How does Competition Affect People Economically and Emotionally?

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Abstract

Competition is fostered in many domains to improve performance, but its psychological impacts on those involved – and thus their overall utility and well-being – have not yet received much attention in the literature. This paper investigates the effect of competitive environments on effort provision and mood by conducting a lab experiment and on that basis proposing a simple model that incorporates mood in the utility function. The paper also explores how past experiences affect people's preferences for competitive payment schemes. The results show that people exert greater effort when they work under competitive payment schemes such as piece-rate and rank-order tournament payments than fixed payments. In contrast, these competitive payment schemes, along with rank feedback, make people feel worse. In particular, people with low ranks suffer more as the working environment becomes more competitive. The findings provide evidence that competitive environments may be detrimental to some people in the left tail of the distribution. Moreover, the paper finds that expected earnings play a more important role than mood in people's preferences for incentive schemes. The study contributes to the literature by introducing the psychological impact of competitive working environments and a potential role of mood in the discussion of preferences.

Keywords: Status; ranking; feedback; happiness; incentives; experiment
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1 Introduction

> "What people fear when they engage in the struggle is not that they will fail to get their breakfast next morning, but that they will fail to outshine their neighbors."
>
> Bertrand Russell (1930), *The Conquest of Happiness*

People often strive to place themselves above others in performance and wealth. This is a well-known phenomenon that is widely accepted anecdotally as well as in the literature: People care about their status, frequently relative status in comparison with others, and this concern affects their decision making as well as their behaviors (e.g., Kuziemko et al., 2014; Charness et al., 2013; Gill et al., 2015; Boyce et al., 2010; Fischer, 2008; Falk and Ichino, 2006; Bull et al., 1987; Lazear and Rosen, 1981; Hannan et al., 2008; Murphy and Cleveland, 1991). In the workplace the consequence involves workers' decision making on labor supply. While in any group of people status exists to a certain extent, people tend to be more aware of it when they face competitive environments.

Indeed, this effect becomes much more salient in competitive environments, and indeed an abundance of studies find that competitive environments improve overall performance substantially in a number of contexts (Azmat and Iriberri, 2010; Charness et al., 2010; Lazear, 1996; Niederle and Vesterlund, 2007; Tran and Zeckhauser, 2012; Shearer, 2004). Governments and companies, even educational institutions, frequently take advantage of this by fostering competition strategically to yield better overall outputs. The ways of making environments more competitive vary. It could be giving rank feedback, symbolic rewards or prize while monetary incentives such as bonuses and salary raise are implemented elsewhere.

In contrast, the potential psychological effects of competition on workers is much less intensively studied in the literature. Despite the positive side of competition, e.g., better average outputs, it seems quite obvious that not everyone in such an environment is truly better off when considering unaddressed psychological consequences. In the presence of status preferences and concerns under competition, it is possible that there are some individuals who perform worse even if overall group or organizational performance rises under competition. This is because competition can be understood as a situation that causes social stress and this can motivate

some in a positive way while threatening others who find it uncontrollable (Salvador and Costa, 2009). Moreover, those who feel threatened by competition may not contribute to the improvement of output levels it seems to generate at a group scale. In addition, it is worthwhile thinking about its impact on overall utility and how people perceive competitive situations or feel about such environments. The underlying cognitive process associated with this emotional effect of competition may play an important role in people's satisfaction and well-being. By additionally looking at psychological reactions to competition, this paper attempts to answer the question whether competition improves people's overall welfare in terms of both economic and psychological happiness. The objective is to shed light on the discussion of utility and preferences by introducing a psychological component to utility and its potential role.

While existing studies provide abundant evidence that people care about their relative position in a reference group and this affects people's economic behaviors and performance, we have limited knowledge regarding how one's relative position affects how she feels (Luttmer, 2005; Clark and Oswald, 1996; Fischer, 2008; Brandts et al., 2006). This paper investigates this aspect while also examining how hard people work under competition. Furthermore, it explores preferences for competition and discusses whether it is worth considering how people feel when it comes to their preferences.

To investigate these phenomena, a lab experiment was conducted in November, 2013 at Cornell University. The experiment was designed to measure both effort provision and mood under various working environments and study what people actually prefer when they are allowed to choose their own working environment. The intensity of competition was manipulated in the lab by varying working environments across the treatments by using rank feedback and three incentive schemes: fixed, piece-rate, and rank-order tournament payments.

Previous studies show that people perform better when they receive relative status feedback and the findings of this paper are well aligned with such existing knowledge. Charness et al. (2010) find that providing performance feedback after work raises outcomes and people exert effort to secure or improve on their relative status. A field experiment with college students in Vietnam conducted by Tran and Zeckhauser (2012) convinces us that making people aware of their relative position in a group affects performance in a real-world setting even if no immediate

monetary incentives are associated with their status. My experiment adopts a setting that is similar to those of previous studies to make subjects more aware of their relative status. In the experiment, rank feedback was provided and also updated while people worked so that they could learn how well they were doing in the reference group whenever they wanted to know during the experiment. The data from my experiment also show the trend towards increasing performance with rank feedback but those findings are not statistically significant. Other studies use incentive schemes instead of simply providing rank feedback to motivate people to work harder and determine their earnings, which contributes to their wealth, based on their performance. Lazear (1996) finds that changing the payment structure of a company from paying hourly wages to paying at a piece rate, i.e., paying per outcome, improves the firm's output. In an experiment of Niederle and Vesterlund (2007), people perform significantly better in a tournament in which they are paid if they win over another participant than under a piece-rate incentive scheme.[1] In my experiment, I use both fixed and competitive payment schemes, namely piece-rate payment and rank-order tournament payment.[2] Insofar as competitive payment schemes make one's relative status affect his earnings, these schemes can affect one's status in terms of earnings distribution. This paper examines whether any differences in these incentive schemes actually matter and affect either performance or mood. The results show that people work harder under competitive payment schemes than under fixed payment schemes. This validates the proposition that people provide greater effort under more intense competition.

In contrast to the rich body of literature on performance, only a few studies have investigated how people *feel* in competitive environments. Studies on satisfaction and subjective well-being using empirical data include Clark and Oswald (1996), who show that satisfaction depends on one's income relative to the reference level of outcome and Luttmer (2005), who finds that people feel worse when they are surrounded by neighbors with relatively high earnings. This implies that people feel better when they do better than others. The findings of Kuziemko et al. (2014) and Gill et al. (2015) show that there is a tendency for people to avoid last place and pursue first place in the distribution of ranks or performance. This implies that people are not

[1] Their experiment was not designed to control for learning over time, which may have affected their results.

[2] The rank-order tournament payment scheme pays differentially according to one's rank in the group while the tournament payment usually refers to a payment that pays only the winner.

happy when they do extremely poorly. Brandts et al. (2006) study the impact of competition by implementing stylized competition in repeated prisoners' dilemma game along with its impact on subjective well-being. Their results show that competition may have a negative impact on subjective well-being. However, the competitive environment in their experiment involves the non-randomness of the reference group and bargaining power, which may have further influence on subjective well-being. My experiment attempted to control for possible social interactions and influences that may affect how people feel. It also tried to capture the emotional state of subjects in competitive environments by measuring mood. The results show a trend towards a decreasing pattern for mood under greater competition and the decreases are statistically significant in the presence of both rank feedback and competitive payment schemes.

In addition to investigating the overall effect on performance and mood, this paper also explores these effects across status distribution. While increases in effort provision in the various locations on the distribution rarely reach statistical significance, mood decreases statistically significantly only for the people who rank low on the left side of the distribution. The findings suggest that people on the left tail of the distribution may suffer more acutely under greater competition.

This paper extends its discussion further by exploring the revealed preferences of subjects who have experienced various degrees of competition. Based on the previous discussion, greater competition may have two types of influences: on the one hand, it may make some people work harder and feel better, and, on the other hand, it may make people work similarly harder but feel worse. If so, would people still choose what brings them the highest earnings? Would how people feel matter for their preferences for the working environment? This study investigates these new aspects and suggests that economic gains outweigh emotional losses. Since subjects were tested under every treatment in my experiment with a within-subjects design, they were asked at the end of the experiment to choose under which payment scheme they would like to work. The payment choices along with the data on effort provision and mood suggest that there may be a trade-off between earnings and mood in utility and mood may play a role in decision-making. Although the conclusions related to mood are suggestive of the effect of mood on utility with current data, the findings of this study contribute to the literature by exploring

the potential influence of how people feel on decision-making along with other conventional considerations of earnings and the costs of exerting effort.

Finally, some terms in this paper, such as "competition" and "mood," need to be defined more specifically for the following discussion. While the definition of "competition" can vary depending on the context, I treat competition as the mark of a situation in which people become aware of their relative positions as a result of pursuing higher status within a group. As competition intensifies, people tend to become more aware of their relative status. Defining "mood" can be more controversial. In this paper, I use a narrow definition of "mood" according to which it is "a conscious state of mind or predominant emotion"[3] or "a state or quality of feeling at a particular time"[4] and do not consider it as overall well-being or happiness. In the experiment, mood was measured with two questionnaires: A mood questionnaire developed by Peterson and Sauber (1983) that is widely used in the field, and a photographic mood questionnaire by Pollak et al. (2011) that has been developed recently.

The remainder of the paper is organized as follows. Section 2 proposes a theoretical framework that incorporates mood into utility and shows that there is a possibility that mood affects one's preferences. Section 3 describes the design of the lab experiment and the procedure in detail. Section 4 presents the results based on the experimental data. Section 5 concludes and discusses the study's limitations and offers suggestions for future research.

2 Theoretical framework

I propose a model that incorporates mood in the utility function when an agent performs a task and apply that model to various payment schemes. In my experiment, fixed, piece-rate, and rank-order tournament payments are investigated along with rank feedback. In this section, I describe these payment schemes without a mood component in the utility function and then add a mood component to the utility function for each payment scheme. I also discuss the implications of adding mood for the results of my experiment. I propose an N-agent model.

[3]Mood [Def. 1]. *Merriam-Webster Online*. Retrieved November, 15, 2015, from http://www.merriam-webster.com/dictionary/mood

[4]Mood [Def. 1]. *Dictionary.com Online*. Retrieved November, 15, 2015, from http://dictionary.reference.com/browse/mood?s=t

The output y_i of agent $i \in \{1, 2, \ldots, N\}$ is a function of effort e_i and random noise ϵ_i that follows a distribution $f(\cdot)$ with mean 0 and variance σ^2. η represents a common shock in productivity.

$$y_i = e_i + \epsilon_i + \eta$$

The cost function $c(e)$ with effort e assumes that $c' > 0$ and $c'' > 0$. In addition, the cost function $c(\cdot)$ and the distribution of random noise ϵ_i are identical for all agents.

2.1 A fixed-payment model

In a standard model with fixed payment W, agent i's utility is

$$U_i = W - c(e_i) \tag{1}$$

I add a mood component m_i to the utility function and assume that all the disutility caused by exerting effort e_i is captured by $c(e_i)$. An additively separable utility function $U(e_i, m_i)$ consists of $u(e_i, \cdot)$ and $v(m_i)$ where $v(\cdot)$ captures the utility of mood and $u(\cdot)$ captures all the other utility components. Then, the utility becomes

$$U_i = u(W - c(e_i)) + v(m_i) \tag{2}$$

A utility-maximizing agent will choose to exert zero effort under fixed-payment schemes regardless of whether the utility function includes a mood component or not. However, the optimal level of utility can change as the mood component m_i is added to the model.

2.2 A piece-rate payment model

Under piece-rate payment, compensation is determined based on one's absolute performance at a piece rate r. The utility for agent i is

$$U_i = ry_i - c(e_i) \tag{3}$$

And the expected utility EU_i is

$$EU_i = E[ry_i - c(e_i)] = re_i - c(e_i) \tag{4}$$

By the first-order condition, $\mathrm{d}EU/\mathrm{d}e_i = r - c'(e_i) = 0$. Thus, $c'(e_i) = r$ for all agents that compete in the piece-rate payment scheme.

As the utility function includes the utility of mood, $v(m_i)$, it becomes

$$U_i = ry_i - c(e_i) + v(m_i) \tag{5}$$

Then, the expected utility EU_i is

$$EU_i = E[ry_i - c(e_i) + v(m_i)] = re_i - c(e_i) + v(m_i) \tag{6}$$

Regardless of the existence of $v(m_i)$ in the utility function, a utility-maximizing agent i chooses effort provision e_i at $c'(e_i) = r$. However, the optimal level of utility alters as the mood component m_i is added to the model.

2.3 A rank-order tournament model

Based on prior studies on tournament theory (Lazear and Rosen, 1981; Lazear, 1996; McLaughlin, 1988), a standard rank-order tournament model can be written as follows:

In a multiple agent tournament model with N prizes $\{W_1, \cdots, W_N\}$ where N is the top rank, the probability of placing kth from the bottom, given that each of the $(k-1)$ other agents supply effort e^*, is

$$\bar{F}_N(k) = \frac{(N-1)!}{(N-k)!(k-1)!} \int F(\epsilon_i + e_i - e^*)^{k-1}[1 - F(\epsilon_i + e_i - e^*)]^{N-k} f(\epsilon_i)\mathrm{d}\epsilon_i \tag{7}$$

where $F(\epsilon_i + e_i - e^*) = P(y_i > y_j)$ is the c.d.f. of i.i.d. ϵ_j.

Then, agent i's objective function can be written as

$$EU_i = \sum_{k=1}^{N} U[W_k - c(e_i)]\bar{F}_N(k) \tag{8}$$

The first-order condition follows as

$$\sum_{k=1}^{N} U'(W_k - c(e_i))(-c(e_i))\bar{F}_N(k) + \sum_{k=1}^{N} U(W_k - c(e_i))\bar{f}_N(k) = 0 \tag{9}$$

where $\bar{f}_N(k) = \partial \bar{F}_N / \partial e_i$ is evaluated at $e_i = e^*$. And $\bar{F}_N(k) = 1/N$ for all k in Nash equilibrium. This leads to the following condition

$$c'(e_i) = \frac{\sum U[W_k - c(e_i)] \cdot \bar{f}_N(k)}{\frac{1}{N}\sum U'[W_k - c(e_i)]} \tag{10}$$

Therefore, a utility-maximizing agent i chooses e_i that satisfies the above equation.

Adding a mood component, the utility function for agent i who earns W_k by exerting effort e_i becomes

$$U(e_i, m_i) = u(W_k - c(e_i)) + v(m_i) \tag{11}$$

As in McLaughlin (1988), agent i obtains u_i with probability $\bar{F}_N(k)$. Then, the expected utility is

$$EU_i = \sum_{k=1}^{N} u[W_k - c(e_i)]\bar{F}_N(k) + v(m_i) \tag{12}$$

The first-order condition is still equation (9). In Nash equilibrium, $\bar{F}_N(k) = 1/N$ for all k. Thus, the effort level is still determined by equation (10). This implies that adding a mood component does not change the optimal level of effort provision but may alter the optimal level of utility.

2.4 Discussions and predictions

In the proposed model, the mood component m_i is neither specified as a specific functional form nor defined further. This makes it possible to represent an agent's mood in the working environment while excluding other factors that can affect utility. The other factors from exerting effort are reflected in function $u(e_i, \cdot)$. I assume that $c(e_i)$ reflects the utility (or disutility) of

both exerting effort and taking a relative position as a result. Accordingly, I let the cost function $c(e_i)$ vary across different payment schemes if necessary.

Applying this model to the experiment and comparing the payment schemes based on the model in a situation in which one's relative position is available to other agents, $u(\cdot)$ determines effort provision whereas m_i represents mood as affected by working environments that vary by payment scheme. In the experiment, measuring productivity provides the level of effort provision e_i and measuring mood yields the information about the mood component m_i. Thus, I was able to observe the values of these components in the utility function during the experiment. Moreover, the data indicating which payment option was most preferred by agents when they were asked in the experiment were also collected.[5]

As discussed earlier, the model proposes that adding a mood component to the utility function does not affect one's decision regarding effort provision and the level of effort provision can still be determined by conventional theories without the mood component. However, this leaves open the possibility that the mood component can affect the optimal level of utility under each payment scheme and therefore affect one's preferences regarding the payment schemes. Without specifying more details about the utility functions used in the model, it is hard to conclude which incentive scheme would generate greatest utility. Nevertheless, the model suggests that it is possible that people work harder under one incentive scheme while preferring another payment scheme due to the existence of the mood component in the utility function. Based on this model, it is feasible to conjecture that people are less happy even when receiving greater earnings under competitive incentive schemes because they feel bad about the ongoing competition fostered by those schemes. In this regard, this model can explain a seemingly odd situation in which agents choose less competitive payment schemes even if they would gain higher earnings under another payment scheme and obtain greater utility under that payment scheme when not considering the mood component in the utility function.

On the other hand, this model does not directly indicate which payment scheme would provide greater effort provision or a happier mood. By exploring the experimental data, we can learn about the role of mood in utility.

[5]The preferences were asked in the Ranking Preference treatment. See Section 3 for the experimental design.

3 Experimental design

3.1 Experimental design

The study used a within-subjects experimental design with five treatments. Both the availability of private rank information and the payment scheme varied across the treatments. The baseline is a treatment with fixed payment and no rank update (Non-ranking Fixed (NR-F) treatment hereafter). In the remaining four treatments, subjects are provided with their rank information, but under the following payment schemes: fixed payment (Ranking Fixed (R-F) treatment); piece-rate payment (Ranking Piece-rate (R-PR) treatment); rank-order tournament payment (Ranking Tournament (R-T) treatment); and finally a preference scheme under which subjects can choose among the R-F, R-PR, and R-T schemes (Ranking Preference (R-P) treatment).

The slider task developed by Gill and Prowse (2012) was used as a task in the experiment and two sets of this task were assigned in each treatment, followed by the Mood Short Form (MSF) questionnaire by Peterson and Sauber (1983) and the Photographic Affect Meter (PAM) questionnaire by Pollak et al. (2011) (Appendixes A and B). At the end of a given session, subjects were then given a final questionnaire to provide basic demographic information (see Appendix C). All the tasks and questionnaires except the PAM questionnaire that was given in a pen-and-paper version were programmed in the experimental software called z-Tree (Fischbacher, 2007) and carried out electronically. The code implementing the slider task is based on the code developed by Gill and Prowse (2012).

A session consisted of five rounds in which the applied treatment varied across the rounds. In other words, the availability of private rank information and the payment scheme in a round differed across treatments, as shown in Table 1. In the treatment with rank update, subjects could see their rank among all the participants in the session.[6]

Under the Non-ranking Fixed treatment, subjects were not informed about their rank in the group of 6 people while they performed the slider task, and their payoff was a fixed amount of $20. In all other treatments, subjects' rank information was updated continuously as long as they kept working on the slider task, and their final rank was provided privately upon completion

[6]Rank information was updated only when subjects kept working. This means that the rank could remain the same if one decided to stop working in the middle of the task.

of the task. Under the Ranking Fixed treatment, each subject's payoff was a fixed amount of \$20 whereas payments under the Ranking Piece-rate and Ranking Tournament treatment were determined according to a participant's performance and rank in the task, respectively. Under the Ranking Piece-rate treatment, the number of completed sliders in the task recorded as a points score was used to calculate the payoff with a piece rate of \$1.25 per point. Under the Ranking Tournament treatment, subjects' rank in the task determined their payoffs in the treatment and the payoff ranged from \$12.50 to \$27.50 (see Appendix D for details). Under the Ranking Preference treatment, subjects were asked to choose one payment option among fixed, piece-rate, and rank-order tournament payment at the beginning of the treatment.[7] At the beginning of each treatment, subjects were informed about the treatment in written form on the computer screen while the instructions were read out loud by the experimenter.

The order of treatments varied across sessions to balance out the effect of subjects' learning over time during the experiment, while the Ranking Preference treatment was applied to the fifth round in all twelve sessions. The other four treatments were applied in the first four rounds of each session, as specified in Table 2. Among the 24 possible orderings of the four treatments, 12 orderings were chosen for this experiment such that every treatment except the Ranking Preference treatment could be tested three times in each round from the first to the fourth round across the 12 sessions.

A set of the slider task consisted of 48 sliders and 2 minutes were allotted to each set of the task. At the beginning, all the sliders were positioned at 0 from 0 to 100 integers and subjects were asked to adjust and position the sliders to 50 to earn a point. The points score for a subject was the number of successfully positioned sliders, which was updated continuously at the top of the computer screen as the subject worked on the task, while the remaining time was shown in the upper-right corner of the screen. In the treatments with rank update, rank information as well as the points score were updated as subjects worked on the task.[8] Two sets of the slider

[7] One of the six payment options chosen by six participants was randomly drawn to determine their payoffs at the end of the treatment.

[8] Subjects were told that they would not be allowed to use the keyboard or the scroll wheel of the mouse during the slider task since they could easily improve performance by using those. In addition, the arrow keys on the keyboard and the scroll wheel of the mouse used in the experiment were disabled by executing a script. Christopher Zeppenfeld (Cologne Graduate School) provided the script to disable the arrow keys of the keyboard and the scroll wheel of the mouse.

task were assigned under each treatment with a 90-second break. Subjects were given 10 sets of the slider task in total over the course of a session.

Upon completion of two sets of the slider task, two sets of questionnaires were given at the end of each treatment to measure how subjects felt under the treatment. The MSF questionnaire with mood questions developed by Peterson and Sauber (1983) was administered electronically using an 11-point scale (0-strongly disagree to 10-strongly agree) followed by a printed PAM questionnaire (see Appendix B) using the Photographic Affect Meter (PAM). On the PAM questionnaire, two separate sets of 16 photographs were provided on each page of the questionnaire and subjects were asked to circle one photo on each page that best captured how they felt at the moment.

The total payment for each subject was decided at the end of each session by randomly drawing one of the five payoffs determined in the five treatments. This randomly drawn payment was added to the show-up fee of $5 and paid to each subject in cash. The additional payment above the show-up fee was on average $22.

Twelve sessions were conducted in mid-November 2013 at the Cornell Lab for Experimental Economics and Decision Research (LEEDR). Six subjects (18 years old or older) participated in each 75-minute session, except one session with 5 subjects, resulting in seventy-one participants in total. Subjects were recruited by the LEEDR lab from its subject pool and only students, including graduate students, participated in the experiment.

3.2 Experimental procedure

As soon as the subjects in a session were seated separately at a desk with a PC, the experiment began with a general explanation: the length of time, tasks, the number of rounds, and the payment. Also, the example of sliders and a set of the slider task were shown to subjects. The subjects were informed that payoffs would be determined in each treatment but only one random draw from five payoffs would be actually paid to them in addition to the show-up fee. After a set of the slider task was given to the subjects for practice, the first treatment started.

At the beginning of every treatment, the experimenter read aloud the instructions about the availability of rank updates and the payment scheme along with explanations of the task

and the questionnaires given during the treatment. The instructions for the treatment varied depending on the treatment. Following the instructions, two sets of the slider task were given with a 90-second break, followed by the MSF and PAM questionnaires. Then, each subject's payoff under the treatment was displayed privately on screen at the end of the treatment. After finishing all five treatments, subjects were asked to complete the final questionnaire.

Upon completion of the final questionnaire, each subject's five payoffs determined in the five treatments were displayed on screen. One of these payoffs was randomly chosen and paid to the subject in cash, concluding the session.

4 Results

4.1 Data description

I use the data collected from the lab experiment with 71 subjects in which every subject finished two sets of the task and answered the MSF and PAM questionnaires in each treatment. The points score, i.e., the number of correctly positioned sliders in the task, can be interpreted as a participant's effort provision. Since every subject finished two sets of the task in each treatment, the pooled data are used when comparing the levels of effort provision between treatments. After subjects were tested under the treatment, two questionnaires at the end of each treatment generated the data on mood. Mood scores were collected from the MSF questionnaire and Positive Affect (PA) and Negative Affect (NA) were collected from the PAM questionnaire.[9] High mood scores indicate a happy and pleasant emotional state. High PA scores indicate high arousal and great pleasure whereas high NA scores imply high arousal and negative feelings. These mood scores are used to compare subjects' moods from one treatment to the next. In addition, data on preferences for payment schemes were collected during the Ranking Preference treatment in which all the subjects chose one payment scheme among the three payment schemes

[9]From the MSF questionnaire, mood scores were calculated by summing up the answers from the first two questions and the reverse-scored answers from the other two questions.
The calculation for Positive and Negative Affect requires two values of Valence and Arousal that are obtained from the PAM questionnaire. Their formulas are as follows:
Positive Affect = 4*Valence + Arousal - 4
Negative Affect = 4*(5-Valence) + Arousal - 4
Refer to Pollak et al. (2011) for further details.

experienced earlier in the session.

Note that the data on effort provision and mood collected from the Ranking Preference treatment were not used in the following analysis due to the potential order effect. The Ranking Preference treatment was always tested in the last round of the experiment across all sessions, unlike the other treatments that were tested in separate rounds depending on the session. This prevents participants from benefiting from learning over time during the experiment or from improving on the slider task near the end of the experiment. Also, mood may be affected by the excitement that typically grows when the experiment approaches the end.

4.2 Effort provision

The descriptive statistics on the data suggest that providing rank information and applying competitive payment schemes such as the piece-rate and rank-order tournament payment lead subjects to work harder (see Figure 1). To investigate whether there is any significant difference in effort provision between the Non-ranking Fixed treatment and the other treatments, I estimate the following equation:

$$y_i = \beta_0 + \beta_1 \tau_{1i} + \beta_2 \tau_{2i} + \beta_3 \tau_{3i} + \beta_4 f_i + \epsilon_i^1 \tag{13}$$

In Equation (13), for each individual i, y_i denotes effort provision, τ_{ji} denotes the dummy variable for each treatment j ($j = 1, 2, 3$ for Ranking Fixed, Ranking Piece-rate, and Ranking Tournament treatment, respectively), f_i denotes female, and ϵ_i^1 denotes the error term. The results shown in columns (1) and (2) in Table 3 show that effort provision improves statistically significantly under the piece-rate and rank-order tournament payment schemes along with rank update compared with effort provision under the fixed-payment scheme with no rank updates. Providing only rank updates to subjects does not improve effort provision significantly but monetary incentive schemes such as the piece-rate and tournament payments improve effort provision, but there is no difference in the effects on effort provision these two competitive payment schemes generate. The Mann-Whitney test supports this result and also shows that there is only a marginally significant difference between the treatments except between the Non-

ranking Fixed and Ranking Piece-rate treatments ($p = 0.091$), and between the Non-ranking Fixed and Ranking Tournament treatments ($p = 0.066$). In addition, male participants do not achieve significantly better performance on the slider task than female participants. In Table 5, individual fixed effects are included in the model and the results are nearly identical with those in Table 3. We also see that when rank information is available, competitive payment schemes such as the piece-rate and rank-order tournament payment schemes increase effort provision compared with the fixed-payment scheme, while we see no difference in effort provision between the Ranking Piece-rate and Ranking Tournament treatments.

4.3 Mood

The mood measures obtained from the MSF and PAM questionnaire are described in Figure 2. The results show that the average mood worsens as we move from the Non-ranking Fixed treatment towards the Ranking Tournament treatment.[10] As in the previous section, I exclude the mood data from the Ranking Preference treatment in the following analysis. Since multiple mood measures were collected from each subject, one overall mood measure can be calculated by combining mood scales from both questionnaires. The mood measures from the MSF questionnaire and positive affect measures from the PAM questionnaire are used to integrate these multiple measures into one.[11]

To see differences in mood between the treatments, I estimate the following equation in which, for each individual i, h_i denotes the mood, τ_{ji} denotes the dummy variable for each treatment Rj ($j = 1, 2, 3$ for the Ranking Fixed, Ranking Piece-rate, and Ranking Tournament treatment, respectively), and ϵ_i^2 denotes the error term:

$$h_i = y_0 + y_1\tau_{1i} + y_2\tau_{2i} + y_3\tau_{3i} + \epsilon_i^2 \tag{14}$$

As shown in Table 3, the data on mood suggest that people feel worse when the rank update is available and the payment scheme is more competitive. The results show that competitive

[10] Subjects' moods recover under the Ranking Preference treatment. However, the recovery of mood under the Ranking Preference treatment seems to be caused by subjects' feeling better towards the end of the experiment.

[11] The standardized values of both mood measures are summed and then standardized again to obtain one mood measure. Negative affect measures are not used in this calculation since positive and negative affect are highly correlated by construction. See footnote 9.

payment schemes such as the piece-rate and tournament payments combined with rank updates make people feel worse, while there is almost no difference in mood between male and female subjects. In addition, when people are informed of their relative positions, the rank-order tournament payment makes people feel worse compared with the fixed payment. Columns (5) through (10) in Table 3 present similar results, supporting the validity of the integration of mood measures. In Table 5, which includes individual fixed effects, the previous findings still hold. Additionally, we observe a significant difference in mood between the Non-ranking Fixed and the Ranking Fixed treatments, driven mainly by the Positive Affect.

4.4 Preferences for competition

In the results, one interesting finding of the experiment is that the average mood is worse under the Ranking Tournament treatment than under the Ranking Piece-rate treatment, while we find no differences in the average effort provision under these treatments. This result could be driven by the difference in the distribution of the effort provision across these two treatments. Figure 3 displays the distribution of the effort provision across these treatments. The two-sample Kolmogorov-Smirnov test for equality of distribution of effort provision shows that there is no statistically significant difference between the distribution of the Ranking Piece-rate and that of the Ranking Tournament treatments ($p = 0.978$). This suggests that the difference in average mood between the Ranking Piece-rate and Ranking Tournament treatments is not be caused by the difference in the distribution of effort provision, but it may be caused by the treatment effect. In other words, people tend to feel worse under the rank-order tournament payment scheme than under the piece-rate payment scheme although their effort provision differs very little across these schemes. This has implications for the following analysis about preferences of competitive payment schemes.

The Ranking Preference treatment provides the data indicating which payment option was preferred by subjects after they had experienced all three payment schemes earlier in the session. When a session reached the fifth round, in which the Ranking Preference treatment was applied, subjects were asked to choose one payment scheme according to which they would like to get paid. Thus, the data indicating the chosen payment options can be interpreted as subjects' revealed

preferences for payment schemes among fixed, piece-rate, and rank-order tournament payment. Under the Ranking Preference treatment, and among 71 subjects, 19 chose the fixed payment, 47 chose the piece-rate payment, and the remaining 5 subjects chose the rank-order tournament payment as their preferred payment option. The average payment under the treatment with the piece-rate payment scheme is higher to a statistically significant extent than were those under the treatments with the other two payment schemes ($p = 0.000$ for both comparisons).[12] Forty-eight subjects (68%) chose the payment option that paid the most under the previous treatments. These results, along with rational expectations theory, explain why the piece-rate payment scheme was preferred most by the subjects.

Figures 4 and 5 display the average earnings and mood under each payment scheme of subjects who chose the same payment scheme under the Ranking Preference treatment. As the figure shows, each group achieved their highest earnings and felt best in the earlier treatment of the experiment in which they were paid according to their preferred payment schemes. This implies that people prefer a payment scheme that brings them the highest gains economically and emotionally. The fact that people chose the payment scheme that brought the highest earnings and best feelings in the past is well aligned with rational expectation theory when assuming that people use past earnings and moods to estimate future earnings and mood.

4.5 Determinants of preferences for competition

To investigate what affects decision-making regarding payment schemes under the Ranking Preference treatment, multinomial logit regressions are conducted with the three payment schemes used in the experiment as the three outcome variables:

$$\eta_{ij} = log\frac{\pi_{ij}}{\pi_{iJ}} = \beta_0 + \beta_1 y_{1i} + \beta_2 y_{2i} + \beta_3 y_{3i} + \beta_4 h_{1i} + \beta_5 h_{2i} + \beta_6 h_{3i} + \epsilon_i^3 \tag{15}$$

[12]The piece rate was determined such that the expected payments from the three payment schemes are similar based on average performance in the pilot experiment that was conducted ahead of the actual experiment. In the actual experiment, however, subjects' average performance in the piece-rate payment round improved and this resulted in the higher payment in the round with the piece-rate payment scheme than in the rounds with the other payment schemes. The average earnings in the piece-rate payment scheme and in the rank-order tournament scheme were \$23.50 and \$20.60, respectively, whereas those in the fixed payment scheme were \$20.00. These amounts did not necessarily add up to one's final payment since it was chosen randomly at the end of the experiment among the five earnings determined in the five rounds of the experiment. However, it is possible that this inequality in payable amounts may have affected subjects' choices under the Ranking Preference treatment.

The log-odds, η_{ij}, is the log ratio of probabilities of i's choosing payment j and the baseline payment J, and y_{ki} and h_{ki} for $k = 1, 2, 3$ are i's earnings and mood, respectively, in the earlier Ranking Fixed, Ranking Piece-rate, and Ranking Tournament treatments.[13]

The coefficient estimates are shown in Table 6. Columns (1) and (2) show that people tend to choose the payment scheme that has paid them higher earnings in the past while their past mood does not significantly affect their decision-making. As column (3) shows, significant estimates are obtained only for past earnings, as both outcome variables are relevant to past earnings experience.

The overall and marginal effects of the explanatory variables were explored as well. The overall effects of past earnings on payment decision-making is statistically significant ($p = .001$) whereas that of mood is not ($p = .207$). In addition, as shown in Table 7, the marginal effects of the explanatory variables in predicting payment choices confirm that past earnings matter to a statistically significant extent in determining preferences for payment schemes. This supports the proposition that people prefer the payment option they expect to bring the highest gains. However, the results suggest that past mood has no significant effects on preferences for payment schemes. It is possible that the experimental results are affected by the failure to match mean earnings across payment schemes since the average earnings under the piece-rate payment scheme are the highest in the experiment. Nonetheless, the results pertaining to the marginal effects suggest the possibility that people care more about earnings than how they feel when deciding which environment they prefer. Another explanation of these results may be that the effect of earnings dominates the effect of mood in such decision-making.

4.6 Analysis by rank group

The analysis of the results based on ranks can provide information pertaining to behavioral features of people across the distribution. To analyze effort provision, a participant's rank from the first set of the task in each treatment is used to regress her effort provision in the second set of the task since the rank and the effort provision in the same set of the task are correlated. To

[13]Since the Ranking Preference treatment lets subjects choose their preferred payment schemes under the premise that they would be provided rank updates during the treatment, the earnings and mood from the ranking treatments have been used in the logit regressions. The results are robust even if the mood data in the Non-ranking Fixed treatment are included in the regressions.

analyze mood, two types of ranks are used: the average of the ranks in the two sets of the task and the rank in the second set of the task only. While effort provision and rank were determined simultaneously based on a participant's experience performing the task, mood was measured after completing the two sets of the task at the end of each treatment. The second rank was also considered separately since the experience in the second set of the task may be more influential on the mood measure. Only data from the Ranking Fixed, Ranking Piece-rate, and Ranking Tournament treatments are used in the following analysis,[14] and any comparison between them in this section assumes the existence of rank feedback. In addition, ranks are categorized into two or three groups, from high to low rank, in the following analysis.

Table 8 describes the treatment effects on effort provision by rank group using both OLS and GLS regressions. We find no statistically significant effects of competitive payment schemes on effort provision except in column (4), which shows that with rank feedback the low rank group increased effort provision under the rank-order tournament payment scheme relative to the fixed-payment scheme. When dividing subjects into high, middle, and low rank groups, we see in column (10) that low-rank people increased their efforts under the rank-order tournament payment scheme relative to the piece-rate payment scheme, but we find no significant changes in the effort provision of the high and middle rank groups. Apparently low-rank participants tried harder to avoid the low earnings that were associated with low ranks under the rank-order tournament payment scheme as opposed to the piece-rate payment scheme, in which the average earnings were greater. Similarly, it is likely that the high-rank participants did not exert greater effort under the rank-order tournament payment scheme since the higher possible earnings were set, unlike in the piece-rate payment scheme, in which they could earn more if they worked harder.

The treatment effects on mood by rank group are shown in Table 9. When I use the average rank from the two sets of the task in each treatment, low-rank subjects feel worse under the piece-rate payment and rank-order tournament payment schemes compared with the fixed-payment scheme, as shown in columns (2) and (5). When I use the rank from the second set only, the results are also statistically significant and become even stronger, as shown in columns (7) and

[14]It is possible to include data from the NR-F treatment. But I am more interested in understanding the behavioral responses to the relative status feedback.

(10), compared with the previous results. On the contrary, high- and middle-rank subjects do not show any significant changes in mood across the payment schemes shown in this table.

The above results on the rank groups show that low-rank participants are most likely to be affected by competitive payment schemes both in effort provision and mood. Furthermore, they suggest that these people exert greater effort and feel worse under competitive payment schemes relative to the fixed-payment scheme while the other groups of people in the other locations of the distribution do not show similar responses. This implies that people on the left tail of the distribution are not only affected economically and emotionally to the greatest extent but they may also be affected the most detrimentally.

4.7 Correlations

Any correlation between effort provision and mood can be investigated using the Spearman correlation coefficient test. Using mood data from the MSF questionnaire but excluding data from the Ranking Preference treatment, I find that the correlation between effort provision and mood is positive and statistically significant ($\rho = 0.234$, $p = 0.000$). Also, using mood data from the PAM questionnaire but excluding data from the Ranking Preference treatment show that the correlations between effort provision and positive and negative affect are statistically significant, respectively ($\rho = .158$, $p = .009$; $\rho = -.155$, $p = .011$). These results imply that people feel better when they perform better although we cannot understand the underlying mechanism determining which affects which. In addition, when using data indicating the perceived level of effort provision obtained from question 2 on the MSF questionnaire (see Appendix A), I find that the correlation between effort provision and the perceived level of effort provision is statistically significant ($\rho = .301$, $p = .000$). This supports the proposition that one's performance is the result of her effort provision and that the slider task results can be interpreted as indicating effort provision.

5 Conclusion and discussion

Competitive environments are often fostered by companies to motivate workers to work harder and perform better by providing relative performance feedback and using incentive schemes. Promotions, symbolic awards, appraisals, and bonuses are examples of such tactics (Gill et al., 2015). While improvement in economic outcomes under competition has been found by many studies, few studies have examined how people feel and how their welfare might change in such environments. Determining the aggregate well-being and utility of workers may require considering both economic outcomes and psychological responses.

In this paper, I conduct a lab experiment to investigate the impact of competition on economic outcomes as a result of effort provision and mood, and explore the potential role of mood in utility. I find that people increase effort provision under the piece-rate and rank-order tournament payment schemes compared with fixed payments. In the experiment, increases in effort provision were roughly the same under the two competitive payment schemes, whereas simply providing relative performance feedback did not improve effort provision to a statistically significant extent. On the other hand, people feel worse as the working environment becomes more competitive under competitive payment schemes while receiving relative performance feedback. In addition, we learned that people with low rank tend to exert greater effort but suffer more emotionally in a competitive environment, whereas the others with higher status do not experience any significant deterioration in mood. Interestingly, when people were asked to choose their preferred incentive scheme as a feature of the working environment, only past earnings mattered as a significant factor in their decision-making while the past mood did not. Although the exact role of mood in determining preferences has not been thoroughly discussed in this paper, the results suggest that mood tends to deteriorate as the working environment becomes more competitive. Moreover, the findings propose the possibility that there may be a threshold regarding preferences beyond which mood starts to matter and plays a role in forming preferences and thereby decision-making. The main contribution of this paper to the literature lies with these conclusions. In addition, understanding mood as a potential component of utility can provide implications for workplace management and the structures of monetary and non-monetary

incentive schemes so that workers and companies can be truly better off altogether.

This study is subject to several limitations. Since the experiment used both rank feedback and multiple payment schemes while applying a limited number of treatments, some effects found are combined effects of both relative status feedback and competitive payment schemes. I could not separate these effects without adding more treatments, which would have lengthened the experiment and might have bored participants. Another concern is the potential transiency of mood. The mood measures used in this study may capture participants' feelings only at a particular moment while a participant's actual mood might not last long enough to enable her to recall it and consider it in later decision-making. It is possible that the temporal gap between the experience of mood and the moment of decision-making in the experiment may have invalidated the effect of mood. In addition, the size of the monetary incentives in the experiment may have affected the results in unknown ways. Despite of these limitations, the findings of this paper can guide further research.

If I could collect more data in the future, it would be interesting to know how the preferences of high-rank participants for various incentive schemes differ from those of low-rank participants. In addition, if I could measure the money equivalent for emotional pain (or gain) by conducting another experiment, I could investigate the role of the mood component in utility more precisely by comparing economic and emotional gains (and losses). Finally, when there is more evidence collected based on this study, it should be possible to develop a comprehensive utility model that incorporates mood as well as earnings.

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Figure 1: Average effort provision by treatment

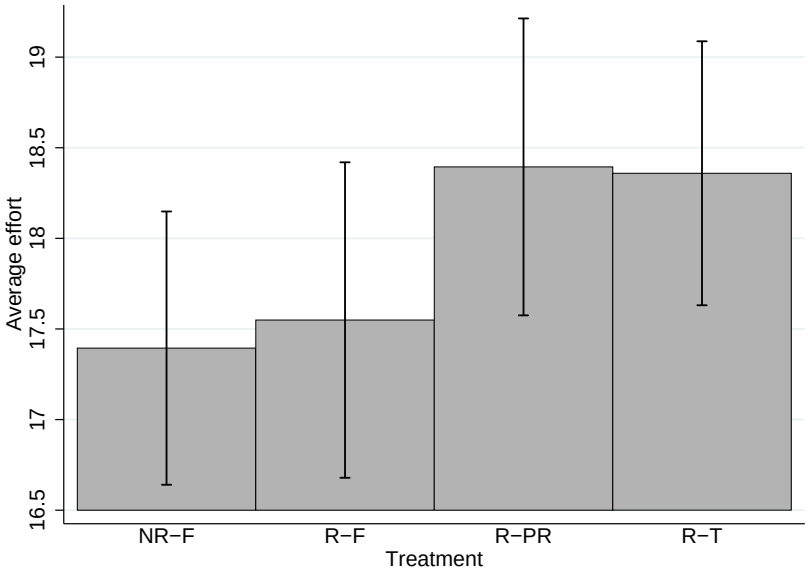
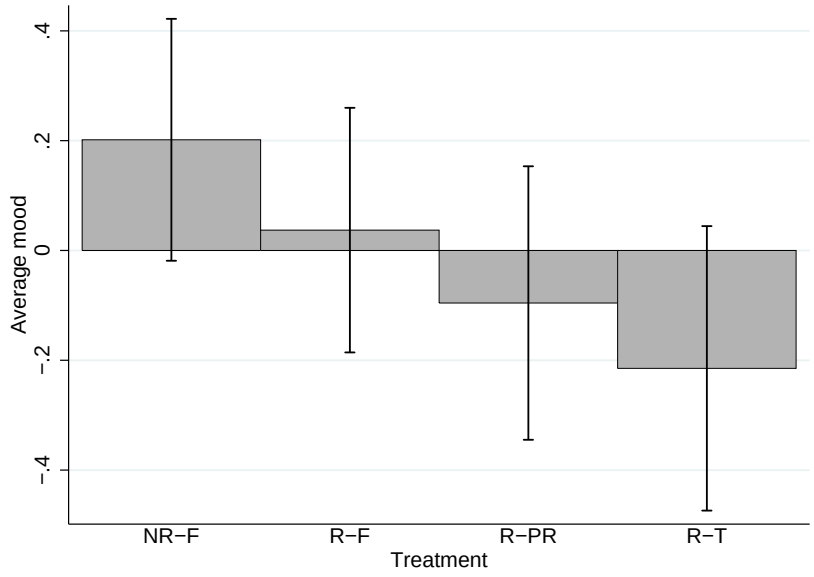
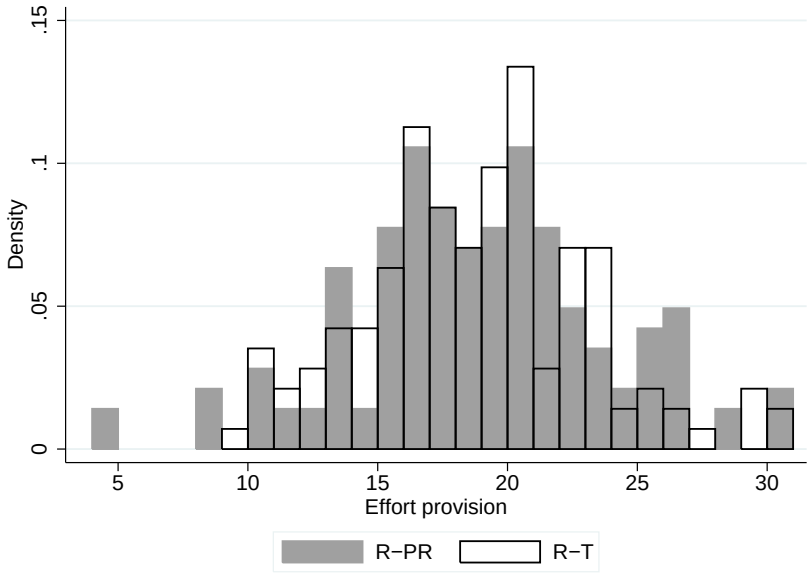


Figure 2: Average mood by treatment



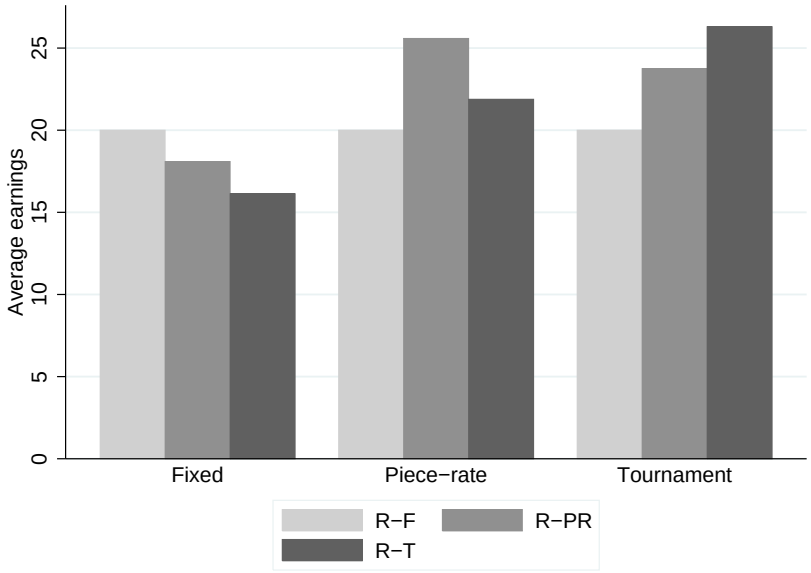
Notes: NR-F denotes the Non-ranking Fixed treatment; R-F denotes the Ranking Fixed treatment; R-PR denotes the Ranking Piece-rate treatment; R-T the Ranking Tournament treatment; R-P denotes the Ranking Preference treatment.

Figure 3: Distribution of effort provision



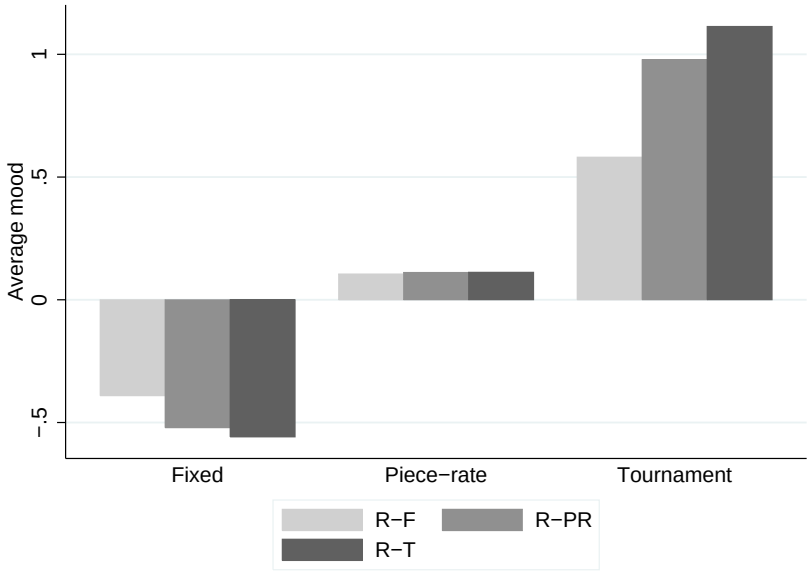
Notes: R-PR denotes the Ranking Piece-rate treatment; R-T the Ranking Tournament treatment.

Figure 4: Average earnings under payment schemes by same choice group



Notes: Each cluster of bars indicates the average earnings under each payment scheme earlier in the experiment of the subjects who chose the same payment in the Ranking Preference treatment.

Figure 5: Average mood under payment schemes by same choice group



Notes: Each cluster of bars indicates the average mood under each payment scheme earlier in the experiment of the subjects who chose the same payment in the Ranking Preference treatment.

Table 1: Treatments

Treatment	Rank feedback	Payment scheme
Non-ranking Fixed (NR-F)	No	Fixed payment
Ranking Fixed (R-F)	Yes	Fixed payment
Ranking Piece-rate (R-PR)	Yes	Piece-rate payment
Ranking Tournament (R-T)	Yes	Rank-order tournament payment
Ranking Preference (R-P)	Yes	Each subject chooses one payment option among the above three; one of the chosen payment options determines everyone's payment

Table 2: Order of treatments in all sessions

Session No.	No. of subjects	Treatment in each round				
		1st round	2nd round	3rd round	4th round	5th round
1	6	NR-F	R-F	R-PR	R-T	R-P
2	6	R-F	NR-F	R-T	R-PR	R-P
3	6	R-PR	NR-F	R-F	R-T	R-P
4	5	R-T	NR-F	R-PR	R-F	R-P
5	6	NR-F	R-PR	R-T	R-F	R-P
6	6	R-F	R-PR	NR-F	R-T	R-P
7	6	R-PR	R-F	R-T	NR-F	R-P
8	6	R-T	R-F	NR-F	R-PR	R-P
9	6	NR-F	R-T	R-F	R-PR	R-P
10	6	R-F	R-T	R-PR	NR-F	R-P
11	6	R-PR	R-T	NR-F	R-F	R-P
12	6	R-T	R-PR	R-F	NR-F	R-P
Total	71					

Notes: NR-F denotes the Non-ranking Fixed treatment; R-F denotes the Ranking Fixed treatment; R-PR denotes the Ranking Piece-rate treatment; R-T the Ranking Tournament treatment; R-P denotes the Ranking Preference treatment.

Table 3: OLS regressions of the treatment effects on effort provision and mood

	Effort provision		Combined Mood		Mood from MSF		Mood from PAM			
							Positive Affect(PA)		Negative Affect(NA)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
R-F	.155	.155	-.165	-.161	-.606	-.606	-.623	-.616	.346	.326
	(.397)	(.397)	(.111)	(.112)	(.478)	(.479)	(.398)	(.400)	(.330)	(.332)
R-PR	1.000**	1.000**	-.297**	-.296**	-1.000**	-1.000**	-.939	-.936*	1.193***	1.185**
	(.398)	(.398)	(.113)	(.113)	(.443)	(.444)	(.473)	(.475)	(.440)	(.441)
R-T	.965**	.965**	-.416***	-.415***	-1.577**	-1.577**	-1.316**	-1.312**	1.744***	1.736***
	(.386)	(.386)	(.139)	(.139)	(.504)	(.505)	(.579)	(.580)	(.542)	(.544)
Female		-.965		.166		.672		.353		-.928**
		(1.027)		(.191)		(.951)		(.562)		(.498)
Constant	17.394***	17.534***	.202*	.099	12.676***	12.269***	9.772***	9.554***	6.654***	7.227***
	(.505)	(.911)	(.111)	(.153)	(.489)	(.749)	(.393)	(.504)	(.346)	(.471)
(R-F)=(R-PR)	F(1,70)=3.92	F(1,70)=3.92	F(1,68)=1.30	F(1, 68)=1.32	F(1,70)=.64	F(1,70)=.63	F(1,68)=.42	F(1,68)=.43	F(1,68)=3.27	F(1,68)=3.33
	p=.052*	p=.052*	p=.260	p=.254	p=.428	p=.428	p=.517	p=.513	p=.075*	p=.072*
(R-F)=(R-T)	F(1,70)=4.14	F(1,70)=4.13	F(1,68)=4.41	F(1,68)=4.43	F(1,70)=4.82	F(1,70)=4.80	F(1,68)=1.59	F(1,68)=1.60	F(1,68)=1.67	F(1,68)=7.71
	p=.046**	p=.046**	p=.040**	p=.039**	p=.032**	p=.032**	p=.212	p=.210	p=.008***	p=.007***
(R-PR)=(R-T)	F(1,70)=.01	F(1,70)=.01	F(1,68)=1.02	F(1,68)=1.01	F(1,70)=1.64	F(1,70)=1.63	F(1,68)=.61	F(1,68)=.61	F(1,68)=1.67	F(1,68)=1.66
	p=.929	p= .929	p=.317	p=.318	p=.205	p=.206	p=.434	p=.437	p=.201	p=.202
(R-F)=(R-PR)=(R-T)	F(2,70)=2.62	F(2,70)=2.61	F(2, 68)=2.21	F(2,68)=2.22	F(2,70)=2.52	F(2,70)=2.51	F(2,68)=.80	F(2,68)=.80	F(2,68)=3.81	F(2,68)=3.86
	p=.080*	p=.081*	p=.118	p=.117	p=.088*	p=.089*	p=.454	p=.452	p=.027**	p=.026**
Observations	568	568	273	273	284	284	273	273	273	273
No. of subjects	71	71	71	71	71	71	71	71	71	71

Notes: NR-F denotes the Non-ranking Fixed treatment; R-F denotes the Ranking Fixed treatment; R-PR denotes the Ranking Piece-rate treatment; R-T the Ranking Tournament treatment; R-P denotes the Ranking Preference treatment. Data under the Ranking Preference treatment are not used in the regressions and the error terms are clustered at the subject level. *, **, and *** denote, respectively, significance at the 10%, 5%, and 1% levels.

Table 4: Rank sum test between treatments

		Effort provision	Combined Mood	Mood from MSF	Mood from PAM	
					Positive Affect	Negative Affect
		(1)	(2)	(3)	(4)	(5)
NR-F vs.	R-F	.704	.275	.432	.120	.296
	R-PR	.066*	.107	.212	.083*	.014**
	R-T	.091*	.020**	.042**	.052*	.005***
R-F vs.	R-PR	.144	.657	.560	.587	.119
	R-T	.198	.151	.210	.303	.038**
R-PR vs.	R-T	.798	.463	.467	.619	.460

Notes: p-values are given in this table. *, **, and *** denote, respectively, significance at the 10%, 5%, and 1% levels.

Table 5: GLS regressions of the treatment effects on effort provision and mood with individual fixed effects

	Effort provision	Combined Mood	Mood from MSF	Mood from PAM	
				Positive Affect(PA)	Negative Affect(NA)
	(1)	(2)	(3)	(4)	(5)
R-F	.155	-.196*	-.606	-.718*	.375
	(.397)	(.108)	(.478)	(.395)	(.329)
R-PR	1.000**	-.321***	-1.000**	-.988**	1.207***
	(.398)	(.111)	(.443)	(.473)	(.441)
R-T	.965**	-.440***	-1.577***	-1.365**	1.758***
	(.386)	(.137)	(.504)	(.579)	(.544)
Constant	17.394***	.222***	12.676***	9.821***	6.640***
	(.237)	(.736)	(.295)	(.294)	(.268)
(R-F)=(R-PR)	F(1,70)=3.92	F(1,68)=1.17	F(1,70)=0.64	F(1,68)=0.31	F(1,68)=3.20
	p=.052*	p=.283	p=.428	p=.577	p=.078*
(R-F)=(R-T)	F(1,70)=4.14	F(1,68)=4.05	F(1,70)=4.82	F(1,68)=1.37	F(1,68)=7.25
	p=.046**	p=.048**	p=.032**	p=.247	p=.009***
(R-PR)=(R-T)	F(1,70)=.01	F(1,68)=1.02	F(1,70)=1.64	F(1,68)=0.61	F(1,68)=1.67
	p=.929	p=.317	p=.205	p=.434	p=.201
(R-F)=(R-PR)=(R-T)	F(2,70)=2.62	F(2,68)=2.03	F(2,70)=.252	F(2,68)=.69	F(2,68)=3.63
	p=.080*	p=.140	p=.088*	p=.504	p=.032**
Observations	568	273	284	273	273
No. of subjects	71	71	71	71	71

Notes: NR-F denotes the Non-ranking Fixed treatment; R-F denotes the Ranking Fixed treatment; R-PR denotes the Ranking Piece-rate treatment; R-T the Ranking Tournament treatment; R-P denotes the Ranking Preference treatment. Data under the Ranking Preference treatment are not used in the regressions and the error terms are clustered at the subject level. *, **, and *** denote, respectively, significance at the 10%, 5%, and 1% levels.

Table 6: Multinomial logit regressions of preferences for payment schemes

vs. Baseline choice		Piece-rate vs. Fixed (1)	Tournament vs. Fixed (2)	Tournament vs. Piece-rate (3)
Past earnings in	Piece-rate	.423***	.157	-.266**
		(.144)	(.211)	(.156)
	Tournament	.081	.868**	.787**
		(.104)	(.442)	(.431)
Past mood in	Fixed	.740	.163	-.577
		(.508)	(1.121)	(1.010)
	Piece-rate	-.207	1.557	1.764
		(.634)	(.1527)	(1.393)
	Tournament	.827	1.516	.688
		(.600)	(1.250)	(1.103)
Constant		-0.466***	-25.839**	-16.373
		(2.804)	(10.688)	(10.328)
Obs.		67	67	67

Notes: The multinomial logit estimates are presented in this table with the standard errors in parentheses. In the regressions, the combined mood measures are used. Also, the earnings in the Ranking Fixed treatment are omitted in the regressions due to the multicollinearity since they do not vary across the observations. *, **, and *** denote, respectively, significance at the 10%, 5%, and 1% levels.

Table 7: Marginal effects of each variable in the prediction of payment choice

In predicting outcome:		Average marginal effect			Marginal effects at means			Mean
		Fixed	Piece-rate	Tournament	Fixed	Piece-rate	Tournament	
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Past earnings in	Piece-rate	-.038***	.047***	-.009**	-.043**	.043**	-.000	23.246
		(.009)	(.009)	(.005)	(.018)	(.018)	(.001)	
	Tournament	-.008	-.021	.030**	-.008	.007	.001	20.604
		(.009)	(.016)	(.014)	(.011)	(.011)	(.003)	
Past mood in	Fixed	-.066	.086	-.021	-.075	.076	-.001	0.000
		(.042)	(.055)	(.037)	(.056)	(.056)	(.002)	
	Piece-rate	.016	-.082	.066	.021	-.023	.003	.003
		(.056)	(.073)	(.049)	(.066)	(.066)	(.007)	
	Tournament	-.075	.049	.027	-.084	.083	.001	.008
		(.051)	(.064)	(.041)	(.063)	(.063)	(.003)	
Obs.		67	67	67	67	67	67	

Notes: The marginal effects (dy/dx) in the multinomial logit regressions are presented in this table with the standard errors in parentheses. * denotes significance at the 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

Table 8: Regressions of the treatment effects on effort provision by rank group

	Effort provision									
	OLS		GLS with individual FEs		OLS			GLS with individual FEs		
	High rank (<3.5)	Low rank (>3.5)	High rank (<3.5)	Low rank (>3.5)	High rank (<2.5)	Middle rank (>2.5 & <4.5)	Low rank (>4.5)	High rank (<2.5)	Middle rank (>2.5 & <4.5)	Low rank (>4.5)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
R-PR	1.085*	1.071	.334	1.223	.150	1.431	-.055	.184	1.32	-1.064
	(.608)	(1.149)	(.468)	(1.335)	(.816)	(1.044)	(1.370)	(.512)	(1.124)	(1.591)
R-T	.708	1.638	.203	1.786*	.155	1.502	.712	.033	1.530	1.482
	(.560)	(.989)	(.587)	(1.031)	(.776)	(1.093)	(1.161)	(.626)	(1.560)	(1.216)
Constant	20.023***	14.929***	20.424***	14.824***	21.808***	16.652***	14.955***	21.839***	16.679***	15.060***
	(.687)	(1.008)	(.294)	(.762)	(.857)	(.863)	(1.126)	(.317)	(.878)	(.784)
(R-PR)=(R-T)	F(1,59)=.31	F(1,50)=.48	F(1,59)=.06	F(1,50)=.32	F(1,39)=.00	F(1,46)=.01	F(1,37)=.38	F(1,39)=.05	F(1,46)=.04	F(1,37)=3.25
	p=.581	p=.493	p=.815	p=.573	p=1.000	p=.929	p=.543	p=.818	p=.848	p=.080*
Observations	121	92	121	92	80	73	60	80	73	60
No. of subjects	60	51	60	51	40	47	38	40	47	38

Notes: The effort provision in the second set of the task was regressed by rank groups that are divided based on the rank in the first set of the task. R-PR denotes the Ranking Piece-rate treatment; R-T the Ranking Tournament treatment. Data under the Non-ranking Fixed and Ranking Preference treatment are not used in the regressions and the standard errors in parentheses are clustered at the subject level. *, **, and *** denote, respectively, significance at the 10%, 5%, and 1% levels.

Table 9: Regressions of the treatment effects on mood by rank group

	Combined mood									
	OLS with average rank					OLS with rank from the second set only				
	High rank (<3.5)	Low rank (>3.5)	High rank (<2.5)	Middle rank (>2.5 & <4.5)	Low rank (>4.5)	High rank (<3.5)	Low rank (>3.5)	High rank (<2.5)	Middle rank (>2.5 & <4.5)	Low rank (>4.5)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
R-PR	.040	-.382	.063	-.013	-.679**	.126	-.361*	.124	-.218	-.429*
	(.162)	(.238)	(.191)	(.190)	(.309)	(.131)	(.202)	(.149)	(.261)	(.249)
R-T	-.108	-.455**	-.034	-.277	-.467*	-.048	-.593**	-.061	-.214	-.586***
	(.198)	(.207)	(.253)	(.217)	(.262)	(.170)	(.229)	(.215)	(.216)	(.205)
Constant	.259	-.235	.387	.028	-.418*	.226	-.196	.330***	.067	-.375**
	(.167)	(.165)	(.241)	(.157)	(.215)	(.152)	(.159)	(.185)	(.191)	(.182)
(R-PR)=(R-T)	F(1,46)=.68	F(1,45)=.12	F(1,29)=.16	F(1,40)=1.11	F(1,26)=.44	F(1,54)=1.01	F(1,47)=1.55	F(1,38)=.83	F(1,39)=.00	F(1,33)=.46
	p=.412	p=.728	p=.690	p=.298	p=.512	p=.320	p=.220	p=.367	p=.986	p=.502
Observations	99	80	58	69	43	113	92	79	67	59
No. of subjects	47	46	30	41	27	55	48	39	40	34

Notes: The regressions are conducted with two types of ranks for each treatment, using the average of the ranks in the two sets of the task, and using the rank in the second set of the task only. R-PR denotes the Ranking Piece-rate treatment; R-T the Ranking Tournament treatment. Data under the Non-ranking Fixed and Ranking Preference treatment are not used in the regressions and the standard errors in parentheses are clustered at the subject level. *, **, and *** denote, respectively, significance at the 10%, 5%, and 1% levels.

Appendix

A The Mood Short Form (MSF) questionnaire

(Given at the end of each treatment)

1. Please answer the following questions. To answer each question, please choose a number from 0 (strongly disagree) to 10 (strongly agree).
   1-1. Currently, I am in a good mood.
   1-2. As I answer these questions, I feel cheerful.
   1-3. For some reason, I am not very comfortable right now.
   1-4. At the moment, I feel edgy or irritable.

2. During the round just finished, how hard do you think you worked? Please choose a number between 0 (not at all) and 10 (extremely).

B The Photographic Affect Meter (PAM) questionnaire

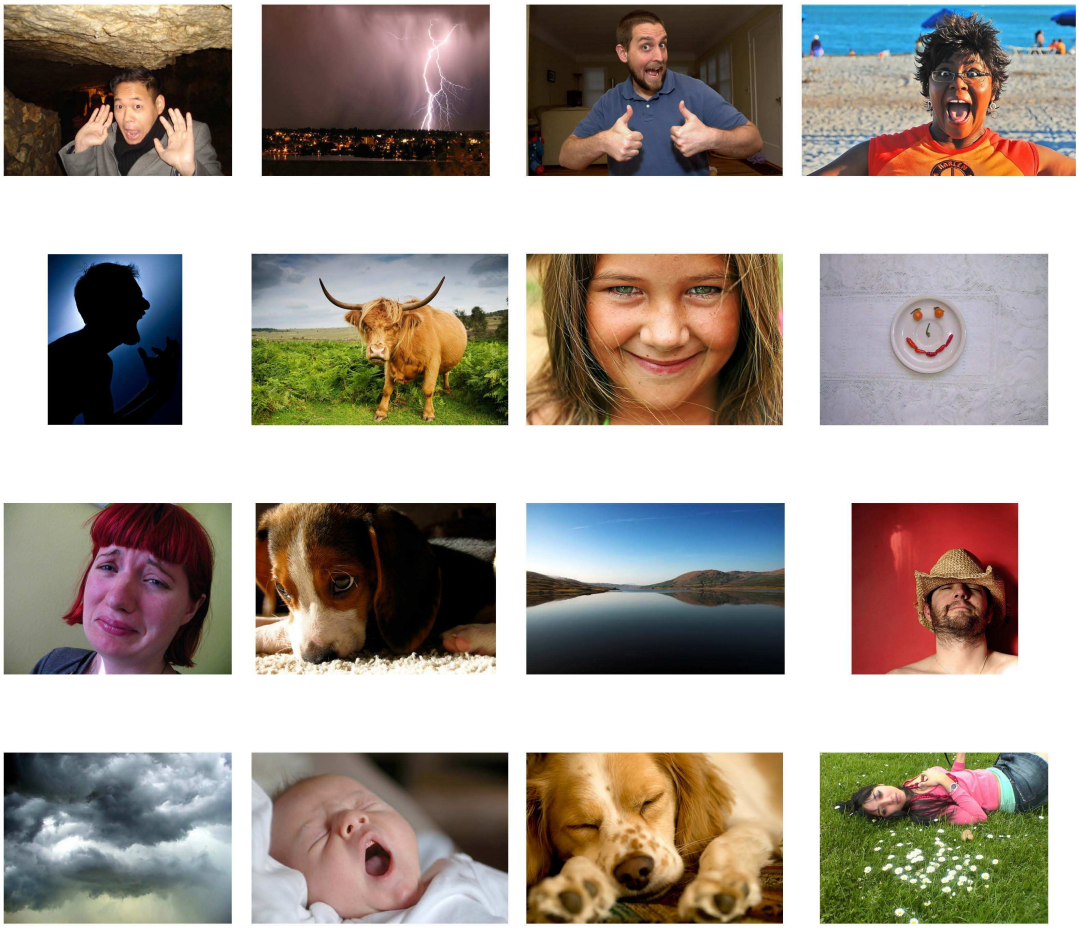
(Given at the end of each treatment)

(Page 1/2)

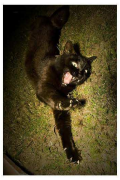
Date/Time: / Round #:

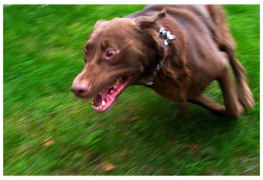
Computer #:

Circle the photo that best captures how you feel right now:



Circle the photo that best captures how you feel right now:



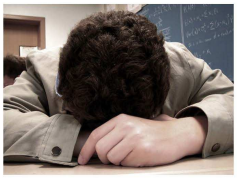










C The final questionnaire

(Given at the end of the session)

[Questions on competition]

1. Do you consider yourself competitive? Please choose a number between 0 (not at all) and 10 (extremely).

2. Do you like to compete? Please choose a number between 0 (not at all) and 10 (extremely).

Please recall the rounds where your ranks were displayed and answer the following questions:

3. How much did it matter to you how well you were doing compared to the others in the group? Please choose a number between 0 (not at all) and 10 (extremely).

4. Did the rank displayed on the screen affect your effort in completing the task? Please choose a number between 0 (not at all) and 10 (extremely).

5. How positive or negative was the effect of the displayed rank on your performance? Please choose a number between 0 (completely negative) and 10 (completely positive).

[Demographic questions]

1. What is your gender? Choose between: male/ female

2. What is your major field of study? Fill in the blank. Example) Economics

3. What is your age? Fill in the blank.

4. Are you an American citizen or a resident? Choose among: citizen/ resident/ none of them

   4-1. If you are not a citizen, what is your nationality? Fill in the blank.

5. Which of the following describes the best of your ethnicity?
   Choose among: American Indian or Alaska Native/ Asian/ Black or African American/ Hispanic or Latino/ Native Hawaiian or Other Pacific Islander/ White/ Other

D Experimental instructions

Instructions at the beginning of the experiment

Thank you for participating in this economic experiment. Before starting the session, please turn off your electronic devices and put them away. Also, put away your personal belongings from the desk.

We will start this experiment by signing the consent form. We are distributing two sets of the consent form and one instructions hand-out. Please take your time to read the consent form carefully. Then, sign at the end of both copies. We will collect one signed consent form when you are ready.

(Collect the consent form)

Please click the *Continue* button on your screen. Now, I will explain the experiment in detail. The *Instructions* handout includes the general information about this experiment. Please take a look at the handout as I read the instructions.

This experimental session consists of five ten-minute rounds and the entire session will take about 75 minutes. In each round, you will perform two sets of the task and answer questionnaires at the end of the round. After finishing all five rounds you will answer another set of questions and a set of demographic questions, and then, the experiment will conclude by determining your payments and paying you on your way out of this laboratory. During the session, you are not allowed to either talk to other participants or look at their screen.

The task you will be assigned during this session is called the slider task. The task consists of sliders that you can see on your screen right now. At the beginning, all the sliders will be positioned at 0 like the one in Figure 1 (see Figure D.1). During the session, you will be asked to adjust the sliders to be positioned at 50 to make it look the one in Figure 2 on your screen (see Figure D.1). When the slider is positioned at 50, it is considered as a completed slider. A completed slider will be counted as a one-point score for your task. When adjusting the sliders, you will use a mouse with disabled wheel and you will not be allowed to use the keyboard.

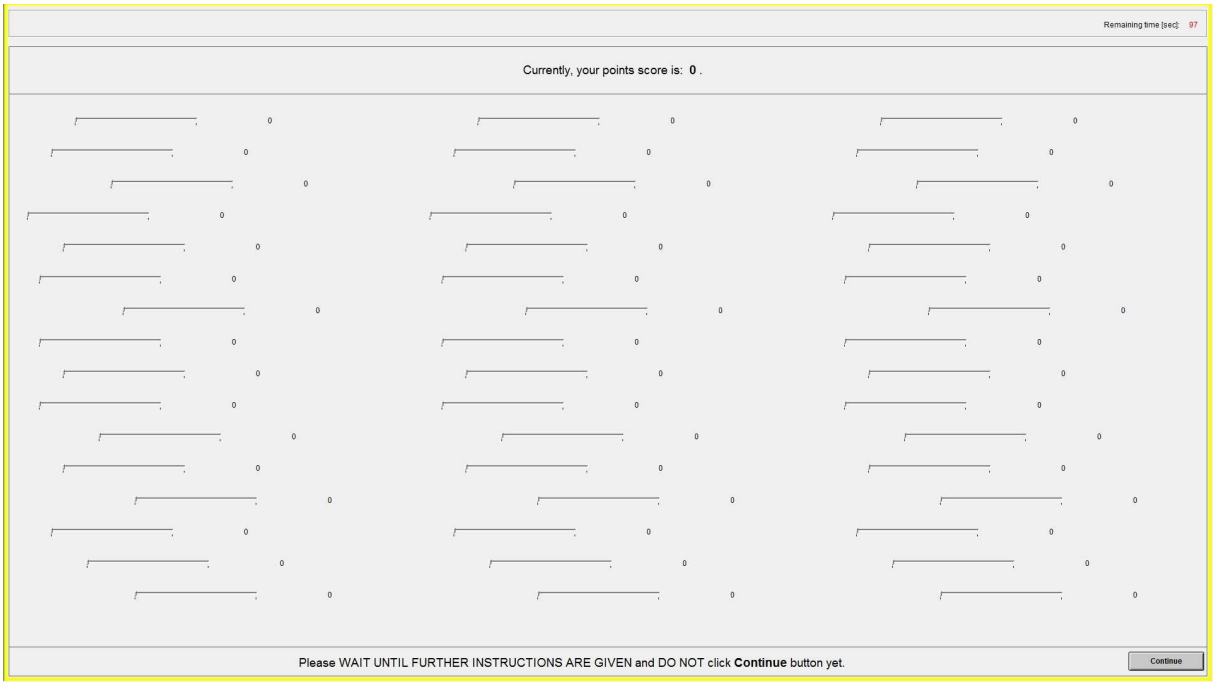
One set of the task consists of 48 of these sliders and you will get a chance to see how a set of the task looks like on the next screen. Please click the *Continue* button at the bottom of

Figure D.1: A slider task

your screen.

Now, you see one set of the task with 48 sliders on your screen (see Figure D.2). This screen shows you how a set of the task looks. You will be given a practice set soon after all the general instructions are provided. Your task is trying to adjust all the sliders on this screen so that they are positioned at 50. You will have 120 seconds (2 minutes) to complete a set of the task and the remaining time will be shown on the upper right corner of your screen. A points score is the number of completed sliders and is displayed on the top of your screen. It will be updated continuously as you work on the task. Depending on the payment scheme of the round, your

Figure D.2: A complete set of slider task



performance in each set of the task may affect your additional payment besides the $5 show-up fee. This set of the task is given twice in one round and a questionnaire follows at the end of the round. You will have five rounds throughout this experiment.

About the payment, your payment will be the sum of the $5 show-up fee and the additional payment that will be determined according to your performance during the session. Your additional payment will be determined by randomly drawing one of the payoffs from the five rounds. Your payoff of the round will be calculated depending on the payment scheme of the round. You will be informed about the payment scheme of the round at the beginning of each round and notified of the payoff of the round at the end of the round. At the end of the session, you will have five payoffs from the five rounds, and one payoff will be randomly drawn by computer to determine your additional payment from this experiment. This amount will be paid to you in addition to the $5 show-up fee. If you have any questions regarding this experiment, please ask me now.

Click *Continue*.

Instructions for each treatment

1. Instructions for the Non-ranking Fixed treatment

   In this round, you will be asked to complete two sets of the task with a 90-second break and you will answer a set of questionnaires at the end of the round. While you are completing the task, your current performance, which is your points score, will be updated continuously. Your payoff from this round will be a fixed amount of $20 regardless of your performance during the round.

   If you have any questions regarding this round, please ask me now.

2. Instructions for the Ranking Fixed, Ranking Piece-rate, Ranking Tournament, and Ranking Preference treatment

   (*Common*)

   In this round, you will be asked to complete two sets of the task with a 90-second break and you will answer a set of questionnaires at the end of the round. While you are completing

the task, your current performance, i.e. your points score, will be updated continuously. In addition, your current rank in the group of 6 people in this lab will be updated as long as you work on the sliders. For example, if your current points score is the highest in the group, your rank will be updated to 1. And if your points score is the lowest in the group, your rank will be displayed as 6. The rank will be 0 at the beginning and rank 0 means that the rank information is not available. As you start working on the sliders, the rank information will be updated.

(*Additional instructions for the Ranking Fixed treatment*)

Your payoff from this round will be a fixed amount of $20 regardless of your performance and ranks during the round.

(*Additional instructions for the Ranking Piece-rate treatment*)

Your payoff in this round will be determined by your own performance during this round. The number of the completed sliders will be counted toward your points score in each set of the task. From the two sets of the task, you will have two points scores at the end of the round. Between these two points scores, just one points score will be randomly drawn by computer and this will be used to calculate your payoff in this round. Each points score accounts for $1.25.[15]

For example, if the randomly-drawn points score is 10, your payoff from this round will be $12.50. If this points score is 20, your payoff will be $25. This may be paid in addition to the show-up fee when this is drawn as your additional payment at the end of the session.

But your ranks in this round do not affect your payoff from this round.

If you have any questions regarding this round, please ask me now.

(*Additional instructions for the Ranking Tournament treatment*)

Your payoff in this round will be determined by your rank. At the end of this round, you will have two ranks from performing the two sets of the task. Among these two ranks,

[15]The piece rate was determined based on the average performance in the R2 treatment in the pilot experiment such that the expected payments from the fixed payment and the piece-rate payment schemes are similar.

one rank will be randomly drawn to determine your payoff in this round. The payoffs corresponding to the ranks are given in the table on your screen.

For example, if the drawn rank at the end of the round is 1, your payoff from this round will be \$27.50. If the rank is 6, your payoff from this round will be \$12.50.[16]

Table D.1: Payoffs corresponding to each rank

Rank	1	2	3	4	5	6
Payoff	\$27.50	\$24.50	\$21.50	\$18.50	\$15.50	\$12.50

If you have any questions regarding this round, please ask me now.

(*Additional instructions for the Ranking Preference treatment*)

The way to determine your payment in this round will be one of the three ways that you experienced in the previous rounds.

First of all, you will choose your most preferred payment option.

Then, among the six choices made by the six participants in the lab, one will be randomly drawn at the end of the round.

And your payoff from the round will be calculated according to the selected method of payoff calculation.

The three payment options are given in the middle of your screen:

Option 1. getting paid a fixed amount of \$20

Option 2. getting paid \$1.25 per points score

Option 3. getting paid according to my rank

By choosing the payment option that you prefer most, you can make it more likely that your choice will be picked at the end of the round.

For example, if 2 participants choose option 1, 2 others choose option 2, and the other 2 choose option 3, three payment options will be equally likely to be picked at the end of the round. However, if 4 participants choose option 1 and the other 2 choose option 2, option 1 will be more likely to be picked than option 2, and option 3 will never be chosen.

[16]The payoffs corresponding to the ranks were chosen such that the expected payments from the fixed payment and the rank-order tournament payment schemes are similar.

If you have any questions regarding this round, please ask me now.

On the next screen, you will choose the payment option that you prefer.

After choosing the payment option you prefer, click *Continue* to start this round.