ in the extent to which the equity principle can be fulfilled by principals. Under the equal wage institution, the equity norm is violated whenever agents differ in their performance. Since both

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<sup>6</sup>Potentially many variables influence a worker’s fairness perception of his wage, e.g., the unemployment rate, unemployment benefits, the prevailing market wage, etc. (see Akerlof 1982, Akerlof and Yellen 1990). These factors are ruled out by our experimental design, allowing us to isolate the influence of co-workers’ wages on fairness perception and effort provision.

workers receive the same wage but have to bear the cost of effort provision, the worker who exerts more effort receives a lower monetary payoff. Under individual wages, principals' behavior determines endogenously whether the equity norm is violated or not. By differentiating wages in accordance to effort differences, principals can adhere to the norm. If we assume that at least some principals do so, we expect to see less norm violations in the IWT than in the EWT.

What are the behavioral consequences of such differences in norm fulfillment? Agents who value equitable treatment should suffer from norm violations, feel dissatisfied and subsequently try to restore equity by adjusting their behavior. Equity theory proposes several possible reactions of agents after norm violations, such as altering own or others' efforts or payoffs, changing one's reference group or quitting the relationship (see Adams 1965). The virtue of our experimental design is that we can clearly identify agents' reactions, because the only variable that an agent can change after experiencing a norm violation is his work effort. An agent who faces a disadvantageous norm violation (i.e., relative underpayment) should lower his effort in the following period. An agent who experiences an advantageous norm violation (i.e., relative overpayment) should increase his effort. Note that a norm violation always includes one agent facing a disadvantageous violation and one agent facing an advantageous violation. Dissatisfaction and the resulting strength of reactions, however, is likely to depend on the direction of the norm violation. Previous evidence suggests that the decrease of effort after a disadvantageous norm violation will be stronger than the increase of effort after an advantageous violation (Loewenstein et al. 1989, Mowday 1991, Thöni and Gächter 2008). Consequently, a violation of the equity norm should lead to an *overall decrease* of efforts in the subsequent period.

If workers care about equitable payment in the sense of the postulated equity norm, aggregate effort in the EWT should thus be lower compared to the IWT since we expect to observe less norm violations in the latter.

### 3 Results

In this section we present the results of the experiment and discuss possible explanations for the observed behavior. We first analyze efficiency implications of the two payment schemes by comparing the effort choices of agents. We then demonstrate that the difference in agents' performance obtains even though monetary incentives—implied by principals' wage setting—should lead to similar effort choices in both treatments. Subsequently, we show that workers' behavior seems to be strongly affected by the equity principle, which is more frequently violated in the EWT. Finally, we report the results of an additional control experiment. They demonstrate that the higher efficiency of the IWT is not driven by the fact that principals can set two wages instead of one (as in the EWT) but by the fact that principals set wages that are in line with the equity principle.

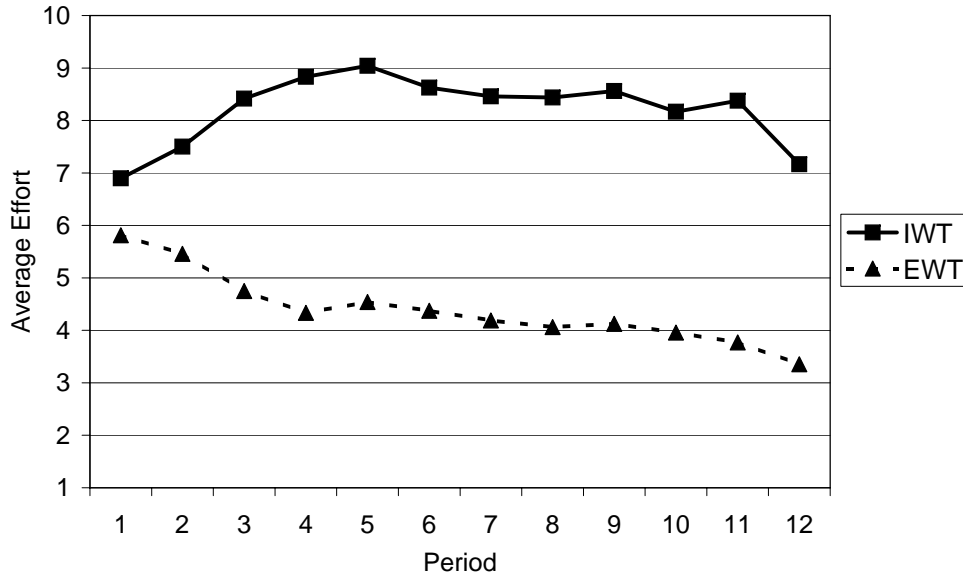
#### 3.1 Effort Choices and Efficiency

Figure 1 shows the development of average efforts over time. Under equal wages, efforts are lower already in the first period (Mann-Whitney test:  $p = 0.03$ )<sup>7</sup> and decrease over time. Efforts under individual wages stay constant (Wilcoxon test for periods 1–6 against 7–12: IWT,  $p = 0.56$ ; EWT,  $p < 0.01$ ). This results in a strong overall treatment difference: average efforts are almost twice as high in the IWT compared to the EWT (8.21 vs. 4.40; Mann-Whitney test:  $p < 0.01$ ). The treatment difference is also present when individual matching groups are considered: the highest average effort of an EWT matching group (5.88) is still lower than the lowest average effort of an IWT matching group (7.47).

The difference in agents' behavior can also be seen in the histogram of effort choices (Figure 2). In the individual wage treatment agents choose the maximum effort of 10 in 49% of the cases; 84% of the choices are higher than 6. Under equal wages, agents choose an effort higher than 6 in only 26% of all cases. The effort decisions are more spread out in the EWT, the minimal effort of 1 being the modal choice with 24% of

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<sup>7</sup>The comparison of first period effort choices is based on individual observations. Unless otherwise noted, all other tests use matching group averages as independent observations. Reported p-values are always two-sided.



**Figure 1:** *Average effort per period. The effort is aggregated per period over all matching groups.*

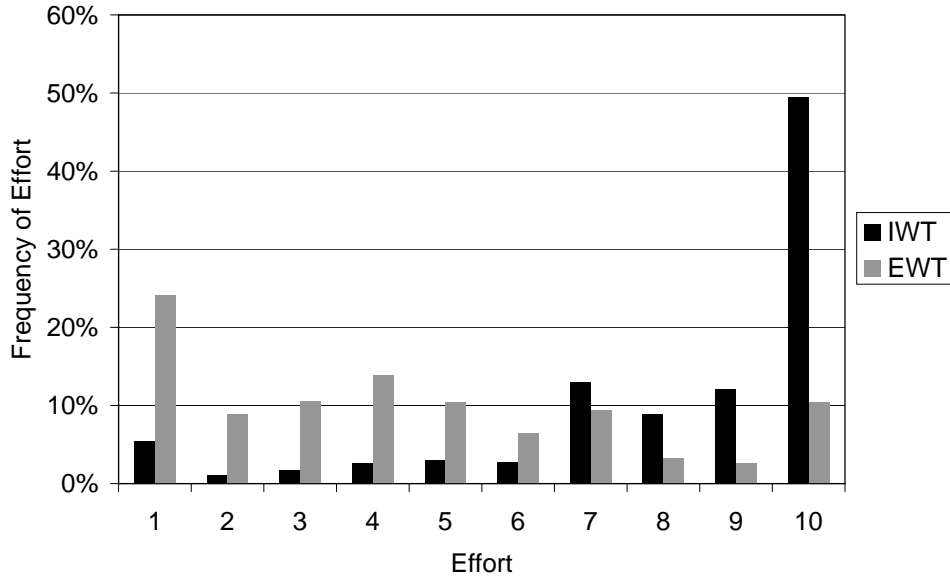
the choices. Since higher efforts increase production and since the marginal product of effort always exceeds its marginal cost, the differences in effort provision directly translate into differences in efficiency.

**Result 1:** *The two payment modes exhibit strong differences with respect to the performance they elicit: agents who are paid equal wages exert significantly lower efforts than agents who are paid individually. This results in much higher efficiency under individual wages.*

Both, the agents and the principals benefit from the increase in efficiency. The average profit per period of a principal is 56 in the EWT compared to 100 in the IWT (Mann-Whitney test:  $p < 0.01$ ), while an agent on average earns 10 under equal wages vs. 17 under individual wages (Mann-Whitney test:  $p < 0.01$ ).

### 3.2 Wage Setting and Monetary Incentives

The strong difference in effort choices suggests that the degree to which gift exchange can mitigate contract enforcement problems depends on the payment mode that is used. Wage equality hampers efficiency, and we hypothesized above that this might be due to horizontal fairness concerns. However, performance differences might also



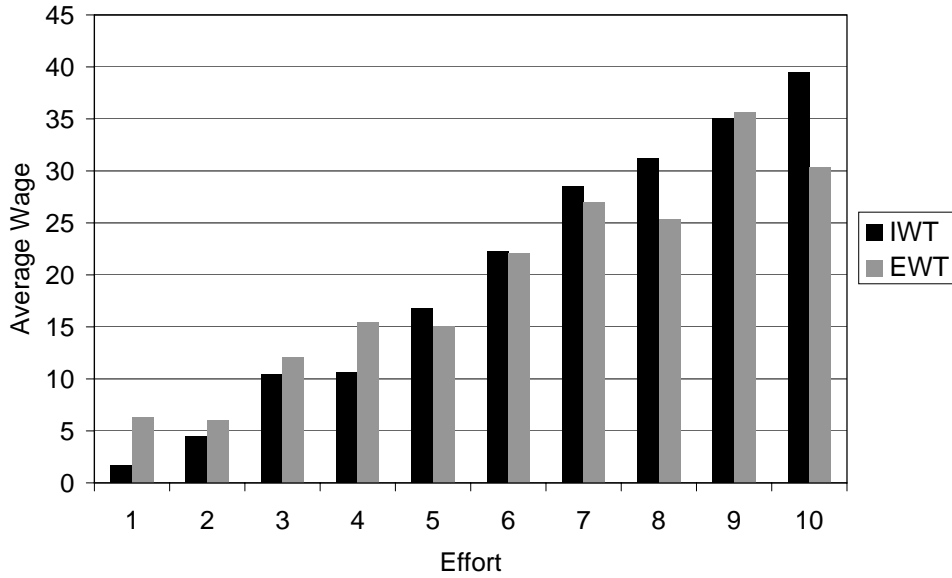
**Figure 2:** *Frequency of effort choices.*

be driven by differing monetary incentives across treatments. To rule this out, we take a closer look at principals’ wage setting and the resulting monetary incentives for the agents.

Figure 3 plots the average wage per effort level in the two treatments. For both treatments we take the wage paid by the principal for each individual effort decision and calculate averages for a given effort level. The graph exhibits the upward sloping effort-wage relation of many gift-exchange experiments. For example, an agent in the equal wage treatment who exerts an effort of 1 receives on average a wage of 6.3 while an agent exerting an effort of 10 receives an average wage of 30.3. In the individual wage treatment, the corresponding wages are 1.7 and 39.5.<sup>8</sup> The effort-wage relation indicates that gift exchange indeed occurs between principals and agents. In both treatments, higher effort levels are reciprocated with higher wages.

<sup>8</sup>Since principals in the EWT have to pay the same wage to both agents, an interesting question concerns how they choose this wage when confronted with a low and a high effort. To answer this question, we assume that the wage-effort relation from the IWT reflects the “true” wage-setting preferences of principals because wage choices are not constrained in this treatment. We regress wages on effort in the IWT and calculate predicted wages for all possible levels of effort. We then calculate the differences between actual wages paid in the EWT and these predicted wages. This analysis shows that the actual wage in the EWT is very close to the average between the predicted wage for the higher and lower effort. This means that principals in the EWT weight the higher and lower effort about equally when deciding on the wage payment.





**Figure 3:** Average wage for a given effort.

**Result 2:** Principals reward higher effort levels with higher wages in both treatments.

Reciprocal behavior of principals generates monetary incentives for the agents. In order to calculate the monetary incentives entailed in principals' wage decisions, one has to take into account agents' cost of effort exertion (see Table 1). Qualitatively, this does not change the picture of the effort-wage relation: higher effort levels seem to lead not only to higher wages, but also to higher profits for the agents. To check this in more detail, we estimate an OLS-model where we regress the agent's profit per period  $\pi_{A_i}$  on his effort level  $e_i$  and a constant. To account for potential differences between treatments we include a treatment dummy  $IWT$ , and an interaction term of the treatment dummy and the agent's effort.  $IWT$  equals 1 for the individual wage treatment and 0 for the equal wage treatment. Reported robust standard errors are adjusted for clustering within matching groups. Estimation results are shown in Column 1 of Table 3. The coefficients indicate that the effort-profit relation is indeed positive in both treatments. On average, an additional unit of effort increases the agent's profit under equal wages by 1.031 points. This coefficient is weakly significant. In the individual wage treatment the effort-profit relation is slightly steeper: an effort increase of 1 leads to an increase in agent's profit of 1.804 points ( $1.031 + 0.773$ ). The difference between treatments, however, is not significant.

We also estimate a second model where we control for the co-worker's effort  $e_j$  (see

Dep. Variable	$\pi_{A_i}$	$\pi_{A_i}$
$e_i$	1.031* (0.535)	0.854** (0.348)
$IWT \times e_i$	0.773 (0.615)	0.995* (0.469)
$cons$	5.927** (2.614)	-5.815*** (1.523)
$IWT$	-3.744 (3.235)	11.004*** (3.274)
$e_j$		2.774*** (0.280)
$IWT \times e_j$		-3.178*** (0.403)
N. Obs.	576	576
$R^2$	0.100	0.238

**Table 3:** Profit regressions. Robust standard errors are adjusted for clustered matching groups and are given in parentheses. For each firm, one observation per period is included in the analysis. The dummy “IWT” is equal to 1 for the individual wage treatment. Significance at the 10%, 5% and 1% level is denoted by \*, \*\*, and \*\*\*, respectively.

Column 2 of Table 3). The results indicate that the co-worker’s effort choice has a substantial impact on an agent’s profit under wage equality while it has a negligible influence if individual wages are paid. An increase in agent  $j$ ’s effort increases agent  $i$ ’s profit in a given period by 2.774 points in the EWT, while the (insignificant) influence in the IWT is  $-0.404$  ( $= 2.774 - 3.178$ ). However, it is still individually profitable for the agents to exert high efforts in the EWT. An additional unit of (own) effort increases the agent’s profit by 0.854 points.<sup>9</sup> Our findings concerning agents’ monetary

<sup>9</sup>One could object that subjects in the experiment did not have access to the analyses we just presented, because these are “ex-post” examinations while subjects only observed behavior and outcomes of their previous groups. We therefore calculate the profit-maximizing effort level for each agent in each period based on the information this subject actually has. If we assume that agents choose the effort level that was on average the most profitable of all effort levels they have observed so far, the calculations show that agents in the EWT could have increased their efforts and profits considerably

incentives can thus be summarized as follows.

**Result 3:** *The wages paid by principals imply similar monetary incentives in both treatments. A higher effort level leads to a higher profit in both treatments.*

### 3.3 The Importance of Equity

In light of the previous result, the strong differences in actual efforts and especially the low effort levels under equal wages are remarkable and stress the significance of non-pecuniary motivations for agents' performance. Agents under equal wages predominantly choose low efforts, thereby foregoing considerable profits. Apparently, equal wages are not reconcilable with agents' horizontal fairness considerations. On the other hand, agents under individual wages provide very high effort levels. Thus, *aggregate* behavior is consistent with the predictions of equity-concerned agents. We therefore focus our analysis of non-monetary motivations on the question whether *individual* behavior is also in line with a concern for the fulfillment of the norm of equity.

#### 3.3.1 Agents' Reactions to Norm Violations

We first analyze how agents react to a violation of the norm of equity. Equity theory argues that agents experience distress from inequity and take action to reduce it—which in our setup means to increase or decrease work effort. The direction of the effort adjustment should depend on the type of norm violation. An equity-concerned agent who works more but does not receive a higher payoff than his co-worker faces a *disadvantageous norm violation*. To restore equity, he can only decrease his effort. Analogously, his co-worker who exerts a lower effort and earns a higher profit faces an *advantageous norm violation* and should increase his effort.<sup>10</sup>

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even by using only their limited information. In the last period, the average profit-maximizing effort level exceeds the average actual level in that period by 61%. By contrast, the average actual effort levels of subjects in the IWT are very close to the profit-maximizing levels.

<sup>10</sup>More precisely, an advantageous norm violation comprises all cases when efforts are equal but profit is higher, or when effort is lower but profit is not. A disadvantageous norm violation occurs if efforts are equal but profit is lower, or if effort is higher but profit is not.

	Effort Down	Effort Constant	Effort Up	N. Obs.
EWT				
<i>No Violation</i>	19.1 %	54.4 %	26.5 %	68
<i>Adv. Violation</i>	12.2 %	43.5 %	44.3 %	230
<i>Disadv. Violation</i>	52.6 %	33.9 %	13.5 %	230
Total	30.7 %	40.7 %	28.6 %	528
IWT				
<i>No Violation</i>	19.2 %	51.8 %	29.0 %	448
<i>Adv. Violation</i>	45.0 %	27.5 %	27.5 %	40
<i>Disadv. Violation</i>	35.0 %	57.5 %	7.5 %	40
Total	22.3 %	50.4 %	27.3 %	528

**Table 4:** *Frequency of effort reactions.*

Table 4 shows how often agents decrease, increase or do not change their effort from period  $t$  to  $t+1$  after they experienced no, an advantageous or a disadvantageous norm violation in period  $t$ . The top panel of Table 4 reports data for the equal wage treatment. When the norm is fulfilled, most agents keep their effort constant (54%) and slightly more agents increase their effort than decrease it. After experiencing an advantageous norm violation, agents tend to increase their effort (44%) and only few reduce it (12%). The opposite is true after a disadvantageous norm violation: the majority of agents decrease their effort (53%) and only few increase their effort in the following period (14%). In line with equity theory these numbers suggest that agents change their effort provision in the direction that makes a violation less likely to occur in the next period.

Behavior in the individual wage treatment (bottom panel) is very similar to behavior in the EWT for the cases of no violation and disadvantageous violations. When the norm is not violated agents mostly keep their effort unchanged. After a disadvantageous norm violation efforts are decreased rather than increased, as in the EWT. The only difference between treatments is observed when agents experience an advantageous norm violation: agents in the IWT tend to decrease their effort while the EWT agents tend to increase it in this case.<sup>11</sup>

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<sup>11</sup>We checked the robustness of the reaction patterns in several ways. For example, it could be that

The pattern of individual reactions to norm violations indicates that agents care about equity; we therefore check next how often norm violations occur in the two treatments. We expected to see more norm violations in the EWT than in the IWT, because the equal wage institution forces principals to set wages that are not in line with the norm of equity whenever agents exert different efforts. This is indeed what we observe. While the norm is violated in 87% of all cases (460 out of 528) in the EWT, the figure for the IWT is only 15% of all cases (80 out of 528). Thus, even if individual reactions in a given situation are similar, agents in the EWT are far more often exposed to norm violations than agents in the IWT. Principals in the IWT seem to understand quite well that agents care about equity and use the possibility to set different wages in a sophisticated way. If efforts differ, they reward the more hard-working agent with a higher wage in 90% of these cases. If agents exert the same effort, principals pay equal wages in 90% of the cases.

**Result 4:** *Agents mostly react to disadvantageous violations of the norm of equity by reducing their effort and by increasing it after an advantageous norm violation. The norm of equity is far more often violated in the equal wage treatment.*

So far we have seen that agents' reactions are largely in line with the hypotheses of equity theory and that treatments differ with respect to the frequency of equity-norm violations. Yet, this is not sufficient to explain the treatment effect, since a norm violation is always advantageous for one agent and at the same time disadvantageous for the other one. If both agents adjust their effort in a similar way but in opposite directions the adjustments will cancel out. However, previous evidence suggests that reactions to a disadvantageous norm violation are stronger than reactions to an advantageous one (e.g., Loewenstein et al. 1989, Mowday 1991, Thöni and Gächter 2008). If this is the case, norm violations could explain the downward trend in the EWT and

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agents react differently to norm violations if they are paid very high or low absolute wages. However, performing the analysis only for agents receiving a wage out of the top or bottom quartile of the ex-post wage distribution does not alter the result. An implicit assumption of our analysis is that the gift-exchange relation is generally intact between principal and agent, i.e., that agents exert a non-minimal effort and that principals pay a positive wage. The results do not change if one restricts the analysis to these cases. Also if one defines gift exchange as requiring the agent's profit to be positive, i.e.  $w_i > c(e_i)$  instead of  $w_i > 0$ , the results are very similar.

the treatment difference in effort provision.

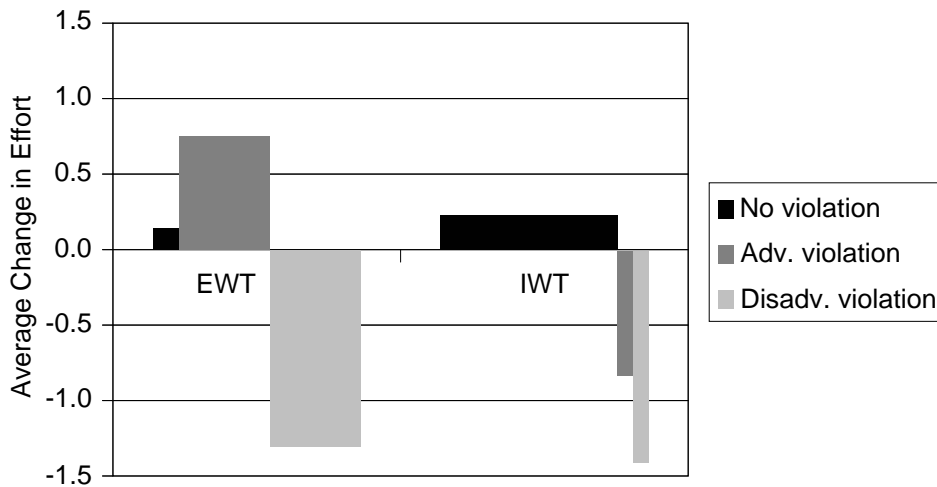
Figure 4 shows the average magnitude of changes in effort provision from period  $t$  to period  $t + 1$  after an agent experienced no norm violation, a disadvantageous or an advantageous norm violation in period  $t$ . The width of the bars corresponds to the number of observations in the respective category (cf. last column of Table 4). When the equity-norm is not violated agents tend to keep their effort constant or even slightly increase it. After a disadvantageous norm violation, agents in the EWT react strongly. They decrease their effort by 1.30. Their co-worker, experiencing an advantageous norm violation, increases his effort but not as strongly. He raises his effort by only 0.75. The difference is statistically significant (Wilcoxon test of the absolute values:  $p = 0.01$ ). In the IWT, both groups of agents experiencing a norm violation decrease their effort. The strength of reactions indicate that agents suffer more from a disadvantageous norm violation than from an advantageous one. This results in an overall decrease of efforts after a norm violation.

**Result 5:** *Agents' reactions to a violation of the norm of equity are asymmetric: the negative reaction of the disadvantaged agents is stronger than the reaction of the advantaged agents. This asymmetry in agents' reactions leads to an overall negative time trend in efforts for the EWT and in the strong treatment difference in effort.*

The analysis above suggests that agents care about equity and experience the equal wage scheme as unfair. Interestingly, even the principals consider the equal wage scheme as less fair. In the post-experimental questionnaire, principals were presented three hypothetical game situations that included effort choices, wage choices, and the resulting payoffs for all players. They were asked whether they considered the resulting allocation as just. One of the three situations reflected their own average behavior in the experiment.<sup>12</sup> The principals did not know that they were facing their own past decisions when answering the question. 63% of the principals in the IWT considered their own decisions fair while only 38% of the principals in the EWT shared this view

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<sup>12</sup>This situation was constructed as follows: We calculated the average effort of the higher-effort and of the lower-effort providers that the principals actually faced during the experiment. We then took the average of the wages the principals paid to the two groups. Finally, we calculated hypothetical payoffs for all three "average" players by considering the costs of the average efforts.



**Figure 4:** *Magnitude of effort reactions. The average change in effort from period  $t$  to period  $t + 1$  is shown given that the agent experienced no norm violation, an advantageous violation or a disadvantageous norm violation in period  $t$ . The width of the bars corresponds to the number of observations.*

(Mann-Whitney test on matching group shares:  $p = 0.03$ ).

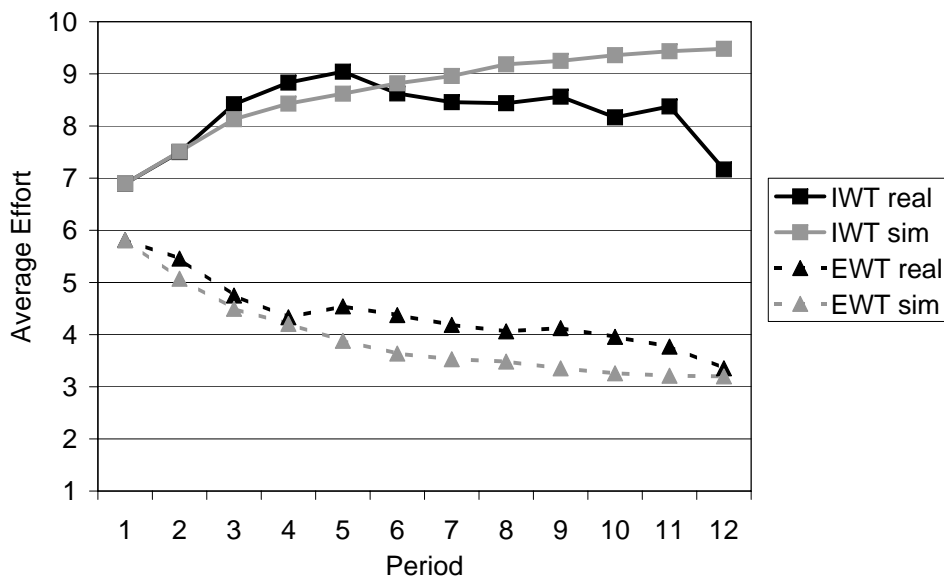
### 3.3.2 Simulation with Equity-Concerned Agents

We demonstrated above that horizontal fairness concerns shape agents' behavior under the two payment schemes. In combination with the frequent violations of the norm of equity in the EWT, this can explain the performance differences across treatments. In order to further illustrate how institutions and equity-concerns interact, we take our previous findings on agents' period-to-period reactions and link them to the aggregate dynamics in the experiment. We do so with a simulation in which all agents are assumed to derive utility from money, but to also suffer whenever the equity principle is not met. When deciding about their effort in a given period, the simulated agents compare their effort and profit in the previous period with the effort and profit of their co-worker in that period. According to the comparison along these two dimensions, four reactions can be distinguished for the simulated agents. (i) For an agent who had a higher effort and a higher profit, the norm of equity is fulfilled and the pecuniary comparison is also advantageous for him, so he keeps his effort constant. (ii) For an agent who exerted a lower effort and got a lower profit, the norm is satisfied but profit maximization is not, thus he partly adjusts his effort in the direction of his co-worker's

effort, i.e., he chooses an effort  $(e_{i,t} + e_{j,t})/2$ . (iii) An agent with higher effort and lower profit feels distressed as he suffers from a disadvantageous norm violation. He adjusts his effort fully and chooses  $e_{i,t+1} = e_{j,t}$ . (iv) Finally, for an agent with lower effort and higher profit the norm violation is advantageous, thus the resulting utility is higher than in case (iii). He chooses an effort  $(e_{i,t} + e_{j,t})/2$ . The reactions in cases (i) to (iv) are in line with the period-to-period reactions presented in Table 4 and Figure 4.

In the simulation, we use actual effort data from the experiment only for the first period. The subsequent effort decisions are based on the simulated profits and simulated efforts of the previous period. The simulated principals pay the average wage for a given effort (IWT) or the average wage sum for a given effort sum (EWT) as calculated from the experimental data. Profits are then calculated as wage minus cost of effort exertion. We use the same matching protocol as in the experiment.

Figure 5 shows how effort choices evolve over time in the experimental data and in the simulations. The simulations ‘*EWT sim*’ and ‘*IWT sim*’ trace the real data very well and are able to reproduce the large effort difference between treatments. In the individual wage simulation, efforts increase like the real efforts although the slight downward trend in the second half of the experiment cannot be reproduced. Efforts in the equal wage simulation constantly decrease down to an effort level slightly above 3 in the final period. This pattern is very similar to the dynamics in the real data.



**Figure 5:** Simulated efforts of agents adopting to equity-norm violations.



Note that the pivotal agent is different between the simulated treatments: in the equal wage simulation the norm of equity is violated when agents choose different effort levels. In these cases, the agent with the higher effort will fully adjust his effort in the direction of his co-worker’s effort while the co-worker will increase his effort level only to the average effort of the last period. In the EWT simulation, the average effort therefore converges to the lowest first period effort as agents are subsequently re-matched: the low-effort providers are pivotal. By contrast, in the IWT the high-effort providers have the decisive impact on the overall outcome. The norm of equity is mostly fulfilled in the IWT. Thus, the agent with the higher effort keeps his effort constant while his co-worker adjusts his effort. The average effort therefore converges to the highest first period effort. We will analyze this point in more detail in the next section.

**Result 6:** *Simulations based on agents who have preferences for money and equitable treatment are in line with the efforts observed in the experiment and are able to reproduce the observed treatment effect.*

### 3.4 Dynamics of High- and Low-Effort Providers

As already seen in Figure 2, subjects exhibit a substantial degree of heterogeneity with respect to effort provision. In the following, we analyze if the agents who are most or least willing to exert effort are affected differently by the two payment modes at hand. A common informal argument claims that equal wages will be especially detrimental to the motivation of high performers but clean empirical evidence is scarce. Furthermore, it is unclear how weakly motivated agents react to equal or individual wages. We also address the question whether high and low performers impact the overall results differently in the two treatments. The simulations presented in the previous section suggest that this could indeed be the case: in the EWT simulation, the low-effort providers are decisive for the final outcome while it is the high-effort providers in the IWT simulation.

To analyze these questions in the experimental data we classify agents according to their effort decision in the *first period*. We define the agent with the highest first-period effort in each matching group as “high-effort provider” and the agent with the lowest

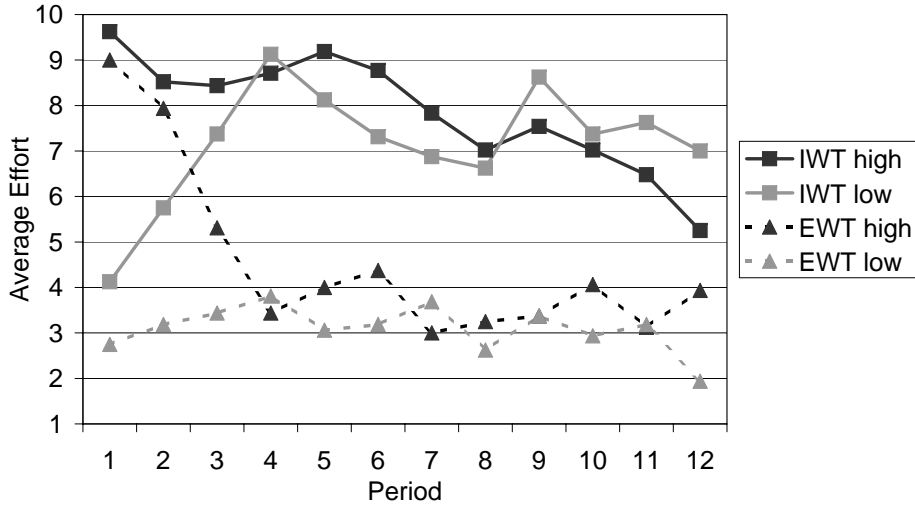
effort as “low-effort provider”. This type definition is chosen because when agents decide on their effort in the first period, they do not have any information about the behavior of other subjects and all learning and coordination processes occur after this initial effort choice. Thus first-period effort is likely to be a good proxy for the intrinsic willingness of a specific agent to exert effort. If some of the subjects are intrinsically inclined to exert high efforts they should show up in the group of high-effort providers. In contrast, if some of the subjects are intrinsically inclined to exert low efforts they should show up in the group of low-effort providers.

In Figure 6 we follow the high-effort providers and low-effort providers in both treatments and show their effort decisions over time. In the first period, the groups of high-effort providers and the groups of low-effort providers are close together across treatments.<sup>13</sup> This changes completely over the course of the 12 periods. In the individual wage treatment, high-effort providers continue to provide high effort levels. Low-effort providers increase their efforts dramatically up to the level of the high-effort providers and even higher in the last periods. In the equal wage treatment, the dynamics are reversed. Here, the low-effort providers keep their effort provision constant and the high-effort providers reduce their efforts to the level of the low-effort providers. In the last six periods, effort levels are not different within treatments (Wilcoxon signed rank test:  $p = 0.67$  (IWT),  $p = 0.78$  (EWT)) while they differ between treatments (Mann-Whitney test:  $p < 0.01$  (high-effort providers),  $p < 0.01$  (low-effort providers)). Put differently, the “good” agents push the “bad” agents up under individual wages while under equal wages the “bad” ones pull the “good” ones down.

These dynamics underline the importance of the different non-monetary motives induced by the two wage setting institutions. Remember that agents face similar monetary incentives in both treatments, but wage equality often violates the norm of equity. Agents in this treatment who are in principle willing to exert high levels of

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<sup>13</sup>First period’s effort levels are not significantly different between treatments for high-effort providers (Mann-Whitney test:  $p = 0.14$ ) while they are close together but different for the low-effort providers (Mann-Whitney test:  $p = 0.03$ ). Within treatments, the high-effort and low-effort providers choose statistically different effort levels in the first period (Wilcoxon signed rank test:  $p = 0.01$  (IWT),  $p = 0.01$  (EWT)).



**Figure 6:** *Effort decisions of high-effort and low-effort providers. In each matching group, the agent with the highest (lowest) effort in the first period is defined as the high (low)-effort provider.*

effort seem to get frustrated and lower their efforts. On the contrary, under individual wages where the norm of equity is intact, good performance spreads. These results suggest that choosing a wage scheme also influences the social dynamics between the agents. In our experiment, individual wages lead to positive dynamics since agents orientate themselves by the most hard-working agents. In contrast, the equal wage scheme focuses agents’ attention on the least motivated agents.

**Result 7:** *The pivotal agent is different between treatments: in the IWT, agents who initially provide low effort align with the high-effort providers over time. In the EWT, agents who initially provide high effort align with the low-effort providers over time.*

### 3.5 The Role of Intentions

So far, we interpret our results as supporting the notion that subjects care about the norm of equity. However, by design our treatments necessarily differ in the number of instruments that a principal has at hand. In the EWT, principals only choose a single wage—whereas principals in the IWT decide on two wages and consequently can tailor reactions individually to agents’ preceding choices. Therefore, agents might attribute a different degree of intentionality to principals’ decisions: in the EWT, the

role of intentions is limited to the level of the wage. The IWT contains an additional element of intentionality because principals also decide on relative wages and consequently whether the equity norm is fulfilled or violated. In light of the literature that stresses the behavioral importance of intentions in situations of reciprocal interaction (e.g., Dufwenberg and Kirchsteiger 2004, Falk et al. 2008a), there is thus a potential alternative explanation for our treatment effect. In other words, one might speculate that the difference is not caused by the different frequency of norm fulfillment *per se*, but rather by the additional element of intentionality.<sup>14</sup>

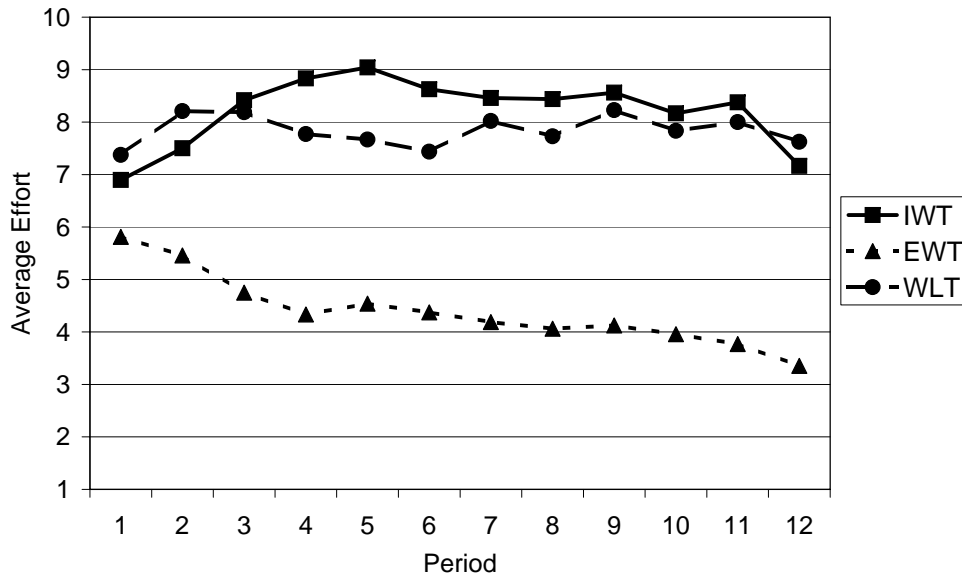
To test this alternative explanation, we conducted an additional control treatment (*wage level treatment* or WLT) that clearly isolates the effect of norm fulfillment on agents' effort choices. As in the EWT, principals in the WLT only choose a single wage. The other agent's wage is then exogenously set by a computer program such that the equity norm is always fulfilled, i.e., agents who exerted a higher effort than their co-worker automatically receive a higher payoff. This is common knowledge. Importantly, this implies that the fulfillment of the equity norm is not attributable to principals' decisions. Except for this change of the wage-setting institution, the instructions and the experimental design were identical to the previous treatments. The 72 subjects who participated in the four additional sessions had not previously taken part in the IWT or the EWT.

The specific equity norm implemented in the WLT experiments dictates proportionality between agents' monetary payoffs and efforts. We chose this "equity formula" as it is probably the most prominent formulation of the equity principle (see Section 2.2). Given a principal's decision for the low-effort agent, the wage for the high-performing agent is exogenously fixed such that both agents receive the same payoff per unit of effort provided, i.e.,  $(\pi_{\text{low}}/e_{\text{low}}) = (\pi_{\text{high}}/e_{\text{high}})$  holds. For example, if the principal observes efforts of 2 and 6 and sets the wage for the low-effort provider to be 5, the payoff of this agent is  $5 - c(2) = 4$  (compare Table 1). Following the equity formula, the payoff of the high-effort provider will then automatically be set to  $(4/2) \cdot 6 = 12$ ; which implies a wage of 20 after taking the cost of providing 6 units of effort into account.<sup>15</sup>

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<sup>14</sup>We thank the Editor, Patrick Bolton, and an anonymous referee for pointing this out.

<sup>15</sup>The equity formula leads to counterintuitive implications whenever negative values for the inputs



**Figure 7:** *Average effort per treatment.*

The wage-setting institution in the WLT is not meant to be an analog of institutions found in actual labor markets, as it is the case for the IWT and the EWT. It exogenously implements the incentive structure that is endogenously created by principals in the IWT.<sup>16</sup> If we observe similar efforts in the WLT as in the IWT we can rule out intentions as an explanation for the difference between our two main treatments, IWT and EWT.

Figure 7 compares agents' mean effort choices over time for all three treatments. As can be seen, the exogenous implementation of the equity norm suffices to elicit or outcomes are possible. Therefore, if in our experiment the efforts differ and the principal's choice of  $w_{\text{low}}$  implies  $\pi_{\text{low}} \leq 0$ , the other agent's wage is instead set such that  $\pi_{\text{high}} = \pi_{\text{low}} + 5$ . This guarantees that the norm of equity is fulfilled for all possible wage-effort combinations. Nevertheless, the high-effort agent still faces the risk of making losses whenever the low-effort agent gets a negative payoff.

<sup>16</sup>As shown in Result 3, the monetary incentives in the IWT imply that profit-maximizing agents should provide non-minimal effort levels. As a consequence of exogenously implementing these implicit incentives in the WLT, new subgame-perfect Nash equilibria necessarily arise. Our focus of interest, however, rests on the comparison of the observed behavior across treatments rather than on comparing behavior to the game-theoretical equilibrium predictions. For a similar approach of "exogenizing" endogenous incentives to test for the impact of intentions, compare for example Blount (1995), Charness (2004), or Cox (2004).

high efforts from the agents. The average effort difference between the WLT and the IWT of only 0.36 is insignificant (Mann-Whitney test:  $p = 0.83$ ). Compared to the EWT, efforts are on average 3.44 units higher in the wage-level treatment (Mann-Whitney test:  $p < 0.01$ ). As in the IWT, efforts do not decrease over time in the WLT (Wilcoxon test for periods 1–6 against 7–12:  $p = 0.44$ ). Also the distribution of efforts in the WLT closely resembles the one in the IWT. Under both treatments, the modal choice is the provision of maximum effort. In the WLT, an effort level of 10 is chosen in 46.5% of all cases, compared to 49% in the IWT.

**Result 8:** *The wage level treatment shows that the treatment difference between the IWT and the EWT is not caused by the fact that principals can set two wages instead of one per se. Differences in equity norm fulfillment—independent of intentionality—seem to be the driving force behind agents’ performance.*

Taken together, the results from the additional control treatment corroborate our previous findings. They suggest that the observed performance differences are not driven by the differing degree of intentionality across treatments. This, of course, does not imply that intentions are unimportant in general; however in our setup, treatment differences are almost exclusively driven by equity considerations.

## 4 Conclusions

In this paper, we studied the interaction of gift exchange with different payment modes; more specifically, we analyzed how horizontal fairness concerns of employees affect the effectiveness of gift exchange as a contract enforcement device. In our experiment, one principal is matched with two agents. The principal pays equal wages in one treatment and can set individual wages in the other. The use of equal wages elicits substantially lower efforts and efficiency in spite of similar monetary incentives: exerting high effort pays off under both wage schemes. The strong treatment difference seems to be driven by subjects’ preferences for horizontal equity and the fact that the equity principle is frequently violated in the equal wage treatment. This is not the case in the individual wage treatment, as principals set wages almost always in line with the norm of equity.

The results of a control treatment support the notion that indeed norm fulfillment per se and not different degrees of intentionality are the driving force behind agents' behavior.

Our results have a number of implications, both for the advancement of existing theories and for the design of wage schemes in practice. First of all, while it is well-known that equal wages can distort monetary incentives, in our experiment they are efficiency decreasing *even though* individuals' monetary incentives are qualitatively not affected. Rather, equal wages oftentimes lead to situations which are considered as unfair by the workforce. This holds in particular because agents are heterogeneous and equal wages violate the equity principle whenever workers differ in their performance. It may thus be oversimplifying to argue that equal wages lead to less envy and therefore higher work morale, as it is frequently done in the political discussion.

In this regard, it is doubtful whether strict wage equality can be reconciled with the use of reciprocal gift exchange to enforce incomplete contracts. Our findings suggest that adherence to the norm of equity is a necessary prerequisite for a successful gift-exchange relation. Consequently, the wage setting institution must provide principals with means to account for possible differences in agents' behavior, e.g., to individually reward agents who outperform their co-workers. The performance of agents in the individual wage treatment and in the wage level treatment shows how effective gift exchange can be, as long as horizontal equity concerns are respected: although explicit contract enforcement is absent, 80% of the possible efficiency gains are realized.

In practice, the discretion to fulfill the norm of equity does not have to be in monetary terms. Perks and non-monetary benefits like extra vacation or awards can be useful devices to motivate workers in this context. These instruments become especially important when it is not possible to wage discriminate on a given hierarchical level, e.g., because the firm's internal pay structure, agreements with a union or legislation dictate wage equality.

The results in this paper should not be interpreted as arguments against wage equality in general. They rather suggest that equal wages come at a cost that has to be weighed against their potential benefits. For example, equal wages are easier to implement than individual wages, and they may encourage peer monitoring and

collaboration. The relative importance of these costs and benefits (and also the impact of the workforce's social preferences more generally) is likely to depend on the details of the institutional setting. These include the production technology, the information structure, and the organizational design of the firm. In this paper we presented results for one such setting. Our design provides a simple and parsimonious framework that can successively be enriched to study these aspects in future research.



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