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Competition in the Workplace: An Experimental Investigation*

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Abstract

We analyze competition between workers in a gift-exchange experiment where two workers are hired by the same employer. In the competition treatment the two employees simultaneously choose their effort whereas in the baseline treatment competition cannot occur since there is only one employee per employer. We find that in the competition treatment employers implicitly set "tournament incentives" by rewarding employees who choose higher effort levels than their co-workers. Here, employees' effort levels increase significantly faster, which can be explained by imitation learning. Furthermore we find that employers decrease their wage payments per unit of effort exerted over time when employing two workers.

JEL Classification numbers: C91, J41, L22, M52.

Keywords: Gift Exchange, Competition, Internal Organization, Multiple Employees

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1 Introduction

Competition in the workplace is an astonishing and widespread phenomenon (e.g. (Marino and Zabojnik 2004)). This kind of internal competition is characterized by several employees who are hired by the same employer and who try to outperform one another in order to receive higher wage or bonus payments. The phenomenon is of great empirical relevance as companies involving multiple employees are frequent in the field.

In an experiment, competition on the workplace could be analyzed as a gift-exchange game, however, the standard version of that game[1] is not suitable for two reasons. The first reason concerns the number of employees per firm. Most papers focus on setups where each employer hires exactly one employee,[2] this is why these papers do not cover the full depth and breadth of these internal competition mechanisms. The second prerequisite relates to the timing of the game: in the standard workhorse model employees act as second movers, i.e., they have a strong incentive to exert low effort levels which, reduces their incentives to outperform each other.[3] We circumvent these problems by using the modified gift-exchange game introduced by Abeler, Altmann, Kube and Wibral (2010) where two employees are matched to one employer and where the timing is reversed.[4]

There is a growing literature on gift-exchange games with multiple employees,[5] but none of them addresses competition in the workplace. Concerning employees' effort choices, most papers do not report significant changes compared to the standard gift-exchange game (e.g., Charness and Kuhn (2007) or Maximiano, Sloof and Sonnemans (2007)). Gächter and Thöni (2010) find that employees care greatly about disadvantageous wage inequality when workers receive a lower wage compared to their co-worker, they decrease their future effort levels. There are also studies reporting the workers' reactions to wage cuts (Gächter and Sefton (2008) and Cohn, Fehr, Herrmann and Schneider (2011)). These papers show that workers' performance significantly decreases after the experience of a wage reduction when their co-workers' wage is held constant. Although all these studies do investigate multiple-employees setups they are sufficiently different to our paper. In contrast to these papers our main interest is not based on the consequences of unequal wage payments, but rather on the dynamics of the competition in the workplace phenomenon in multiple workers environments.

If employers pay higher wages to the employees who exert a higher effort level compared to their co-worker it can be considered as an implicit rank-order tournament where

[1] Fehr, Kirchsteiger and Riedl (1993). The literature on gift-exchange games is huge (for a survey see Gächter and Fehr (2002) or Charness and Kuhn (2011)).

[2] For example Fehr, Kirchsteiger and Riedl (1998), Charness (2000), Brandts and Charness (2004), Pereira, Silva et al. (2006) and Owens and Kagel (2010).

[3] Engelmann and Ortmann (2009) find that responder behavior in gift-exchange games where employers first move is very sensible to parametrization, i.e., responders often tend to exploit proposers.

[4] This framework enables the *employers* to reciprocate high effort choices of the employees as in other papers such as Falk and Kosfeld (2006), Heinz, Juranek and Rau (2011) or Eriksson and Villeval (2011) who report gift-exchange results where employers can express non-monetary reciprocity to employees.

[5] In Altmann, Falk and Huffman (2009), the number of employees per firm is endogenous.

workers are paid according to their relative performance. Lazear and Rosen (1981) show theoretically that this kind of payment structure can result in optimal allocations if workers are risk neutral. Since tournament incentives are crucial for competition in the workplace we will control if employers in our experiment create these incentives by offering extra payments to workers who exert a higher effort level than their co-workers. These more productive workers would receive a payment similar to a bonus payment additional to the normal wage payment which only relates to the chosen effort level.

Our setup builds on Abeler et al.'s (2010) study which analyzes the effects of different payment regimes in a reversed gift-exchange game. The authors compare two different treatments called *Individual-Wage Treatment* and *Equal-Wage Treatment* to analyze the impact of possible *norm violations* on the average effort levels. They distinguish between disadvantageous and advantageous norm violations, where a disadvantageous (advantageous) norm violation is defined as a situation in which an agent exerts higher (lower) efforts but does not receive a higher (lower) payoff than the co-worker. The paper documents that norm violations lead to a substantial crowding out effect, that is, workers who face a disadvantageous norm violation lower their effort in the following period. This results in a significant treatment effect, as there are many more norm violations in the treatment where employers cannot discriminate in wages compared to the treatment where this possibility is given. Abeler et al. (2010) report that the average effort level of the Individual-Wage Treatment is roughly twice as high as the average effort level in the Equal-Wage-Treatment.

In this paper we replicate Abeler et al.'s (2010) Individual-Wage Treatment and compare it to a baseline treatment where only one employee is matched to one employer and where competition in the workplace cannot play a role. In both treatments the employees act as first movers and simultaneously decide about their effort choices, afterwards the employers choose the corresponding wages for each of the workers. The principals have the possibility to determine an individual wage payment for each employee and therefore to set tournament incentives. Put differently: as the employers can observe the employees' effort choices, they can reward employees who exerted higher efforts by paying them higher wages. Thus, in the treatment with two employees per firm, workers face competitive pressure while choosing their effort levels.

Competition in the workplace can also be regarded as a dynamic process which is connected to learning behavior. First, fast-learning employees will have significant advantages in the intra-company competition. Second, before new employees can possibly compete in the workplace, they have to learn about the competitiveness of their new workplace. That is, they have to figure out if or to what extent their employer reciprocates competitive behavior in the workplace and additionally they need to find out to what extent or on which occasions their co-workers compete with each other. This line of reasoning shows the importance of learning processes in the context of competition in the workplace.[6]

[6]Cabrales and Charness (2011) also report that teammates imitate their "colleagues" in a team production

To the best of our knowledge our paper is the first which analyzes this kind of competition in an experiment. Other studies (e.g., Fehr, Kirchler, Weichbold and Gächter (1998), Fehr and Falk (1999), Bartling, Fehr and Schmidt (2010) and Brandts, Gërxhani, Schram and Ygosse-Battisti (2010)) address competition from another point of view: they analyze competition *for* the workplace where employees compete to be hired in contrast to the competition *in* the workplace phenomenon where employees who work for the same employer try to outperform one another in order they receive higher payoffs.[7]

Our results emphasize that the employers set the tournament incentives which allow competition in the workplace to occur. This is why individual effort choices are increased, especially in the early periods of the game, when a significant learning process can be found. Furthermore we show that imitation learning[8] serves as an explanation for this learning process. The data highlights that employers are also affected by competition between the workers. In the competitive treatment they significantly reduce their generosity towards the employees over time. In the non-competitive treatment this effect vanishes.

Our paper is organized as follows: in the next section we present our experimental design and our results are presented in Section 3, Section 4 concludes.

2 Experimental Design and Procedures

In this experiment we consider a two-stage game with two different types of players: employers and employees who are matched into firms. Compared to the standard gift-exchange game the timing of our game is reversed: in the first stage the employees choose an effort level and in the second stage the employers determine a wage payment for the employees. We choose this approach, as employees have the possibility to shirk in the standard gift-exchange game, i.e., they can choose minimum effort levels despite of having received positive wage payments. This aspect complicates the formation of competitive pressure between the workers as they both have an incentive not to exert above minimum effort levels. This is why the reversed gift-exchange game is better suited to tackle our research questions.

Effort is costly to employees and beneficial to the employer while wages are beneficial to employees and costly to the employer. The workers' and employer's actions and the corresponding payoffs are exactly the same as in Abeler et al. (2010). One unit of effort

gift-exchange study. The authors report that low-skilled agents show enhanced social learning and are more likely to reject an offered contract menu after their teammate also rejected a contract menu in the previous period.

[7] For experimental evidence on the effects of competition see Niederle and Vesterlund (2007) or Flory, Leibbrandt and List (2010). These settings are different from ours in that they do not analyze gift-exchange setups. They focus on gender effects due to competitional effects. Chen (2003) points out that too harsh internal competition may create incentives to sabotage the work of abler colleagues. Note that our framework instead focuses on the possibility to outperform colleagues in terms of effort choices.

[8] Imitation learning was theoretically introduced by Vega-Redondo (1997), for further evidence on imitation learning see, e.g., Huck, Normann and Oechssler (1999), Offerman, Potters and Sonnemans (2002), Apesteguia, Huck and Oechssler (2007).

Effort Level e	1	2	3	4	5	6	7	8	9	10
Costs $c(e)$	0	1	2	4	6	8	10	13	16	20

Table 1: Effort - Cost-of-effort relation

increases the payoff of an employer by 10 units, whereas the employees' payoff is reduced by respective effort costs (see Table 1). Employees can choose effort levels between one and 10. The wages paid by the employer must not exceed 100. They subtracted from the employer's payoff and allotted to the employees.

We compare two different treatments: the *Single-Employee-Treatment (SET)*, and the *Multiple-Employees-Treatment (MET)*. Following Abeler et al. (2010), the base game of both treatments is repeated for 12 periods and a random matching routine is employed. In contrast to Abeler et al. (2010), the only difference between our treatments is the number of employees per firm: in SET there is only one employee per firm whereas firms consist of one employer and two employees in MET. We also applied a slight change in SET payoffs compared to the payoffs used in Abeler et al.: to avoid wealth effects and to ensure comparability, we doubled employers' payoffs' for SET as reported in Table 2 which summarizes the players' payoffs.

Treatment	Payoff Employer	Payoff Employee i
SET	$2 \cdot (10e - w)$	$w - c(e)$
MET	$10(e_1 + e_2) - w_1 - w_2$	$w_i - c(e_i)$

Table 2: Payoffs

In MET both employees are paid from the money generated by their effort choices. The employer has to decide on the wages for both employees. Evidence of prior gift-exchange games (e.g., Fehr et al. (1993)) suggests that due to reciprocal behavior employees exert higher levels of effort if employers pay higher wages. Due to the reversed timing, it should be the employers who show reciprocal behavior. However, as employers can observe the efforts of both workers it might be that "tournament incentives" are implicitly set - as the move order is reversed, employers can easily reward higher effort choices. That is, they can pay higher wages to employees who exert a higher effort, yielding competition for high wages amongst the employees. The difference in the number of employees per firm therefore enables us to control for this competition in the workplace effect generated by the existence of a second employee.

The experiment was conducted in November 2010 at the *AWI Lab* of the University of Heidelberg using the z-Tree software package by Fischbacher (2007) and Greiner's (2004) online recruitment system. At the beginning of the experiments participants were randomly placed into matching groups which remained constant for the whole session. Each matching group comprised three firms, i.e., three employers and three workers in SET and three employers and six workers in MET. At the beginning of each period the

members of a matching group were randomly matched into firms. This procedure resulted in nine independent observations for the SET and four independent observations for the MET.

Additional data was provided by Abeler et al. who conducted prior sessions in April 2005 at the *BonnEconLab* of the University of Bonn. Table 3 compares the Abeler et al. (2010) data to our MET observations.

Dataset of	Avg. Effort	Avg. Wage
Abeler et al. (2010)	8.21	31.97
Our MET data	8.09	29.32

Table 3: Comparison of the datasets (Benndorf and Rau (2012); Abeler et al. (2010))

A Mann-Whitney test shows that there is practically no difference between the average effort levels of Abeler et al. (2010) and our data (two-sided p-value = 0.999). The same is true when considering average wages (two-sided Mann-Whitney p-value = 0.865). Thus we successfully replicate Abeler et al.'s (2010) results. We pool the data elicited by Abeler et al. (2010) with our MET data in order to increase the informative value of the statistical analysis. The Abeler et al. sessions comprise eight independent matching groups, thus we analyze 12 independent observations for MET and nine independent observations for SET.

In total, 90 subjects participated in our experimental sessions. In SET 54 subjects took part and 36 subjects participated in our MET-sessions. In both treatments the base game was repeated 12 times and a session took about one hour. Each participant started with an endowment of 400 points which also served as show-up fee for the participants. The profits achieved by the participants were converted at an exchange rate of 0.01 Euro/point. This resulted in an average payoff of € 10.33 which corresponded to about $14.05 at that point in time.

3 Results

In this section we present the results of our experiment. First, we analyze whether the employers explicitly set tournament incentives as this behavior is a prerequisite for competition in the workplace. Second, we present the employees' average effort levels and the corresponding statistical analyses. Finally we consider the development of these effort levels over time and analyze the employers' behavior dependent on efforts exerted. We report two-sided p-values throughout.

3.1 Competition in the workplace

Due to the existence of the second employee the employers have the possibility to set tournament incentives,[9] i.e., to pay a premium to those employees exerting higher efforts than their co-worker (henceforth "high types" and "low types"). We therefore analyze wage payments for high and low types in MET. We find evidence for tournament incentives set by the employers, that is, high types receive higher wages (36.69) whereas low types only receive a wage of 19.26. These differences in our results cannot be exclusively explained by the effort levels. It also seems that agents exerting a higher effort than their co-workers receive a premium simply for being more diligent. Table 4 reports the results of a regression with *wage* as a dependent variable controlling for this phenomenon.[10] Note that the regression is restricted to cases where the employees choose different effort levels, because tournament incentives do not cover cases where the employees choose identical effort levels.

	wage
effort	3.909***
	(0.508)
higher	4.427**
	(1.650)
period	-0.440*
	(0.235)
constant	-0.922
	(2.787)
# obs.	576
R-squared	0.344

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Regression results of tournament incentives

The independent variables of the regression are *effort* (which represents the effort chosen by the employees), and *higher* (which is a dummy variable equal to one if a subject has chosen a higher effort than his co-worker). Furthermore, we control for the corresponding *period* (1-12). The OLS regression reveals that *effort* and *higher* are significant. That means, higher effort levels increase employees' wages. It also shows that employers pay higher wages to workers who outperform their co-workers in contrast to workers who do not "win" the tournaments. We thus find support that tournament incentives are set by our employers. Finally, we find that workers receive lower wages in later periods (we will discuss this in more detail in section 3.4).

[9] We thank Matthias Wibral for pointing out this issue.

[10] The standard errors of this regression are adjusted for 36 clusters representing individual employers as all employers determine two wage payments per round.

Result 1 *The employers trigger internal competition between the employees by making an extra payment to employees who exert a higher effort level compared to their co-worker.*

Table 5 summarizes the average effort levels in different periods of time. It shows that the average effort is higher in MET compared to SET. That is, workers in the competitive treatment exert an average effort level of 8.17 in contrast to SET where average effort is only about 7.44. Nevertheless, this difference is not statistically significant (p-value = 0.255).

	First half			**Second half**			
	Periods 1-3	Periods 4-6	Increase	Periods 7-9	Periods 10-12	Increase	Avg.
SET	7.22	7.31	0.09	7.86	7.35	-0.51	**7.44**
MET	7.65	8.68	1.03	8.39	7.94	-0.55	**8.17**

Table 5: Average effort levels over time

However, considering the first half of the game (periods 1-6) , we observe a significant learning effect in MET: there is an intense increase in the effort levels (1.03 units of effort; Wilcoxon matched-pairs test p-value = 0.004), whereas effort levels are nearly unchanged in SET: here, the difference is not statistically significant, it is only about 0.09 effort units (Wilcoxon matched-pairs test p-value = 0.407). These findings can be interpreted as a consequence of internal competition between the MET workers. The result indicates that learning plays an important role for competition in the workplace.[11]

Result 2 *On average the introduction of a second employee does not result in increased effort levels. However, in periods 1-6 there is an intense increase of efforts in the competitive treatment whereas there is no such increase in the non-competitive treatment.*

3.2 Behavior over time

The development of the average effort levels over time is significantly different across treatments which is illustrated by Figure 1. It comprises both treatments: the blue line which represents SET and the black line which depicts MET. In general, the MET effort levels are higher than the SET effort levels.[12] Considering the early periods (the first half of the game, periods 1-6) we find a steep increase of efforts in MET,[13] i.e., in MET there is a positive correlation between effort and period in the first half of the game (sign-test p-value < 0.01). There is no such correlation in SET. The sign-test p-value for periods 1 - 6 is 0.289, hence, in contrast to MET we cannot reject the null-hypothesis of no correlation between effort and period in SET.[14]

[11] We will return to learning behavior later on.

[12] Note that the black line is above the blue line in each single period except period 2.

[13] In the early periods, 11 out of 12 matching groups have Spearman's rank correlation coefficients between effort and period that are positive.

[14] The periods 3-9 seem to be a more promising choice to detect a correlation effort and period in SET (compare Figure 1). In this interval there is also no significant correlation, the corresponding p-value is 0.180.

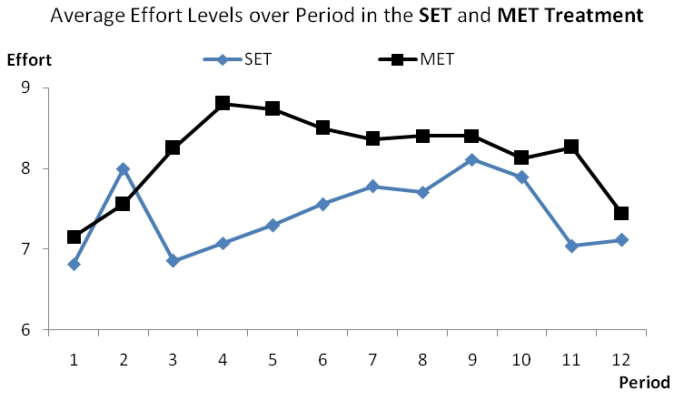

Figure 1: Average Effort Levels over Period

The different dynamics documented above support our intuition that the learning processes are more efficient in MET compared to SET. Focusing on the first period of the game we find no difference between the average effort levels of our treatments (Mann-Whitney p-value = 0.776). At this point in time neither MET nor SET employees have any information about the employers' reactions to their effort choices. The employees first have to learn their employer's reaction and to gauge to what degree the employers reciprocate high effort levels. In MET this "early learning process" results in a significant increase of the average effort levels, but there is no indication for such a learning process in SET.

Result 3 *In MET effort levels correlate positively and significantly with the period variable during the early periods of the game. This type of correlation cannot be found in SET.*

3.3 Imitation learning

One possible driver for the different dynamics is imitation learning,[15] a simple learning process suggesting that players imitate the most successful action choice of the previous period. The concept of imitation learning cannot be applied in the SET treatment because there is only *one* employee who is employed by an employer. Therefore this worker would not obtain any information about the effort level a co-worker might chose. In contrast, MET employees have all the information necessary to make use of the imitation heuristic by monitoring the effort levels chosen by their co-workers. It is the aim of this subsection to figure out whether imitation learning is present in MET.

In this analysis we focus on a subsample of our dataset. We restrict our regression to observations where subjects earned less than their co-worker in the previous period. Otherwise imitation learning would suggest that a large fraction (about 67% of all cases in MET) of employees leave their effort choices unchanged and this may bias the results.

[15] More detailed descriptions can be found in Vega-Redondo (1997), Huck et al. (1999), Offerman et al. (2002) or Apesteguia et al. (2007).

	(1) $e_{i,t} - e_{i,t-1}$	(2) $e_{i,t} - e_{i,t-1}$
imit	0.464***	0.507***
	(0.076)	(0.0996)
imit_nv		-0.743***
		(0.1156)
nv		-2.061***
		0.5661
constant	0.066	0.741
	(0.153)	(0.2496)
# obs.	261	
# subjects	65	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Regression results of imitation learning

Using a random-effects model and adjusted standard errors for the 12 clusters of the MET match groups we estimate the following regression:

$$e_{i,t} - e_{i,t-1} \;=\; \alpha_0 \;+\; \alpha_1 \cdot imit \;+\; \alpha_2 \cdot imit\_nv \;+\; \alpha_3 \cdot nv \;+\; \epsilon$$

where $e_{i,t}$ and $e_{i,t-1}$ denote the effort choice of subject i in period t and period $t-1$, respectively. *imit* denotes the difference between the most successful effort choice of the previous period and the effort level chosen by the corresponding subject in the previous period, i.e., *imit* always specifies the exact change of an imitation player's effort choice between period $t-1$ and t. It contains integers between -10 and 10 if the employee was less successful than his co-worker. If both employees received the same payoffs in the previous period, we assume that imitation players consider only the lowest effort choice because it is less risky. *imit_nv* is an interaction term between *imit* and the *nv* variable which is a dummy indicating whether the corresponding subject experienced a disadvantageous norm violation in the previous period (see Abeler et al. (2010)). Advantageous norm violations are not covered by this analysis as we consider only observations of subjects who earned less than their co-worker in the previous period.

The regression results are reported in Table 6. We find that the employees are prone to imitation. In our first regression we do not control for norm violations and find that the effort changes are largely in line with the imitation predictions. The *imit* coefficient is approximately 0.5 and highly significant.

Furthermore we infer that norm violations have a significant and substantial impact on the effort choices. The coefficient for the dummy is about -2 and the coefficient for the interaction term about -0.74, both coefficients are highly significant. The sign of the sum of the *imit* and *imit_nv* coefficients is particularly striking: it is negative, indicating that the employees still use the information about their co-worker to adjust their effort

choices. Yet this adjustment based on the information about the other employee results in an increase of the effort levels and not in the decrease predicted by imitation learning.[16]

Our results do imply a decrease of an employee's efforts after a norm violation but this decrease is captured by the *nv* dummy which represents a general effort decrease that is not related to imitation learning. This is why we conclude that norm violations can be interpreted as a disturbance of imitation learning: the employees do not comply with the concept's predictions after experiencing a norm violation.

Result 4 *Imitation learning can explain the different developments of the average effort levels across treatments. Norm violations can be interpreted as disruptions of the imitation learning process.*

3.4 Employers' reactions

The results reported so far are evidence that the employers' behavior is also affected by the existence of a second employee. In section 3.1 we showed that employers pay lower wages in later periods, the imitation behavior we observed in section 3.3 may also affect the employers' decision-making process. Employers anticipating the employees' imitation behavior may adapt to this kind of behavior, e.g., by paying very low wages to employees exerting low effort levels. There are, however, numerous other explanations why the employers' behavior may change. This is why the following paragraphs analyze the employers' reactions to the existence of the second employee.

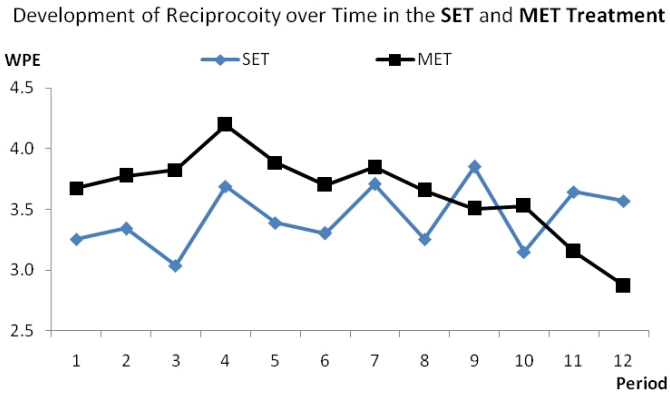

Figure 2: Development of Reciprocity over Time

Figure 2 shows the development of the average *wage payments per unit of effort exerted (WPE)*. Even though the WPE measure has comparable levels across treatments there is a substantial difference regarding the dynamics. In SET there is no distinct development of this measure: there is no apparent difference between the WPE of the early periods in SET compared to the last periods of the game. However, in MET a clear effect can be

[16] Imitation will always predict effort decreases if there was a disadvantageous norm violation in the previous period. A negative coefficient of the interaction term therefore indicates a positive change of effort levels.

found, i.e., there is a decreasing trend of the average wage payments per unit of effort. In contrast to the early periods, employers significantly decrease their wage payments in the final periods. The time trend of the average wage payments per unit of effort exerted is also significantly different across treatments. In MET there is a significantly negative correlation between the period variable and the average wage payment per unit of effort exerted (sign-test p-value = 0.038), but there is no such correlation in SET (sign-test p-value = 0.508).[17] A decreasing trend in MET can be observed but there is no such development in SET.[18]

Figure 3 supports this result: the left diagram presents MET-employers' wage payments per effort level (split into three effort intervals) in periods 1-6 compared to the wage payments per effort level in periods 7-12. The right diagram presents the same analysis for SET-employers' wage payments.

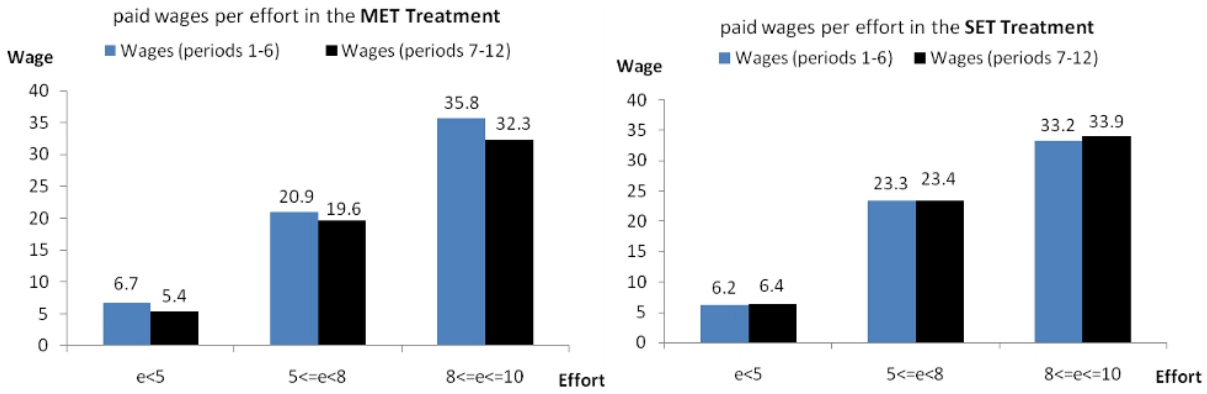

Figure 3: Paid wages per effort in the MET- and SET-Treatment (P:1-6 vs. P:7-12)

It can be clearly seen that in MET the wages paid per effort interval decreases in periods 7-12 compared to periods 1-6. This holds true for every effort interval. When efforts were below five, average wage payments decrease in periods 7-12 from 6.7 (periods 1-6) to 5.4 (periods 7-12). This difference is statistically significant (Wilcoxon matched-pairs test p-value = 0.028). For $5 \leq e < 8$ average wages also decrease from 20.9 (periods 1-6) down to 19.6 (periods 7-12). However, this difference is statistically not significant (Wilcoxon matched-pairs test p-value = 0.824). When employees' average effort level was $8 \leq e \leq 10$, average wages also decreased from 35.8 (periods 1-6) to 32.3 (periods 7-12). This difference is weakly significant (Wilcoxon singrank test p-value = 0.100). If we focus on the diagram for SET, we do not observe these findings at all: in each of the three intervals there is nearly no development over time. That is, employers always choose the same average wage for each of the three effort intervals. These results once more underline that the employers' reciprocity decreases over time in the presence of two workers. Because of

[17] In MET 10 out of 12 matching groups have negative Spearman's rank correlation coefficients. In SET only three of nine groups have negative coefficients.

[18] Note that in the first period, employers pay higher levels of WPE in MET compared to SET. However, this difference is not significant (Mann-Whitney p-value = 0.292 on individual level data).

competition in the workplace between workers in MET, employers seem to play the two workers off against each other by systematically decreasing individual wages.

Result 5 *In contrast to SET the wages paid per unit of effort decrease over time in MET. In this environment with two employees, employers decrease their reciprocal behavior in the second half of the game.*

4 Conclusion

How should an efficient workplace be designed? Our results may give answer to this question. We find that employing more than one worker results in a clear cut improvement of employees' effort levels over time because employers can induce tournament incentives by systematically rewarding workers who outperform their co-worker. Workers in the multiple employee treatment are therefore faced with competitive pressure and increase their effort levels compared to the single employee case. Even though competition in the workplace does not affect the aggregate effort levels, competition intensifies over time. In particular, there is a distinct, increasing development of the effort levels in the first half (periods 1-6) of the game if and only if there are multiple employees. This is a clear indication of the enhanced learning of employees who can compare their outcomes to those of a co-worker. The learning process in the environment of multiple employees is primarily driven by imitation. Considering only cases where imitation predicts a non-zero change of effort levels, we find that employees' behavior is in line with the imitation predictions. The results confirm those of the economic literature on peer effects at the workplace which report that workers increase the average effort levels over time in the presence of co-workers because of learning behavior and social pressure (compare, e.g., Falk and Ichino (2006); Mas and Moretti (2009)).

Analogously to Abeler et al. (2010) our findings document that norm violations play an important role in MET. The results reveal that norm violations are harmful for imitation learning. That is, employees systematically decrease their effort choices after prior norm violations. The fact is that employees are prone to imitation and competition adds valuable insights especially for organizational economics. Employers or managers should note that competition can substantially stimulate learning processes and that norm violations abate this enhanced learning.

The analysis also shows that a second employee working for the same employer influences employers' behavior. The increasing competitive pressure between the workers forces employees to raise their effort choices over time. The data documents that employers anticipate this. We find that employees systematically pay a smaller wage for each unit of exerted effort over time. This finding is striking because there has not been any other gift-exchange study which reports decreasing levels of reciprocity over time.[19]

[19]The prevalance of reciprocity in gift-exchange games is well-documented in the literature (Gächter and

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Appendix: MET- Instructions

Welcome to this experiment on decision making.

Please read these instructions carefully. At the end of these instructions you will be asked to answer several control questions. The experiment will begin as soon as each participant answered the control questions correctly. The experiment is anonymous, i.e., you will not get to know with which other participants you are interacting.

During the experiment you can earn „Experimental Currency Units" (ECU). Your earnings depend on your decisions and on the other participants' decisions as well. After the experiment the ECUs will be **converted into Euros** at the following **exchange-rate**:

1 ECU = 1 Cent

Please wait at your desk until we ask you to come to receive your payment. After the experiment, please bring all the documents we handed out to the place where you will receive your payment.

You begin with a starting capital of **400 ECUs (€4,-)**. It increases if you make profits and it decreases if you experience losses during the experiment. Note, that you can always rule out the possibility of making losses by your own decisions.

Please also note that you must not talk to the other participants during the experiment. In this case we need to abort the experiment immediately. **If you have any questions please raise your hand and we will answer them personally.**

Appendix: MET- Instructions

In this experiment participants either act as an **employer** or as an **employee**. At the beginning of the experiment, you will be randomly assigned one of these roles. Your role does not change during the experiment.

The experiment will be repeated for **12 periods**. In each period participants are randomly divided into groups of three people. Each group consists of one **employer** and of two **employees** called employee 1 and employee 2. Your decisions are only reported to the other two members of your current group. The other participants are not informed about your decisions.

Each period comprises two stages. In the **first stage employee 1 and employee 2 each choose an effort level**. Their decision is independent of the other employee's decision. There are ten different effort levels the employees may choose. **The lowest possible effort level is 1 and the highest one is 10**. Each unit of effort exerted by an employee produces 10 ECUs for the **employer**. For instance if the effort level is 1 the employer will receive 10 ECUs, if the effort level is 2 the employer will receive 20 ECUs, etc. If the effort level is 10 the employer receives 100 ECUs.

Choosing an effort level is costly for the employees. The higher the effort level, the higher the corresponding costs. However, the costs only depend on the effort level an employee chooses for himself. The effort level chosen by the other employee does not affect the costs. For an employee, the costs of choosing an effort are as follows:

Effort level:	1	2	3	4	5	6	7	8	9	10	
costs:	0	1	2	4	6	8	10	13	16	20	ECUs

Thus, choosing an effort level of 1 does not provoke any cost for the employee. Choosing a level of two costs 1 ECU, etc.; choosing a level of 10 costs 20 ECUs. All employees have the same cost table and it is the same for all periods.

Appendix: MET- Instructions

In the **second stage** the employer is informed about the effort choices of employee 1 and employee 2. After that the employer chooses wage payments w1 and w2 for employee1 and employee2, respectively. The wage payments for the employees may either be equal or different. A wage payment for an employee must not be lower than 0 ECUs and it must not exceed 100 ECUs.

At the end of a period both employees and the employer are informed about the effort levels, about the wage payments and about the resulting profits.

Thus, in each period, a participant's profit in ECUs is as follows:

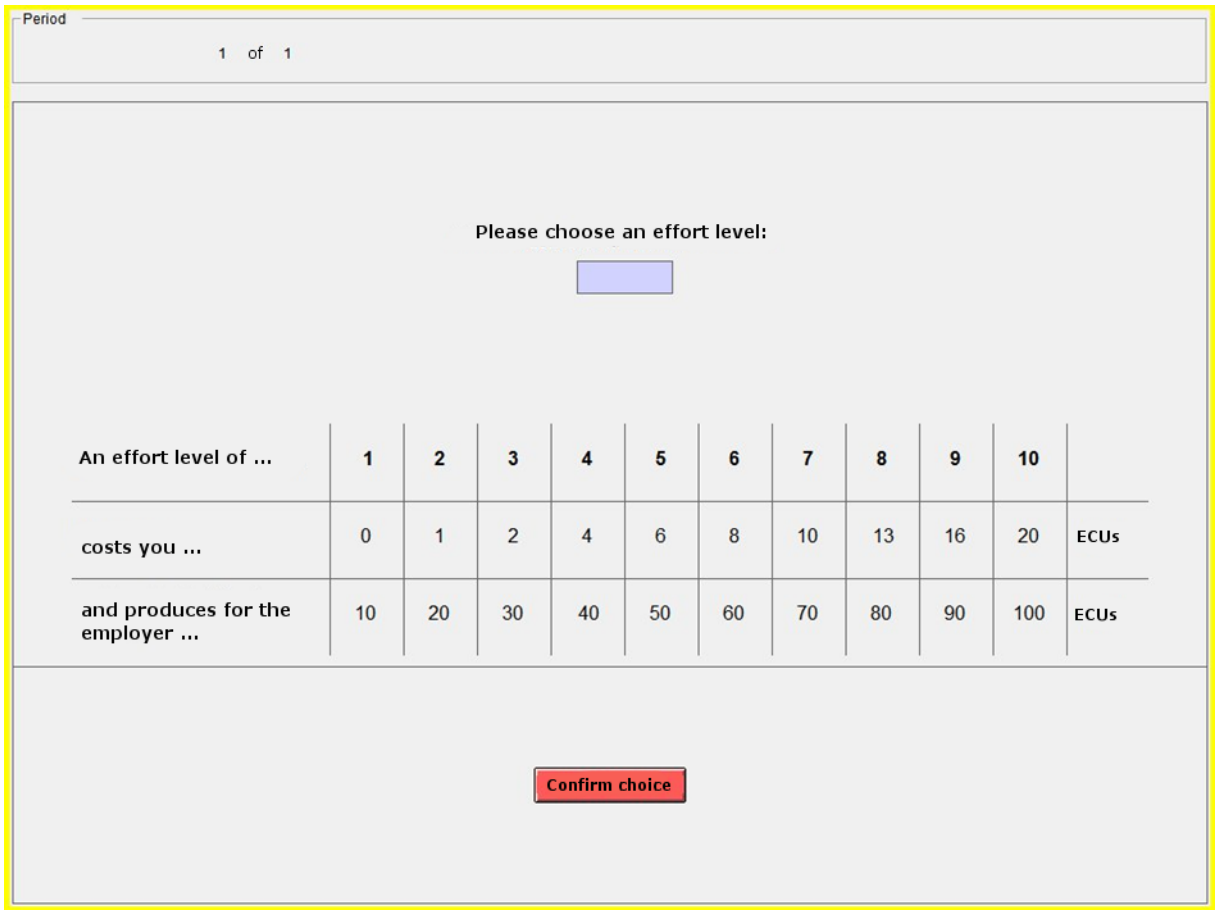
Employer's profits	=	10 x effort level chosen by employee 1 + 10 x effort level chosen by employee 2 – wage payment for employee 1 (w1) – wage payment for employee 2 (w2)
Employee 1's profits	=	wage payment for employee 1 (w1) – cost of effort chosen by employee 1
Employee 2's profits	=	wage payment for employee 2 (w2) – cost of effort chosen by employee 2

At the end of the experiment, you will receive your total profits. They consist of the starting capital and the sum of the profits earned in each period of the experiment.

Appendix: MET- Instructions

Effort screen

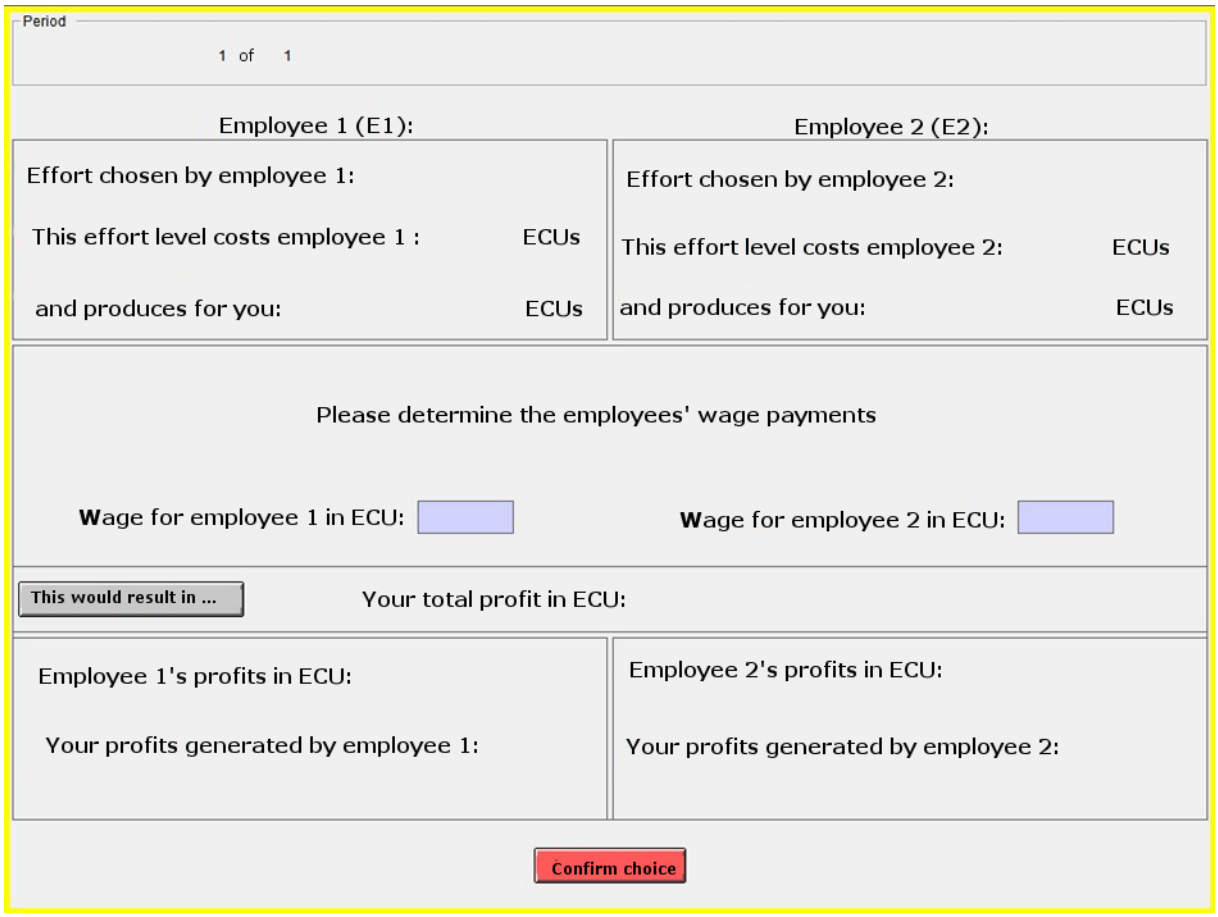
Below, you can see a screenshot of the input screen an employee is faced with when choosing his effort level. The effort–cost-of-effort relation and the amount of profits generated for the employer are reported in the lower area of the screen. The employees choose their effort levels in the upper part of the screen and confirm their choice by clicking the red button. This screen is only visible for employees.



Appendix: MET- Instructions

Wage payments screen

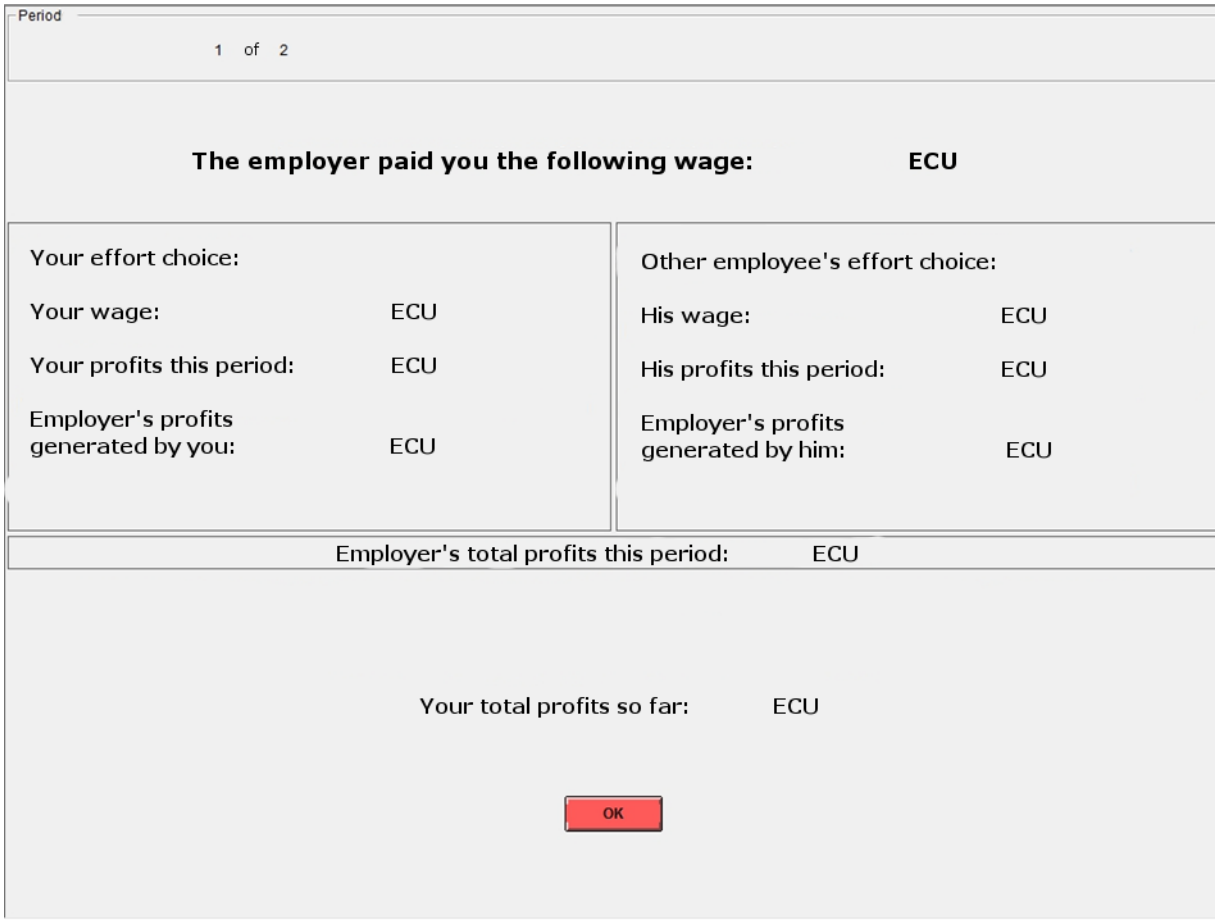
Below, you see the screen employers face when they determine the wage payments w1 and w2. It displays detailed information on the effort choices, the corresponding costs and the profits generated in the upper part of the screen. The employer can enter wage payments in the blue input boxes in the middle of the screen. By clicking on the „This would result in...“ button”, the employer may calculate the profits resulting for himself and for both employees. If desired, the employee may enter and try different wage payments by clicking the blue input boxes and the „this would result in ...“ button again. Finally, the employer confirms his final choice by clicking the red button. This screen is only visible for employers.



Appendix: MET- Instructions

Feedback screen

At the end of each period, the employees are informed about their wage payment in the upper part of the feedback screen. In the middle of this screen a summary of choices and profits of the corresponding period is displayed. In the lower part, employees can track their total profits, i.e., their starting capital plus the sum of their earnings in previous periods. The screenshot below is an example screen for employees. The screen the employers face is similar but here, the upper part is empty.



Please raise your hand if you have any further questions.

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