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## Performance Pay, Sorting and Employers Choice:

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# Performance Pay, Sorting and Employers' Choice: Are Tournaments an Attractive Payment Method?

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## Abstract

In this paper I analyze the attractiveness of a rank-order tournament if both market sides, employers and workers, can choose between several payment systems. I consider the self-selection of workers into different payment schemes, their effort provisions and the payment system choices of managers in a real effort laboratory experiment. Depending on the stage of the experiment, workers are either randomly tied to a manager or are sorted into the available payment schemes (a fixed wage, a piece-rate and a rank-order tournament) according to their preferences. When managers decide over the payment systems a cheap (low prize) tournament yields larger manager profits than a piece-rate contract. This is not the case for high prize tournaments. Furthermore, regarding workers' choices I find a clear self-selection pattern: More productive workers self-selected into the variable payment schemes (piece-rate and tournament) and most workers prefer the "safer" option piece-rate to the tournament. Especially the low prize tournament is not chosen by many productive workers. As a consequence, even the low prize tournament does not yield larger manager profits than the piece-rate contract. These findings show that in conditions in which a piece-rate payment is possible, rank-order tournaments are not simultaneously attractive for workers and employers.

*JEL classification:* C91, D81, D82, J31

*Keywords:* Personnel economics, Sorting, Incentives, Productivity, Ability, Piece-rates, Tournament, Experiment

## 1 Introduction

Companies operate in different environments which usually require different worker types. The worker type that fits into a highly productive, but also somewhat risky environment, like an IT start-up, is very likely a different worker, than the one demanded in more traditional and conservative industry, like the automotive industry. A firm can suffer if its employees do not fit in the given organizational structure, since a mismatch of worker type and firm often results in a low worker performance and high turnover, which lead to lower firm profits. Therefore attracting the right worker type is an important factor for

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the success of a company. The opportunity to provide a contract offer to potential employees creates the possibility for employers to screen the desired worker type. While some workers with certain individual characteristics, such as intrinsic motivation, specific skills or high risk aversion, will be attracted by a given payment scheme, other agents will avoid the same contract, because its structure does not fit their preferences. Therefore different payment schemes will lead to a systematic self-selection of workers and result in distinct workforce compositions. In this context I investigate the attractiveness of tournaments for employers and employees.

Rank-order tournaments are a popular payment method investigated in many theoretical (e.g. Lazear and Rosen (1981), Green and Stokey (1983) and Nalebuff and Stiglitz (1983)) and experimental papers (e.g. Bull et al. (1987), Eriksson et al. (2009), Bartling et al. (2009) and Balafoutas et al. (2012)). A main feature of these tournaments is that the payment of workers does not directly depend on their individual output, but on their relative performance. Consequently for employers the costs of a tournament are independent of the performance of workers, at least when prizes are independent of output. On the one hand this independence can be profitable for a company, if the tournament leads to high effort provisions of workers, but is relatively cheap. In such cases the firm can generate a larger profit compared to output based payment schemes, like a piece-rate. But on the other hand such a tournament is usually cheap, because the expected payoffs for workers are low. Further, a tournament is a risky payment scheme for workers, since their payoff is not fully determined by their own effort. These aspects might result in a tournament that is not well liked by productive workers.

In a setting in which employees can choose between different payment methods a company must offer a tournament that is attractive for good workers. Since these workers are productive they have a high expected income from output based payment schemes and therefore a tournament that attracts these kind of workers might be very expensive for employers. Consequently it is unclear whether with worker sorting a tournament can be attractive enough for productive workers, while at the same time being sufficiently cheap for firms to yield larger profits than a piece-rate.

The payoff of an offered contract depends on the sorting behavior of workers and on the incentive effect of the different payment schemes. Both, the sorting and the incentive effect need to be understood in order to determine the optimal, meaning payoff maximizing, contract in such a competitive environment. Therefore information on employer and employee preferences, on workers effort choices, the risk preferences of all actors etc. is necessary. Field data usually lacks the information on workers abilities to analyze the influence of self-section on performance. The same can be said for the preferences of employers, since in field data usually only the pure contract choice and no additional information is observed for managers (firms). Therefore I use an experimental setting with a real effort task, which allows causal inferences on the factors determining sorting and effort provision. Using my setup I address the following question: Can a tournament be attractive for workers and at the same time cost-efficient for employers in the presence of an alternative piece-rate payment scheme? In particular I explore the questions whether a tournament is an effective way of attracting productive workers, how self-sorting of workers takes place if multiple incentive contracts are available and what determines the payment system choices of employers in non competitive and in competitive environments.

The real effort experiment contrasts two different environments. In the first part workers and employers - called managers - are randomly paired in groups of three - one manager and two workers - and managers choose their preferred payment system among the three offered possibilities (fixed wage,

piece-rate or rank-order tournament). In this environment only an incentive effect is possible, since workers cannot influence their payment scheme.

In the second part of the experiment worker sorting is feasible. Each manager is grouped together with two other managers and then states her preference ordering over all three payment systems. These preferences are fulfilled under the restriction that each payment system has to be offered by exactly one manager. At the same time, six workers are grouped together and state their preferences over the three offered payment systems. Therefore workers are no longer exogenously matched with a manager, but select their preferred payment system. The preference orderings of workers are fulfilled under the restriction that each manager receives exactly two workers (like in part one). In this sorting priority is given to the more productive workers. This matching procedure results in competition among the employers for the most productive workers and allows for self-sorting of these workers.

There are two treatments, which differ in the prizes for tournament participants. In the low prize treatment tournament participants receive smaller prizes and consequently the tournament is relatively cheap for employers and not very attractive for productive workers. In the high prize treatment the prizes are larger and therefore the expected payoff of workers in the tournament and the costs for managers are higher.

The first part elicits preferences of managers in the absence of workers' choices and allows testing for the incentive effect of the different payment schemes in the absence of a sorting effect. I show that a tournament, even with relatively low prizes, is as effort inducing as a piece-rate contract. Employers benefit from offering a tournament in the low prize treatment, since the low costs and simultaneous high effort provisions of workers yields the largest profits. The second part reveals information about the preferences for different payment schemes of workers and managers with workers' self-selection. My results show that the self-selection of workers depends on their productivity, but also on the treatment, their relative self-assessment and their gender. Since workers self-select into payment schemes, the low prize tournament does not yield larger manager profits anymore. Therefore the tournament advantage for managers in the low prize treatment vanishes.

Given the practical relevance of the questions addressed, there is a surprising low number of papers concerned with the choice of employers between different payment systems. This study is one of the few that is concerned with employers' choices between contracts. Fehr et al. (2007) conduct an experiment with chosen effort, in which subjects in the role of employees can offer different contracts. They are mainly concerned with the effect of inequality aversion on contract choices. They find that incentive contracts yield higher effort provisions than trust contracts and that a bonus contract outperforms both. In the experiment by Karakostas et al. (2013) managers decide between a revenue sharing, a bonus and a trust contract. The majority of the employers in their study choose a revenue sharing contract. In contrast to my study, in both of these papers there is never a competition for workers between the employers and these studies do not consider worker sorting.

Besides these papers, there exists a large experimental literature that is concerned with fixed wage offers to subjects. In this literature the employers choose between different parametrization of contracts and not actually between contract types. The best known example of such a procedure is the "gift-exchange" game, which is concerned with the question whether higher (fixed) wages result in higher effort provision. These studies demonstrate that high wage "gifts" of employers, in the form of unconditional offers, are on average rewarded with higher effort choices by workers. Therefore it pays for

employers to offer above minimum wages. Akerlof (1982) described the effect theoretically and Akerlof and Yellen (1990) applied it to the labor market. Fehr et al. (1993) showed the effect in an experiment and it has been replicated in many different environments in the lab and in the field.<sup>1</sup> In the gift-exchange game employers' choices are not the contract type, instead they choose the fixed wage. Therefore the parameter employers control (and choose) is the offered fixed wage. Similarly in Falk and Kosfeld (2006) employers restrict the minimum effort level of workers. In their paper they use a modified gift-exchange game with the possibility to restrict the effort choice of employees from below. In this setting employers clearly choose what to offer, but the choice is again between different parameterizations of the same contract type.<sup>2</sup>

There exists a larger body of literature that is concerned with the sorting of workers. The self-selection of workers is one major factor explaining output differences between payment schemes. The sorting effect and its consequences for productivity has most prominently been documented by Lazear (2000). His field experiment shows that the self-selection into a piece-rate scheme accounts for a large share of the performance increase. Leuven et al. (2011) are especially concerned with the role sorting plays in explaining differences in observed productivity in tournaments. With their field experiment of undergraduate students they demonstrate that an incentive effects attributed to higher tournament prizes can almost completely be explained by the sorting behavior of subjects into the different tournaments. Different to my study, they concentrate on different tournaments for the same subjects and not the choice between different payment schemes. In a laboratory setting Dohmen and Falk (2011) have shown that more productive workers self-select into variable payment schemes and additionally that variable payment schemes attract individuals with certain characteristics, such as higher willingness to take risks. These results indicate that offering a payment scheme that is attractive to workers, in an environment with possible self-selection, can be profitable for employers, but also that preferences of workers depend on more than the incentive structure of contracts.

In Dohmen and Falk (2011) workers choose between a fixed wage and a variable wage alternative (depending on the treatment the alternative is a piece-rate, a tournament or a rent sharing contract). Eriksson et al. (2009), Bartling et al. (2009) and Balafoutas et al. (2012) are concerned with the endogenous choice of workers between a tournament and a piece-rate scheme. In all of these papers all subjects are workers and the choices of workers are independent of the choices of other subjects. These studies do not include the role of an employer, whose payoff depends on the performance of the worker(s). Additionally there exists a literature on gender differences in the willingness to participate in a tournament and to compete in different environments (e.g. see Niederle and Vesterlund (2007) and Datta Gupta et al. (2013)). These studies show that women shy away from competition and do not enter tournaments or competitive environments as often as they should in order to maximize their earnings, while men tend to participate in tournaments too often.

To understand why some contracts are offered and how workers react to these offers it is important to analyze which payment schemes employers prefer. Therefore this paper elicits preferences of subjects for different payment schemes in the role of employers and their payoff depends on the performance of

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<sup>1</sup>As a starting point see Fehr et al. (1997), Fehr et al. (1998), Fehr and Falk (1999) and Gneezy and List (2006)

<sup>2</sup>Anderhub et al. (2002) test several predictions from the principal agent model. In their paper subjects do not choose between different contracts, but rather between different parameterizations of the same contract type. Lindner et al. (2013) conduct an experimental investigation in which either employers or employees choose between two equivalent tournaments. However, their setting does not feature a choice between different payment systems.

their workers. Consequently a fellow subject within the experiment benefits from a higher effort and not an external experimenter. This could influence the performance of workers, since the gift-exchange literature has shown that reciprocity of workers plays a huge role in setting the profit maximizing wage. It is possible that the employers' choice of a specific payment system has an effect on the effort provision of subjects, similar to the effect of choosing the height of the fixed wage. Further, in most studies that focus on the worker side, there is no competition among workers. Workers always receive their most preferred payment system. This is not the case in my study as the number of workers that can enter each payment system is limited.

The paper adds to the literature mainly in three aspects. First, this study provides evidence on the question whether a tournament can be an attractive payment system for workers and managers, when simultaneously a piece-rate contract can be offered. Second, it is one of the few papers that in depth analyses the behavior of employers in an environment, in which different payment schemes are available. Third, the sorting of workers in this paper takes place in a competitive environment, which allows me to analyze the sorting behavior of subjects in a more natural setting.

My results reveal the importance of worker sorting for the profitability of a payment scheme. While the experiment suggest that a tournament is as effort inducing as a piece-rate, only with high prizes the tournament is attractive enough for productive workers to prefer the tournament over a piece-rate. But with high prizes the tournament is so costly that managers are not better off compared to a piece-rate. Of course a reduction in the tournament prizes is not attractive for workers and consequently the productive workers do not select the tournament any more. This sorting leads to equally large profits for managers with a piece-rate and those with a tournament. These findings illustrate that if a piece-rate is possible, rank-order tournaments are hardly simultaneously attractive for workers and employers. This might be part of the explanation, why tournaments, despite their good incentive structure, are rarely used as a major payment system.

The paper is organized as follows. The next section describes the experiment, treatments and outlines the hypotheses. Section 3 provides all the results. I present first the evidence on the choices of employers and the resulting profits. Then I investigate the choices and the sorting of workers and discuss the influence on manager profits. Lastly I analyze the implications of the different environments on gift-exchange behavior in fixed wage contracts. Section 4 discusses the implications of the findings and concludes.

## **2 Experimental design**

In order to address the questions raised in the introduction I need a dataset that enables me to identify individual characteristics, such as productivity in the given task and risk preferences, for all subjects, as well as data on the chosen payment schemes for workers and offered payment methods by managers. Such a rich data set is hard to obtain outside of a controlled environment, like a laboratory. Especially data on productivity and preferences about payment schemes are typically not elicited in real world labor markets. Also certain personal characteristics, like risk preferences, are difficult to measure outside a laboratory. In order to collect this information and to exogenously change the incentive structures without any disturbances, I conduct a laboratory study. While the laboratory provides an ideal environment to control possible outside influences, it is clear that not all aspects of labor markets can be modeled.

However, I believe that experiments provide a very useful and valuable tool in the study of incentives, self-selection and sorting. The main advantage is the possibility to disentangle the sorting effect from any incentive effects.

## 2.1 The real effort task

The real effort task subjects perform is the counting of ones in a table of zeros and ones. Each table contained ninety digits and for each digit the probability of a one was between 0.3 and 0.7. The randomly determined probability was constant within a table and varied between tables. The randomization ensures enough variation of the number of ones to prevent subjects from guessing the answer.

It is an easy to understand task and for most subjects it should not be very enjoyable. It therefore resembles some features of many work tasks, which typically can be solved by the workers who face it, but are not enjoyable in itself. The task provides a natural measure of productivity and the data documents a decent amount of heterogeneity in the productivity of subjects.

Figure 1: Example of task

## 2.2 Structure of the experiment

The experiment consisted of 10 stages, which all subjects went through in the same <sup>5</sup> Subjects were informed about the approximate duration of the experiment (90 minutes) and existence of multiple stages. Written instructions on the computer screens were provided for each stage.

The first two stages familiarized subjects with the task. They first solved a table without any incentives (stage one) and then a second table with payment (stage two). Each subject started with 150 points and for each second until the correct solution was entered two points were deducted from their payment. For a wrong answer 20 points were deducted and subjects could enter a new answer. They could not make losses. Subjects solved different tables, but all tables had the same probability of a one (40%) for each digit. The times needed to solve the first and second table are performance indicators I and II respectively.

The main measure of productivity comes from stage three, in which subjects worked on the task for five minutes. They were asked to solve as many tables as possible and were paid with a piece-rate

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<sup>3</sup>A similar task, with a different table size and probability distribution, was used by Abeler et al. (2011).

<sup>4</sup>As an illustration consider the time needed to solve the second table subjects had to solve. Subjects needed between 18 and 112 seconds for the correct answer.

<sup>5</sup>In the appendix table 7 contains short descriptions of all stages and an English translation of the instructions given to subjects in the beginning of the stages.





performance of their workers.<sup>6</sup> Each completed table earned the manager 14 points, independently of the payment scheme. With all three payment schemes the workers wages were paid out of the earnings of the manager. Additionally a manager received 50 points if she solved at least 10, but less than 20 tables, 100 points if she solved between 20 and 40 tables or 150 points if she solved more than 39 tables. With  $x_M$  being the number of tables solved by the manager, the payoff for manager  $W$ , which is independent of the performance of her workers, is given by

$$W = \begin{cases} 0, & \text{if } x_M < 10; \\ 50, & \text{if } 20 > x_M \geq 10; \\ 100, & \text{if } 40 > x_M \geq 20; \\ 150, & \text{if } x_M \geq 40. \end{cases}$$

Therefore a manager earned

$$w_i^M = \begin{cases} 14 * (x_i + x_j) - 2 * w^F + W, & \text{if she chose a fixed-wage;} \\ 14 * (x_i + x_j) - 8 * (x_i + x_j) + W, & \text{if she chose a piece-rate;} \\ 14 * (x_i + x_j) - T^w - T^l + W, & \text{if she chose a tournament.} \end{cases} \quad (4)$$

Participants could also answer 25 trivia questions instead of counting ones. The quiz was without payment and served as an alternative task. Subjects could go back and forth between solving tables and answering the quiz. The quiz should ensure that subjects did not work out of boredom.

All participants were first informed about the possible payment options, how workers and managers were paid in each payment scheme and the existence of the quiz as an alternative. Then a random draw determined the player roles - worker or manager. Managers then chose their preferred payment system and in case of a fixed payment selected the fixed wage. Finally workers were informed about their payment scheme and started working.

While stage five yields the revealed preferences of managers without worker self-selection, this stage does not deliver any information about workers' preferences. In stage seven subjects kept their respective roles - managers stayed managers and workers remained workers. The possible payment methods remained the same - with identical parameters - and also the working time and the trivia quiz were unchanged. All subjects were informed that in a group each payment system had to be offered by exactly one manager. Managers first entered the fixed wage they would pay in case of a fixed wage contract and then stated their preference ordering. This procedure ensures that each manager could rank the three payment systems using the fixed wage she would like to pay.

Managers received a payment scheme taking into account the stated preferences of all three managers in the group. First, all the first preference of managers were taken into account. If a payment scheme was ranked first only by one manager she received this payment system. If two or more managers ranked the same payment system first the tie was broken randomly. Next the second choice of all managers that did not receive their first choice was considered. Again any ties were broken randomly, such that if two managers stated the same first and second choice one received her third choice. These procedure ensured

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<sup>6</sup>Giving managers the option to solve tables has two advantages. First, it was harder for subjects in the lab to determine who is a worker and how is manager and second it provided additional insurance for managers to avoid losses in the working stages.

that managers had an incentive to state their preferred ordering over all three contracts.

Once the managers were allocated to the three possible contracts, the six workers in the group saw the payment schemes (including the offered fixed wage) and stated their preferences over these three contracts. After all six workers had made their choice, the stated preferences were used to match exactly two workers to each manager.

The six workers within one group were ranked from 1st to 6th, based on their performance in stage three. While the preferences orderings were fulfilled whenever possible, any ties were broken in favor of higher ranked workers. This mechanism ensured that subjects being ranked 1st or 2nd within their group received their first choice for sure. All other workers only got their preferred payment system if less than two other workers with a higher ranking selected this payment scheme. Due to this procedure more productive subjects were more likely to receive their preferred payment system. The entire procedure for the matching of managers and workers was common knowledge, but workers did not know their exact rank. Therefore subjects might have had a belief about how well they performed in stage three, but there was no feedback about their true ranking.<sup>7</sup>

In stages four, six and eight I collected data on the subjects' impressions: "How hard did you work in the just completed stage?", "How difficult was the task?" and "How stressed did you feel?". Further their beliefs about their ranking within the group were elicited. In stage three I asked "How many subject in the group of 9, do you think, have solved fewer tables than you?", while in stages five and seven workers were asked "How many of the other workers solved less tables than you?" (in a group of six) and managers were asked "How many tables did your workers solve in this stage?". The impressions about task difficulty, exerted effort level and stress level were answered on seven point Likert scales (No stress at all - Very stressful) without any incentives. Their stated belief about their ranking subjects was rewarded if they predicted their rank correctly or +/- 1 position. The same was true for the statement of managers if they correctly estimated the number of tables solved by their workers, +/- 3 tables. All questionnaires were conducted before a subject received feedback on his or her payment in the working stage and subjects received payments for the questionnaires at the end of the experiment.

In stage nine I elicited the risk preferences of subjects using a Holt and Laury (2002) lottery choice between two alternative lotteries. In stage 10 subjects answered a final questionnaire regarding how well they liked the experiment, how difficult they perceived the task and how fair they would rate the payment systems. The fairness ratings were done on seven point Likert scales and subjects answered the question for a fixed wage with the height of 100, 200, 300 and the value of the tournament prize  $T^w$  in points. They also stated how fair they consider the piece-rate and the tournament to be as a payment system. Additionally I elicited the average grade of their high school diploma, their high school graduation year, whether they are currently a student and whether they work (at least part time). At the end subjects were informed about their earnings.

### **2.3 Treatment differences**

The only difference between the two treatments was the size of the tournament prizes. In the low prize treatment the tournament winner received 400 points while loser earned 25 points. Essential this is a tournament with a prize of 375 points and a sure payoff of 25 points for both participants. In the high

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<sup>7</sup>Workers who were paid with a tournament received some information about the other worker within the same firm via the feedback whether they won the tournament or not in stage five. Managers only knew the sum of tables their two workers solved.

prize treatment the tournament prizes were 450 and 50 points respectively. Prizes were constant within a session which means subjects faced the same tournament prizes in stages five and seven. The total cost of the tournament for a manager was the sum of the two prizes, 425 points in the low prize treatment and 500 points in the high prize treatment. These tournament prizes were also the boundaries of the possible fixed wages.

While the differences in the prizes might not look substantial they can be very meaningful. It is more obvious for managers, since they have to consider both tournament prizes. For them the tournament in the low prize treatment is 75 points less expensive (15%), which translates into about 6 tables solved by their workers. For workers the higher tournament prize means that they have to solve more than 56 tables in a piece-rate in order to earn more than as a tournament winner and 50 in case of the low prize tournament. A difference of six tables is quit substantial, given that the average for all subjects in the five minutes working time in stage three (half of the working time in stages five and seven) was 14.

Further a third treatment with the high prize tournament prizes was conducted, but the requirement in stage seven that each manager had to offer a different payment scheme was lifted. Therefore all three managers could offer their preferred payment scheme. Since there are no incentives for stating any order for the not chosen payment schemes of managers or workers, in this treatment I only have the first choice of managers and workers. The matching procedure for workers was identical to that of the other treatments and favored again the choices of more productive workers. Since the treatment is identical to the high prize treatment until stage six, the data is analyzed jointly with the high prize treatment data for stages 1-6.

## **2.4 Procedures**

The entire experiment was computerized (zTree, Fischbacher (2007)), instructions were provided on screen and all interactions were anonymous. Any additional aids to count the ones in the table, like calculators etc., were not allowed.<sup>8</sup> The sessions were conducted at the mLab of the University of Mannheim (2 high prize session, 2 low prize sessions and 3 of the control treatment) and in the AWI-laboratory of the University of Heidelberg (3 session in the low prize treatment and 3 sessions in the high prize treatment). Overall 234 subjects - 113 males and 121 females, mostly undergraduate students - participated in the experiment. Each session consisted of 18 subjects - two groups of three managers and six workers each. A point in the experiment was exchanged for 1.3 Cents. On average subjects received 14.9 €, including a two € show-up fee.

## **2.5 Hypotheses**

### **2.5.1 No competition stage**

In the no competition stage managers selected a payment system to pay their workers. In order to maximize their earnings managers had to consider the costs as well as the incentives to workers of a payment system. The fixed wage contract did not provide an incentive for workers to exert effort. If a manager selected a fixed wage contract she had to trust her workers that they will supply effort anyway. Since also a piece-rate and a tournament were available, there was no reason for managers to offer a fixed

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<sup>8</sup>However, some subjects used a their finger, the mouse courser or a pen to count the ones. This was not stopped by the experimenter.

wage. Therefore I expect that no manager chooses a fixed wage contract in either treatment.<sup>9</sup>

**Prediction 1.** *No manager offers a fixed wage contract in the no competition stage. If a worker receives a fixed wage contract he provides no effort.*

Assuming that managers ruled out the fixed wage, the question is whether a tournament or a piece-rate yields a higher profit. Both contracts provide incentives for workers to exert effort, since with both payment schemes the expected worker payoff is higher with more solved tables. Given that workers cannot select into a certain contract in stage five, there is no sorting effect to consider. Whether a tournament is attractive for the manager depends on the costs of the tournament. For the high prize tournament workers needed to solve at least 36 tables to ensure a positive profit for the manager (cost of tournament: 500 pts, profit for each table: 14 pts). Naturally this number is lower (31), in the cheaper low prize treatment. Similarly, workers had to solve more than 62 tables in the high prize treatment and 53 tables in the low prize treatment for a manager to earn a higher profit with the tournament than with the piece-rate. Assuming that the higher tournament prizes did not significantly increase the performance of workers, managers should earn a higher profit with the tournament than with a piece-rate in the low prize, but not in the high prize treatment.

**Prediction 2.** *The tournament is more profitable than the piece-rate in the low prize treatment, but not in the high prize treatment.*

Since a tournament is riskier than a piece-rate contract for managers, it is not obvious that managers prefer the tournament over the piece-rate, even if it yields larger profits on average. However, due to the cost advantage managers should be more likely to choose a tournament in the low prize than in the high prize treatment.

**Prediction 3.** *More managers offer a tournament in the low prize than in the high prize treatment.*

### 2.5.2 Competition stage

The main difference of stage seven was the possibility of worker sorting. While workers still had no incentive to provide any effort with a fixed wage, it is more likely that workers with a fixed wage provided some effort than in stage five. In stage seven one manager in each group had to offer a fixed wage, therefore some workers received a fixed wage. If workers are “fair minded”, they might provide effort with a fixed wage contract in stage seven, but not in stage five, since in stage five the offered contract was a choice of the manager and therefore even the “fair minded” workers might not have a reason to exert effort. Given that the fixed wage does not provide incentives to work most wage offers by managers should be relatively low and therefore the fixed wage contract is the most unattractive contract, especially for productive workers.

**Prediction 4.** *There is self-selection of workers. More productive workers prefer a piece-rate or a tournament to the fixed wage in both treatments.*

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<sup>9</sup>The gift-exchange literature has shown that, in the absence of other contract possibilities, high wages typically result in substantial effort provisions. However, these results were obtained without the alternative of other contract types.

Due to the self-selection I expect that even if managers offer "fair" fixed wages, the effort provision of workers is not sufficient to yield large profits. Therefore managers with a fixed wage have smaller profits than those that offered a piece-rate or tournament.<sup>10</sup>

**Prediction 5.** *Manager profits with a fixed wage are lower than with a piece-rate or tournament in both treatments.*

The other side of the self-selection is, that it provided managers with a chance to attract productive workers. A good contract, from the view point of the managers, should be chosen by productive workers and provide sufficient incentives for those workers who select into this payment scheme. If that is the case, such a contract generates high profits for managers.

For a tournament to be attractive to workers, it must be perceived as a better contract than the piece-rate. Whether a subject believed that he could earn more with a piece-rate or a tournament depended on two aspects: How many tables he expected to solve and his belief about the chances of winning the tournament.<sup>11</sup> The probability of winning the tournament is determined by the performance of the other worker in the tournament. For subjects that believed that they could solve more than 56 tables (high prize or more than 50 tables in low prize) the piece-rate offered higher earnings opportunities. The potential earnings of all other workers were higher in a tournament than in the piece-rate. The higher prizes made the tournament more attractive in the high prize treatment, therefore I expect more workers to prefer the tournament to the piece-rate in the high prize than in the low prize treatment.

**Prediction 6.** *More workers want a tournament in the high prize than in the low prize treatment.*

Given the higher prizes the self-sorting of workers should lead to on average more productive workers in the tournament in the high prize condition even if workers had higher beliefs regarding the productivity of the other workers. However, the increase of the productivity of workers compared to the piece-rate is most likely not sufficient to cover the costs of the tournament in the high prize treatment.

**Prediction 7.** *The higher average productivity of workers in the high prize tournaments is not sufficient to yield larger manager profits than with the piece-rate.*

While the described sorting of workers could result in many workers not wanting the low prize tournament, the design of the experiment ensured that each manager received exactly two workers. Therefore the design limited the negative effect from sorting for managers by guaranteeing that even when they offer an unattractive payment system they cannot end up an insufficient number of workers. Nevertheless, the sorting of workers should lead to a lower average productivity of workers in the tournament and this negative effect should off-set the savings from the lower prizes in the low prize treatment. Therefore in the competition stage manager profits with a tournament should not be larger than the profits with a piece-rate in the low prize treatment.

**Prediction 8.** *Due to the self-selection of workers manager profits in the low prize tournaments are not larger than with a piece-rate.*

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<sup>10</sup>The experimental design allowed for gift-exchange to take place. For a more detailed description of the possible effects regarding the offered fixed wages and expected performance of workers with a fixed wage payment see section 3.6 below.

<sup>11</sup>It is important to note that managers had no influence on the height of the piece-rate. While this makes the piece-rate relatively unattractive for managers, it allows for a cleaner comparison between groups and session.

Predictions 2, 7 and 8 together yield the main statement I am testing with this experiment. While a tournament might be an attractive payment scheme for managers in the absence of worker sorting (prediction 2) it loses its advantage with sorting, since the tournament is either too costly for managers (prediction 7) or not attractive enough for workers (prediction 8).

### 3 Results

#### 3.1 The incentive effect

The no competition stage provides an ideal environment to analyze the incentive effect, since workers were randomly allocated to managers and therefore payment schemes. There were four payment schemes: the fixed wage, the piece-rate and the tournament with low and high prizes. Figure 2 below displays the mean number of solved tables by workers split for the payment schemes and separately for both treatments. Using the number of tables solved by each worker under a specific payment scheme and conducting Mann-Whitney U tests (MWU) yields that, significantly more tables were solved by workers with a piece-rate or a tournament than with a fixed wage in the high prize treatment (MWU tests, p-values  $< 0.01$ )<sup>12</sup> - left graph. While workers with a fixed wage supplied more effort than prediction 1 assumed, the average effort was low.

There is no difference between the worker performances between the two variable payment schemes in either treatment (MWU tests, p-values  $> 0.19$ ). In the low prize treatment no manager choose a fixed wage and therefore no comparison between the fixed wage and any variable payment scheme can be made. Testing the performance of workers with the same variable payment scheme between treatments (e.g. tournament with high vs. tournament with low prizes) does not yield a significant difference (MWU tests, p-values  $> 0.10$ ). Therefore the larger tournament prizes in the high prize treatment did not result in higher effort provision by workers. Either the difference in prizes is too small to induce higher effort or the incentives in the low prize treatment were already sufficient for workers to supply their maximum effort. The fact that the average tournament performances were very similar to the piece-rate results supports the later explanation.

#### 3.2 Employers' choice

In the no competition and the competition stage managers preferences for the different payment scheme were elicited. In the no competition stage they selected a payment scheme, knowing that sorting was impossible and in the competition stage they stated a preference ordering over the three payment schemes. The choices of managers in stage five - see table 1 - imply that managers expected the incentive effect described above. Most managers selected a variable payment scheme: while in the low prize treatment all managers selected a variable payment scheme, 40 of 48 did that in the high prize treatment.<sup>13</sup> These results are roughly in line with prediction 1 even so the prediction is not completely fulfilled, since some managers offered a fixed wage.

Overall the tournament was only chosen eight times - like the fixed wage - and the cheap tournament

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<sup>12</sup>All tests in this paper are two-sided unless indicated differently.

<sup>13</sup>In stages one to six the two treatments "Competition" and "High Prize" are equivalent. The only difference was in stage seven. Therefore "HIGH" pools the results of these treatments for the analysis of stage five.

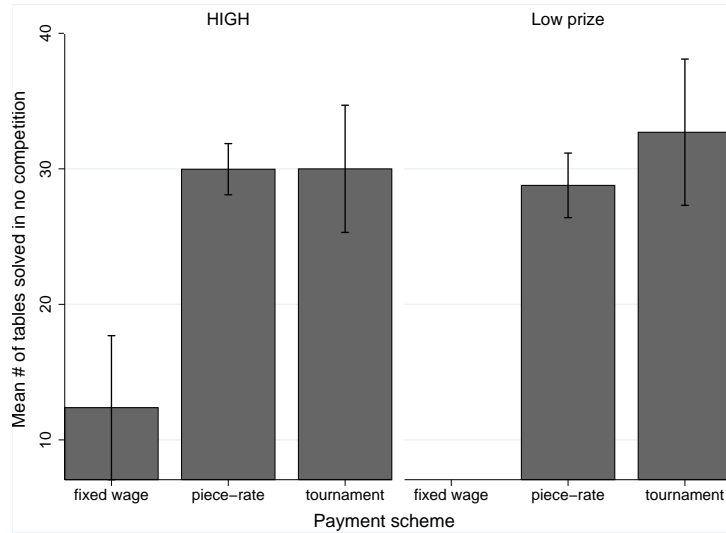


Figure 2: Mean of tables solved by workers by payment schemes

was chosen about as often as the high prize tournament (48 managers made a choice the HIGH treatments and 30 in the low prize treatment). There is no significant difference between the distributions of the two treatments regarding the variable payment schemes (p-value = 0.28 for a Fishers Exact Probability Test (FEPT)). Clearly the piece-rate was the most preferred payment scheme in both treatments.

Table 1: Managers' choices

Payment scheme	No competition		Competition	
	HIGH	Low Prize	High Prize	Low Prize
fixed wage	8	0	3	1
piece-rate	37	25	23	24
tournament	3	5	4	5
Total	48	30	30	30

Notes: In the no competition stage "HIGH" pools "High Prize" and "Competition" choices. For the competition stage the first choices of managers are shown.

In stage seven managers had to consider a potential sorting effect additionally to the incentive effect, since workers could sort themselves into the different payment schemes. Managers stated a complete ordering of all payment schemes and had a higher probability of receiving higher ranked schemes. Therefore they were incentivized to rank their preferred payment system higher. Nevertheless, it can be optimal not to rank the most preferred payment scheme first. If a manager believed a particular payment system, lets say the piece-rate, to be popular among all managers and if she wanted to avoid another payment scheme, lets assume the fixed wage, then it might have been optimal to rank the tournament first to ensure herself the tournament and avoiding the fixed wage.

However, such a behavior is only better than stating the true ranking under several conditions: First, a manager needed a smaller "preference difference" between their first and the second ranked option than between their second and third options. Second, she needed to believe that the other managers had the same preference order and third she must have believed that other managers would not act strategically

and ranked the three options according to their preferences. Only if all three conditions are fulfilled ranking the second most preferred payment systems first makes sense. For all of the analyses that follow, I use the first choices of managers and therefore assume that the revealed preferences represent the true preferences.

The first choices of managers are listed in the right part of table 1 for each treatment. Like in stage five, the piece-rate is the preferred payment scheme and there is no significant difference between the treatments (FEPT p-value > 0.10).<sup>14</sup> Similar to the analysis of the workers first choices, see section 3.4 below, I conducted a more detailed analysis of the payment scheme choices of managers. However, there are no clear results from the analysis. Probably because the number of observations is only half that of the worker choices or because strong preferences for the piece-rate results in a small amount of variation within the sample, I am not able to identify a significant influence of personal characteristics of managers, such as risk preferences, productivity beliefs or gender, on the preferences for different payment schemes.

### 3.3 Manager profit and optimal contract

#### 3.3.1 No competition stage

In order to maximize their payoff managers in stage five needed to choose the payment scheme that provides the best incentives relative to the costs of the contract. Figure 3 displays the mean profit for managers separately for payment schemes and treatments. Only profits generated by workers (# of solved tables \* 14 - wage payment) are included (no earnings from questionnaires and own work).

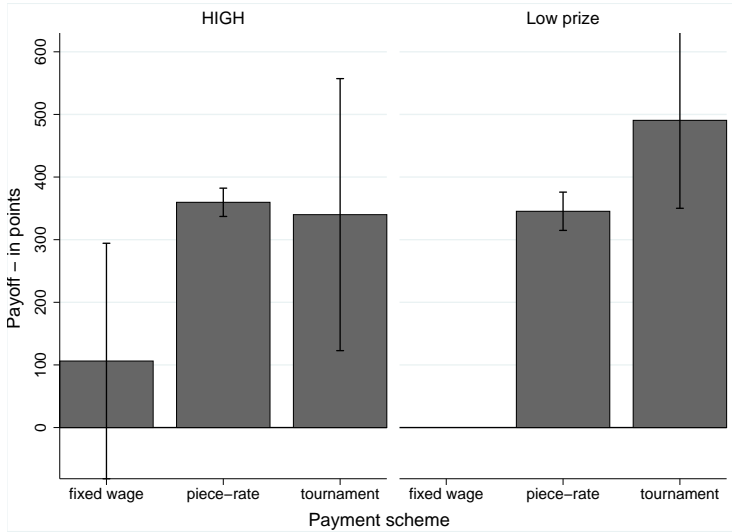


Figure 3: Managers' profits - no competition stage

In the high prize treatment the fixed wage contract yielded the lowest profit (MWU pairwise com-

<sup>14</sup>Even when managers did not have an incentive to rank their preferred payment scheme first a manager should never rank it third. In total the piece-rate was ranked third by no manager, while the tournament was ranked third by 35 and the fixed wage by 25 managers. These numbers further support the finding of strong preferences for the piece-rate over the two other payment schemes. This is also true for each treatment separately, since 50% (15 managers) ranked the fixed payment and the tournament 3rd in the low prize treatment, while the tournament was ranked 3rd by 67% (20 of 30 managers) and the fixed wage by 10 in the high prize treatment). While this indicates a higher preference of the low prize tournament this difference is not significant (FEPT, p-value > 0.29).



parisons p-values < 0.05), while the variable payment schemes generated about equal profits (MWU test p-value > 0.77). Therefore in the high prize treatment both variable payment schemes were equally profitable for managers, however ex-ante the tournament was riskier, since managers faced the risk of negative profits. By the nature of the piece-rate losses were impossible, which makes the piece-rate preferable for risk averse managers. Further, as the error bars demonstrate, the variance of the profit was higher with the tournament contract, which further makes the tournament less attractive for risk averse managers.

In the low prize treatment the average profit was higher with the tournament than with the piece-rate (MWU test p-value 0.024). While workers solved as many tables in the tournament as in the piece-rate, the reduced costs in the low prize tournament resulted in higher profits. Without worker sorting the low prize tournament outperforms the piece-rate and represents the payoff maximizing choice. The possible profit increase was very sizable, since the piece-rate yielded a mean profit of 345 points while the tournament resulted in mean of 490 points - a difference of 145 points (= 1.89 €) and an increase of more than 40% compared the piece-rate.

### 3.3.2 Competition stage

Since in stage five the preferences of more productive workers were fulfilled first, manager had to take a possible sorting effect into account. Figure 4 below provides managers profits split for payment systems and treatments. Since each contract had to be offered by exactly one manager in each group all three contracts were used. In both treatments the fixed wage contract resulted in the lowest profits (MWU tests p-values < 0.05 for the comparisons with the tournament and for the comparison with the piece-rate in the high prize treatment; p-value for the comparison with the piece-rate in the low prize treatment is 0.08). While these findings illustrate that the fixed wage contract was not very profitable for the managers on average, the fact that each manager could choose the fixed wage she wanted creates the possibility that a fixed wage contracts could have been rather profitable.<sup>15</sup>

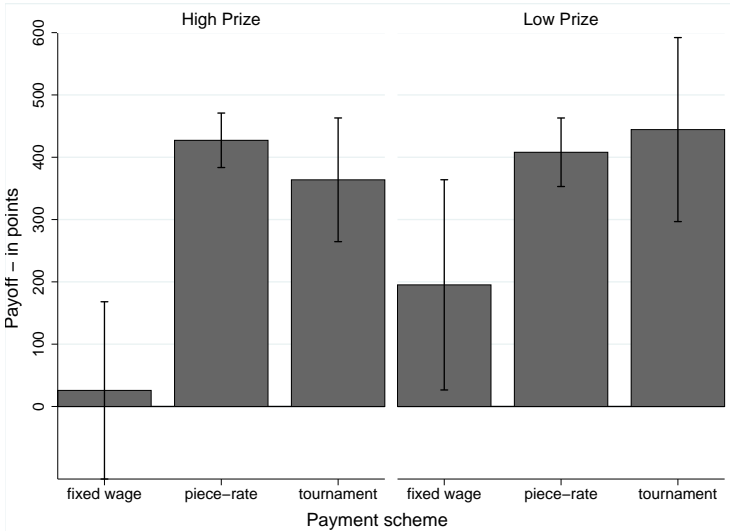


Figure 4: Managers' profits - competition stage

<sup>15</sup>The offered fixed wages and the worker performances with a fixed wage are analyzed in section 3.6 below.

The profit difference between the piece-rate and the tournament is never significant (MWU test p-values  $> 0.20$  in both treatments). Different than in stage five, the tournament did not outperform the piece-rate, but also it was never worse. However the disadvantages of the tournament for risk averse managers remain. The low prize tournament lost its advantage due to workers sorting. The self-sorting behavior of workers and its consequences for managers are analyzed in the next section.<sup>16</sup>

### 3.4 Workers' choice and self-selection

Workers stated their preferences for the payment schemes in stage seven. When analyzing their selections it is important to keep in mind workers' preferences and several individual characteristics, like risk preferences or productivity, were elicited, but not the utility costs of working. Therefore it is possible to calculate payoff maximizing choices and to determine the influence of individual characteristics on the sorting behavior, but not feasible to conclude whether the behavior was utility maximizing.

Workers ranked the payment schemes knowing that a higher ranking of a payment scheme increased the probability of receiving this contract. The mechanism created an incentive to rank the payment systems according to their preferences. The fact that priority was given to more productive workers might have resulted in slightly different strategic behavior depending on the productivity. Since very productive workers were basically guaranteed to receive their first choice, their incentives for stating their true preferences for the second and third choice were small. However they had no reason to state a false preferences order of their second and third choices and since no feedback was given until the end of the experiment workers could base their behavior only on their believed ranking and not the true ranking. The following analysis focuses on the first choice of workers. The left panel of table 2 states the first choices of all workers split for the two treatments. In both treatments the piece-rate contract was ranked first by 50% or more workers. The tournament was stated first more often in the high prize treatment (18 workers selected the tournament in high prize vs. 9 in low prize), but the distributions are not significantly different (FEPT p-value 0.15).

A payoff maximizing worker had to consider several factors. With a variable payment scheme, piece-rate and tournament, the wage depended either on the number of tables solved or whether he solved more tables than another worker. Therefore the ability of a worker to solve tables was the most important determinant for his expected wage. It is therefore likely that workers with different productivities preferred different contracts. Using performance indicator three, the average productivity of all workers is reported in the right panel of table 2 split for their first choices.<sup>17</sup>

Workers that preferred the fixed wage solved the fewest tables during in the effort elicitation stage. Either these workers did not want to work hard, therefore performed purely in stage three and consequently chose the payment system that did not require them to spend any effort at all or they were willing to exert effort, but were not very productive. In the low prize treatment workers choosing the tournament were the most productive. The difference between workers wanting a fixed wage and those preferring the tournament is significant (MWU test p-value 0.04). The average productivity of workers wanting the

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<sup>16</sup>Comparing the profits of manager across treatments for the same payment scheme yields no significant differences (MWU tests, p-values  $> 0.17$ ).

<sup>17</sup>While performance indicator three is mainly used in the analysis, there is a high degree of correlation between all three measures and therefore most results are unchanged if performance indicator one or two is used instead. Table 8 in the appendix lists the Spearman rank correlation between the three indicators and between the indicators and the workers' performance in the two working stages.

Table 2: First choices and average productivity of workers

Payment scheme	Workers first choices		Mean productivity (# of tables solved in stage three)		
	Treatment		Treatment		
	High Prize	Low Prize	High Prize	Low Prize	Pooled
fixed wage	12	16	11.92	12.13	12.04
piece-rate	30	35	14.77	13.89	14.29
tournament	18	9	14.06	15.44	14.52
Total	60	60	13.98	13.65	13.82

piece-rate and those preferring the fixed wage is not significant (MWU test p-value 0.11). In the high prize treatment the most productive workers selected the piece-rate (significantly different to the fixed wage productivity, MWU test p-value < 0.01) and the productivity difference for workers ranking the tournament or the fixed wage first is significant at the 10% level (MWU test p-value 0.07).<sup>18</sup>

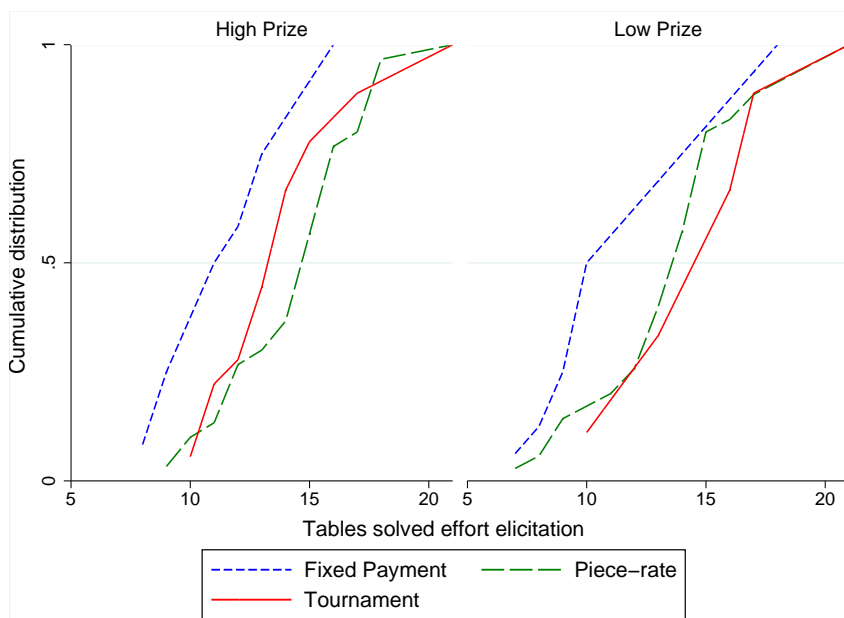


Figure 5: Sorting into variable payment schemes

To graphically demonstrate the productivity sorting into the variable payment schemes, figure 5 plots the cumulative distribution of performance indicator three separately for the stated preferences and treatments. The figure shows the productivity difference of workers who prefer the fixed wage to the other workers. No clear difference can be found between the variable payment schemes. For both treatments the lines for the piece-rate and the tournament actually cross each other. This sorting result is similar to the effect reported by Dohmen and Falk (2011). They further report that sorting is not driven by productivity alone, but other individual characteristics - the willingness to take risks, gender,

<sup>18</sup>Comparing the average productivity for the pooled data results in highly significant differences for the comparisons between the fixed wage and the two variable payment schemes (both MWU test p-values < 0.01) and in an insignificant difference between the piece-rate and the tournament (MWU test p-value 0.95).

... - also play an important role. In order to determine the influence of worker characteristics I use a multinomial probit regression. The results are stated in table 3, which reports the marginal effects at the means for all continuous regressors and marginal effects for a change of dummy variables from 0 to 1. From left (column 1) to right (column 3) the results for a worker that ranked the fixed wage, the piece-rate or the tournament first are reported. Besides the performance indicator three, several worker characteristics (gender, risk attitudes and self assessment) and parameters exogenous to the workers (high or low tournament prizes and the height of the offered fixed wage) are used in the regression.

*Productivity* is the number of tables solved during stage three, *Gender* is a dummy which is one for males, *Risk attitude* is a measure of risk-aversion (number of safe lottery choices in stage 9; more risk-averse subjects make more safe choices) and *Self assessment* is the belief of a worker how many workers solved less tables than himself in stage three (higher numbers mean better relative ranking), *Treatment* is a dummy variable which is one for the low prize treatment, *Treat. & self ass.* is an interaction term between self assessment and the treatment dummy and *Fixed Wage* is the height of the offered fixed wage (rescaled by dividing the wage in points by 10).<sup>19</sup>

Table 3: Multinomial probit workers' choice

	(1)		(2)		(3)	
	Fixed wage		Piece-rate		Tournament	
	Marg. Eff.	(SE)	Marg. Eff.	(SE)	Marg. Eff.	(SE)
<i>Ind. characteristics</i>						
Productivity	-0.04***	(0.01)	0.03	(0.02)	0.01	(0.01)
Gender (d)	0.04	(0.06)	-0.15**	(0.07)	0.11**	(0.05)
Risk attitude	-0.02	(0.02)	0.01	(0.02)	0.01	(0.02)
Self assessment	0.02	(0.02)	-0.03	(0.02)	0.01	(0.02)
Treat. & self ass. (d)	-0.02	(0.03)	-0.08*	(0.04)	0.10***	(0.03)
<i>Contract parameters</i>						
Fixed Wage	0.02***	(0.00)	-0.02***	(0.00)	0.00	(0.00)
Treatment (d)	0.14	(0.14)	0.45**	(0.20)	-0.60***	(0.17)
Observations	116		116		116	

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  All standard errors are clustered at the session level. Subjects with multiple switching points in the risk elicitation are excluded. (d) for discrete change of dummy variable from 0 to 1.

For ranking the fixed wage first there are two significant factors: Unproductive subjects are more likely to choose a fixed wage and a higher fixed wage increases the likelihood of choosing the fixed wage. Both are significant at the 1% level and support the findings on worker sorting from above. An unproductive subject has a lower expected income from a variable payment schemes and is therefore less likely to choose one, while a larger fixed wage makes a fixed wage more appealing. As expected, the treatment does not matter for subjects choosing a fixed wage.

For the decision to select a piece-rate two individual properties matter, as well as the offered fixed wage and the treatment. Males were less likely to choose a piece-rate, a finding which corresponds to the

<sup>19</sup>In total 120 workers, 60 in each treatment, participated in the experiment. Four observations are deleted, since these subjects reported multiple switching points in the lottery. For these four subjects it is not clear how to interpret the lottery choices and therefore these observations are dropped.

literature on tournaments, that reports that men like to compete in a tournament.<sup>20</sup> All other things equal men are 15% less likely to select the piece-rate. There are two effects which depend on the treatment. Workers with a more positive self assessment do not choose the piece-rate in the low prize treatment and workers were more likely to choose a piece-rate in the low prize treatment. The positive marginal effect of the self assessment makes intuitively sense, since workers that believed to be more productive than others were more likely to enter the tournament. Presumably this belief corresponds to a high expected winning probability in the tournament. It is more surprising, that the effect is only significant in the low prize treatment. One possibility could be that in the high prize treatment more subjects, which think of themselves as not so good, wanted to enter the tournament and took the risk of losing, since the potential prize was larger.

The tournament results can be seen as the "mirror" of the piece-rate results. Men are 11% more likely to prefer the tournament (5% level) and workers are less likely to want a tournament if the prize is low. Also the self assessment of workers only matters in the low prize treatment. Subjects with a higher belief about their relative productivity are more likely to choose the tournament only in the low prize treatment.

Risk attitudes did not matter for any choice. Generally variable payment schemes and especially a tournament are considered as risky for workers, since the wage payment is unknown at the beginning. But there are two remarks to make: First the risk in the piece-rate in this experiment was low. Subjects had already worked for more than 15 minutes on the tasks when they stated their preferences. Therefore they had a good idea how many tables they would solve within the working time. Second, risk preferences were elicited with lottery choices and not with a general statement "how willing a subject is to take risks in general" as in Dohmen and Falk (2011). They argue, that there is a high correlation between the risk measures, but use the questionnaire answers since there seems to be more noise in the lottery choices. While it is possible that the lottery task did not perfectly measure the risk attitudes of subjects regarding employment choices, it is still surprising to find no influence at all of these risky choices on the selection behavior.

In total the regression yields three main results: First, productivity matters for the choice of a variable payment scheme. Second, there is a treatment effect, workers like the tournament more, when the prizes are larger and third, gender plays a role in the sorting. Females are less likely to choose a tournament. Therefore these results support the findings from above (productivity sorting) and indicate a treatment effect, which could be assumed but not shown in the choice data in table 2.

### **3.5 Workers' earnings**

Workers had a say in the payment scheme they received in the competition stage, therefore it is possible to analyze whether they made a choice that maximized their earnings. In this calculation it is assumed that a worker wanted to maximize his earnings from the working stage.<sup>21</sup> Figure 6 graphs the mean payoff for workers split for the payment schemes and treatments. For the fixed wage the bar displays the mean of the fixed wages, while for the tournament the bar represents the mean of the tournament prices.

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<sup>20</sup>E.g. see the seminal paper of Niederle and Vesterlund (2007).

<sup>21</sup>If a fixed wage yielded a lower income than in another payment scheme, it could still be the case that the utility of the worker was higher than with another payment scheme, since the worker might have been working less hard. Further the analysis does not take the payoff of other subjects, in particular the payoff of the respective manager, into account, since it does not consider social preferences of workers.

In both payment schemes the average earnings of workers did not depend on the performance of workers. However, in the tournament the individual worker payoff depended on the relative performance. Only in the piece-rate the performance of workers influenced the average earnings.<sup>22</sup>

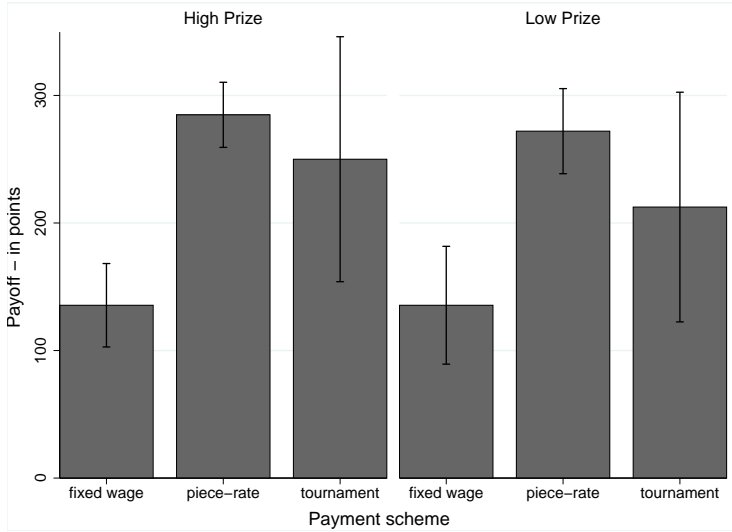


Figure 6: Workers' payoff - competition stage

Testing the differences in average earnings yields significant differences between the fixed wage and the piece-rate in both treatments ( MWU test p-value < 0.01 in both treatments), which demonstrates the lower earnings of workers in the fixed wage contract. While a MWU test does not reveal a significant difference between the fixed wage and the tournament, this might not be the best test for this comparison, since due to the payoff rule for the tournament 50% of all subjects in the tournament received a very low wage (25 or 50 points), while the other 50% received a high wage of 400 or 450 points. A t-test with unequal variances instead results in a significant difference in the earnings of workers with a fixed wage vs. those with a tournament in the high treatment (p-value 0.027). The identical test for the low prize treatment yields an insignificant difference with a p-value of 0.12.<sup>23</sup> Taken together these results confirm that workers in the fixed wage contracts earned less than with a variable payment scheme.

The 58 tables solved by a worker with a piece-rate were the most solved by any worker. Also the second most productive worker - who solved 52 tables - was paid with a piece-rate.<sup>24</sup> Considering that a worker earned 8 points per table in the piece-rate scheme, the tournament prize of 400 points (low prize) and 450 points (high prize treatment) was equivalent to 50, respectively 56.25, solved tables with a piece-rate. For a subject that was able to solve 50+ tables, the piece-rate offered a higher earnings potential. This was only true for 2 out of the 40 subjects with a piece-rate contract. None of the workers with a tournament contract solved more than 47 tables. Therefore each winner of a tournament earned more than he would have received with the same performance under a piece-rate.

To determine the payoff maximizing choice of a worker his ability has to be taken into account.

<sup>22</sup>When the individual performance of a worker is taken into account the expected payoff of a worker in the tournament can be calculated based on his probability to win the tournament. Such an analysis is performed later in this section.

<sup>23</sup>The difference between the payoff for workers with a tournament and a piece-rate is never significant in either treatment (t-test p-value high prize treatment 0.47 and 0.21 in the low prize treatment).

<sup>24</sup>To put this numbers into perspective, the highest number of tables solved by a worker in a tournament was 47 (two more solve 46) and 40 with a fixed-wage.

Therefore the following analysis compares the realized payoffs of workers that stated the piece-rate as their first choice and actually ended up working under a piece-rate in the competition stage with the hypothetical payoffs these workers would have received in a tournament. In this calculation the following assumptions are used: First, the worker performance in the piece-rate is assumed to be the performance a worker would have had in a tournament. Second, the probability of winning the tournament ( $p_{win}$ ) for each worker is determined by his rank among all other workers in the tournament. If he solved more tables than all other workers, his winning probability is one and if half of the workers solved more tables than him his winning probability would be 50%. etc.<sup>25</sup> The expected payoff in a tournament is then  $p_{win} * T^w + (1 - p_{win}) * T^l$ , with  $T^w$  and  $T^l$  being the respective tournament prizes.

In figure 7 for each of these workers the realized payoff in the piece-rate (x-axis “Payoff competition”, in points) and the calculated expected payoff in a tournament (in points) are displayed. The triangles in the graph represent subjects in the high prize treatment and the dots indicate subjects in the low prize treatment. The upward sloping line is the 45 degree line. Subjects that are placed below this line earned more with the piece-rate, then they would have earned in expectation in the tournament. These subjects maximized their expected earnings by being in the piece-rate. Subjects that are above the 45 degree line would have earned more if they had chosen the tournament instead.

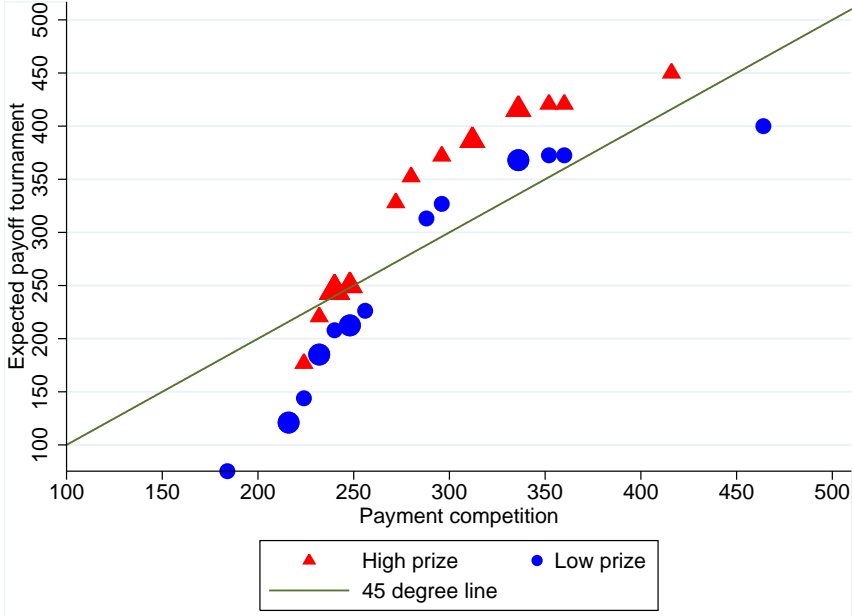


Figure 7: Expected vs. realized payment of workers who choose a piece-rate

Workers who did not solve many tables are in the bottom left of the graph. These workers were better off with the piece-rate and therefore made the payoff maximizing choice by selecting the piece-rate. These subjects are mostly from the low prize treatment. The workers which are placed the middle to upper right of the graph would often times have earned more by joining the tournament. The difference in the tournament prizes between the treatments can be seen in the vertical difference between the two groups. Many subjects are above the line, but while workers in the low prize treatment (dots) are only marginally above the 45 degree line, workers from the high prize treatment are much further above the

<sup>25</sup>The performances of workers in the tournaments of both treatments are pooled to get a finer grid on the winning probability. The pooling is justified, since the analysis has shown that the number of tables solved in the two tournaments was very similar.

line. This indicates that their “lost earnings” due to choosing the piece-rate instead of the tournament were much larger.

In each treatment 17 workers wanted and received a piece-rate.<sup>26</sup> Table 4 sorts these 17 workers in each treatment in one of two categories, depending on whether their expected payoff would have been higher in the tournament or not. In the high prize treatment, for 15 of the 17 workers, the expected payoff would have been higher in the tournament while this is only the case for six subjects in the low prize treatment.

Table 4: Highest expected earnings

Highest earnings with	Treatment	
	High Prize	Low Prize
tournament	15	6
piece-rate	2	11
Total	17	17

Notes: Earnings in tournament are calculated expected earnings. Earnings in piece-rate are the actual earnings of stage seven.

The table and the graphical analysis demonstrate the clear difference between the two treatments. With the low tournament prize, the expected earnings in the tournament were not large enough to result in an improvement over the piece-rate for many subjects. Together with the risk of loosing the tournament, this payment scheme was understandably unattractive for these workers. But especially workers in the high prize treatment might have earned higher wages in the tournament, at least in expectation.<sup>27</sup> In the high prize treatment the tournament is attractive if workers only care for their expected payoff. However, the analysis above does not take other aspects of the different payment schemes into account, e.g. riskiness or “fairness”, therefore a tournament might not be attractive for some of the workers in the high treatment, even if it would yield them higher expected earnings. Nevertheless, the calculations above clearly shown that a tournament is unattractive for workers in the low prize treatment.

### 3.6 Gift-exchange

There is a large literature concerned with the question, whether an employer that pays higher (fixed) wages to his or her employees is rewarded with a higher effort. Beginning with Fehr et al. (1993) this question has been experimentally tackled quite often and the literature that emerged has shown that in deed higher “wage gifts” typically result in higher effort provision by workers. There are two aspects of the theory that can be tested with the experiment in this paper. The more obvious one is whether gift-exchange takes place. To answer this question one can look at the offered wages and resulting effort provision of workers in the competition treatment.

A second test can be conducted using the fixed wage offers and effort provisions in the no competition stage. Different than in the competition stage a fixed wage was likely considered to be fair or

<sup>26</sup>Some of these workers cannot directly be found in the graph, since the used calculation method treats workers with the same number of tables solved under the piece-rate identically. Therefore some of the points in the graph represent two or three workers. This is indicated in the graph by larger symbols.

<sup>27</sup>A similar analysis can be done for workers that wanted and got the tournament. The results from this analysis can shown in the appendix.



unfair not only depending on the height of the fixed wage contract. While a manager might have been forced to offer a fixed wage in the competition stage, this was not the case in the no competition stage. A worker in the no competition stage that received a fixed wage therefore might have considered it an “unfair” choice, since the manager had other, in the eyes of the worker possibly better, payment schemes to choose from. Or it could increase the effect of providing a fixed wage, since the fixed wage could have been seen as signal of trust. It is therefore unclear whether a relatively “high” fixed wage offer was perceived as a gift by workers or not.

The only other paper, that in which the gift-exchange phenomena is analyzed with an employers choice between different contracts is Fehr et al. (2007). In their trust-incentive treatment (TI) they provide employers with the choice between a trust and an incentive contract. The trust contract is a classical fixed wage offer, while the incentive contract includes a potential fine for shirking workers. While their study is different to mine in many aspects (e.g. chosen effort, repeated choice and other wage contracts to choose from) it is still interesting to note that they report an increased effort choice for higher wages in the trust contract which is smaller compared to the typical findings. In their setting gift-exchange takes place, but is not as efficient as in the studies in which only a fixed wage contract is available. In principle the question can also be analyzed in Karakostas et al. (2013), but the data given in the paper does not allow for a separate test of the hypothesis that gift-exchange is weaker in fixed wage contracts that are “voluntary”.

In table 5 the result of an OLS regressions of the performance of a worker under the fixed wage payment scheme in stages five and seven are presented. In column 1 are the estimation results for the no competition stage and in column two are the coefficients for the competition stage. The dependent variable is the number of tables solved during the respective working time. *Fixed wage* is the wage a worker received (in points, dividend by 10), *Gender* is a dummy variable that is one for males, *Productivity* is productivity indicator three, *First choice - fixed wage* is a dummy which is one for workers in the competition stage that chose the fixed wage as their most preferred payment scheme and *Treatment* is a dummy that is one in case the tournament prize is low.<sup>28</sup>

Table 5: OLS estimation gift-exchange

dep. var.: # of tables solved	(1) No Competition		(2) Competition	
	Coefficient	(SE)	Coefficient	(SE)
Fixed wage	0.41	(0.31)	0.95***	(0.18)
Gender	0.04	(6.78)	6.46*	(2.90)
Productivity	0.81	(0.49)	-0.22	(0.69)
First choice fixed wage			-10.36**	(3.47)
Treatment			8.18**	(2.93)
Constant	-3.55	(7.62)	1.12	(9.02)
Observations	16		40	
R <sup>2</sup>	0.125		0.420	

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$  All standard errors are clustered at the session level.

<sup>28</sup>There is no treatment dummy in the regression of the no competition stage, since a fixed wage was never chosen in the low prize treatment (see table 1).

Overall only 8 managers offered a fixed wage in the no competition stage, therefore the regression is based only on 16 observations. With this number of observations there are no significant coefficients. Column 2 reports the regression for the competition stage. Here by design 40 subjects ended up with a fixed wage. The gift-exchange hypothesis predicts, that larger fixed wage payments result in higher effort and therefore in more tables solved by the workers. The significant positive coefficient on *Fixed wage* confirms this hypothesis. A 10 point higher wage, lead to about one more table solved. Given that a manager received 14 points for each table it was beneficial for employers to offer a higher fixed wage.

The *First choice fixed wage* coefficient describes an opposite effect. Workers that self-selected into a fixed wage did this, because they received their wage independently of their supplied effort. Therefore these workers selected into a fixed wage and did not supply a lot of effort. In particular they supplied less effort than workers that wanted a different payment scheme, but did not get their first choice. Since the inclusion of *Productivity* ensures that this effect is not due to productivity sorting, the significant coefficient demonstrates a selection based on the “unwillingness” to work into the fixed wage contract. The coefficient is relatively large, with about 10 tables less solved by workers who stated the fixed payment as their first choice. There is no obvious reason why, but the table also shows that males in a fixed wage contract tended to supply a little more effort than females.

Table 6: Average stated fairness

Payment schemes	Treatment	
	High prize	Low prize
fixed wage:		
100 points	2.45	2.65
200 points	4.90	4.15
300 points	5.15	5.35
tournament prize	5.20	5.70
tournament	2.50	2.45
piece-rate	5.20	5.50

Notes: “Fairness” rankings on a 1-7 Likert scale. Only workers and with a fixed wage in stage 7 are considered in averages.

Interestingly also the treatment matters. In the low prize treatment workers solved about eight tables more under the fixed wage, controlling for the other regressors. One possibility for this difference could be that workers that cared for a “fair” fixed wage might have considered the same wage offer “fairer” in the low prize than in the high prize treatment, since in the high prize treatment the tournament was a better alternative. To analyze whether workers in the low prize treatment considered the same fixed wages as more fair than workers in the high prize treatment their responses to the questionnaire in stage 10 can be used. Table 6 states the average fairness ranking (from 1 - 7) for the question “How fair do you consider a fixed payment of ... points for the task?” of workers being paid with a piece-rate in stage seven separately for treatments. As expected, workers rated a higher fair wage always as more “fair” in both treatments, but the differences are small.<sup>29</sup> Workers in the two different treatments considered the fixed wages as about equally fair. These results further demonstrate that the positive coefficient in

<sup>29</sup>A MWU test states a marginal significant difference (p-value 0.09) for the fairness statements regarding a fixed wage of 200 points. But against the hypothesis stated above, the high fairness rankings are in the high prize treatment, so this cannot explain the significant treatment coefficient in the regression of table 5.

column two of table 5 is neither explained by a different productivity of subjects in the two treatments, nor by a different fairness ranking of the fixed wage by subject.

A closer look at the raw data for both stages shows that the positive *treatment* coefficient is explained by four workers in the low prize treatment, who received a high wage (250 points and more) and solved many tables (30 and more). If these observations are excluded for the regression the *treatment* coefficient becomes insignificant. While there is no reason to exclude these observations, this procedure confirms that the positive coefficient is driven by these observations. One manager paid 270 points as a fixed wage in the low prize treatment (largest fixed wage paid in the entire experiment) and both workers supplied a lot of effort in this case. Therefore, the difference between the treatments might more likely be that more high wage offers were made in the low prize treatment - for whatever reason - and not that workers responded more positively to the wage offers in the low prize treatment.

These results demonstrate that there is gift-exchange in an environment in which managers offer a fixed wage, but other payment methods are available. However, whether this effect is also present if the workers knew that the manager chose the fixed wage and there was the possibility to offer a different payment scheme is not definitely answered.<sup>30</sup> While the regression in the no competition stage fails to provide a significantly positive coefficient (*fixed wage*), the low number of observations does not allow a definite conclusion.

## 4 Discussion and conclusion

In this paper the attractiveness of a rank-order tournament if both market sides, employers and workers, can choose between several payment systems is analyzed. My study demonstrates that the incentive effect of the tournament is only an advantage for managers, if workers are not able to sort themselves into different contracts. With worker self-selection a tournament does not generate larger firm profits than a piece-rate. While a tournament can be an attractive payment scheme for productive workers if the prizes are sufficiently high, for a manager a tournament with such high prizes does not yield greater profits than a piece-rate contract. This finding is likely part of the explanation why a tournament is usually not the main contract scheme for most workers in labor markets, despite its good incentives.

These results could explain why tournaments are usually used as “add-ones” in labor market relations - like as a promotion tournament or competition for a bonus - and not as the main payment scheme. As soon as other incentive inducing payment methods are available - the piece-rate in my study - managers have no advantage by offering a tournament anymore. The fact that a tournament does never worse than a piece-rate might be conditional on the fact, that the used matching procedure ensures that each manager receives a sufficient number of workers. In real world labor markets this is not given. Since my study shows that a tournament is not well liked by many workers, the risk of not finding enough workers when offering tournament like payment schemes could be large, but if job openings are not filled or take long to be filled firms profits will most likely suffer.

Additionally there is a clear sorting pattern of workers. More productive workers prefer the variable payment schemes, confirming the findings of Dohmen and Falk (2011). However, the experiment does not replicate their results regarding the importance of risk preferences for workers' choices. A main

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<sup>30</sup>Abeler et al. (2010) find that the equity norms matters for gift-exchange. My results suggest, that similar a fairness norm plays a role as well. If a manager can offer another contract, that is not worse for her, but better for the worker (e.g. a piece-rate) choosing the fixed wage might be an unkind act and therefore higher wages do not yield higher effort provisions.

reason for the difference could be that due to the chosen design the offered fixed wages differ, depending on the offers made. There is no given height of the fixed wage, which results in on average lower fixed wages than in the Dohmen and Falk experiment.<sup>31</sup> Further the analyze identifies the impact of several other individual characteristics of workers on their revealed preferences: women shy away from the tournament, workers with a higher perception of their own productivity are more likely to choose a tournament and also the treatment and therefore the height of the tournament prizes matters for the attractiveness of the tournament. The productivity sorting of workers might be even stronger outside of the laboratory, since there exists a larger variety of possible contracts. Therefore my study shows that tournaments might not be used very often simply because they are either unattractive for workers or too expensive for firms.

Since managers did not prefer the cheap tournament over the piece-rate, even without the possibility of worker selection, the advantage of the low prize tournament seems to be unexpected. The study does not deliver a clear result regarding the question how manager preferences differ with individual characteristics. Maybe individual characteristics are not as important in the role of a manager as in the role of a worker. But it is also possible that the lower number of observations, the design results in twice as many data points for the workers than for the managers, hides some effects. The fact that there is almost no variation in the preference statements of managers make it hard to draw any definite conclusions.

This paper is a first attempt in understanding what drives the decisions of employers in offering a payment scheme, when there is competition for workers. While the competition for workers does not effect the preferences of managers, the separation of the incentive and sorting effect demonstrates the importance of worker sorting for the firms success. The explicit choice between different incentive schemes influences which payment schemes are attractive for productive workers and as a result a tournament is not generating higher profits than a piece-rate. In further research it will be interesting to investigate the importance of sorting for the profitability of tournaments more thoroughly in especially with regard to different payment schemes and more variation in tournament prizes.

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<sup>31</sup>In their setting Dohmen and Falk (2011) always gave subjects the alternative of a fixed wage of 400 points. This was about 1/3 of the tournament prize (1300 pts) and 2/3 of the average payoff in their piece-rate treatment. In my experiment the average fixed wage in the competition stage was 135 points, which is only about half of the average of the earnings under the piece-rate (263 pts).

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## **Appendix**

Design of the Experiment									
Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9	Stage 10
First Table	Skill Elicitation	Effort Elicitation	Questionnaire I	No Competition	Questionnaire II	Competition	Questionnaire III	Risk Preferences	Questionnaire
solve one table as fast as possible	solve one table as fast as possible (paid)	work for 5 min solve as many tables as possible piece-rate of 8 pts per table	state amount of stress [0-7] state amount of effort [0-7] How many subjects performed worse? [0-8]	random sorting into managers and workers managers choose payment system 10 min working stage	state amount of stress [0-7] state amount of effort [0-7] How many subjects performed worse? [0-8]	managers face same choice workers state preferences over contracts 10 min working stage	state amount of stress [0-7] state amount of effort [0-7] How many subjects performed worse? [0-8]	10 binary lottery choices	fairness ranking of contracts rate experimental task and experiment questions to high school and employment status

Table 7: Overview of the experiment

## Appendix I.1: Performance indicators

The table below lists the Spearman rank correlation for all three performance measures, as well as the Spearman rank correlation between the three measures and the number of tables a worker solved in stages five and seven if he was paid with a variable payment scheme.

For performance indicator I there are 225 observations (9 subjects did not solve the table correctly in the given time). For performance indicators II and III there are 234 observations. The table presents pooled data for all treatments. There are 140 observations used for the tables solved in stage five, 110 observations for the number of tables solved in stage seven and 101 for the correlation of the performances in stages five and seven. The difference to the 234 total subjects comes from workers with a fixed wage payment and managers. Both types of subjects are excluded for these two correlations. Since many workers do not provide a lot of effort if they are paid with a fixed wage, these observations are not included. Remember: Performance indicator I is the time needed to solve the first table, performance indicator II is the payoff received for solving the 2nd table and performance indicator III is the number of tables solved in stage three.

Table 8: Spearman rank correlation among performance indicators

	Productivity indicator I	Productivity indicator II	Productivity indicator III	Tables solved stage five	Tables solved stage seven
Productivity indicator I	1.0000				
Productivity indicator II	-0.1736	1.0000			
Productivity indicator III	-0.1845	0.4335	1.0000		
Tables solved stage five	-0.3117	0.5474	0.7406	1.0000	
Tables solved stage seven	-0.3442	0.5259	0.5589	0.7688	1.0000

Notes: All correlations are significant with p-values < 0.01.

## Appendix I.2: Tournament choice

In figure 8 I repeat the analysis of section 3.4 for all 21 subjects that stated the tournament as their first choice and actually received the tournament. The x-axis shows the payoff these subject would have received if they had been paid with a piece-rate - assuming they would have solved the same number of tables. On the y-axis their *expected payoff* from the tournament is given. As before this expected payoff is calculated by determining the winning probability using the number of tables solved of all workers that worked under a tournament in the competition stage and then multiplying the winning probabilities with the tournament prizes, which depend on the treatment. Workers that won the tournament are displayed with solid markers (triangles for the high prize treatment and dots for the low prize treatment), while tournament losers are shown with hollow triangles/circles.

The line is the 45 degree line, indicating whether a subject had a higher expected payoff in the tournament (triangle/dot is above line) or with the piece-rate (symbol is below line). For most subjects choosing the tournament was, in expectation, the payoff maximizing choice. Interestingly, almost all workers that maximized their expected payoff with the choice of the tournament also ended up winning the tournament (most symbols above the line are solid). Especially for workers in the high prize treatment (triangles) choosing the tournament lead to a larger expected and most of the time also realized payoff. For workers in the low prize treatment the tournament leads to a bigger expected payoff, at least for productive workers, but the distance to the line is much smaller indicating that the tournament was especially interesting for productive workers in the high prize treatment.



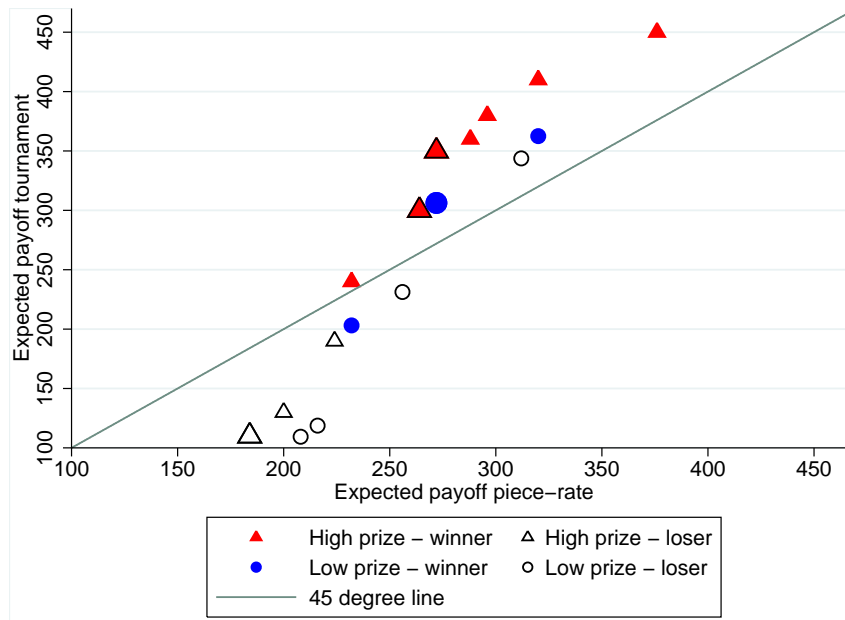


Figure 8: Expected vs. realized payment of workers who choose a tournament

### Appendix I.3: Performance in competition stage

The graph below reports the average performance of workers in the competition stage seven, split for payment schemes and treatments. There are three observations from this graph: First, the differences between the treatments are small. Second, the most productive subjects are in the piece-rate and third the fixed wage performance is clearly the worst.

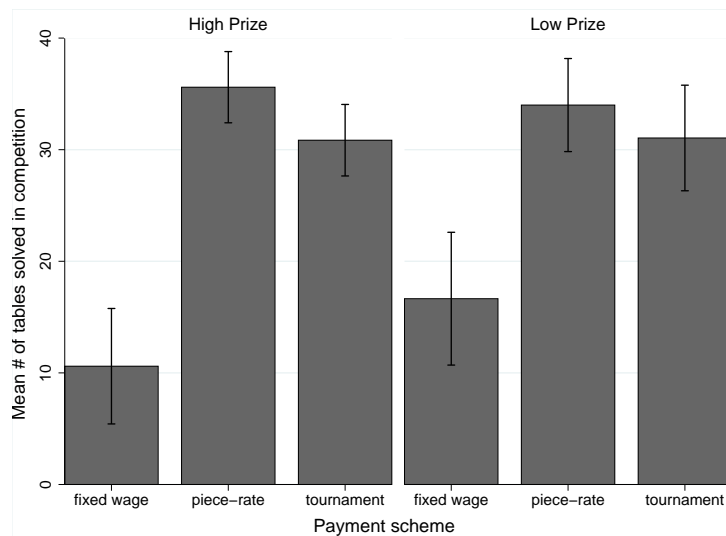


Figure 9: Mean of tables solved by workers in the difference payment schemes - by treatment

## Appendix II

Below are the English translations of the original German instructions for the high prize treatment. The original instructions are available from the author upon request. The instructions for the low prize treatment are almost identical, but with a different value for the bounds of the fixed wages and different tournament prizes. Instructions were given on the screen and the instructions of each stage were shown before the individual stages. Since the questionnaire in stages 4, 6 and 8 were almost identical for workers only the question that differs for managers is given for stages 6 and 8. All emphasizes shown are in the original instructions.

### Welcome

WELCOME!

Thank you, that you decided to take part in this study. The experiment lasts approximately 2 hours and you will receive your reward directly at the end of the experiment.

The study consists of multiple parts and at the start of each section you will see the instructions on your screen. Each screen with instructions will be marked by the header **Instructions**. If you still have questions after reading the instructions, please raise your hand. An experimenter will come to you to answer your question in private.

In the different parts of the study you can earn points. At the end of the study all points are converted to Euros and result in your payment. **10 points** are always **13 Cents**.

Please remain quite during the duration of the study and do not talk to the other participants. During the experiment you will have to solve multiple exercises. You have to solve these tasks without any aids. Because of this, please store all your cell phones, calculators, paper, pens, books and so on in your bag.

Please click on FORWARD.

### Stage 1

#### Instruction Part I

It is your task to count how often the digit **one** appears in the table below. The table consists of ones and zeros. You can see an example in the lower left. This table has **38** ones.

You have a total of 57 seconds. Please solve the task as quickly as possible.

Here you can enter your answer and confirm your entry.

Please click on FORWARD. Your time starts as soon as all participants have clicked on FORWARD and when you see the table on your screen.

### Stage 2

#### Instruction Part II

In this part you have to solve an identical task to the part before.

Different than before you will be paid for the correct solution of the task. Your payment is higher, the quicker you solve the task correctly. You have a total of 75 seconds. The quicker you enter the correct

number, the higher your payment. In the beginning you have 150 points. Each second that elapses until you enter the correct answer, results in a deduction of 2 points from your payment.

If you take 20 seconds to solve the task you receive 110 points for this part.

If you enter a wrong number, 20 points will be deducted from the remaining points and you can enter a new number. You will only receive a payment if you enter the correct number within 75 seconds.

Under no circumstances your payment can be negative.

Please click on FOWARD. Your time starts as soon as all participants have clicked on FORWARD and when you see the table on your screen.

### **Stage 3**

#### **Instruction Part III**

Your tasks in part three of the study is it to solve as many tables as possible. You will again see a table with ones and zeros, like in the previous parts. However, now the task is not to solve one table, but to solve as many tables as possible. A new table will only appear if you have solved the previous one correctly.

You have a total of 5 minutes to count as many tables as possible the number of ones. After you have entered the correct answer for a table, a new table appears. If your answer is wrong, you will see a message and you can enter a new answer.

For each correct answer you receive 8 points. Each wrong answer results in a deduction of five points from your payment.

If you solve three tables correctly and enter one wrong answer you receive 19 points for this part of the study. The remaining time is shown in the upper right corner.

Please click on FORWARD now. The next part starts as soon as all participants have clicked on FORWARD.

### **Stage 4**

The working time of five minutes is over.

Please state as how exhausting you experienced the task in the previous part: Very easy - Very hard

Please state how much effort you extorted for the task in the previous stage: Not at all - As much as possible

In total there are 18 participants in this session in two groups. You therefore belong to a group of 9 participants. Please estimate how many participants in this group solved **less** tables than you in the previous part?

Your payment for this task is higher, the better your estimate is. If your estimate is correct you receive **75.0** points. If your estimate did not over or undershoots by more than one person you receive **37.5** points. If your estimate over or undershoots by more than one person you do not receive a payment for this task.

0 - No one, no participant solved less tables than me.

8 - I solved the most tables, all other eight participant solved less tables than me.

## Stage 5

### Instruction Part IV

The instructions for part four are somewhat longer. Therefore you can go back and forth with the Page 1 and Page 2 buttons, which you can see at the bottom of the screen, below the screen with the instructions.

With the start of the next part there are two different roles in the experiment. Each participant is from now on either an employee or a manager. Despite the fact that employee and managers can be female as well as males, the instructions will call all managers female managers (*Note: there is a gender distinction in German*) while all employees are male employees.

For the next part of the experiment three participants will form a group. Each group acts in the following part as one firm. In each firm there is **one** manager and **two** employees. Also the selection who will be a manager and who will be an employee is randomly determined by the computer.

The task of the employees is it, like in the parts before, to count the number of ones in tables. For this all participants have **10** minutes. Which means the working time is exactly twice the time from the previous part.

How you will be paid for this task depends on the decision of the manager which payment scheme to choose. The payment of the manager, however, depends mainly on the number of correctly solved tables by the employees (more on this on page 2 of the instructions).

Below the tasks and the choices of managers and employees are described. Please read these instructions carefully and raise your hand in case you have some remaining questions after reading the instructions.

Managers have three different payment schemes to choose from:

Fixed wage	Variable payment	Competition
Each employee gets a fixed wage. This wage is independent of the number of tables solved by the employee.	Each employee receives for each correctly solved table a payment. Each correct answer yields an employee 8 points.	At the end of the working period the employee, who solved more tables correctly, receives a wage of 450 points. Hereby it is not relevant how many tables he solved. It is only important whether he solved more or less tables than the second employee in his firm.
The managers chooses the height of the fixed wage. It must be at least 50 points and can maximally be 450 points.	This means the payment of the employee only depends on the number of tables this employee solved correctly.	The employee that solved fewer tables receives a wage of 50 points. If both employees solve the same number of tables a lottery draw determines who receives which wage. The payment of a employee therefore only depends on whether he solved more or less tables than the 2. employee.
Each of the two employees within a firm receives the same fixed wage.		

## Instruction Part IV Page 2

The payment of managers consists of two different components.

1) Each manager receives for each correctly solved table by her employees **14** points. However, she has to pay the employees with this revenue. This means from her earnings the wage payments to the employees are deducted. Here the manager has the choice between the three payment schemes described on the previous page. The manager makes her choice and workers are told the payment scheme before the start of the working period.

2) A manager receives a payment depended on the number of tables she solves correctly.

If the manager solves more than 10, but less than 20 tables, she receives 50 points. Does she solve more than 20 but less than 40 tables, she receives 100 points and if she solves more than 40 tables she receives 150 points. This payment is added to her earnings.

The payment of a manager therefore depends on the number of tables solved by her workers as well as on the number of tables she solves herself.

### Example

Assume that the manager solved 14 table herself and her employees solved 20 and 10 tables. The manager therefore receives a payment of 50 points +  $(20+10)*14 = 470$  points.

From this payment the wages of the employees are deducted. This means, dependent on the payment scheme, which the manager selected at the start of this part, the following wage payments are deducted from her payment:

With the variable payment  $(20+10)*8$  points, so a total of 240 points are deducted. With a fixed wage the manager has to pay the fixed wage and with a competition she has to pay a total of 400 points.

### Quiz

In this part of the experiment, both, managers and employees, have the possibility to do something else besides counting ones in tables.

Below the table there will be two buttons. With the button “Quiz” a participant can switch to a window in which quiz questions are asked. With the button “Experiment” the screen switches back to the table.

During the time a participant is on the quiz screen he or she cannot solve any tables. The answering of quiz questions is not paid. Each participant can go back and forth between the experiment and the quiz during the entire working time.

When you have understood these instructions and do not have any further questions, please click on FORWARD.

### Stage 6 - Questionnaire for mangers

*First two questions are identical to stage 3.*

How many tables, do you think, have been solved by your employees?

Your payment for your estimate is higher, the better your estimate is.

If your estimate is correct you receive **37.5** points.

If your estimate is not wrong by more than plus or minus three tables, you receive **18.8** points.

If your estimate is wrong by more than three tables, you do not receive a payment for this task.

*Workers again state how many workers they believe solved less tables than they them self. [0-6]*

## Stage 7

### Instruction Part V

This part 5 is very similar to the previous one. Again managers can choose between the three payment schemes for their employees (competition, fixed wage or variable payment). Also the payment of the managers and the working time stay the same. However, different to before, the employees are **not** tied to one manager any more.

In this part of the experiment **three** managers and **six** employees are grouped together. Each manager will offer a **different** payment scheme, which means that each payment scheme will be used by one firm. First managers choose the height of the fixed wage, which they are willing to pay, if their firm wants / has to pay a fixed wage. Then each of the managers states which payment schemes she wants the most, which one she likes second best and which one she likes the least.

If two (or more) managers prefer the same contract (choose the same contract as their “first choice”) a random draw determines who can offer this contract. After this the second choice of the remaining managers are considered and it is tried to fulfill these choices. If again the managers agree in their second choice one manager has to offer her third choice. Hereby the previously chosen fixed wage of the manager that offers a fixed wage is chosen.

After the statements of the managers (and possibly the random draw) decides, which manager offers which contract, the employees choose between the different contracts. Each employee states which of the three payment scheme he prefers most, which one would be his second choice and which one he likes the least.

Different than the statements of the managers **not a random draw** decides if multiple employees prefer the same payment system, but the statements of an employee that solved **more tables in part 3** are fulfilled first. (This was the part in which each participant was asked to solve as many tables as possible within five minutes.) According to the choices of the employees each manager again receives two employees. Each firm therefore again consists of one manager and two employees.

### Summary

Managers again receive 14 points for each table that was correctly solved by one of her employees. From this payment they have to pay the wage of their employees.

The same three payment schemes as in the part before are possible: Variable payment, competition or a fixed wage. The details of the payment schemes of the three methods also have not changed, e.g. the height of the variable payment is still 8 points per table.

The split in employees and managers remains unchanged. If you have been an employee before, you are also an employee in this part.

Like in the part before there is again a quiz for all participants. The participation in the quiz is not paid for any participant.

## Example

Each manager now states which fixed wage she would pay. Then each manager states the order in which she would select the different payment schemes.

After these statements have been used to determine which manager offers which contract, each employee sees the choices of all three managers on his screen. Each payment scheme has a number 1-3. The employee then states the order in which they would select these three payment methods.

The number of the method you prefer the most you please state in the field "1st Choice", the number of the method you want as your second choice you please state in the field "2nd Choice" and in the field "3rd choice" you state the method you like the least.

Please click on FORWARD, once you have understood these instructions.

### *Selection of fixed wage - managers*

Your role in this study is unchanged. This means you are still a manager.

Please select now which fixed wage you will be paying your employees, in case you want / have to offer a fixed wage in this part.

Reminder: Different than before employees are not directly linked to a manager. This means workers see your wage offer, as well as the contracts of the other managers. Each manager offers a different contract, this means that if you offer a fixed wage, the other two managers offer a competition and a variable payment.

Please select the height of the fixed wage for your workers [in points]:

Reminder: You receive 14 points for each table that is correctly solved by one of your employees. If you select a fixed wage, each employee receives the same wage, independent of the number of tables he solved.

In the variable payment from the 14 points 8 points go to the employee.

In the competition the employee that solved more tables receives 450 points and the employee that solved fewer tables receives 50 points.

### *Selection of managers*

Possibility 1: **Fixed wage** of **X** points

Possibility 2: **Variable payment**

Possibility 3: **Competition**

1st choice, 2nd choice, 3rd choice

Reminder: You receive 14 points for each table that is correctly solved by one of your employees. If you select a fixed wage, each employee receives the same wage, independent of the number of tables he solves.

In the variable payment from the 14 points 8 points go to the employee.

In the competition the employee that solved more tables receives 450 points and the employee that solved fewer tables receives 50 points.

## Worker selection screen

The three managers of your group offer the following contracts:

Offer 1: Fixed wage                      Offered wage: X points

Offer 2: Competition

Offer 3: Variable payment

Please select your favorite order of the contracts. The higher you rank an offer, the likelier it is, that you will receive this offer.

Enter the number of the offer you like best in the first field, the number of the second best offer in the second field and the number of the contract you like least in the third field.

### Stage 8 - Questionnaire for managers

*Identical to stage 6 above.*

### Stage 9 - Questionnaire

#### Questionnaire page 1 of 3

In the questions on this page you play for real money. Below you see 10 bets we offer you. Please decide in each row whether you want bet A (left column) or bet B (right column).

Please indicate now in each row, whether you want the left or the right bet.

Once you have finished the questionnaire, we will play out one of the 10 bets. This means a random draw will determine which row we will play. In the selected row, we will play the bet you have chosen.

#### Example

e.g. in the first row you have the choice between bet A, which pays 2 Euros with 10% probability, but with 90% 1.60 Euro. You can also choose bet B, which pays with 10% probability 3.85 Euros and with 90% 0.10 Euro.

The money you earn we add to your total income of the study.

#### Bet A

10% chance of winning 2 Euro and 90% of 1.60 Euro.  
20% chance of winning 2 Euro and 80% of 1.60 Euro.  
30% chance of winning 2 Euro and 70% of 1.60 Euro.  
40% chance of winning 2 Euro and 60% of 1.60 Euro.  
50% chance of winning 2 Euro and 50% of 1.60 Euro.  
60% chance of winning 2 Euro and 40% of 1.60 Euro.  
70% chance of winning 2 Euro and 30% of 1.60 Euro.  
80% chance of winning 2 Euro and 20% of 1.60 Euro.  
90% chance of winning 2 Euro and 10% of 1.60 Euro.  
100% chance of winning 2 Euro and 0% of 1.60 Euro.

Bet A / B  
Bet A / B  
Bet A / B  
Bet A / B  
Bet A / B  
Bet A / B  
Bet A / B  
Bet A / B  
Bet A / B  
Bet A / B

#### Bet B

10% chance of winning 3.85 Euro and 90% of 0.10 Euro.  
20% chance of winning 3.85 Euro and 80% of 0.10 Euro.  
30% chance of winning 3.85 Euro and 70% of 0.10 Euro.  
40% chance of winning 3.85 Euro and 60% of 0.10 Euro.  
50% chance of winning 3.85 Euro and 50% of 0.10 Euro.  
60% chance of winning 3.85 Euro and 40% of 0.10 Euro.  
70% chance of winning 3.85 Euro and 30% of 0.10 Euro.  
80% chance of winning 3.85 Euro and 20% of 0.10 Euro.  
90% chance of winning 3.85 Euro and 10% of 0.10 Euro.  
100% chance of winning 3.85 Euro and 0% of 0.10 Euro.



*Questionnaire page 2 of 3*

How well did you like the task in this experiment?	Not at all - - - - - Very good
As how difficult have you perceived the task in this experiment?	Very easy - - - - - Very difficult
How well did you like the entire experiment?	Not at all - - - - - Very good
Please state for the following payment schemes for a worker in part 4 and 5 of this experiment?	
Fixed payment of 100 points	Very unfair - - - - - Very fair
Fixed payment of 200 points	Very unfair - - - - - Very fair
Fixed payment of 300 points	Very unfair - - - - - Very fair
Fixed payment of 450 points	Very unfair - - - - - Very fair
Variable payment of 8 points per table	Very unfair - - - - - Very fair
Competition with 450 points for the best worker and 50 for the other	Very unfair - - - - - Very fair

*Questionnaire page 3 of 3*

Please state your Abitur grade: If your highest school diploma is not a German Abitur e.g. Matura, A-levels, ... please state a **0** in the field.

Please state your final high school math grade: If your final math grade was not in the German 15 point system please state a **0**.

Please state your final high school German grade: If your final German grade was not in the German 15 point system please state a **0**.

Please state the year of your highest high school certificate:

Please state your gender: female - - male

Are you currently enrolled as a student at a University or University of Applied Science? Yes - No

Are you working at a University / University of Applied Science?  
(e.g. as teaching or research assistant, doctoral student or employee) Yes - No

Do you have a job outside of the university? [e.g. employee, teacher, servant, ... ] Yes - No