WORKING PAPER SERIES

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Karina Gose/Abdolkarim Sadrieh

Working Paper No. 8/2013

OTTO VON GUERICKE
UNIVERSITÄT
MAGDEBURG

FACULTY OF ECONOMICS
AND MANAGEMENT

Impressum (§ 5 TMG)

Herausgeber:
Otto-von-Guericke-Universität Magdeburg
Fakultät für Wirtschaftswissenschaft
Der Dekan

Verantwortlich für diese Ausgabe:
Karina Gose and Abdolkarim Sadrieh
Otto-von-Guericke-Universität Magdeburg
Fakultät für Wirtschaftswissenschaft
Postfach 4120
39016 Magdeburg
Germany

http://www.fww.ovgu.de/femm

Bezug über den Herausgeber
ISSN 1615-4274

Strike, coordination, and dismissal in uniform wage settings

Karina Gose* and Abdolkarim Sadrieh†

University of Magdeburg

March 2013

- revised January 2014 -

Abstract

We study a gift exchange game with 12 employees and one employer. When the employer can offer individually differentiated wages in a setting without collective action, we observe high levels of wages, effort choices, and total earnings. When the employer is restricted to offering a uniform wage, trust and reciprocity drop dramatically due to widespread shirking. The stepwise introduction of two collective action mechanisms, strike and coordination, increases the employees' share of the total earnings, but does not mitigate the free-riding problem. Adding employment risk to the collective action setup drives up wages, reduces free-riding, and leads to higher total earnings. However, this increase in productivity is not sufficient to achieve the high levels of wages, efforts and earnings that we observe with individually differentiated wages.

Keywords

fair wage-effort hypothesis, efficiency wages, wage compression, labor unions, unemployment

JEL Codes

C92, D23, J33, M52

Acknowledgements

We are thankful for the comments and suggestions from the audiences at the research seminars of the Paris School of Economics and of the University of Duisburg-Essen, as well as from the participants of the ESA 2012 Meeting in Cologne, the IMEBE 2013 in Madrid, and the Florence Workshop on Behavioural and Experimental Economics 2013. We are also grateful for the hospitality of the Rady School of Management, UC San Diego, where large parts of this paper were written. We are especially indebted to Steven Keary for programming the experimental software and assisting during the experimental sessions. Financial support from the Deutsche Forschungsgemeinschaft is gratefully acknowledged (DFG SA 1350/3-1).

* karina.gose@ovgu.de – Faculty of Economics and Management, University of Magdeburg, PO Box 4120, 39016 Magdeburg, Germany

† sadrieh@ovgu.de – Faculty of Economics and Management, University of Magdeburg, PO Box 4120, 39016 Magdeburg, Germany

"*Up in Seattle, the leadership deals with the union. That's how they negotiate with employees. Here we are developing a culture of trust and respect.*"
Jack Jones, vice president and general manager of Boeing South Carolina, 2012

1. Introduction

When Boeing started its new high-tech production site in South Carolina, Jack Jones, vice president and general manager of Boeing South Carolina, described Boeing's new approach to labor relationships as "[…] a culture of trust and respect," which he contrasted with the earlier approach of mainly dealing with organized labor (Peterson 2012). The two approaches that Jack Jones refers to are distinct, because in one the employer directly bargains with the individual workers, while in the other the employer bargains with a collectively deciding workforce. Switching from organized labor settings to gift exchange systems (Akerlof 1982), in which employers trust employees to reciprocate to fair wages with correspondingly fair effort choices, seems to be a general trend in industrial production (Greenhouse 2013).

The main goal of this study is to identify the role of gift exchange for behavior in multi-worker firms with and without collective action mechanisms. Most of the previous behavioral studies on gift exchange in labor relations focus on bilateral work relationships and find clear evidence for reciprocal behavior (Charness and Kuhn 2007, Brown, Falk, and Fehr 2004, Gächter and Falk 2002, Fehr, Kirchsteiger, and Riedl 1993). The few studies that are available on gift exchange in multi-worker settings find similar evidence on reciprocal behavior, but do not consider the effect of collective action mechanisms (Abeler et al. 2010, Brandts et al. 2010, Gächter and Thöni 2010, and Maximiano, Sloof, and Sonnemans 2007).

Since labor relationships in the field are under numerous varying influences that make it almost impossible to isolate and identify causal relationships, we use a controlled lab experiment to assess the behavioral effects that we are interested in. We start with a control treatment and vary the parameters of labor contracts and collective action mechanisms. This systematic approach allows us to isolate the effects of each of the features on wages, effort choices, and payoffs.

Our basic model (*Free Wage*) consists of a 12-worker gift exchange game, in which the employer offers individual wages to each of her 12 employees, who can either reject or accept the offer and provide costly effort.[1] In each of the 12 bilateral work relationships, the employ-

[1] WLOG, we use female pronouns to refer to the employer and male pronouns for the employees.

er earns the residual value of the output after paying the wage. She can incur a loss, if the wage paid is greater than the effort provided by the employee.

In our first treatment variation (*Uniform Wage*), the employer can no longer differentiate wages, but has to offer a uniform wage to all employees. In two further treatments, we integrate collective action mechanisms into the uniform wage treatment. In *Strike*, the employees can collectively reject the uniform wage offer, in which case no production occurs and no wages are paid. If the wage offer is not collectively rejected, the game continues as in *Uniform Wage*. In *Coordination*, an effort coordination mechanism is introduced that allows the employees to coordinate on a non-binding effort or a non-binding strike suggestion. Thereafter, the game proceeds as in *Strike*. In the fifth treatment (*Dismissal*), we introduce employment risk to the coordination setting. Whenever the employer incurs overall losses, she chooses one of the work relationships that is then terminated.

In our basic 12-worker setting with bilateral contracts, we find strong support for reciprocal behavior that is in line with earlier findings from smaller games. Interestingly, gift exchange breaks down when the employer cannot differentiate wage offers in the uniform wage treatments. Analyzing the effort choice behavior of the employees in the uniform wage setting, we find that the employer's trust breaks down due to the large extent of free-riding behavior among the employees. While the collective action mechanisms significantly increase the fraction of the total earnings appropriated by the employees, they cannot alleviate the free-riding problem. Introducing employment risk to the game, however, reinstalls the employer's trust in the employees' reciprocity. Compared to the case of collective action without employment risk, the dismissal mechanism induces higher wages and efforts and leads to greater total earnings at the price of sustained unemployment.

The remainder of the paper is structured as follows: In section 2 we introduce the related literature on gift exchange and collective action. In section 3 we describe the experimental design including the game, the procedure, the treatments, and the hypotheses. In section 4 we discuss our results before concluding in section 5.

2. Related Literature

The fact that wages above the market equilibrium are often observed in labor markets led to a number of influential models of behavior in labor relationships. The "efficiency wage" concept (Shapiro and Stiglitz 1984) claims that workers are paid wages above the market equilibrium wage to ensure that remaining in the work relationship and providing effort dominates the outside option of accepting another job at market equilibrium wage (or being unem-

ployed). In fact, a number of experimental studies show that fear of exclusion (or ostracism) can induce sustained high levels of voluntary contributions in public goods settings (e.g. Cinyabuguma, Page, and Putterman 2005; Maier-Rigaud, Martinsson, and Staffiero 2010). Brown, Falk, and Fehr (2014) find that the threat of dismissal into unemployment induces employees in an experimental setting to exert more effort than the minimum level required.

Many employers, however, do not agree that the threat of dismissals (i.e. risk of unemployment) contributes to increased workers' morale, which they believe is crucial to work performance (Bewley 1999). On the contrary, they often believe that positive incentives, e.g. wage hikes, can enhance the workers' morale and effort provision, as proposed by Solow (1979) and elaborated by Akerlof (1982) and Akerlof and Yellen (1990). The concept of gift exchange in labor relationships is in line with some evidence from complex field data (e.g. Collard and de la Croix 2000) and is also supported in various controlled laboratory experiments (e.g. Fehr, Kirchsteiger, and Riedl 1993). In controlled field experiments the evidence is mixed. While some studies find evidence for reciprocal wage-effort relationships (e.g. Kube, Maréchal, and Puppe 2012), others only find workers' negative reciprocity to wage cuts (e.g. Kube, Maréchal, and Puppe 2013) or report that workers' positive reciprocity to high wages quickly disappears over time (Gneezy and List 2006). Hennig-Schmidt, Rockenbach, and Sadrieh (2010) compare field and laboratory experiments and conclude that workers' reciprocity in the field is often hampered (or dampened) by the lack of information concerning the profitability of their work effort for the employer.

Positively reciprocal behavior is also observed in multi-worker gift exchanges games (Brandts et al. 2010, Maximiano, Sloof, and Sonnemans 2007). But, some questions remain. Using a slightly different experimental design, in which workers first provide effort, before being paid a uniform wage, Abeler et al. (2010) find substantially lower effort choices than usually observed in the standard experimental setup. They conjecture that workers provide little effort to avoid being relatively worse off than their co-workers. Other studies conclude that uniform wages (or the compression of wages) may increase effort provision, by increasing worker morale and the harmony among employees (Lazear 1989).

Unionization is usually inseparably connected to the concept of equal pay. A sophisticated body of literature on the topic of labor unions has emerged over the last decades. While there is consensus that unionization leads to lower wage dispersion (e.g. Freeman 1980, Slichter, Healy, and Livernash 1960), the evidence on the influence of unions on firm performance remains ambiguous. Some studies find a positive effect of unionization on productivity (Allen 1984, Clark 1980a, 1980b, Brown and Medoff 1978). Bulkley and Myles (1996) propose a

model with efficiency wages in which unionization increases both wages and productivity. However, other studies provide contrasting evidence. Doucouliagos and Laroche (2003) show that unionization in the U.K. has had negative effects on productivity, while in the U.S. it has not. Doucouliagos and Laroche (2009) later find negative effects even for U.S. data. Vedder and Gallaway (2002) provide similar evidence for the U.S., claiming that unionization has had harmful aggregate effects on the economy and that unions are associated with lower rates of growth in income and jobs. They even point out that labor moves from union-intense areas to areas with relatively low rates of unionization. Schnabel (1991) and Laroche and Wechtler (2011) find a negative effect of unions on firms' profits in Germany and France.

3. Experimental design

We conduct a laboratory experiment using a classical gift exchange game to compare wage and effort choice behavior in treatments with and without uniform wages, collective actions, and employment risk. In the following, we first introduce the 13-player game with one employer and 12 employees. Then, we describe the experimental procedure and give a detailed description of the treatments and the hypotheses.

3.1 The game

We study a gift exchange game with one employer and 12 employees. The employer can incur a loss in this variant of the game, if the sum of wages paid is greater than the total productivity of the employees.[2] The employer is in 12 independent work relationships, one with each employee. In the first stage of the game, the employer submits a wage offer $w_i \in [0,100]$ to each employee i, $i=1 \ldots 12$. After the employees receive the wage offers, each employee either rejects $r_i=1$ or accepts $r_i=0$ the offer. In case an employee rejects the wage offer, neither the employer nor the employee receives earnings from their work relationship. (The employer can, however, receive earnings from her work relationships with the other employees.) In case the employee does accept the wage offer, he chooses an effort level *e* between 10 and 100 and incurs a non-linear, monotonously increasing cost of effort *c(e)* with the values displayed in table 1.[3]

[2] Brown, Falk, and Fehr (2004) use a similar game with two players but in a market situation. Gose and Sadrieh (2012) use a two player variant without a market situation. Maximiano et al. (2007) use a five-player version of the game with one employer and four employees but without a labor market, providing the employer with a lump sum payment that was high enough to cover any potential loss.

[3] The cost of effort schedule that we use corresponds to the schedule used in most of the experimental gift exchange literature following Fehr, Kirchsteiger, and Riedl (1993).

Table 1: Cost of effort schedule

Effort *e*	10	20	30	40	50	60	70	80	90	100
Cost of effort *c(e)*	0	1	2	4	6	8	10	12	15	18

The employee i earns $w_i - c(e_i)$, if he accepts the wage offer and 0 if he rejects the wage offer. The employer earns the sum of the efforts minus the wages paid in all work relationships, in which the contracts were accepted:

$$\Pi_{\text{employer}} = \sum_{i=1}^{12} (e_i - w_i) \cdot (1 - r_i)$$

Note that after the production is completed, the employer observes all effort levels chosen by the employees, as well as the wages, the incurred cost of effort, and the payoffs. Each employee observes his own wage, his cost of effort, as well as his own and the employer's payoff. The employees, however, do not observe each others' individual wages, effort choices and payoffs.

As in all gift exchange games of this type, the only strict subgame perfect equilibrium of our game consists of wages set at the smallest positive value (1 in our experiment) and effort choices at the smallest possible level (10 in our experiment). This holds for all the treatments that we study.[4]

3.2 Experimental procedure

We recruited subjects using the Orsee platform (Greiner 2004). All participants were university students, who had at least a minor in economics or management. Participants were randomly assigned to visually isolated cubicles in the laboratory and had no possibility to identify each others' roles in the experiment.

To determine the role of the employer, subjects answered six standardized multiple-choice questions from the GMAT catalogue within a five minute time limit. The subject who scored best was assigned the role of the employer.[5] Ties were broken by a random draw. Instructions

[4] There are also two non-strict subgame equilibria with wages at zero and either effort levels at the minimum or contract rejection. Given that the players can be sure to earn positive payoffs in the strict equilibrium, but cannot in these non-strict equilibria, it seems unlikely that the non-strict equilibria are relevant.

[5] This procedure was used in all treatments, ensuring internal validity. We chose to allocate the role of the employer merit-based to avoid a situation in which the employees refuse to exert effort, because they believe that the employer is not entitled to reaping the earnings from 12 work relationships. When comparing the results of our baseline treatment to the literature, however, we do not find any indication that our procedure induced structurally different behavior. Furthermore, since the subjects are not informed about each others' GMAT scores, rank comparisons cannot affect behavior.

were given in two parts. The first part contained information about the selection process using the GMAT questions. Subjects were not aware of the game that followed, but were told that scoring higher in the GMAT selection would increase their chances of earning more later on. In fact, being the employer in our game means having 12 opportunities to earn payoff in work relationships, whereas employees only have a single work relationship to earn payoffs. (Note that in equilibrium the employer earns 108 times more than an employee.)

After the GMAT selection procedure, instructions for the main part of the experiment were distributed to the subjects and read aloud. Subjects' questions were answered individually in the cubicles according to standard protocol that allowed only explanations of the game but no suggestions on behavior or outcomes.

The main part of the experiment was computerized using z-Tree (Fischbacher 2007). The game was played for 15 rounds in the same matching groups. The sum of earnings over all rounds was paid individually to each participant after the experiment. The exchange rate of experimental points to Euros was 1 to 0.02, i.e. 1 Euro for 50 points.[6] Each session lasted about 75 minutes with earnings ranging between 1.30 Euro and 44.90 Euro depending on treatment and role.

3.3 Treatments and Hypotheses

Our study consists of five treatments (see table 2). With the first two treatments we compare behavior in an efficiency wage setting with multiple employees and discriminatory wages (*Free Wage* treatment) to one with uniform wages (*Uniform Wage* treatment). In the third and fourth treatment, we introduce collective action opportunities to the game. Finally, in the last treatment we introduce employment risk for the employees in the case the employer's total earnings are negative.

We planned and conducted the same number of independent observations in every treatment. In some sessions, however, an employer went bankrupt. Losses are possible in our experimental design, if the employer chooses very high wages, but the employees do not reciprocate with high effort choices. While most employers with losses from a certain round or a certain work relationship recouped these losses during a session (in other rounds or in other work relationships), four employers (two in *Coordination*, one in *Uniform Wage* and one in *Strike*) ended the entire session with a loss that they could not recoup. We decided to take these four

[6] The exchange rate of US-Dollars to Euros at the time was on average 1.338.

firms out of the data analysis, because the employer's anticipated bankruptcy may have had distorted incentives in those groups.

Table 2: Treatments

Treatment	Wages	Collective action	Employment risk	# subjects	# ind. obs.
Free Wage	Discriminatory	None	None	104	8
Uniform Wage	Uniform	None	None	91	7
Strike	Uniform	Strike	None	91	7
Coordination	Uniform	Strike and coordination	None	78	6
Dismissal	Uniform	Strike and coordination	in case of employer's negative total earnings	104	8
Total				468	36

In *Free Wage* employers are in 12 distinct and independent work relationships. For each of these work relationships the employer independently specifies a wage and the employees choose their effort after observing the wage offer. Each employee only observes his own wage offer, his own effort, his own payoff and the employer's total earnings in each round. The set-up is very similar in *Uniform Wage*, except that the employer must specify the same wage offer for all 12 work relationships. The two treatments are related to the multi-worker treatments in Abeler et al. (2010) and Maximiano, Sloof, and Sonnemans (2007), but different in a few important ways. In Abeler et al. (2010) the sequence of choices is reversed with employees first choosing efforts and the employer then choosing pay. Additionally, their setup is different from ours in that their work relationships are not completely independent, but interconnected through disclosure of information on wage and effort choices. In Maximiano et al. (2007) the sequence of actions is the same as in our case, but the game is played only once in a uniform wage setting without a free wage control. While Maximiano et al. (2007) find wages and wage-effort relationships to be similar when comparing bilateral work relationships in one- and four-worker settings, they do not provide a picture of the development of wages and wage-effort relationship over time. As Abeler et al. (2010), however, have shown, efforts and wages can dramatically fall over time in uniform wage settings. Taking the results of the two previous studies together, we arrive at the following two hypotheses:

H1: Wages, efforts, and payoffs are higher in Free Wage than in Uniform Wage.

H2: Wages and efforts decrease in Uniform Wage over time.

In the first of the collective action treatments (*Strike* treatment) the employees can vote to collectively reject the employer's uniform wage offer. We implement the strike decision by asking each employee to vote for or against the collective wage rejection. If a majority of em-

ployees (strictly more than 50 percent) votes for a strike (i.e. the collective rejection of the offered wage) all employees and the employer receive zero payoff for this round of the game.[7] We are not aware of any previous studies that analyze the effect of strikes in efficiency wage settings. Generally, strikes are assumed to enhance the bargaining position of the employees, thus, to increase the uniform wage offers and the employees' earnings (e.g. Stewart 1990). Our experimental setup in fact enables employees to use the strike option in early rounds in order to enforce wage hikes for later rounds. Hence, our third hypothesis is:

H3: Wages and employees' payoffs are higher in Strike than in Uniform Wage.

While *H3* stipulates that strikes increase employees' bargaining power, forcing employers to pay higher wages, there is no reason to believe that strikes will mitigate the free-rider problem among the employees. Hence, we have reason to believe that we will observe a decline of wages and efforts in *Strike* just as in *Uniform Wage* (see *H2*):

H4: Wages and efforts decrease in Strike over time.

In the empirical literature on organized labor in the field, we can find both accounts of productivity increases and decreases due to the establishment of collective action opportunities (e.g. Doucouliagos and Laroche 2003, 2009, Bulkley and Myles 1996, Allen 1984, Clark 1980a, 1980b, Brown and Medoff 1978). Since we find no clear connection between the strike option and productivity, but find evidence reporting the benefits of effort coordination (e.g. Duncan and Stafford 1980), we introduce the second collective action treatment. From the point of view of behavioral economics, effort coordination may be favorable for effort enhancement in a multi-employee setting, because it reduces the strategic risk of being exploited by free-riding co-workers. Abeler et al. (2010) argue that a lack of effort coordination in combination with horizontal fairness concerns among employees is the main reason for effort level deterioration in uniform wage settings.

In the second collective action treatment (*Coordination* treatment) an effort coordination stage is added to the game in order to provide employees with an effort coordination tool. After receiving the wage offer, each employee in this treatment votes either for a collective rejection of the wage offer (i.e. votes for strike) or submits an effort level that he suggests as appropriate for the given wage offer. The highest effort level (including the strike option) that is ac-

[7] Note that in the strict subgame perfect equilibrium, strikes are not observed, because in any subgame with a positive wage offer, accepting the offer and exerting minimum effort is more profitable than striking. Note, however, that as in most median voter games, other Nash equilibria (not subgame perfect) may exist, in which collective action is sustained by a non-marginal majority, because any individual deviation only affects the size of the minority vote, but not the outcome.

ceptable for the majority of the employees is shown to all employees as a non-binding effort suggestion. If the majority of employees votes for a strike, the strike is not automatically implemented but shown as the majority vote. If after the vote, the majority of employees chooses the reject the wage offer, a strike is implemented exactly as in the treatment *Strike*. Given the coordination option, we expect to observe a lower variance in the employees' effort choices:[8]

H5: Variance of efforts is lower in treatments with a coordination mechanism than in treatments without.

H6: Effort and wage choices show a smaller tendency to fall over time in treatments with a coordination mechanism than in treatments without.

Since employment risk is an essential ingredient of labor relationships, we introduce our last treatment (*Dismissal* treatment), in which a dismissal option is added to the setup used in *Coordination*. The dismissal option specifies that one of the employees is laid off in each round, in which the employer's total earnings are negative. In the case of negative total earnings the employer is asked which employee's labor contract she would like to terminate. The laid off employee remains out of work for all remaining rounds of the experiment, but receives an unemployment benefit of 5 points per round.[9] Note that although the unemployment benefit is greater than the equilibrium wage, it does not disrupt the equilibrium, because there are no employer losses and, thus, no layoffs in equilibrium.

Obviously, if negative employer earnings are observed over the course the experiment, the number of work relationships drops below 12 and unemployment rises.[10] As the number of terminated work relationships increases, the total productive capacity of the firm decreases.[11] Note, however, that the firm's productivity and the employer's earnings may actually increase, depending on the relationship between wage and effort in the remaining relationships compared to the situation before dismissal.

[8] The coordination mechanism may reduce the variance in effort choices due to conformism based on conditional cooperation (Fischbacher/Gächter/Fehr 2001). In our game conditional cooperation suggests that employees prefer to exert effort to the same degree as others do. This drives effort choices towards the suggested level.

[9] We chose the unemployment benefit to be the smallest possible equal distribution wage in a single work relationship.

[10] In order to avoid an easy identification of the unemployed due to their inactivity in the lab, we asked them to indicate their estimate of the suggested and chosen median effort for the offered wage in each round.

[11] The automatic dismissal of one employee that we chose to implement has the advantage that the employees' beliefs concerning the timing and the extent of dismissals are controlled. We did not have a pool of excess subjects who would replace the dismissed, because in our collective action setting, adding subjects with different amounts of experience would have made comparisons more difficult and biased concerns for fairness.

The dismissal mechanism clearly increases the bargaining power of the employer by giving her the choice which employee to dismiss. But, note that by dismissing an employee the employer also loses the possibility to earn payoffs from the work relationship she terminates. Hence, dismissal has potentially negative payoff effects both for the employer and the employees. However, given the fact that the risk for the employer concerns only one of many work relationships, while the risk for the employee concerns his only work relationship, we hypothesize that dismissal will have a strong incentive effect on employees, leading to higher effort level choices:

H7: Effort levels are higher in Dismissal than in the other treatments with uniform wages.

Although the threat of dismissal remains in place throughout all rounds except the last, the negative consequences of dismissal fall over time, until they fade out in the last round. Hence, we can conjecture that any positive effect of the dismissal mechanism on effort choices will gradually wear off:

H8: Effort choices show a tendency to fall over time in Dismissal.

4. Results

4.1 Development of wages and effort choices

Figure 1 displays the average effort and wage choices in *Free Wage* and *Uniform Wage*. Additionally, the graphs show average minimum and maximum effort in each of the two treatments. It is immediately clear that average wages and average effort levels in *Uniform Wage* are substantially lower than in *Free Wage*. The differences are significant for both variables already in the first round (one-sided U-test, $p = 0.004$ for effort choices and $p = 0.06$ for wages) and increase over time (one-sided U-test, $p = 0.001$ for effort choices and $p = 0.003$ for wages), as both variables fall in *Uniform Wage* but are sustained or rise slightly in *Free Wage*.[12] The significant first round difference in wages seems to indicate that the employers in *Uniform Wage* were expecting to see lower average effort levels than the employers in *Free Wage*. As can be seen in table 3, the substantially lower productivity in *Uniform Wage* leads to substantially lower payoffs for the employers and employees when compared to *Free Wage* (one-sided U-test, $p = 0.01$ for employees and employers). Given these results, *H1* is fully supported.

[12] Our statistical tests are based on rounds 1-14 to avoid a bias due to end-effects. All reported treatment differences remain unchanged in quality and differ only slightly in quantity if we include round 15 in our tests.

We test *H2* by running separate rank correlation analyses for each of the independent observations in the two treatments. We find that the rank correlation coefficients for wages over time are neither significantly positive nor significantly negative in *Free Wage* and in *Uniform Wage* (one sample median test on rank correlation coefficients, not significant at 5% level). We find similar results for the correlation of effort choices to time, which shows no significant effect in *Free Wage* and in *Uniform Wage* (one sample median test on rank correlation coefficients, not significant at 5% level). *H2* is not supported by our conservative non-parametric test. The negative rank correlation coefficient and the visual inspection of Figure 1 seem to indicate that effort level slightly decline over time in *Uniform Wage*. This is strongly supported by our regression analysis in section 4.3.

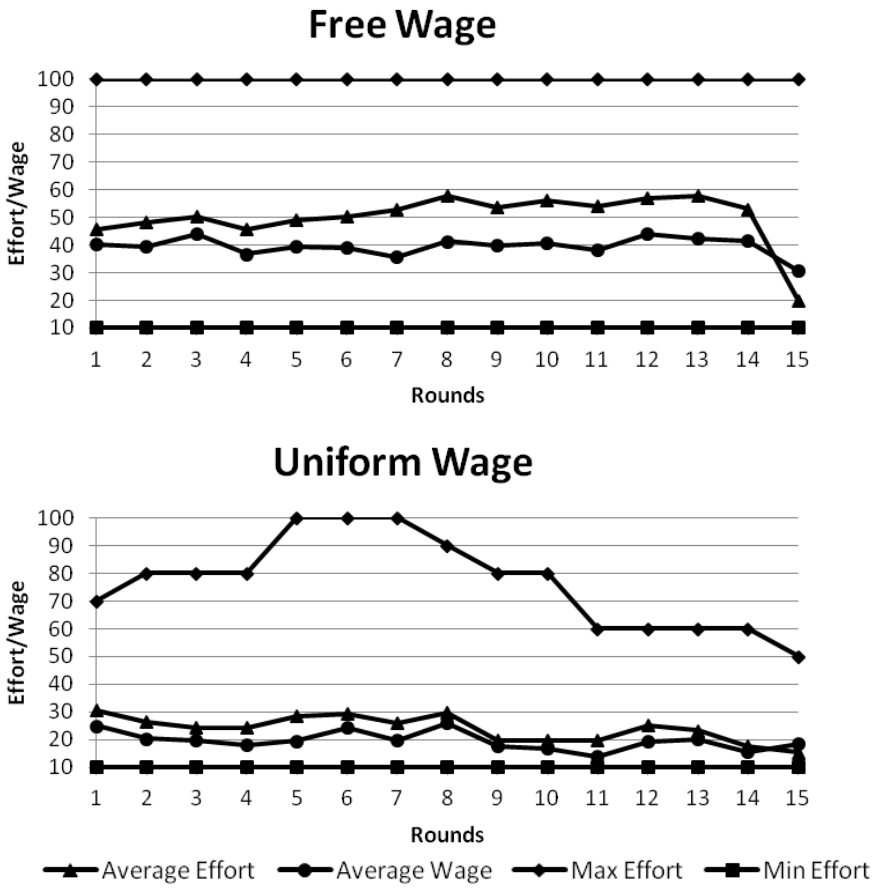

Figure 1: Average wage and effort choices in *Free Wage* and *Uniform Wage*

Figure 2 shows the development of wages and effort choices in *Strike* and *Coordination*. Interestingly, the first round wages and efforts in the two collective action treatments are not significantly different from the values in *Free Wage*. Although both of these treatments implement uniform wages, it seems that employers' beliefs on average effort levels were more similar to the employers' beliefs in *Free Wage* than in *Uniform Wage*. Over all rounds, however, wages and effort levels are significantly higher in *Free* Wage than in *Strike* and *Coordination* (one-sided U-test, p = 0.005 and p = 0.01), in which we observe wage and effort choic-

es that are statistically indistinguishable from those in *Uniform Wage*. Thus, *H3* cannot be supported. In fact, average wages and effort choices decrease in *Strike* over time. We test this by running separate rank correlation analyses for each of the independent observations in *Strike*. We find that the rank correlation coefficients for wages and effort choices over time are significantly negative in *Strike* (one sample median test, p = 0.018 for both variables). Given these results, *H4* can be fully supported.

Table 3: Average wages, effort choices and payoffs over all treatments

Treatment	Wage	Effort			Payoffs	
	Avg.	Avg.	Min.	Max.	Employees	Employers
Free Wage	40.15	52.08	16.61	90	32.94	121.32
Uniform Wage	19.80	24.63	10.41	50.82	17.80	53.56
Strike	21.07	23.09	10.13	51.79	19.21	23.86
Coordination	23.12	24.52	11.34	51.59	21.09	15.55
*Dismissal**	40.00	42.47	24.10	65.89	34.83	25.87

* all values for *Dismissal* are calculated excluding the dismissed employees

As hypothesized, wages and effort choices decrease over time in *Strike*. Adding a coordination device, however, does not seem to effectively stop the decline as conjectured in *H6*. This is supported by the fact that the correlation coefficients for wages over time in *Strike* and *Coordination* are lower than those in *Uniform Wage* (one-sided U-test, p = 0.000 for *Strike* and p = 0.051 for *Coordination*), but are statistically indistinguishable in *Strike* and *Coordination*. Since we observe declining effort levels both in *Strike* and *Coordination*, we must reject *H6*.

A closer look at the distribution of effort choices and suggested effort levels shows that those employees who suggest below-median effort almost perfectly stick to their suggestions (average ratio chosen to suggested effort = 1.031, std. error = 0.012), i.e. there is no upward adjustment of efforts to the median. Those employees who suggest above-median effort generally choose lower effort levels that are closer to the median than their own suggestions (average ratio chosen to suggested effort = 0.688, std. error = 0.015). Since effort levels fall over time, the overall effect of the coordination devise hardly has an impact on earnings. Obviously, the coordination device that we introduce does not affect behavior as expected, perhaps because it does not successfully reduce the variance of effort level choices. We test the observed effort choice variances using a U-test and find no significant difference comparing *Strike* to *Coordination*. Hence, we must also reject *H5*.

Our analysis so far provides little evidence for a sustained effect of the collective action mechanisms strike and effort coordination on the development of wages and efforts. While the option to strike positively affects first round wages, the variance of effort responses is so high, that the initial wage level cannot be sustained by the employer. Surprisingly, the effort coordination that we introduce cannot mitigate the free-rider problem, resulting in an effort variance that is not lower than in the other treatments with uniform wages. Obviously, overcoming the free-riding problem requires a stronger incentive mechanism than the collective action mechanisms provide.

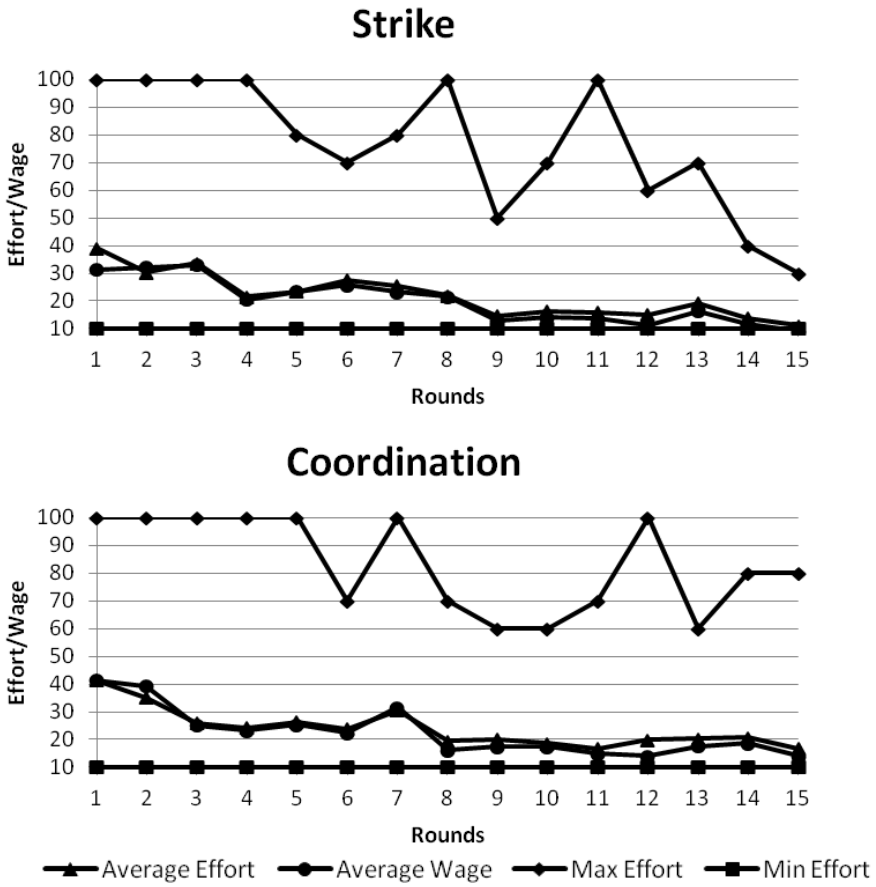

Figure 2: Average wages and effort choices in *Strike* and *Coordination*

Note the similarity of the situation, in which the employees in our setup are, to other public good settings. All employees benefit from the group's reputation for reciprocal effort choices, but every employee has an individual incentive to take the uniform wage that is based on the workforce reputation and to free-ride on it by shirking. The literature on other public good settings shows that punishment options are more effective than rewards in eliciting a sustained high level of provision (Gürerck, Irlenbusch, and Rockenbach 2009). In the field, a typical sanction that threatens shirking employees is dismissal, i.e. the threat of losing the job.

Figure 3 shows the development of average wages and effort choices in *Dismissal*, the treatment in which employees face an employment risk. We find that the first round wages and effort levels in *Dismissal* do not differ significantly from those in *Free Wage*. But, they are significantly higher than those in *Uniform Wage* (one-sided U-test, p = 0.004). Unlike the effort choices that remain stable in *Free Wage* and *Uniform Wage*, effort in *Dismissal* shows a tendency to decrease over time (one sample median test, p = 0.05). Hence, *H8* that predicts effort choices to decrease over time in *Dismissal* (due to the decreasing reputational benefits as the rounds to left play decrease in number) is supported.

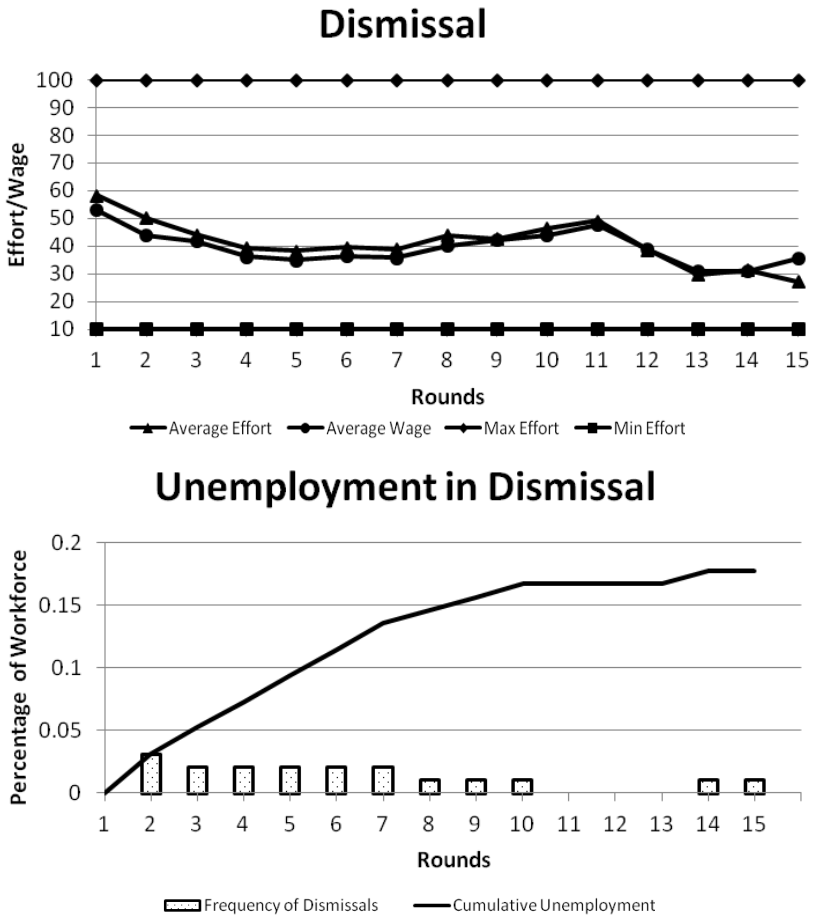

Figure 3: Average wages, effort choices and unemployment in *Dismissal*

Comparing wage and effort levels in *Dismissal* to the other three treatments with uniform wages, we find that *H7* is supported fully, because wage and effort choices are significantly (or weakly significantly) higher overall and throughout the experiment.[13] In fact, comparing the wage and effort levels in *Dismissal* to those in *Free Wage*, we find no significant differences overall. Only towards the end of the sessions in *Dismissal*, as the negative consequenc-

[13] The only exception is that the difference misses the significance mark by a small margin (one-sided U-test, p=0.172) when comparing the overall average wages in *Coordination* to those observed in *Dismissal*.

es of unemployment decline, free-riding increases and average wage and effort choices fall below the levels in *Free Wage*.

The rate of dismissals shown in the bottom panel of Figure 3 reveals how the frequency of dismissals falls and reaches zero in rounds 11-13, indicating that in these rounds none of the employers incurred a loss. Evidently, it takes a number of rounds before employees learn the enforcement effect of the dismissal mechanism. However, as unemployment becomes less threatening towards the end of the experiment, free-riding increases and average effort decreases making employers vulnerable to losses again. If we generalize the dynamics of free-riding and dismissal that we observe here, we can conjecture cautiously that longer sessions would not lead to much higher total unemployment rates than the peak of about 20 percent that we observe here (see the right panel of Figure 3).

Introducing the dismissal mechanism may affect wage and effort choices in two ways. On the one hand, employers' may choose higher wages anticipating that the employees are willing to exert higher levels of effort per unit of wage to avoid dismissal. On the other hand, if the least productive employees are dismissed, the mere selection may lead to higher employer earnings. We quantify the selection effects by calculating average employer earnings excluding and including the dismissed workers starting from round 1. We observe that dismissed employees are always selected amongst those exhibiting lowest effort levels. We find that the selection effect accounts for only 37 percent of the total positive treatment effect when compared to *Coordination*. The remaining 63 percent can be attributed to the anticipation effect.

4.2 Distribution of wage-effort combinations

Bilateral gift exchange settings are known to establish productive work relationships with wages, effort choices, and payoffs that are substantially higher than the levels predicted in equilibrium. Our *Free Wage* treatment replicates these findings and contributes to the literature by showing that the sustained and positive reciprocal interaction also holds when a single employer is in a large number of bilateral work relationships with different employees. As soon as the employer is deprived of her capability to discriminate between the employees by setting each wage separately, productivity plunges dramatically. We observe this effect in our *Uniform Wage* treatment, in which choosing a wage above the equilibrium wage generally means incurring a loss for the employer, due to the high level of free-riding by the employees. Figure 4 displays average effort choices for each of the ten wage brackets in *Free Wage* and *Uniform Wage*. The diagonal line marks the border between wage-effort combinations that are

profitable (above the line) and those that incur a loss (below the line) for the employer. The size of the circles indicates the number of wage-effort combinations observed.

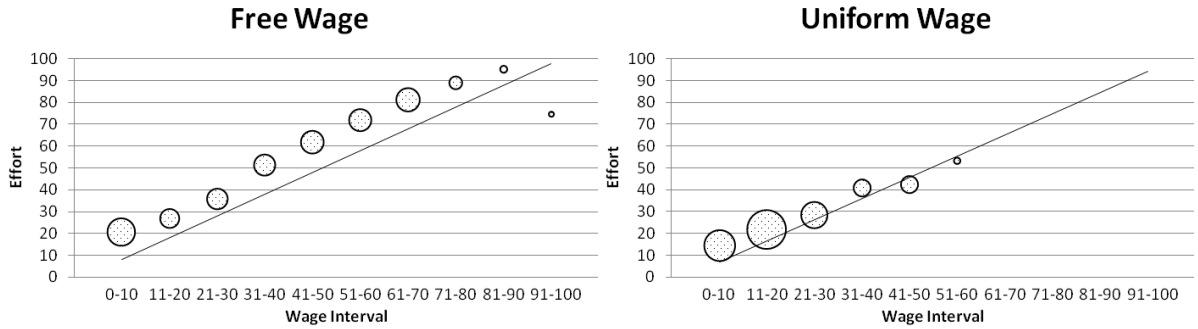

Figure 4: Effort per wage interval in *Free Wage* and *Uniform Wage*

It is immediately evident that the low performance of the work relationships in *Uniform Wage* is not simply due to employers' low wage offers, but related to the fact that employees' average effort choices are too low (below the diagonal) to be profitable for the employer at wages above 40.[14] Even for wages between 11 and 40, the chance of losing money is substantial. (Note that with wages at 10 and below, losses are not possible, due to the game structure.) In contrast, the return is significantly positive for all wage levels up to 90 in *Free Wage*. Clearly, setting a uniform wage based on observed average effort of many employees creates incentives for each of the employees to shirk, hoping that others will not.

The *Uniform Wage* treatment provides employees with the best possible conditions for free-riding on others' effort choices. And, as we have shown, they try to take advantage of the overall worker reputation that can be considered as a public good. However, due to the high degree of free-riding, this reputation quickly declines. In *Strike* and *Coordination*, we add collective action mechanisms to the uniform wage setting and examine their effect on the work relationships. Since wages and effort level choices are very similar in those two treatments and in *Uniform Wage*, it is not surprising that the distributions of wage-effort combinations in *Strike* and in *Coordination* – as show in figure 5 – are also almost indistinguishable. The figure also shows that employers on average incur a loss for wages greater than 30 in *Strike* and in *Coordination*. Obviously, both collective action instruments fail to mitigate the free-riding problem among employees.

Given that the dismissal mechanism positively affects wages and effort choices, we expect to see the distribution of wage-effort combinations in *Dismissal* above the diagonal line. Figure

[14] For wages above 40 the average employer payoff from the work relationship is statistically indistinguishable from zero.

6 supports this impression only partially, showing that the dismissal option cannot fully alleviate the free-riding problem. The figure also shows that wage-effort combinations in *Dismissal* are more evenly distributed than in the uniform wage treatments without dismissal. The picture is, in fact, quite similar to the distribution of wage-effort combinations in *Free Wage*. The only substantial and significant difference between the two distributions is that in *Free Wage* the distribution lies further above the diagonal line than in *Dismissal*, indicating higher employer payoffs in *Free Wage*.

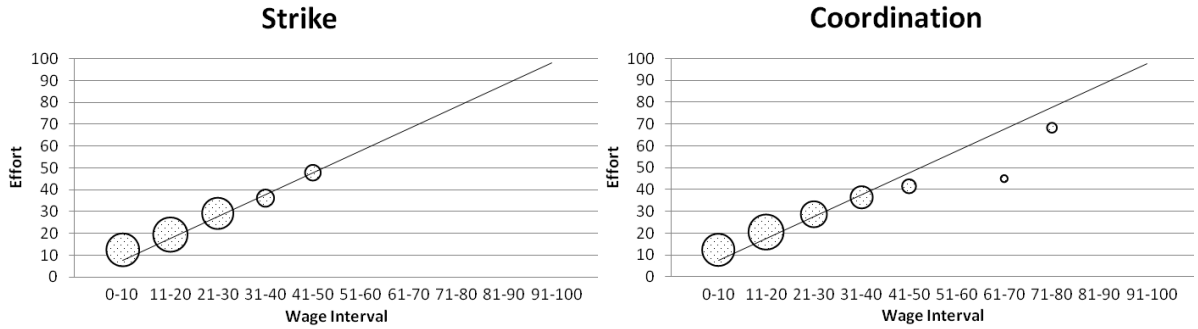

Figure 5: Effort per wage interval in *Strike* and *Coordination*

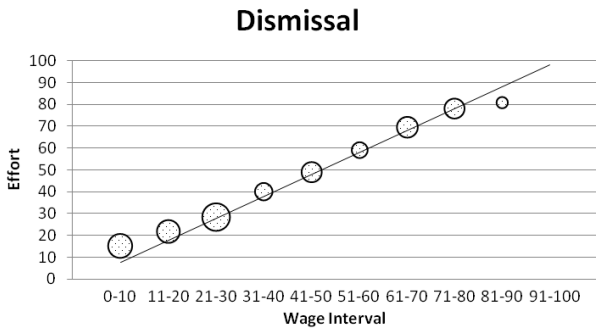

Figure 6: Effort per wage interval in *Dismissal*

Figure 7 shows the distribution of average employer and employee earnings in each treatment. The earnings share of the employer is greatest in *Free Wage* (about 29 percent) and smallest in *Strike*, *Coordination*, and *Dismissal* (about 10-11 percent). Compared to *Uniform Wage*, the collective action treatments exhibit significantly higher employee shares of the total earnings, indicating that collective action has an effect on the distribution of payoffs. Introducing collective action to the uniform wage setting, however, does not resolve the free riding problem that leads to significantly lower total earnings. Adding the dismissal mechanism to the uniform wage setting with collective action, we find that the employees' share of total earnings remains high and the incentives to shirk are reduced, leading to increased total earnings.

For all treatments with a strike option, we also run a regression of the employees' payoff share on dummy variables representing the first, the second, the third, and the fourth strike in

a firm (see table 4).[15] We find a significantly negative effect of the first strike, no significant effect of the second and third strike, and a significantly negative effect of the fourth strike. Hence, actually engaging in a strike has a negative effect on the employees' share of the total pie, even though having the strike option (but not using it) increases the employees' share. This effect seems akin to an effect reported in a trust game by Fehr and Rockenbach (2003). They show that having a punishment instrument but not using it leads to significantly greater reciprocal returns on trust than not having the instrument in the first place. But, having the instrument and using it leads to lower payoffs than not having it. Similarly, in our experiment, being able to strike, but not striking gives a higher payoff share to the employees than not having the possibility to strike in the first place. Actually going on strike, however, reduces the payoff share of the employees.

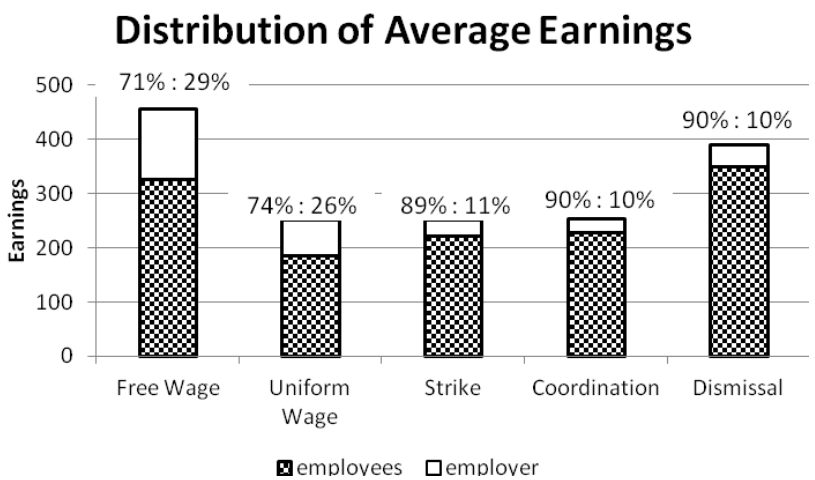

Figure 7: Distribution of average earnings over treatments.
The ratios indicate the share of average employee to employer earnings.

[15] A larger number of strikes was observed so rarely that a statistical analysis is not feasible.

Table 4: Tobit regression with employee share of total earnings as dependent variable

	Coefficient	Bootstrap std. error
Constant	0.9156 ***	0.0192
One strike	-0.1733 ***	0.0613
Two strikes	0.0573	0.1511
Three strikes	0.1214	0.1704
Four strikes	-0.2813 ***	0.0789

N = 272, 21 groups (firm cluster), Wald statistics: $\chi^2 = 30.25$, p = 0.000. 1000 bootstrap replications based on firm clusters. *** significance at 1%, two-tailed.

4.3 Regression Analysis

We wrap up our results section with a regression analysis. We present three models to examine the magnitudes of the effects that we have already uncovered with non-parametric tests. We examine how effort choices are affected by the time horizon, the wages, and the treatments. We use Tobit regressions with bootstrapped standard errors and clusters defined at the firm level. All results are presented in table 5.

In Model I, we analyze the effect of the round number, the offered wage, and the treatment dummies on the effort choices. We additionally use the square of the offered wage as an explanatory variable, because it increases the model fit substantially, indicating that the wage-effort relationship is better predicted by a slightly concave function than a linear function.[16] Correspondingly, we find that both the offered wage and its square have significant coefficients in all our models. The coefficient of the offered wage is positive and the coefficient of its square is negative in all models. Hence, our subjects exhibit effort-wage-reciprocity as also observed in the large majority of experimental studies on labor relationships. We do not find an overall effect of the round number on the magnitude of reciprocity. The significantly negative coefficients of the treatment dummies in Model 1 support our observation that effort choices are highest in *Free Wage*, which is our base line treatment (i.e. the omitted treatment dummy). Effort levels seem lowest in the two collective action treatments (*Strike* and *Coordination*). In fact we find that the coefficients of these treatment dummies are significantly smaller than the coefficients of the other two treatment dummies. However, the differences

[16] Previous studies also find a similar effect and include the square of the offered wage in their regression analysis (e.g. Fehr et al. 1998, Fehr and Falk 1999).

between the coefficients of *Uniform Wage* and *Dismissal* and between *Strike* and *Coordination* are not significant. Although, there are significant differences among coefficients, the magnitudes of the treatment effects on effort choices are actually not far from one another.

With Model II we expand Model I to check for treatment-wage interaction effects. Our main results remain unchanged. All the coefficients from Model I have the same sign and are of a similar magnitude even though not all significances survive. Interestingly, none of the treatment-wage interactions have a significant effect. Hence, we must conclude that wage offers affect effort choices in a similar way in all treatments.[17]

Model III is a different expansion of Model I, in which we included interaction terms between round and the treatment dummies. We find that in all treatments the negative effect on effort choices increases over time with three of these coefficients being significant. All four coefficients are of the same magnitude and show no statistical differences. The model shows that in *Uniform Wage* and *Dismissal* the negative treatment effects build up over time while in *Strike* and *Coordination* there is a strong overall negative treatment effect that is independent of the round. The effects the offered wage and its square are almost exactly as in Model I.

Comparing our three models, it seems clear that the reciprocal response to wages is completely robust in all model specifications, but the treatment effects are all negative. In *Strike* and *Coordination* they are present from the beginning, while they are mainly dynamic in *Uniform Wage* and *Dismissal*. None of the treatment effects varies with the level of the offered wage. These results support our findings concerning the dynamics of wages and efforts in the hypotheses *H2* and *H4* predicting that efforts will decrease over time in *Uniform Wage* and in *Strike*. While the latter reiterates the result of our non-parametric analysis, the former adds to that analysis, in which the negative correlation coefficient that we found was not significant. Supporting the result of our non-parametric tests, the regression analysis also does not support *H6*, because we find a significant decline of efforts over time both in treatments with and without the coordination mechanism. Similarly, our non-parametric and our regression results support *H8* that predicts a decline of effort choices in *Dismissal*.

[17] These apparent similarities result from the structurally different wage-effort relationship for wages below 10, because these wages guarantee positive employer payoffs. Running regression model II (see table 5) only for wages above 10 results in negative coefficients of the wage-treatment interaction terms. These coefficients are significantly different from one another. Note that all our results remain qualitatively unaffected using the regression for wages above 10. Thus, we can conjecture that for wages greater than 10 the marginal return to wage significantly differs in most treatment comparisons.

Table 5: Tobit regression with effort as dependent variable

	Model I		Model II		Model III	
	Coefficient	Bootstrap std. error	Coefficient	Bootstrap std. error	Coefficient	Bootstrap std. error
Constant	-2.4884	3.2572	-5.272	3.3570	-10.5786 ***	3.8283
Round	-0.3053	0.2135	-0.3185	0.2028	0.8015 *	0.4175
Wage	1.7413 ***	0.0906	1.8190 ***	0.1226	1.7776 ***	0.0950
Wage_squared	-0.0070 ***	0.0011	-0.0071 ***	0.0014	-0.0076 ***	0.0011
Uniform Wage	-11.4362 ***	3.4818	-6.4799	5.0744	-0.6755	5.8231
Strike	-17.4765 ***	2.3185	-17.1005 ***	4.2311	-7.6714 *	3.9404
Coordination	-16.7120 ***	2.5615	-10.9126 **	5.1522	-9.6642 *	5.8761
Dismissal	-11.5925 ***	2.4891	-8.0675 *	4.4391	1.0584	4.2851
Uniform Wage * Wage			-0.1694	0.1222		
Strike * Wage			0.0351	0.1252		
Coordination * Wage			-0.1855	0.1440		
Dismissal * Wage			-0.0850	0.0786		
*Uniform Wage * Round*					-1.5167 ***	0.5615
*Strike * Round*					-1.4170 ***	0.5152
*Coordination * Round*					-0.9972	0.7847
*Dismissal * Round*					-1.7443 ***	0.5256

N = 5244, 36 groups (firm cluster), Model I: Wald statistics: χ^2 = 1825.95, p = 0.000; Model II: χ^2 = 2328.04, p = 0.000; Model III: χ^2 = 2251.95, p = 0.000. 1000 bootstrap replications based on firm clusters. *** significance at 1%, ** at 5%, and * at 10% level, two-tailed.

5. Conclusions

In this experiment, we study gift exchange in multi-worker firms with and without collective action mechanisms. We find a high level of trust and reciprocity in a multi-worker environment, in which the employer maintains an independent bilateral work relationship with each of her 12 employees. In contrast, when the employer can only offer a uniform wage to all employees, we observe a dramatic decrease in wages, effort choices, and profits over time. A closer look at the data shows that trust and reciprocity in the uniform wage setting break down, because the average effort provided by the employees falls short of the level that is necessary to guarantee positive payoffs for the employer. Assuming that employers choose the uniform wage based on the reputation of the workers for reciprocally providing high lev-

els of effort, a worker's investment in reputation (i.e. providing high effort) is individually costly, but exerts a positive externality on the other workers. Our results show that free-riding is the main driving force that hinders the sustained existence of trust and reciprocity in such multi-worker uniform wage settings.[18]

One main research question of our study is, whether collective action can positively affect the performance of multi-worker firms in efficiency wage settings. In the field, we can identify a number of mechanisms that may alleviate the free-riding problem and enhance the employees' wages and the firm's profitability. Two of our additional treatments are concerned with simple collective action mechanisms that are common in labor relations. We find that strikes and effort coordination significantly increase the employees' share of total earnings, but this comes at the cost of substantially and significantly smaller total earnings than in a setting with free wages. Hence, our analysis shows that while collective action effectively increases the bargaining power of the employees, it cannot alleviate the severe free-riding that harms total earnings by disrupting trust and reciprocity in the uniform wage treatments. This result is surprising, because the collective action mechanisms are generally believed to have a positive influence on wages, due to the employees' increased bargaining power. The important contribution of our experimental study is the insight that collective action mechanisms may increase earnings shares, but decrease wages in a gift exchange setting, if employees cannot reduce the extent of free-riding within their own rank and file.

Our last treatment introduces employment risk to the game with uniform wages, strikes, and effort coordination. We find that the employees' risk of being dismissed does not shift the effort-wage profiles of the employees substantially upwards when compared to the uniform wage settings without a dismissal mechanism. But, since employers are significantly more likely to dismiss employees with a history of low effort choices than of high effort choices, the dismissal mechanism induces a positive correlation of expected wages and past performance. Anticipating the positive incentive effect of the dismissal mechanism, the employers offer significantly higher wages with than without an employment risk. These significantly

[18] Obviously, as Abeler et al. (2010) show, fairness considerations can be another reason underlying the free-riding behavior, because the employees have equity concerns and dislike providing more than and receiving less than their peers. In our experiment, however, we do not expect this effect to be very strong, since the employees do not have information on each others' effort choices and payoffs. An alternative fairness explanation for the low effort choices that we observe could be that employees are reducing the inequality between their own earnings and those of the employer. This, however, does not seem to hold, because of two reasons. First, it does not explain why there are treatment differences in effort choices. Second, in all our collective action treatments, the earnings differences between employees and employers are much more to the advantage of the employees than in *Free Wage* where employees exert much higher levels of effort. For a more detailed discussion of employee-employer comparisons in multi-worker settings see Gose (2013).

higher wages are reciprocated with significantly higher effort choices of the employees, leading to increased total earnings. Additionally, since the least productive employees are dismissed, the remaining employees' average productivity increases, leading to a further increase of the firm's per capita earnings. Hence, the dismissal mechanism seems to be an effective instrument to reduce free-riding in a situation in which the employer pays uniform wages and cannot differentiate wages.

Like any model-based study, our experimental design obviously cannot capture all features of labor contracts and collective action mechanisms that are present in the field. The substantial treatment differences that we observe, however, indicate that the identified behavioral effects should not be fully ignored in the design of contractual and institutional provisions in the management and organization of labor. In this respect, there are two main implications of our findings for labor relations.

First, we can establish that above-equilibrium performance in multi-worker environments requires some element of incentive compatible pay even in gift exchange settings. Uniform wages without any differentiation and without a risk of unemployment (e.g. due to job guarantees, life time tenures, etc.) cannot limit free-riding even if collective action mechanisms are available.

Second, unions and other labor organizations that use collective action mechanisms and bargain uniform or scaled wages are only able to achieve extraordinary benefits for their members, if they can install institutional measures that successfully mitigate any free-riding among their own rank and file. Without a mechanism to curb free-riding, the employees' share of total earnings increases, but this may come at the cost of a severe drop in total earnings that offsets the employees' advantage of having a larger share. In other words, our results suggest that the most successful labor unions are those that have a strong internal control of their members' workplace behavior in addition to a powerful set of collective action instruments.

Finally, a combination of these implications may give insight into the observed decline of unionization in most developed economies and, especially, in the USA (Greenhouse 2013). On the one hand, the cost advantage of using uniform and scaled wages has dissipated due to the increased utilization of enterprise resource planning and application software that simplifies wage differentiation and adaption enormously. On the other hand, the legal environment, especially the right-to-work laws passed in many states, have reduced the degree of control that labor unions can exert at the workplace, diminishing their capability to reduce free-riding behavior among the workforce.

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Appendix A – Experimental Instructions

[in all treatments]:

General information on the experiment

You are participating in a study concerning the labor market. During the experiment you can earn payoffs in ECU (experimental currency unit). At the end of the experiment your ECU account will be converted into Euros at a rate of 1 ECU = 0.02 Euro. You will receive your earnings in cash after the experiment.

Please keep in mind that during the experiment you may only exchange information with the other participants via the experimental software. Other forms of communication are not allowed and can lead to your expulsion from the experiment.

The participants are divided into 2 groups of 13 individuals each. Each group consists of 1 employer and 12 employees. The role of the employer is randomly assigned to one of the participants, who scored highest during the previous management test. Your role in the game is displayed on the top of your screen. The group constellation of the 13 participants in your group remains the same until the experiment ends.

[in *Free Wage*, *Uniform Wage*, and *Strike*]:

The labor market in the experiment lasts for 15 rounds of which each has 2 stages:

<u>Stage 1:</u>

[in *Free Wage*]: In the first stage, the employer proposes a wage offer for each employee. This wage offer can be different for each employee.

[in *Uniform Wage* and *Strike*]: In the first stage, the employer offers a wage to the employees. He/she cannot differentiate between the employees, i.e. each employee receives the same wage offer.

<u>Stage 2:</u>

In the second stage, the employees decide individually, whether and how much they are actually willing to work for the wage offers that they received in stage 1.

[in *Coordination* and *Dismissal*]:

The labor market in the experiment lasts for 15 rounds of which each has 3 stages:

<u>Stage 1:</u>

In the first stage, the employer offers a wage to the employees. He/she cannot differentiate between the employees, i.e. each employee receives the same wage offer.

<u>Stage 2:</u>

In the second stage, each employee submits an effort suggestion. Each employee indicates whether and how much he/she is willing to work for the wage offer. All employees are informed of the highest suggested effort that is supported by the majority of employees (at least 50% + 1 additional employee).

<u>Stage 3:</u>

In the third stage, the employees decide individually, whether and how much they are actually willing to work for the wage offers that they received in stage 1.

[in all treatments]:

Your decisions are processed electronically and your payoffs are calculated automatically. Your total payoff is the sum of all individual payoffs over all rounds.

Please, keep in mind that in each of the 15 rounds you will be interacting with the same employer and the same employees.

Information concerning the labor market:

- [in *Free Wage*]: At the beginning of each round, the employer submits a wage offer $w_i \geq 0$ ECU for each employee *i*. The wage offer may be different for each employee.

  Each wage offer w_i is only communicated to employee *i*.
- [in *Uniform Wage*, *Strike*, *Coordination*, and *Dismissal*]: At the beginning of each round, the employer submits a wage offer $w \geq 0$ ECU. This offer is identical for each employee. It will be communicated to all employees.
- [in *Coordination* and *Dismissal*]: Each employee next indicates whether and how much he/she is willing to work for the wage offer. The highest effort suggestion that is supported by the majority of employees (at least 50% + 1 additional employee) is communicated to all employees.
- [in *Coordination* and *Dismissal*]: After the employees are informed of the effort suggestion, each employee individually decides whether and how much effort he/she will actually provide. This decision is communicated to the employer.
- [in *Strike*, *Coordination* and *Dismissal*]: If the majority of employees (at least 50% + 1 additional employee) decide to reject the wage offer, neither the employees nor the employer receive any payoffs from the employment relationship in the current round.
- [in all treatments]: If an employee decides not to work for the wage offer, he/she and the employer receive no payoffs from their work relationship in the current round. The employer, however, can earn from his/her other work relationships. This depends on the other employee's decisions.
- [in *Dismissal*]: If the total payoff of the employer falls below zero during a round, the employer terminates one of the work relationships at the end of the round, i.e. he/she continues to employ all but one of the employees who were previously active. The employer decides which work relationship to terminate.
- [in *Dismissal*]: If the work relationship of one or more of the employees is terminated, these participants can follow the experiment until the end, but they will not be able to submit effort suggestions, nor will they earn wages or make effort decisions. They receive a fixed payoff of 5 ECU per round for remaining in the experiment until the end. Once a work relationship is terminated, it cannot be reactivated until the end of the experiment.

[in *Coordination* and *Dismissal*]:

Determination of effort suggestion

- In the second stage of the round, each employee *i* ($i = \{1,...,I\}$) makes a suggestion on whether and how much he/she is willing to work for the wage offer given by the employer in stage 1 of the round.
- The employee *i* submits an effort suggestion by choosing an effort level between 10 and 100 percent, where 10 percent is the lowest possible effort choice and 100 percent is the highest.

- If employee *i* would like to suggest not to work for the given wage offer, he/she chooses the option "decline."
- The exact calculations of the round payoffs for employees and the employer are shown below.
- All employees are informed of the highest effort suggestion that is supported by the majority of employees (at least 50% + 1 additional employee). If it is not possible to determine a majority suggesting an effort level above 10%, all employees are informed that the effort suggestion is the lowest possible effort level (10%).

[in all treatments]:

Calculation of round payoff – employee

- In the third stage of the round, each employee makes his/her actual decision on effort choice, i.e. each employee decides whether and how much he/she works for the wage offer that he/she received in stage 1.

[in *Free Wage* and *Uniform Wage*]:

- If employee *i* decides not to work for the wage offer, then his/her payoff for this round is 0 ECU.
- If employee *i* chooses an effort level, he/she receives the offered wage minus his/her cost of effort $c(e_i)$ (see table 1).

[in *Strike*, *Coordination*, and *Dismissal*]:

<u>Case 1: The wage offer is rejected by the majority of employees:</u>

- If the majority of employees (at least 50% + 1 additional employee) reject the wage offer, every employee earns 0 ECU for this round.

<u>Case 2: The wage offer is accepted by the majority of employees:</u>

- If the majority of employees do not reject the wage offer, but employee *i* decides not to work for the wage offer, then his/her payoff for this round is 0 ECU.
- If the majority of employees do not reject the wage offer and employee *i* chooses an effort level, he/she receives the offered wage minus his/her cost of effort $c(e_i)$ (see table 1).

[in all treatments]:

- Employee *i* decides how much effort to provide by choosing an effort level between 10 and 100 percent, where 10 percent is the lowest possible effort and 100 is the highest.
- The higher the effort level that employee *i* chooses, the higher the cost of effort that employee *i* has to bear.
- The higher the effort level that employee *i* chooses, the higher the payoff of the employer.

Table 1 – Possible effort choices und corresponding cost of effort:

Effort choice e_i	*10%*	*20%*	*30%*	*40%*	*50%*	*60%*	*70%*	*80%*	*90%*	*100%*
Cost of effort $c(e_i)$	*0*	*1*	*2*	*4*	*6*	*8*	*10*	*12*	*15*	*18*

[in *Free Wage*]:

- The round payoff of employee *i* is:

$$\text{payoff}_{\text{employee}i} = \begin{cases} 0 & \text{if employee } i \text{ chooses not to work} \\ w_i - c(e_i) & \text{if employee } i \text{ chooses an effort level} \end{cases}$$

  Where w_i is the wage that employee *i* receives.

[in *Uniform Wage*, *Strike*, *Coordination*, and *Dismissal*]:

- The round payoff of employee *i* is:

$$\text{payoff}_{\text{employee}i} = \begin{cases} 0 & \text{if employee } i \text{ chooses not to work} \\ w - c(e_i) & \text{if employee } i \text{ chooses an effort level} \end{cases}$$

  Where *w* is the wage that employee *i* receives.

[in *Dismissal*]:

<u>The work relationship with employee *i is terminated by the employer*:</u>

If the work relationship of one or more employees is terminated by the employer due to previous losses, each of the no longer active participants receives 5 ECU for every round until the end of the experiment.

[in all treatments]:

Calculation of round payoff – employer

- The employer decides on a wage $w \geq 0$ ECU in stage 1 of the round.

[in *Free Wage*]:

- If employee *i* decides not to work for the wage offer, then the employer's payoff from this work relationship for this round is 0 ECU.
- If employee *i* chooses an effort level, the employer will earn the following payoff from this work relationship for this round:

$$\text{Payoff}_{\text{employer}} = 100 \cdot e_i - w_i$$

  Where e_i is the effort that employee *i* chooses (For your calculations keep in mind that 10 percent = 0.1, 20 percent = 0.2 etc.).
- The round payoff of the employer is the sum over all employer payoffs from the individual work relationships:

$$\text{Payoff}_{\text{employer}} = \sum_{i=1}^{I} \begin{cases} 0 & \text{if employee } i \text{ chooses not to work} \\ 100 \cdot e_i - w_i & \text{if employee } i \text{ chooses an effort level} \end{cases}$$

[in *Uniform Wage*]:

- If employee *i* decides not to work for the wage offer, then the employer's payoff from this work relationship for this round is 0 ECU.

- If employee *i* chooses an effort level, the employer will earn the following payoff from this work relationship for this round:

$$\text{Payoff}_{\text{employer}} = 100 \cdot e_i - w$$

  Where e_i is the effort that employee *i* chooses (For your calculations keep in mind that 10 percent = 0.1, 20 percent = 0.2 etc.).

- The round payoff of the employer is the sum over all employer payoffs from the individual work relationships:

$$\text{Payoff}_{\text{employer}} = \sum_{i=1}^{I} \begin{cases} 0 & \text{if employee } i \text{ chooses not to work} \\ 100 \cdot e_i - w & \text{if employee } i \text{ chooses an effort level} \end{cases}$$

[in *Strike*, *Coordination*, and *Dismissal*]:

<u>Case 1: The wage offer is rejected by the majority of employees:</u>

- If the majority of employees (at least 50% + 1 additional employee) reject the wage offer, the payoff of the employer for this round is 0 ECU.

<u>Case 2: The wage offer is not rejected by the majority of employees:</u>

- If the wage offer is not rejected by the majority of employees, but employee *i* decides not to work for the wage offer, then the employer's payoff from this work relationship for this round is 0 ECU.
- If the wage offer is not rejected by the majority of employees and employee *i* chooses an effort level, the employer will earn the following payoff from this work relationship for this round:

$$\text{Payoff}_{\text{employer}} = 100 \cdot e_i - w$$

  Where e_i is the effort that employee *i* chooses (For your calculations keep in mind that 10 percent = 0.1, 20 percent = 0.2 etc.).

- The round payoff of the employer, in case the wage offer is not rejected by the majority of employees, is the sum over all employer payoffs from the individual work relationships:

$$\text{Payoff}_{\text{employer}} = \sum_{i=1}^{I} \begin{cases} 0 & \text{if employee } i \text{ chooses not to work} \\ 100 \cdot e_i - w & \text{if employee } i \text{ chooses an effort level} \end{cases}$$

[in all treatments]:

- Keep in mind that each wage offer $w > 10$ may lead to a loss from the work relationship with employee *i*, if he/she chooses an effort level that is too low.
- Additionally, keep in mind that all wage offers $w > 100$ will inevitably lead to a loss from the work relationship with employer *i*, since he/she will not be able to generate more than 100 ECU even at the highest effort level. For this reason, the employer is not allowed to allocate more than $I \cdot 100$ ECU in wages per round (i.e. for 12 work relationships the budget limit is 1,200 ECU).

[in *Dismissal*]:

<u>The work relationship with employee *i is terminated by the employer*:</u>

- If the total payoff of the employer is negative during any round, the employer terminates one of the work relationships that are still active by the end of the round. The employer decides which work relationship to terminate.
- If the work relationship with one or more employees is terminated by the employer due to previous losses, the employer receives no more payoffs from the terminated work relationships. He/she may, however, receive payoffs from the other work relationships. This depends on how the other employees decide.

Appendix B – GMAT Questions

Management Test Cubicle number:

You have **5 minutes** to answer the following questions.

The better you perform, the higher the chance that you have the possibility of earning more money than the other participants during the following experiment.

You may not be able to answer all questions within the given time frame.

Please be quiet, concentrated, and work quickly without any aid. Furthermore, keep in mind that communication with the other participants is not allowed.

1) $2x + 3y = 16$ and $y = -6x$; $-x = ?$

- A) -1
- B) 4/5
- C) -4/5
- D) -5/4
- E) 1

2) After running a series of television advertisements, a leading beverage producer saw its sales increase by 25% to 1 million Euros per month. Prior to the advertising campaign, about how many Euros in sales did the company average per day?

- A) 1.25 Million Euro
- B) 800,000 Euro
- C) 750,000 Euro
- D) 27,000 Euro
- E) 10,000 Euro

3) $n^5(16k-8)(n^{-3}) = n^2$; if n does not equal zero, k =

- A) 2
- B) 9/16
- C) 1
- D) ½
- E) 5/8

4. If x and y are positive integers, is the following cube root an integer?
$\sqrt[3]{x + y^2}$

1. $x = y^2 \cdot (y-1)$
2. $x = 2$

- A) Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient to answer the question asked.
- B) Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient to answer the question asked.
- C) BOTH statements Together are sufficient, but NEITHER statement ALONE is sufficient to answer the question asked.
- D) EACH statement ALONE is sufficient to answer the question asked.
- E) Statement (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data are needed.

5.) Hans is obviously a bad fisherman. During the past season, in which he and the five members of his team spent four months on a boat together off Fehmarn, he caught fewer fish than any of his teammates. Which of the following, if true, most weakens the argument above?

- A) Two seasons ago, Hans fished on another boat off Fehmarn and caught more fish than any member of that boat.
- B) Before becoming a fisherman, Hans piloted a fishing boat whose members regularly caught record numbers of fish.
- C) While fishing the past season, Hans fell sick for a week and did not catch any fish during that time.
- D) Unlike the other fishermen on his boat, at the order of the captain, Hans fished the last season with experimental bait.
- E) Amongst the fishing community at Fehmarn, Hans has a reputation for being an especially bad fisherman.

6.) Susann has 16 gummy bears in her pocket. She has 8 red ones, 4 green ones, and 4 white ones. What is the minimum number of gummy bears she must take out of her pocket (without looking) to ensure that she has one of each color?

- A) 4
- B) 8
- C) 12
- D) 13
- E) 16

Otto von Guericke University Magdeburg
Faculty of Economics and Management
P.O. Box 4120 | 39016 Magdeburg | Germany

Tel.: +49 (0) 3 91 / 67-1 85 84
Fax: +49 (0) 3 91 / 67-1 21 20

www.fww.ovgu.de/femm

ISSN 1615-4274