WORKING PAPER SERIES

Fair Wages Survive Multiple Sources of Income Inequality

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Working Paper No. 9/2013

OTTO VON GUERICKE
UNIVERSITÄT
MAGDEBURG

FACULTY OF ECONOMICS
AND MANAGEMENT

Impressum (§ 5 TMG)

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

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

Bezug über den Herausgeber
ISSN 1615-4274

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June 2013

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Abstract

When an employee in a gift exchange game earns significantly less than the employer, the source of employer income does not affect effort choices. However, to induce one unit of effort, the employer has to pay higher wages than in a game without payoff inequality.

Keywords

Gift exchange, fair wage-effort hypothesis, reciprocity, inequity aversion, tit for tat

JEL Codes

C91, D31, M52

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1. Introduction

Over the years, a large body of literature has emerged around the fair wage-effort hypothesis (Akerlof/Yellen 1990, 1988) as well as the gift exchange game (Fehr et al. 1993), which is employed to provide the corresponding experimental evidence. Whereas early experimental studies focus on the relationship between one employer and one employee (e.g. Fehr et al. 1998, Gächter/Falk 2002), newer studies consider multi-worker relationships (e.g. Maximiano et al. 2007, Gächter/Thöni 2010). Studying these multi-lateral gift exchange games can provide insights into employee behavior in organizations of higher complexity. Furthermore, the efficiency of work relationships, in which the employee faces disadvantageous payoff inequality, can be examined.

Since no study has yet investigated whether the source of disadvantageous payoff inequality has an effect on employee effort provision, this study systematically investigates this question using controlled lab experiments. The results indicate that receiving a wage that is perceived as fair leads employees to choose positively reciprocal effort levels irrespective of the source of payoff inequality. However, when the employer earns significantly more than an employee, he has to pay higher wages to induce effort choices similar to those observed in situations without payoff inequality. Since receiving a fair wage seems to drive the results rather than inequity concerns, I propose to describe behavior in multi-round gift-exchange games using a tit-for-tat model that comprises generosity.

2. Experimental Design

I compare behavior in three gift-exchange settings: two bilateral games (treatments *1on1* and *165*), in which an employer has a work relationship with a single employee, and a 13-lateral game (treatment *Large Group* (*LG*)), in which an employer has work relationships with 12 employees. Thus, in the bilateral treatments, both employer and employee earn from only one work relationship. In *LG*, however, the employees earn from one work relationship with their employer, while the employer earns from 12 different work relationships.

In the first stage of the bilateral game, the employer submits a wage offer $w \in [0,100]$. After the employee receives the wage offer, the employee can either accept ($a = 1$) or reject ($a = 0$) the wage offer. In case the employee decides to accept the wage offer, he chooses an effort level e and incurs a non-linear cost of effort $c(e)$ (see table 1). In case the employee rejects the wage offer, neither the employer nor the employee receives earnings from the work relationship.

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

In both bilateral game settings, *1o1* and *165*, the employee earns $\left(w - c(e)\right) \cdot a$.

In *1on1*, the employer earns the effort minus the wage paid: $\pi_{\text{employer}}^{1o1} = (e - w) \cdot a$. In *165*, the employer receives a lump sum payment of 165 in addition to the production and earns $\pi_{\text{employer}}^{165} = (e - w) \cdot a + 165$.

I choose 165 since each employee contributes an average of 15 experimental currency units of employer earnings in *1o1*. 165 then simulates the efficiency of eleven co-workers. *165* is thus introduced to test if the source of employer income has an effect on effort choices, i.e. whether employees' effort choices are different, once the employer actually has to work for the additional earnings by managing 12 work relationships, or is simply rich by nature.

In the 13-lateral game, the employer submits a wage offer $w_i \in [0{,}100]$, $i = 1 \dots 12$ to each employee i. The decision to accept the wage offer and the production proceed as described above. Each employee earns $\left(w_i - c(e_i)\right) \cdot a_i$. The employer earns the sum of efforts minus the sum of wages:

$$\pi_{\text{employer}}^{13-lateral} = \sum_{i=1}^{12} (e_i - w_i) \cdot a_i\,.$$

All of the treatments lasted for 15 rounds with fixed employer-employee groups and the total payoff amounting to the sum of the round income. In order to determine the role of the employer, I let the subjects answer six standardized multiple-choice GMAT questions within a five-minute time limit. The subject who scored best was assigned the role of the employer. Ties were broken by a random draw.

Overall 182 subjects participated in the study with 25 independent observations for *1on1*, 14 independent observations for *165*, and 8 independent observations for *LG*. Each session lasted about 75 minutes with earnings ranging between 0.50 euro and 62.30 euro depending on treatment and role.

3. Results

I observe a positive monotonous relationship between average wage and average effort in all treatments (one-tailed Spearman correlations; all correlations significant at 1%: $\rho_{1o1} = 0.901$, $\rho_{LG} = 0.929$, $\rho_{165} = 0.758$[1]). Figure 1 shows average effort per wage unit over ten different wage intervals for the three treatments. The size of the circles indicates the frequency, with which wages are observed. The diagonal indicates wage-effort combinations that lead to zero employer earnings, i.e. all points above the diagonal result in positive employer payoffs, whereas points below the diagonal result in employer losses.[2] It is thus evident that effort choices in *1o1* lead to highest employer payoffs, as the wage-effort combinations lie further above the diagonal than in *LG* and *165*. Positive employer payoffs can also be observed in *LG*, however, not for high wages. Average wage-effort combinations in *165* show a large variance and are also very close to the diagonal, indicating only small employer payoffs from the production.

Table 2 reports average effort, wage, and relative wage, i.e. wage paid per unit of effort. Both, average effort and average wage are statistically indistinguishable between the three treatments (one-tailed U-test). Nevertheless, average relative wages in *LG* and in *165* are significantly larger than in *1o1* (one-tailed U-test, $p_{LG} = 0.018$, $p_{165} = 0.003$). Note, however, that average relative wages in *LG* are not statistically different from those observed in *165* (one-tailed U-test). This leads to three important results, which are also supported by the regression results (see table 3):

First, a positive wage-effort relationship results in repeatedly played gift exchange games even if the employees face disadvantageous payoff inequality. This holds for *165* and for *LG*.

Second, when the employer earns more than an employee, he must offer higher wages to induce the same amount of effort.

Third, irrespective of the source of disadvantageous income inequality, employees do not elicit different average effort choices (one-tailed U-test). Thus, when choosing effort levels, employees do not seem to care whether the employer is rich by nature (treatment *165*) or has to work for the additional earnings by managing 12 work relationships (treatment *LG*).

[1] To exclude repeated game effects from being the sole driver of the results, I conducted a further treatment, in which each of the 12 employers in *165* interacted only once with each of the 12 employees. The correlation between wages and effort levels remains highly significant at 1% with $\rho = 0.553$ (one-tailed Spearman correlation).

[2] For *165* the diagonal marks the profitability of a work relationship for the employer before the lump sum is added.

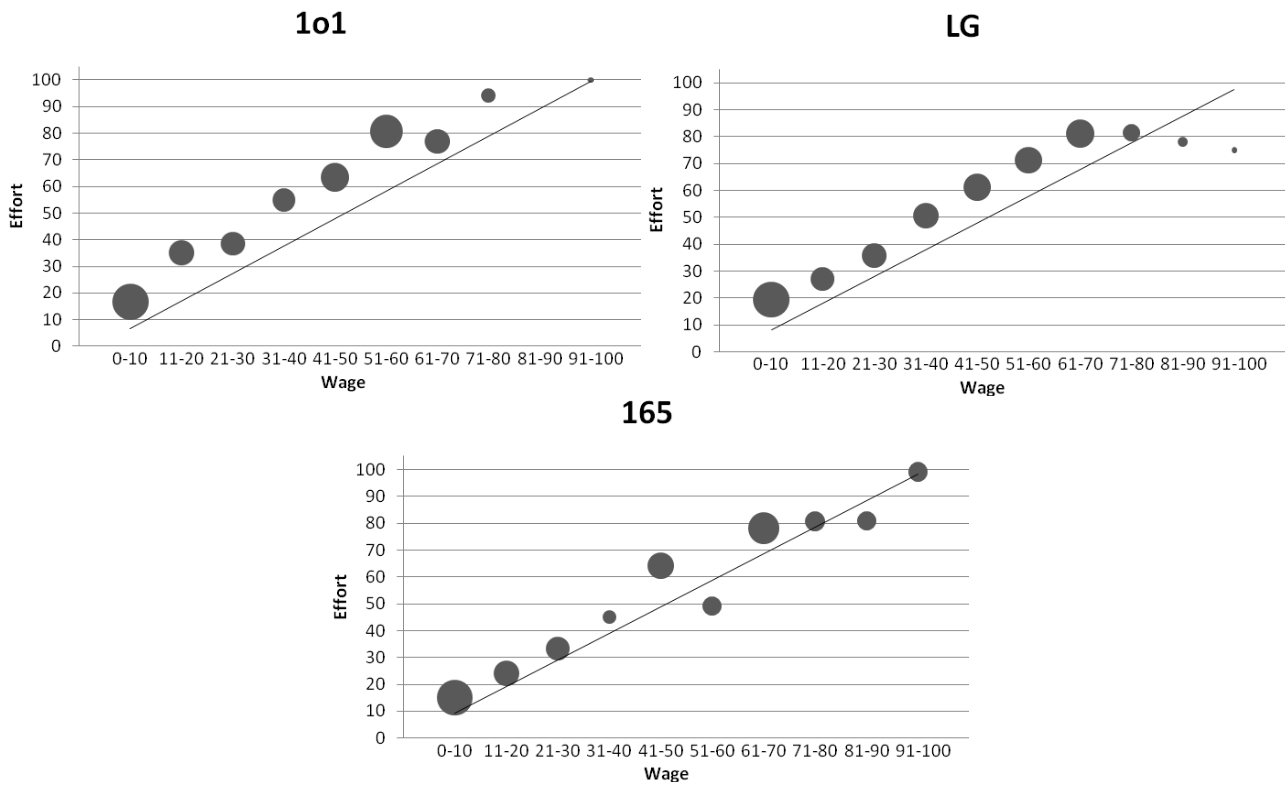

Figure 1: Wage-effort combinations.

Table 2: Average effort, wage, and relative wage.

Treatment	avg effort	avg wage	avg relative wage
1o1	52.687	37.887	0.823
LG	50.182	39.583	1.054
165	51.515	45.808	1.203

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

Effort	Coefficient	Std. error	Coefficient	Std. error
	Model I		Model II	
Wage	0.945***	0.024	1.098***	0.060
LG	-3.537	3.822	3.139	4.665
165	-8.074**	3.514	0.298	5.039
*LG**wage			-0.177***	0.067
*165**wage			-0.211**	0.085
Const	16.422***	2.303	10.690***	3.108

N = 1743, model I: Wald χ^2 = 1508.78, p = 0.000; model II: Wald χ^2 = 1517.86, p = 0.000;
*** significance at 1%, ** at 5%, * at 10% level, two-tailed.

4. Behavioral Predictions

Note that in *1o1* an inequity averse employee can avoid disadvantageous payoff inequality for almost any given wage. In *165*, however, disadvantageous payoff inequality can only be avoided for wages larger than 87. Maximum likelihood estimations show that the Fehr/Schmidt (1999) model is able to explain the data observed in *1o1* significantly better than a model of pure money maximization. For the employees, I obtain a coefficient for disadvantageous inequality aversion α of 0.235 and a coefficient for advantageous inequality aversion β of 0.221 (see left part of figure 2).[3] However, the Fehr/Schmidt (1999) model cannot be used to describe results in *165* (see right part of figure 2, coefficients: $\alpha = 2.891$, $\beta = 0.635$). This also holds true for wages above 87, i.e. when employees can avoid disadvantageous payoff inequality. The model parameters that I estimate for *165* either violate the parameter restrictions imposed by Fehr/Schmidt (1999) or give extremely large standard errors.

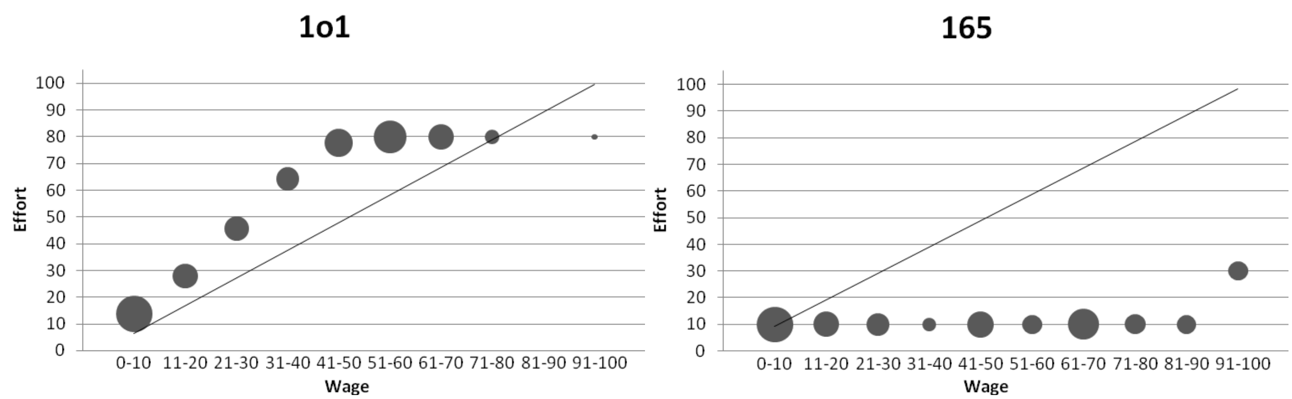

Figure 2: Predictions according to Fehr/Schmidt (1999).

Figure 3 shows the median expected employer earnings from production. The median expected employer earnings and the confidence intervals are derived from a data set of 2,000 ordered logistic regressions on 80% of the observations from *1o1* and *165*, which are used to predict the remaining 20% of the corresponding data sets. As can be seen from figure 3, there exists a wage range, in which expected employer earnings increase with wages. In *1o1* this range exists for wages between 15 and 61 and in *165* for wages between 33 and 68.[4] Thus, there seems to be a threshold indicating

[3] I fit the model under the assumption that subjects choose their utility maximizing effort response given their concern for inequity aversion and their wage offer. Additionally, I suppose that employees err to some degree when making their decisions. Since learning cannot be observed in the data, I fit the two models to all wage-effort pairs collected in *1o1* and *165*.

[4] Note that expected employer earnings already start to fall during the wage interval 60-71, because the ability of the employee to positively reciprocate to large wage offers is restricted due to the game structure, which caps effort at 100.

wages that are considered fair. An increase in wages from that point on leads to an expected increase in employer earnings. Therefore, employers should be concerned with determining a fair wage offer, rather than a wage offer that minimizes payoff inequality.

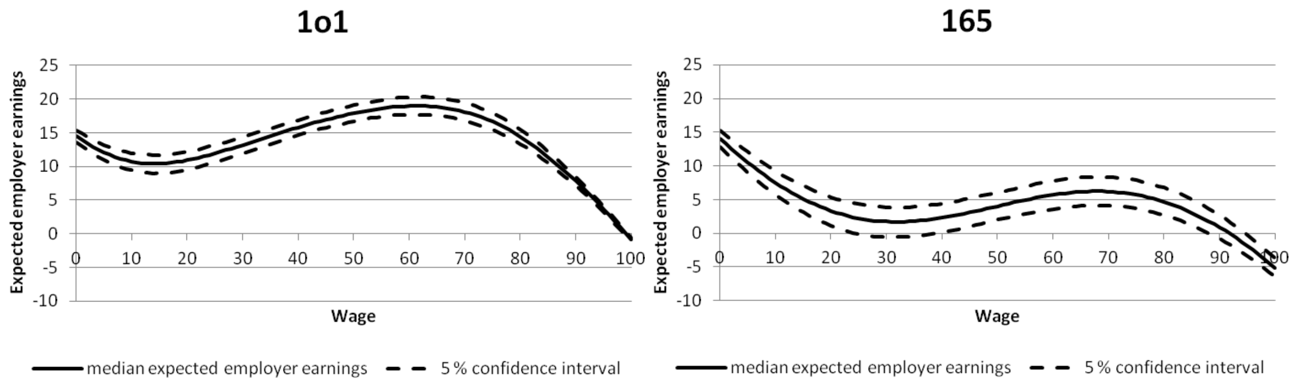

Figure 3: Expected employer earnings and bootstrapped 95% confidence interval.

Instead of showing concerns for inequity aversion, employees seem to reciprocate wage offers with effort choices according to a tit-for-tat fashion that comprises generosity (Nowak/Sigmund 1992). Thus, the reactive strategy of an employee can be described by probability *y(w)*. With probability *y(w)* the employee chooses $e \geq w$. This probability depends on the wage offer, meaning that a high wage offer has a higher probability of triggering an effort response leading to positive employer earnings. Thus, the employees' payoff function seems to follow $\left(w - c\left(min(w + x(w),100)\right)\right) \cdot a$ with probability *y(w)* and $\left(w - c\left(max(w - z(w),10)\right)\right) \cdot a$ with probability $(1 - y(w))$, i.e. the higher (lower) the wage offer, the higher the probability for positive (negative) reciprocity and the higher the extend of positive (negative) reciprocity. Figure 4 shows the corresponding predictions of the wage-effort relationship for *1o1* and *165*. These predictions are based on estimates, which are derived from ordered logistic regressions on the two data sets (see table 4).

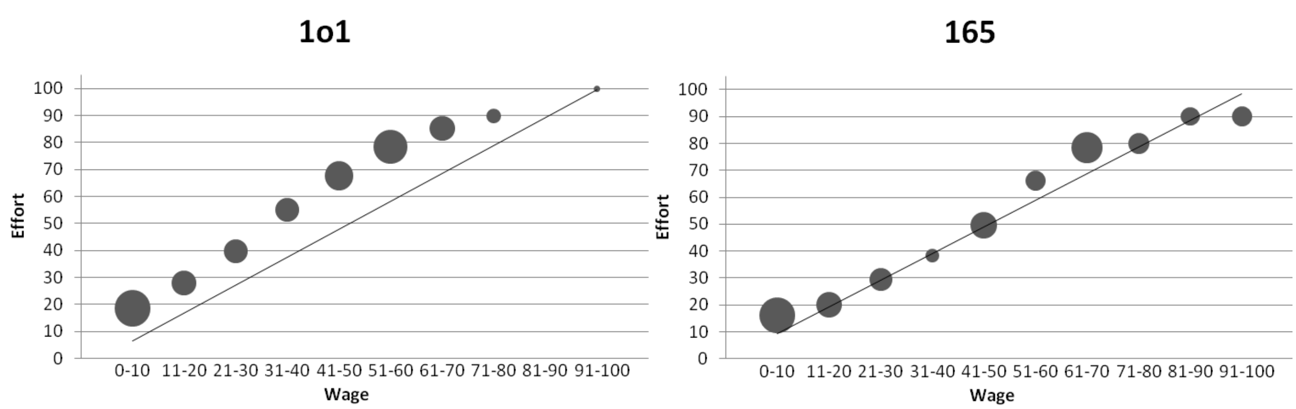

Figure 4: Predictions according to tit for tat.

Table 4: Ordered logistic regression with effort as dependent variable.

Effort	Coefficient	Std. error	Coefficient	Std. error
	1o1		*165*	
Wage	0.111***	0.007	0.072***	0.007
/cut1	1.414	0.222	1.848	0.295
/cut2	1.951	0.232	2.368	0.316
/cut3	2.517	0.248	2.596	0.329
/cut4	3.477	0.285	3.030	0.353
/cut5	4.361	0.326	3.666	0.389
/cut6	5.095	0.356	4.084	0.418
/cut7	6.133	0.398	4.583	0.448
/cut8	6.932	0.429	4.868	0.461
/cut9	8.138	0.472	5.934	0.506

1o1: N = 335, LR χ^2 = 353.56, p = 0.000, Pseudo R^2 = 0.2378; *165*: N = 198, LR χ^2 = 161.56, p = 0.000, Pseudo R^2 = 0.2063.

4. Conclusions

I systematically investigate the influence of disadvantageous payoff inequality on employees' effort choices. I introduce three treatments: a standard bilateral gift-exchange game, a 13-lateral gift-exchange game, in which the employer gains from 12 work relationships, and a bilateral gift-exchange game, in which the employer receives an additional lump sum payment. In the latter two treatments, employees can only avoid disadvantageous payoff inequality when they receive generous wage offers. I find a highly positive correlation between wages and effort choices in all three treatments. However, wages per unit of effort are significantly larger if the employer has the opportunity to earn from multiple work relationships or receives a lump sum payment.

The results have two main implications: On the one hand, there is support for the fair wage-effort hypothesis, because high effort levels are present despite the unequal distribution of employer and employee payoffs. Inequity aversion apparently does not drive high effort choices. Instead, effort choices seem to follow a tit-for-tat pattern. Therefore, it seems more important for companies to determine wage levels their employees consider fair, than to determine conditions for payoff equality.

On the other hand, the findings add to the external validity of the fair wage-effort hypothesis for macroeconomic studies, as effort provision is not negatively affected by commonly observed income inequality due to company size or employer wealth. Furthermore, employee effort choices respond similarly to different sources of disadvantageous income inequality. Thus, when making their effort choices, employees are not concerned whether the employer is rich by nature or has to put forth an increased effort to manage multiple work relationships to earn additional payoffs.

Acknowledgements

The author would like to thank Matthias Held, Steven Keary, and Karim Sadrieh for their contributions. Financial support from the Deutsche Forschungsgemeinschaft (DFG SA 1350/3-1) and the Land Sachsen-Anhalt is gratefully acknowledged.

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ISSN 1615-4274