

# Right Contract for Right Workers?

## Incentive Contracts for Short-term and Long-term Employees

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### Abstract

This study examines a principal’s incentive contract choice and wage offers, and agent effort in the case of long-term and short-term employment relationships. The study is motivated by the observation made from a unique dataset collected by the World Bank and the National Bureau of Statistics of China based on the survey of 12,400 manufacturing firms in 120 cities in China: companies offer different pay contracts to regular and temporary workers. Prominent contract choices include: an explicit incentive contract such as piece-rate; an implicit incentive contract, for example, “fixed wage+bonus”; and finally a trust contract such as “fixed wage only”. We propose a theoretical model to show a principal’s contract choice, wage offers, and agent effort in long-term and short-term relationships. Using a real-effort laboratory experiment, we find that piece-rate has the strongest incentive effect on short-term agents’ effort and is dominantly chosen by principals. Nevertheless, the bonus contract works almost as well as piece-rate for long-term agents. In addition, we find that the effect of the bonus contract on effort is mainly driven by the second-stage bonus, suggesting that fixed payment alone cannot be an effective mechanism to improve worker performance.

Keywords: Incentive Contract; Short-term and Long-term Relationship; Principal-Agent Model; Piece Rate; Experiment

JEL Classification: Personnel Economics J32, J33, M5, M12

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# 1. Introduction

The incomplete contract and agency problem suggest that agent effort would be at the minimum enforceable level in the principal-agent model. Therefore, incentive contracts that tie workers' pay to their performance are needed to align workers' interests with principals'. An incentive contract could be explicit or implicit. An explicit contract could be a piece rate plan that rewards employees based on a pre-determined formula, while an implicit contract would not specify explicitly the amount of payoff conditional on effort (MacLeod 2007). In this study, we considered two types of labor relationships, namely long-term and short-term relationships. We examined a principal's incentive contract choice and agent effort conditional on the contract choice in these two types of relationships. Many observations have been made that temporary workers are paid lower wages and less benefits than regular long-term employees (Segal and Sullivan 1997). However, there is little evidence of whether or not firms provide different pay schemes for short-term and long-term employees.

In 2005-2006, as part of the World Bank's Global Investment Climate Project, the World Bank China division and the Enterprise Survey Division of the National Bureau of Statistics of China jointly conducted a survey of 12,400 manufacturing firms from 120 cities in China. The sample firms were selected via stratified random sampling and thus were representative of the population. In the sample, 7,628 firms employed both temporary and regular workers in their operation. They were asked to report the percentage of various pay forms in the total compensation for temporary and regular employees. Based on this data, different pay contracts were identified. For example, "piece rate only" refers to the case that a firm offers piece rate exclusively to the corresponding type of worker (i.e., piece rate was 100% of the total pay). Table 1 shows the distribution of firms by pay scheme and the average monthly salary under each pay scheme for regular and temporary workers. The five most popular contracts are: fixed wage only; fixed wage plus bonus; piece-rate only; fixed wage plus piece-rate; fixed wage combined with both bonus and piece-rate; and the rest are grouped into one category labeled as "others".<sup>1</sup>

As shown by Table 1, the types of pay contract offered to regular and temporary workers are significantly different ( $p = 0.000$ , Pearson's chi-square test). In particular, the dominant payment

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<sup>1</sup>The detailed description of the survey and data are available from authors. The accurate definition of different pay schemes is not given in the questionnaire. It is possible that respondents had different understanding of what a pay scheme means. Nevertheless, since these pay schemes are popular in business, there is usually a common understanding of its meaning. For example, in China's business context, bonus is a kind of performance-based pay that is given to employees after performance evaluation is conducted by the end of a year, quarter, or month. Bonus amount or how bonus is tied to performance is, in general, not revealed to employees before the task is completed.

Table 1: Type of Compensation Scheme

Compensation Type	Regular Employee		Temporary Employees	
	Percentage	Monthly Wage	Percentage	Monthly Wage
Fixed Wage Only	15.64	166.5	14.74	119.1
Fixed Wage+Bonus	33.18	203.3	10.47	142.1
Piece Rate Only	10.11	132.6	38.40	112.5
Fixed Wage+Piece Rate	14.12	146.4	11.54	119.9
Fixed Wage+Bonus+Piece Rate	18.21	161.3	8.11	129.8
Others	8.74	162.6	16.74	118.0
Observations	7628	7628	7628	7628

*Notes:* The monthly salary is in the US Dollar.

scheme is different: 38% of the surveyed companies used the piece-rate only contract for their temporary employees whereas 33% of them chose fixed wage with bonus for regular employees. Regarding wages for temporary and regular employees, companies choosing fixed wage with bonus provided significantly higher wages to regular employees compared to companies using other payment schemes ( $p = 0.000$ , two-sided two-sample t-tests). These companies also offered significantly higher wages to temporary workers, but the difference in average salary between different payment schemes is relatively smaller for temporary workers compared to regular workers.

The survey data shows that firms are inclined to offer fixed wage with bonus to regular workers and offer piece rate to temporary workers. However, with the survey data, we cannot pin down specific mechanisms behind employers' contract choice and wage offers, nor observe employees' effort under different pay schemes. Therefore, we conduct a real-effort laboratory experiment to study the contract choice of principals. By modeling a long-term relationship as finitely repeated games between principals and agents while a short-term relationship as one-shot games, we examine how principals choose different pay contracts for regular and temporary workers, i.e., piece-rate vs. fixed-wage with/without bonus. Moreover, given principals choosing fixed-wage with/without bonus, we compare the amount of fixed wage and bonus offered by principals between one-shot games and repeated games. Last but not least, after controlling for wage offers, we study whether agents exert different amounts of effort in a long-term and short-term relationship.

To guide our experiment, we built a principal-agent model to predict principals' contract choice and wage offers, and agent effort in the two types of relationships. The experiment data shows piece rate is chosen over fixed wage in both short-term and long-term relationships. However, in long-term relationships and with a bonus option, a significant portion of principals divert from choosing piece rate (i.e. choosing fixed wage with bonus), and in this treatment principals offer higher wages and agents exert greater effort.

The rest of the paper is organized as follows. We review relevant literature in Section 2. Section 3 contains a theoretical model. In Section 4 we describe the experiment design. Hypotheses and results are reported in Section 5. Finally, in Section 6, we discuss the results and conclude the paper. All proofs are in Appendix A. Experiment instructions and a post-experiment survey are in Appendix B and C.

## 2. Literature Review

Our study is closely related to the literature in lab labor on incentive contract and gift exchange (Charness and Kuhn 2011). Regarding incentive pay, researchers compared piece-rate with fixed wage, and found that piece-rate has an incentive effect on workers' productivity, as well as a sorting effect of attracting and retaining high-ability workers (Lazear 1986). Both lab and field experiments provided strong evidence for both effects, especially for the sorting effect (Shearer 2004, Cadsby et al. 2007, Eriksson and Villeval 2008, Dohmen and Falk 2011, Larkin and Leider 2012). The effect of piece-rate on productivity was also well documented in studies using firm payroll data (Paarsch and Shearer 2000), and in field research taking advantage of natural experiment settings when firms changed their compensation scheme from piece-rate to fixed wage or vice versa (Lazear 2000, Franceschelli et al. 2010). Despite its advantages, piece-rate was criticized for the potential to lower quality and raise injuries as employees focused on speed and quantity under piece-rate (Paarsch and Shearer 2000, Freeman and Kleiner 2005). Using data from shoe manufacturing, Freeman and Kleiner (2005) further showed that productivity was higher under piece-rate, but firm profit was lower because of higher labor and material costs. Altogether, previous research suggested that piece-rate increased productivity but not without any limitation.

Moreover, Fehr and Schmidt (2000) and Fehr et al. (2007) extended the contract comparison from the fixed wage contract to a two-stage contract in which a fixed wage is offered in stage 1 and a voluntary and unenforceable bonus is offered in stage 2 after agents exert effort. They compared the two contracts with an incentive contract including a fixed upfront wage and a fine for an unsatisfactory effort level. Both studies showed that compared to the incentive contract, the bonus contract is superior in terms of eliciting higher effort from employees and is more likely to be chosen by employers. More importantly, using an inequality aversion model, they showed that selfish principals would mimic fair principals by choosing the bonus contract but give a low bonus to agents with high effort. In addition, Fehr et al. (2007) suggested that the trust contract in which only an upfront wage is offered is less efficient than the incentive contract, suggesting the importance of a bonus in principals' contract choice and agents' effort.

The gift-exchange literature provided an explanation for the effect of the fixed wage contract. Being offered above market-clearing wages, employees will likely supply more effort in return for the “gift” from the employer (Akerlof 1984, Akerlof and Yellen 1988, 1990). Following Akerlof’s seminal work, many experimental studies were conducted to test “gift exchange” behaviors in the labor market. Abundant experimental evidence suggested that workers in general behaved reciprocally, as the effort level increased with offered wages (Fehr et al. 1997, Fehr and Falk 1999, Hannan et al. 2002, Gneezy 2003, Fehr and List 2004). However, there are also a few different voices: Charness et al. (2004) raised concerns about the robustness of laboratory gift exchange since they found that the degree of gift exchange weakened with the inclusion of a payoff table in the instruction, and one possible reason they proposed was the framing effect. Using field experiments, Gneezy and List (2006) examined the long-term effect of “gift exchange” and discovered that the effect declined over time. Particularly, employee effort in the first few hours on the job was significantly higher in the “gift” treatment, but after the initial few hours, the effect diminished. These results indicated the importance of examining the relationship between wage and effort in a longer time horizon.

Most aforementioned experimental studies examined one-shot or temporary relationships between an employer and employees. However, long-term relationships are also important since people often engage in repeated interactions. Furthermore, long-term relationships, which can be modeled as repeated interactions in games, bring up new concerns such as reputation that influences principals’ contract choice and agents’ effort levels. Extant theoretical studies suggested that in a long-term relationship where players are interacted repeatedly, cooperation in terms of high wage and high effort can emerge if the cost of damaging the long-term relationship is greater than the immediate benefit (Klein and Leffler 1981, Fudenberg and Maskin 1986, MacLeod and Malcolmson 1989, Healy 2007). For instance, some players would imitate true reciprocal ones by playing a “tit-for-tat” in earlier periods (Kreps et al. 1982). Allowing finite horizons and anonymous interactions, Healy (2007) proposed a full reputation equilibrium (FRE) with stereotyping, i.e., perceived type correlation, to explain cooperation in earlier periods and defect in the last period. These theories demonstrated that reputation concern is an effort enforcement mechanism and hence the fixed wage contract would be more effective to induce high effort in repeated games.

Regarding experimental studies with repeated games, Eriksson and Villeval (2008) found that compared to players who are randomly rematched in each period, principals in repeated interactions offered a higher wage, and agents supplied a higher average effort.<sup>2</sup> Moreover, high-skilled employees were less likely to switch to piece-rate in repeated games than in one-shot games. Altogether,

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<sup>2</sup>Unlike studies such as Fehr and Schmidt (2000) and Fehr et al. (2007) where principals choose contract schemes, Eriksson and Villeval (2008) asked agents to choose a contract such as a trust contract or piece-rate.

they conjectured that a stronger social motivation and reputation concern in repeated interactions weakened the impact of both sorting and incentive effects of piece-rate. In a different experiment in which only a fixed-payment (trust) contract is present, Brown et al. (2004) allowed principals to choose whether or not to form a long-term relationship with trading agents, and observed that in successful long-term relationships the offered wage and agent effort were both higher. Their experimental evidence supported that long-term relationships are an effective enforcement mechanism in absence of the third-party enforcement. With a slightly different focus, List (2006) tested whether subjects who expected future interactions with partners behaved more cooperatively is driven by reputation concerns or social preferences, and his field experiment results supported that the reputation effect is more important.

Compared to prior studies which focused on the fixed wage contract and its comparison with piece-rate, we extend the comparison to three contracts including: (1) a trust contract in which only an upfront fixed wage is offered; (2) a bonus contract in which both an upfront fixed wage and an unenforceable bonus are available; and (3) piece-rate. The most relevant study is Fehr et al. (2007) who studied the first two contracts and another incentive contract with punishment for an unsatisfactory effort level. Piece-rate is also a form of incentive contract but is different from the incentive contract in Fehr et al. (2007). We chose the three contracts to study since they are consistent with the payment schemes observed in the survey. Moreover, we extend the study to repeated games and examine behavioral differences between one-shot and repeated games. Eriksson and Villeval (2008) and Brown et al. (2004) also studied repeated interactions between principals and agents; our study is different from them in the following aspects: first, compared to Eriksson and Villeval (2008), we examined the contract choice of principals while they studied agents' choice; second, compared to Brown et al. (2004), we do not endogenize the relationship choice but focus on employers' contract choice in different relationships.

### **3. Theoretical Framework**

In this section, we analyze a principal-agent model and assume the existence of both fair and selfish players (Fehr et al. 2007). In a one-shot game, we first characterize each type of principals' equilibrium decisions and agents' best response on the equilibrium path for each contract, from which we derive the equilibrium contract choice for each type of principals. Then, we extend the model to a finitely repeated game and discuss conditions for Full Reputation Equilibrium (Healy 2007) in which selfish players would mimic the fair type in early periods.

In a principal-agent model where a principal employs an agent to produce goods, after observing

principals' contract choice, an agent chooses effort  $e \geq 0$ . She incurs a cost  $c(e)$  where  $c'(e) > 0$ ,  $c''(e) \geq 0$  and also brings a gross revenue  $v(e)$  for the principal where  $v'(e) > 0$  and  $v''(e) \leq 0$ . In the following analysis, we simply assume that  $v(e) = 2e$  and  $c(e) = \frac{1}{2}ke^2$  for the tractability of the solution.

To mimic the real-life payment schemes that we observed in the survey data, we study the following contract options.

1. Piece-Rate Contract (PC): the principal pays \$1 for each unit of effort invested by the agent. The principal and agent's monetary payoffs are given by  $M_P = e$  and  $M_A = e - \frac{1}{2}ke^2$ .
2. Trust Contract (TC): the principal offers an unconditional fixed wage \$ $w$ . The principal and agent's monetary payoffs are given by  $M_P = 2e - w$  and  $M_A = w - \frac{1}{2}ke^2$ .
3. Bonus Contract (BC): the principal offers an unconditional fixed wage \$ $w$ , and may pay a bonus \$ $b$  after observing the agent's effort  $e$ . The principal's bonus payment is unenforceable. The principal and agent's monetary payoffs are given by  $M_P = 2e - w - b$  and  $M_A = w + b - \frac{1}{2}ke^2$ .

To focus on the principal's choice of different contracts, we simplify the piece-rate contract by keeping the incentive rate fixed (\$1 per unit of effort), and hence do not allow principals to choose different incentive rates under piece-rate. We set this incentive rate deliberately so that if principals offer  $w=e$  under trust contract or  $w+b=e$  under bonus contract, then payoffs would be the same as those under piece-rate. Moreover, as in Fehr et al. (2007), we study the contract choice between piece-rate and each of the other two contracts. We begin our analysis by specifying the utility function.

First of all, if both the principal and agent are only interested in their own material payoffs, the principal will not pay any bonus after the agent extends efforts, and the agent has no incentive to invest in any effort. piece-rate would be a dominant contract over the trust or bonus contract. However, if principals and agents have a concern for social preference, the prediction will be less clear. Therefore, we assume two types of players including a selfish type and a fair type. Moreover, a player believes that the probability of encountering a fair opponent is  $q$ .

Second, prior theoretical studies proposed different approaches of modeling social preference, e.g., an inequality aversion model in Fehr and Schmidt (1999) and Bolton and Ockenfels (2000), and a social welfare maximization model in Charness and Rabin (2002). The main purpose of the theoretical model here is not to compare different social preference models, but to explain individual behaviors that deviate from the predictions under the self-interest assumption. Therefore, we

simply assume the existence of other-regarding preference and characterize equilibrium behaviors. In the main analysis, we present the results following Charness and Rabin (2002), though other social preference models predict similar results.<sup>3</sup>

As in Charness and Rabin (2002), we construct the utility function of the fair type as below:

$$U_i = M_i + \sigma (M_j - M_i)^+ - \rho (M_i - M_j)^+ = \begin{cases} \rho M_j + (1 - \rho) M_i & \text{if } M_i \geq M_j \\ \sigma M_j + (1 - \sigma) M_i & \text{if } M_i < M_j \end{cases},$$

where  $M_i$  is player  $i$ 's monetary payoff and  $i \in \{\text{Principal, Agent}\}$ .  $\sigma$  is the parameter for a player's degree of envy while  $\rho$  represents her charity concern.<sup>4</sup> In addition,  $0 < \sigma \leq \rho \leq 1$ .

Furthermore, in order to keep the analysis tractable and obtain analytical solutions, we make a further simplification by focusing on the cases where  $\sigma = 0$  and  $\rho > 0.5$ . This parameter value is chosen based on prior experiments in which subjects exhibit strong charity concern but relatively small envy concern, e.g., Charness and Rabin (2002) and Chen and Li (2009). Thus, the utility function of fair type is reduced to,

$$U_i = M_i - \rho (M_i - M_j)^+ = \begin{cases} \rho M_j + (1 - \rho) M_i & \text{if } M_i \geq M_j \\ M_i & \text{if } M_i < M_j \end{cases},$$

which implies that a person only cares about her own monetary payoff when she makes less than the other, and is concerned about social welfare when her payoff is higher than the other.

### 3.1 One-shot game

In this subsection, assuming one-shot games, we first analytically solve each type of agent's optimal effort decision under different contracts, then use backward induction to determine each type of principals' optimal contract choice. We follow the same technique as Fehr et al. (2007) to derive theoretical predictions in one-shot games and present the proof in Appendix A.

When the piece-rate contract is used, the agent will always earn less than the principal because the monetary payoff is the same for them but the agent incurs the cost of effort. Assuming  $\sigma = 0$  and  $\rho > 0.5$ , we summarize the equilibrium behavior in the following lemma.

**Lemma 1** *Conditional on the piece-rate contract,*

<sup>3</sup>We also conducted the analysis on the basis of inequality aversion (Fehr and Schmidt 1999), and obtained similar insights.

<sup>4</sup>As it is difficult to define misbehavior for principals' contract choice and wage amount, we omit agents' reciprocity parameter in Charness and Rabin (2002). Intuitively, if we allow reciprocity, it will be more likely that principals would deviate from choosing piece-rate.



1. Both fair and selfish agents choose effort  $e_f^* = e_s^* = \frac{1}{k}$ .
2. The selfish principal's expected monetary payoff is  $M_P^* = \frac{1}{k}$ , and the fair principal's expected utility is  $U_P^* = \frac{2-\rho}{2k}$ .

In the trust contract, as the wage  $w \geq 0$  is paid upfront, the selfish agent will not invest in any effort, while the fair agent invests in a nonnegative amount of effort to maximize her expected utility. The following lemma characterizes the equilibrium behavior.

**Lemma 2** *Conditional on the trust contract,*

1. The selfish agent always chooses  $e_s^* = 0$ .
2. If  $q \leq \frac{1}{2}$ , both selfish and fair principals offer  $w^* = 0$ . Consequently, the fair agent chooses  $e_f^* = 0$  and all players' utilities (payoffs) are 0.
3. If  $q > \frac{1}{2}$ , both selfish and fair principals offer  $w^* = \frac{4q^2-1}{k}$ , and the fair agent chooses  $e_f^* = \frac{2(2q-1)}{k}$ . Thus, both types of principal's utilities (payoffs) are  $M_P^* = U_P^* = \frac{(2q-1)^2}{k}$ .

Due to uncertainty in the bonus stage, the bonus contract induces a signaling game in which the agent may take the upfront wage offer as a signal of the principal's type. The next lemma shows that a separating equilibrium does not exist, and a unique pooling equilibrium solution is characterized.

**Lemma 3** *Conditional on the bonus contract,*

1. No separating equilibrium exists in which the selfish principal's upfront wage offer differs from that of the fair principal.
2. A unique pooling equilibrium exists.
  - (a) Both types of principals offer  $w^* = \frac{q}{(2-q)k}$ .
  - (b) Both types of agents choose effort  $e^* = \frac{2q}{(2-q)k}$ .
  - (c) In the bonus stage, a fair principal gives  $b_f^* = \frac{2q}{(2-q)^2k}$ , while the selfish principal pays zero.
  - (d) The selfish principal's expected monetary payoff is  $M_P^* = \frac{3q}{(2-q)k}$ , while the fair principal's expected utility is  $U_P^* = \frac{q(4-3q)}{(2-q)^2k}$ .

By using backward induction, we derive each type of principal's optimal contract choice between piece-rate and trust contracts in the following proposition.

**Proposition 1** 1. *The selfish principal will always choose piece-rate.*

2. *When  $q > q_1(\rho) = \frac{1}{2} + \frac{1}{2}\sqrt{\frac{2-\rho}{2}}$ , the fair principal chooses trust contract. Otherwise, she chooses piece-rate.*

Similarly, we compare the principal's equilibrium utility (payoff) between piece-rate and bonus contracts. The following proposition summarizes the theoretical predictions.

**Proposition 2** 1. *When  $q > \frac{1}{2}$ , the selfish principal chooses the bonus contract. Otherwise, she chooses piece-rate.*

2. *When  $q > q_2(\rho) = 2 - \frac{1}{1-\frac{1}{2}\sqrt{\frac{\rho}{2}}}$ , the fair principal chooses the bonus contract. Otherwise, she chooses piece-rate.*

Proposition 1 (2) implies that with a certain proportion of fair players, the principal would choose the trust (bonus) contract over piece-rate. Moreover, as  $\frac{1}{2} + \frac{1}{2}\sqrt{\frac{2-\rho}{2}} > 2 - \frac{1}{1-\frac{1}{2}\sqrt{\frac{\rho}{2}}}$ , we expect the likelihood of deviating from piece-rate is higher for the bonus contract than trust contract.

### 3.2 Repeated Game

In the following analysis, we consider a finitely repeated game with  $T$  periods. We show that compared to one-shot games, repeated games induce players' reputation concern in which principals (agents) choose high wage (effort) in early periods to prevent future punishment from the opponent. Therefore, there would be a stronger incentive for principals to deviate from piece-rate and for agents to exert higher effort in repeated games.

To illustrate the reputation effect, we take the approach in Healy (2007) and consider a specific equilibrium, the *full reputation equilibrium* (FRE). We define the FRE as that (1) the trust (bonus) contract is chosen over piece-rate in every period including the last period  $T$ ; (2) both types of agents fully cooperate in all but the last period, investing in the first-best efficient effort level,  $e^{FB} = \arg \max_e \{v(e) - c(e)\} = \arg \max_e \{2e - \frac{1}{2}ke^2\} = \frac{2}{k}$ , which is higher than the effort level under piece-rate; (3) both types of principals also fully cooperate in that they would equalize the monetary payoff between them and agents in all but the last period. Consequently, with FRE, there is no belief updating in the first  $T - 1$  periods. The equilibrium behavior in the last period is the same as that in the one-shot game.

In the next Proposition, we predict that no FRE exists if the choice is between piece rate and trust contracts because equilibrium behavior in the last period is the same as in the one-shot game and as shown in Proposition 1(1) selfish principals would always choose piece-rate over trust

contracts. Between piece-rate and bonus contracts, with a high  $q$ , selfish players have the incentive to mimic the fair type in the first  $T - 1$  periods; hence, the belief would not be updated; and as shown in Proposition 2(1), if  $q$  is high enough, selfish principals would choose the bonus contract in the last period, so FRE can be sustained.

**Proposition 3** *In a finitely repeated game in which a principal and an agent are matched in every period,*

1. *if the contract choice is between piece-rate and trust contracts, there is no full reputation equilibrium.*
2. *if the contract choice is between piece-rate and bonus contracts, there is a full reputation equilibrium if and only if the following conditions are satisfied: (1)  $q > q_3(\rho) = \max\{\frac{14}{15}, 2 - \frac{1}{1-\frac{1}{2}\sqrt{\frac{\rho}{2}}}\}$ , (2)  $\forall t < T, e_t = \frac{2}{k}$ , (3)  $w_t + b_t = \frac{3}{k}$ , and (4)  $\frac{(6-T+t)(2-q)-2q}{2(2-q)k} \leq b_t \leq \frac{2(2q-1)}{k(2-q)}$ .*

In summary, by incorporating social preference into the utility function, first, we predict that principals could potentially deviate from piece-rate in one-shot games. The likelihood of deviation would be higher when a bonus is combined with an upfront-wage. Second, we obtain the conditions for Full Reputation Equilibrium in repeated games and show that FRE only exists when a bonus is available. Since we implement a real-effort experiment in which the cost function is not pre-determined, we are not able to do the point-estimation of the theoretical prediction. However, the theoretical framework could provide a guidance for our experimental design and for analyzing experimental data. Nevertheless, the theoretical analysis has limitations: our model predicts that principals may choose the bonus contract in both one-shot and repeated games, but it cannot provide a directional comparison of the likelihood of choosing the bonus contract between one-shot and repeated games because of the existence of multiple NE in repeated games; furthermore, we can only restrict the comparison between trust and bonus contracts in repeated games by focusing on the existence of FRE, and leave other potential equilibria to explore in the future.

## 4. Experimental Design

In this section, we outline our experimental design and describe experimental procedures. We implemented a  $2 \times 2$  factorial design as shown in Table 2. We examine the relational effect by comparing individual behavior between one-shot games and repeated games, while test the bonus effect by investigating behavioral differences between no-bonus and bonus treatments.

At the beginning of each session with 12 subjects, half of the subjects were randomly assigned as players A while the other half were players B. The role for each player was fixed until the end of

Table 2: Experimental Design

Bonus	Game Structure	Session Name	Number of Subjects
No-Bonus	One-Shot	NoBonus-OneShot	$12 \times 4$
	Repeated	NoBonus-Repeated	$12 \times 4$
Bonus	One-Shot	Bonus-OneShot	$12 \times 4$
	Repeated	Bonus-Repeated	$12 \times 4$

the experiment. In the first stage of each round, players A began with choosing a contract between piece-rate and fixed wage with/without bonus. If players A opted for fixed wage, they also chose the amount, which is a nonnegative integer up to 100.<sup>5</sup> In contrast, If players A chose piece-rate, players B would receive 1 token for each unit of work they finished.

In the second stage of each round, players B were, first, informed of As' contract choice and the amount of the upfront wage if the fixed wage contract was chosen, then they were asked to participate in a real-effort slider task which was adapted from Gill and Prowse (2012). For each slider that players B finished, players A received 2 tokens. This was common knowledge between both players. In the end of the task in each round, the number of sliders B finished was revealed to her corresponding player A.

In the bonus treatment, conditional on the fixed wage contract being chosen, there was a third stage in which players A were asked to give players B another amount of tokens. In contrast, there was no bonus stage in the no-bonus treatment. The amount of bonus is also a nonnegative integer up to 100.

To examine the relational effect, we implemented different matching protocols to mimic long-term and short-term relationships. In the one-shot game treatment, players A and B were randomly rematched in each round, while in the repeated-game treatment, after a player A and B was matched at the beginning of the first round, they kept playing against each other until the end of the experiment. The experiment had 20 paying rounds and one practice round at the beginning. A sample instruction is included in Appendix B.

After the experiment, we gave each participant a post-experiment survey which collected their demographic and personality trait information, such as risk- and loss aversion. The post-experiment

<sup>5</sup>Before the experiment, we conducted a separate session and implemented piece-rate for 20 paying rounds, and the maximum number of finished slider is 35. In the experiment instruction, we provided summary statistics as an example of agents' productivity. By allowing the maximum wage to be 100, we make sure there is no cap on agent effort.

questionnaire is included in Appendix C.

We conducted 16 independent computerized sessions at the Economic Science and Policy Experimental Laboratory in Tsinghua University from March 2013 to June 2013, yielding a total of 192 subjects. All our subjects are students in Tsinghua University, recruited by email from a subject pool for economics experiments. Each subject participated in only one session. We used z-Tree (Fischbacher 2007) to program our experiments. Each session lasted approximately one and half hour with the first 15 minutes used for instructions. The exchange rate was 1 RMB per 6 tokens.<sup>6</sup> In addition, each participant was paid a 10 RMB show-up fee. The average amount that participants earned was 98 RMB, including the show-up fee. Data are available from the author upon request.

## 5. Results

In this section, we present the treatment effect on the contract choice, the amount of wage offer, and agent effort. Throughout the analysis, we treat each pair of principals and agents in the repeated game as one independent observation, whereas each session with 12 subjects in the one-shot game as one independent observation. Standard errors are clustered at the independent observation level to control for potential interdependency in individual decisions across periods and subjects. Second, we report two-sided p-values and use the 5-percent statistical significance level as the cutoff for the effect significance.

### 5.1 Contract choice

We first examine the treatment effect on principals' contract choice. First, Propositions 1 and 2 imply that in the one-shot game, the threshold of deviating from piece-rate is lower when the bonus option is available. Second, in the repeated game, Proposition 3 shows that the FRE cannot be sustained without the bonus option. Using the existence of FRE as a criterion, we expect that the bonus option will decrease the likelihood of principal choosing piece-rate in the repeated game. Thus, we have the following prediction.

**Hypothesis 1 (Bonus Effect on Contract Choice)** *The likelihood of choosing piece-rate is lower in bonus treatments than no-bonus treatments.*

In contrast to the bonus effect in Hypothesis 1, our theory cannot provide directional predictions on the relational effect on the contract choice.

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<sup>6</sup>The currency exchange rate is 1 USD= 6.2 RMB.

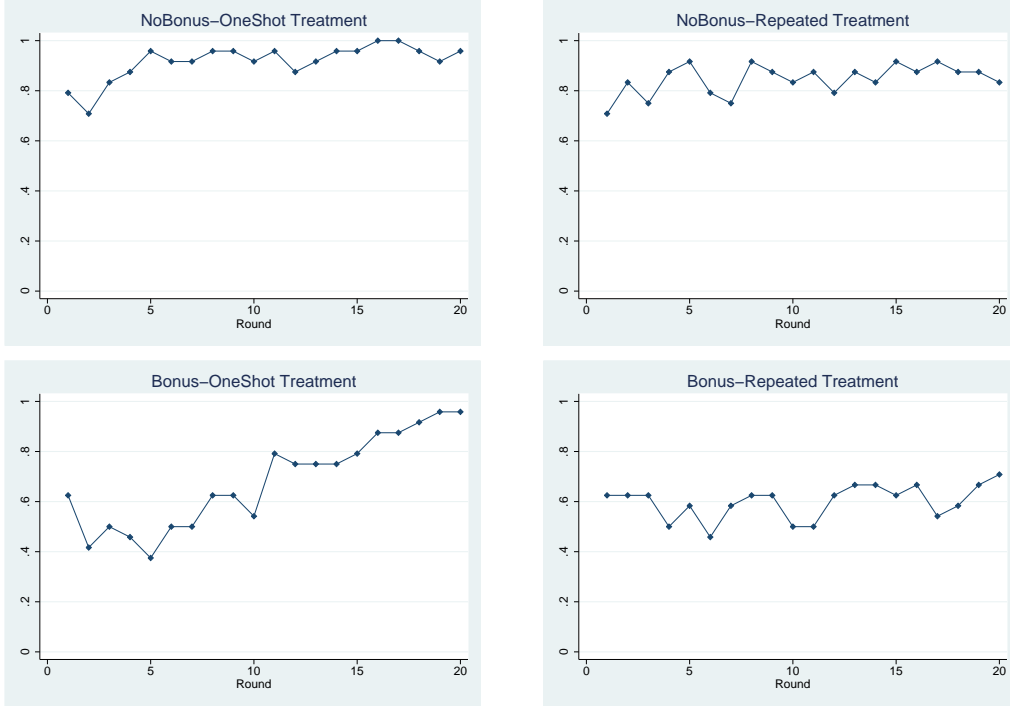


Figure 1: The Proportion of Principals Choosing Piece-Rate by Treatment

Figure 1 shows the proportion of principals choosing piece-rate in each of four treatments and the x-axis is the number of rounds. Between fixed wage and piece-rate contracts, the percentage of principals choosing piece rate started at 80% and increased to above 90% in the later rounds in both one-shot and repeated games (the upper two panels). Between bonus and piece-rate contracts, the percentage of principals choosing piece-rate started at roughly 50% at the beginning of the experiment and increased to above 90% in the end of experiment in the one-shot game treatment (the lower left panel), while remained at 50-60% in the repeated-game treatment (the lower right panel).

We perform the proportion tests for all 20 rounds and for the first and second 10 rounds, respectively. The results are reported in Table 3. In both one-shot and repeated games, the share of principals choosing piece-rate is significantly lower in the bonus than no-bonus treatment (one-shot: 92 vs. 68,  $p = 0.000$ ; repeated: 85 vs. 60,  $p = 0.005$ , two-sided test of proportions).<sup>7</sup> Between one-shot and repeated games, since a significant proportion of principals choose the bonus contract in early periods in both one-shot games and repeated games, we do not find a significant difference in the first 10 rounds. We only observe a significant difference in later rounds when in one-shot

<sup>7</sup>We use probit regressions with treatment dummies for the proportion comparison and the standard errors are clustered at the independent observation level.

games principals revert to piece-rate while in repeated games they continue to choose the bonus contract (Bonus-OneShot vs. Bonus-Repeated: 84 vs. 63,  $p = 0.008$ , two-sided test of proportions).

Table 3: The Proportion of Piece-Rate

<b>All Rounds</b>	No-Bonus	Bonus	<i>Bonus Effect</i>
One-Shot	92	68	$p = 0.000$
Repeated	85	60	$p = 0.005$
<i>Relational Effect</i>	$p = 0.127$	$p = 0.242$	
<b>Rounds 1-10</b>	No-Bonus	Bonus	<i>Bonus Effect</i>
One-Shot	88	52	$p = 0.000$
Repeated	83	58	$p = 0.004$
<i>Relational Effect</i>	$p = 0.259$	$p = 0.424$	
<b>Rounds 11-20</b>	No-Bonus	Bonus	<i>Bonus Effect</i>
One-Shot	95	84	$p = 0.002$
Repeated	87	63	$p = 0.019$
<i>Relational Effect</i>	$p = 0.073$	$p = 0.008$	

By results in Table 3, we reject the null in favor of Hypothesis 1. Our findings are consistent with prior studies (Fehr and Schmidt 2000, Fehr et al. 2007) that showed principals are more likely to choose the bonus contract over the incentive contract in one-shot games. As our experiment lasted 20 rounds whereas there were 10 rounds in Fehr and Schmidt (2000) and Fehr et al. (2007), we observed different patterns in the second 10 rounds. Moreover, although we do not have a theoretical prediction regarding the relational effect on the contract choice, experimental data shows that principals are less likely to choose piece-rate in repeated games than in one-shot games under bonus treatments and in the later rounds.

## 5.2 Wage offers

In this subsection, we examine the wage offer conditional on the trust (bonus) contract being chosen. First, Lemma 2 and 3 suggest a negative bonus effect on the upfront wage in one-shot games. Conditional on a high  $q$ , e.g.,  $q > 0.597$ , the upfront wage in the trust contract should be higher than in the bonus contract. Moreover, the bonus option has a negative effect on the total wage for selfish principals because the upfront wage is lower and selfish principals do not pay a bonus, while it has a positive impact on the total wage for fair principals because  $w^{Bonus} + b^{Bonus} > w^{Trust}$ . Altogether, the direction of the bonus effect on the total wage in one-shot games is unspecified, which is left to explore with experimental data. Second, in repeated games, the existence of FRE implies a higher total wage throughout the periods to  $T - 1$ , and the FRE could only exist under

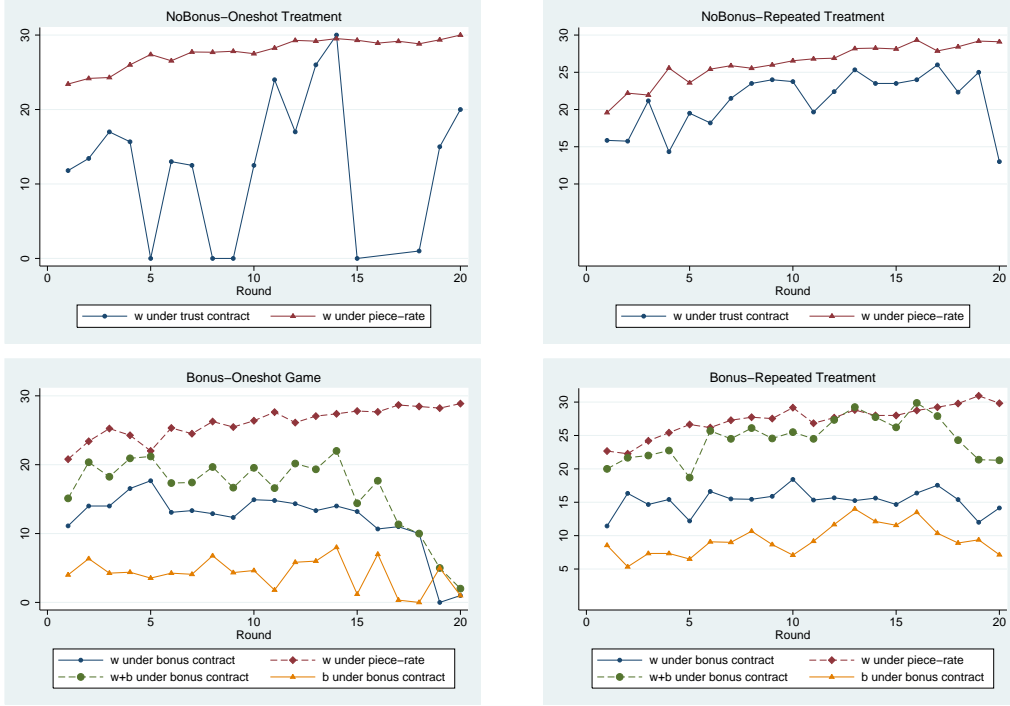


Figure 2: Wage Offers by Treatment

the bonus contract. Therefore, we predict that the bonus option would have a positive effect on principals' total wage offers in repeated games. In summary, we have the following prediction.

**Hypothesis 2 (Bonus Effect on Wage Level)** *The total wage is higher in the bonus treatment than no-bonus treatment in the repeated game.*

Next, we examine the relational effect on the total wage. In one-shot game, under the bonus contract, selfish principals will not give a bonus, and hence when agents make an effort decision they would not engage in high effort in anticipation of no bonus if they meet a selfish principal. In the repeated game, since it is proved that the FRE can exist under the bonus contract (Proposition 3), and by definition of FRE, principals would offer a high wage and bonus while agents invest in the first-best effort. Therefore, we predict that the repeated interaction has a positive effect on principals' wage offers under the bonus contract.

**Hypothesis 3 (Relational Effect on Wage Level)** *Conditional on the bonus contract, principals offer a higher total wage in the repeated game than one-shot game.*

Figure 2 shows the upfront wage, bonus, and the total wage in the four treatments under the trust/bonus contract. For comparison, we also show the wage under piece-rate, which is equal to



the amount of effort. In all four treatments, wage under piece-rate is higher than the total wage under the trust/bonus contract. The regression analysis suggests that under piece-rate there is no treatment effect on wage. We, then, focus on the treatment effect on wage when trust or bonus contract is chosen. The upper two graphs show that in the no-bonus treatment, wage is higher in the repeated game than one-shot game. The lower two graphs show that in the bonus treatment, the total wage is higher in the repeated game than one-shot game. Moreover, the bonus is also higher in the repeated game, but not for the upfront wage. Finally, the graph for the Bonus-OneShot treatment shows that the offered upfront wage and total wage decline in the later rounds.

Table 4: Regression Analysis for the Amount of Total Wage Offers: OLS Model

	One-Shot	Repeated	NoBonus	Bonus	All
	(1)	(2)	(3)	(4)	(5)
Bonus	4.598 (6.295)	3.806* (2.136)			4.525 (5.932)
Repeated			6.277 (6.342)	6.030*** (1.973)	6.531 (6.042)
Bonus*Repeated					-0.626 (6.289)
Period	-0.142 (0.158)	0.247** (0.103)	0.224 (0.193)	0.064 (0.113)	0.111 (0.099)
Constant	14.82** (5.448)	18.24*** (1.775)	12.18** (5.115)	17.88*** (2.019)	13.00** (5.538)
Observations	194	266	114	346	460
$R^2$	0.055	0.085	0.145	0.143	0.169

Notes: 1. Robust Standard Errors are in parentheses.

2. Significant at: \* 10%; \*\* 5%; \*\*\* 1%.

Table 4 reports the OLS regression results, showing the treatment effect on the total wage if the trust/bonus contract is chosen. The dependent variable is the total wage which is equal to the upfront wage in no-bonus treatments and equal to the sum of the upfront wage and bonus in bonus treatments. Independent variables include the bonus dummy (Column 1, 2 and 5), the repeated-game dummy (Column 3, 4 and 5), the interaction term of the two treatment dummies (Column 5), and the period variable which controls for the learning effect (Column 1-5). Columns 1 and 2 demonstrate the bonus effect in one-shot and repeated games, separately. First, the bonus option is insignificant in one-shot games (Column 1: 4.598,  $p > 0.1$ ). Second, the bonus effect on the total wage in repeated games is only marginally significant (Column 2: 3.806,  $p = 0.083$ ), thus the regression results weakly support Hypothesis 2. In Column 4 of Table 4, the estimated

coefficient for the repeated-game dummy is positive and significant at the 1% level (6.03,  $p = 0.005$ ) in bonus treatments. In contrast, there is no significant relational effect in no-bonus treatments (6.277,  $p > 0.1$ ). Thus, we reject the null in favor of Hypothesis 3, suggesting a significant relational effect on the total wage, conditional on the bonus contract. In sum, the presence of bonus does not necessarily increase the total wage in one-shot games and only marginally increase the total wage in repeated games. In contrast to the bonus effect, conditional on the bonus contract being chosen, the relational effect is significant in that principals offer a higher total wage in repeated games than one-shot games.

Next, we examine the treatment effect on the upfront wage and bonus, separately. In particular, we are interested in understanding which component of wage offers, the upfront wage or bonus, drive the significant relational effect on the total wage.

Table 5: Regression Analysis for the Amount of Upfront Wage Offers: OLS Model

	One-Shot	Repeated	NoBonus	Bonus	All
	(1)	(2)	(3)	(4)	(5)
Bonus	0.048 (6.118)	-5.343** (2.499)			0.008 (5.780)
Repeated			6.277 (6.342)	1.616 (1.913)	6.705 (6.038)
Bonus*Repeated					-5.300 (6.285)
Period	-0.104 (0.166)	0.108 (0.137)	0.224 (0.193)	-0.046 (0.128)	0.034 (0.109)
Constant	14.55** (5.455)	19.56*** (1.981)	12.18** (5.115)	14.16*** (1.254)	13.55** (5.545)
Observations	194	266	114	346	460
$R^2$	0.005	0.096	0.145	0.013	0.092

Notes: 1. Robust Standard Errors are in parentheses.

2. Significant at: \* 10%; \*\* 5%; \*\*\* 1%.

We first present the treatment effect on the upfront wage. Table 5 presents the same set of analysis as Table 4, except that the dependent variable is the upfront wage rather than the total wage. Columns 1 and 2 show the bonus-treatment effect on the upfront wage in one-shot and repeated games, separately. Columns 3 and 4 report the relational effect under no-bonus and bonus treatments, respectively, and Column 5 is the pooled results. Though Lemma 2 and 3 imply that in the one-shot game, the upfront wage under the trust contract should be higher than that under the bonus contract, our experimental data shows no significant difference between them (Column

1 of Table 5: 0.048,  $p > 0.1$ ). Moreover, as shown in Table 4, the total wage is higher in the bonus treatment than the no-bonus treatment in the repeated game, but we observe a significantly lower upfront wage in the bonus-repeated treatment in Table 5, suggesting that the higher total wage must be driven by a large bonus. In addition, since Table 4 shows a significant relational effect on the total wage in bonus treatments, while Table 5 suggests no significant relational effect on the upfront wage in either bonus or no-bonus treatments, it suggests that the significantly higher total wage in the repeated game should also be driven by the bonus. Therefore, we continue to explore the relational effect on the bonus. It lies in our interest to understand whether the high bonus in repeated games is triggered by agents' high effort, or because of principals' stronger social preference towards long-term agents even after controlling for agents' performance.

Table 6: Regression Analysis for the Amount of Bonus: OLS Model

	Bonus Treatments	
	(1)	(2)
Repeated	4.415** (1.913)	2.514 (1.775)
Number of Finished Sliders		0.353*** (0.0921)
Period	0.110 (0.087)	0.111 (0.081)
Constant	3.713** (1.436)	-3.280 (2.039)
Observations	346	346
$R^2$	0.111	0.295

*Notes:* 1. Robust Standard Errors are in parentheses.

2. Significant at: \* 10%; \*\* 5%; \*\*\* 1%.

We then report the OLS regression results for the treatment effect on the bonus amount in Table 6. The dependent variable is the amount of bonus under the bonus contract. Independent variables are the repeated-game dummy and the period variable. Furthermore, we control for the number of finished sliders in Column 2. We find that conditional on choosing the bonus contract, principals offer a higher bonus in repeated games than one-shot games. However, the significant relational effect on the bonus amount disappears after controlling for agent effort. This finding suggests that the significant relational effect on the bonus amount is driven by agents' high effort. It is not necessary that principals would unconditionally pay agents more under fixed matches. In bonus treatments, since principals are the last mover in the sense that they observe agent effort

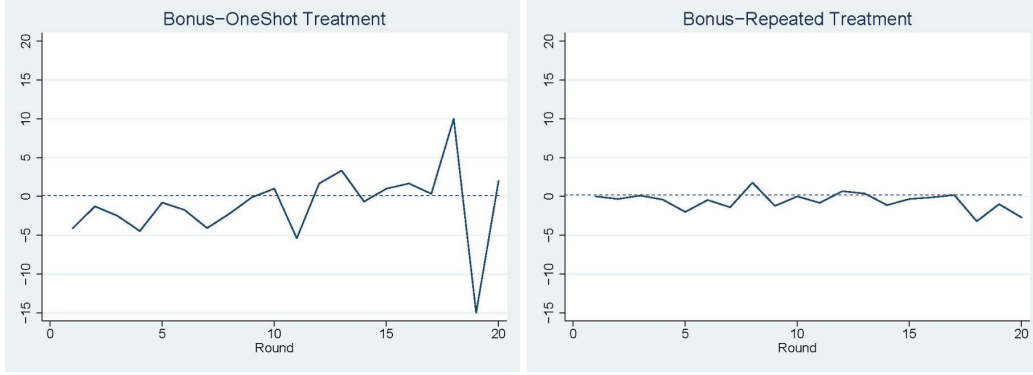


Figure 3: Principals' Reciprocity in Bonus Treatments

and then make a bonus offer, we calculate

$$\text{A's reciprocity} = \text{B's total wage} - \text{The number of finished sliders}$$

This measure, to some degree, shows how principals reciprocate agent effort, and so we name it “A’s reciprocity”.

Figure 3 presents principals’ reciprocity levels in one-shot games (left panel) and repeated games (right panel). If the reciprocity level is higher than or equal to zero, it suggests that on average, principals behave fairly and agents’ payoff is comparable to that under piece-rate (since  $w=e$  under piece-rate). Otherwise, it indicates that principals exploit agents by not offering a high enough wage. We find that in one-shot games, principals do not offer a high enough wage to compensate agent effort in almost all rounds. In comparison, in repeated games, agents’ earnings are largely matched with their performance level. We also observe an end-game effect in repeated games in which principals’ reciprocity is negative (Round 18: -3.2; Round 19: -1; Round 20:-2.7). This result is generally consistent with FRE predictions in Proposition 3.

### 5.3 Agent Effort

First, we examine the bonus effect on agent effort. Lemma 2 and 3 show that under the trust contract selfish agents invest in zero effort, and fair agents choose effort  $e^{Trust} = \frac{2(2q-1)^+}{k}$ .<sup>8</sup> Under the bonus contract, both selfish and fair agents choose effort  $e^{Bonus} = \frac{2q}{(2-q)k}$ . It can be shown that  $\frac{2q}{(2-q)k} > \frac{2(2q-1)^+}{k}$  for all  $q \in [0, 1]$ . Therefore, we predict that agent effort is higher under the bonus contract than trust contract in one-shot games. Further, based on Proposition 3, we expect that the bonus option will also impose a positive effect on the agent effort level in repeated games because FRE can only exist in the bonus condition.

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<sup>8</sup> $x^+ := \max\{x, 0\}$ .

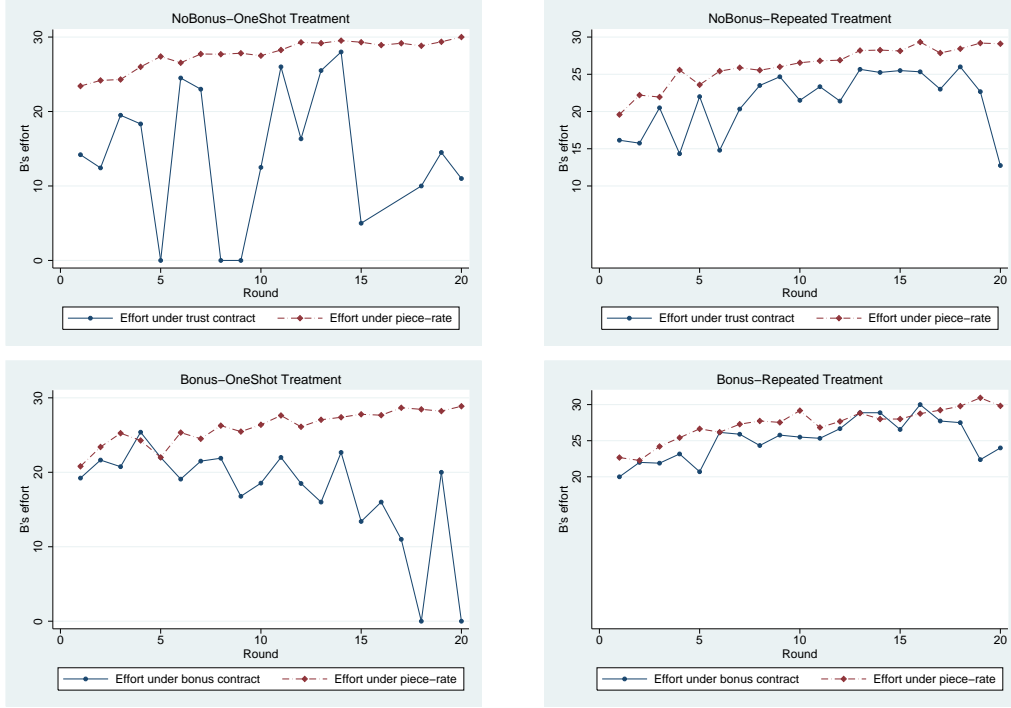


Figure 4: Agent Effort by Treatment

**Hypothesis 4 (Bonus Effect on Effort Level)** *Agent effort is higher in the bonus treatment than no-bonus treatment.*

Then, we examine the relational effect on the effort level. The reasoning here is similar to that for wage offers in the prior subsection. In one-shot games, agents would not engage in high effort because they expect that some principals would not pay a high bonus. In contrast, in repeated game, FRE exists under the bonus contract, implying that agents would engage in the first-best effort level, which should be higher than the optimal effort in one-shot games. Therefore, we have the following hypothesis.

**Hypothesis 5 (Relational Effect on Effort Level)** *Conditional on the bonus contract, agents exert higher effort in repeated games than one-shot games.*

Figure 4 depicts average effort in each round in the four treatments. For comparison, we show average effort under both piece-rate and trust/bonus contracts. When piece-rate is chosen, there is no treatment effect on agent effort. Further, in all four treatments, agent effort is higher under piece-rate than under trust/bonus contracts, and the difference is significant except for the bonus-repeated game treatment (the lower right panel). When piece-rate is not chosen, and under trust/bonus contracts, the treatment effect is evident.

Table 7: Regression Analysis for Agents' Effort: OLS Model

	One-Shot	Repeated	NoBonus	Bonus	All
	(1)	(2)	(3)	(4)	(5)
Bonus	4.355** (1.676)	7.183*** (1.370)			4.250*** (1.478)
Repeated			-0.217 (1.026)	4.657** (1.788)	1.124 (1.357)
Bonus×Repeated					3.312 (2.118)
Upfront Wage	0.585*** (0.112)	0.506*** (0.117)	0.748*** (0.059)	0.448*** (0.118)	0.551*** (0.085)
Period	-0.322* (0.149)	0.245*** (0.0899)	0.048 (0.09)	0.018 (0.126)	0.043 (0.098)
Constant	9.755*** (1.616)	7.725*** (2.331)	4.838*** (1.437)	13.45*** (2.304)	7.582*** (1.251)
Observations	194	266	114	346	460
R-squared	0.214	0.371	0.614	0.196	0.305

*Notes:* 1. Robust Standard Errors are in parentheses.

2. Significant at: \* 10%; \*\* 5%; \*\*\* 1%.

In Table 7, agent effort is measured by the number of sliders that she finished. In Columns 1 and 2 of Table 7, the estimated coefficients for the bonus dummy are positive and significant at the 1% level. In Column 4, the estimated coefficient for the repeated game dummy is positive and significant at the 5% level. The estimated coefficients for the upfront wage are also positive and significant at the 1% level. Moreover, the estimated coefficient for Period, is negative and marginally significant in one-shot games ( $-0.322$ ,  $p = 0.067$ ), while it is positive and significant in repeated games ( $0.245$ ,  $p = 0.01$ ).

The positive coefficient estimate for the upfront wage in all four treatments indicates that the higher upfront wage induces higher effort, suggesting the existence of “gift-exchange” under the trust/bonus contract. In addition, after the upfront wage is controlled for, the significantly positive bonus-treatment effect suggests that agents exert additionally higher effort under the bonus treatment. Thus, we reject the null in favor of Hypothesis 4.<sup>9</sup> The significantly positive effect of repeated games under the bonus contract supports Hypothesis 5. Furthermore, we observe a negative period effect in the one-shot game.<sup>10</sup> We conjecture that agents in the Bonus-OneShot

<sup>9</sup>The results are robust whether or not the upfront wage is included.

<sup>10</sup>In a simple regression where the dependent variable is agent effort under the bonus contract in the Bonus-OneShot treatment and the independent variable is the period variable, the estimate coefficient is  $-5.55$ ,  $p = 0.015$ . In comparison, it is  $0.03$  ( $p > 0.1$ ) for NoBonus-OneShot treatments.

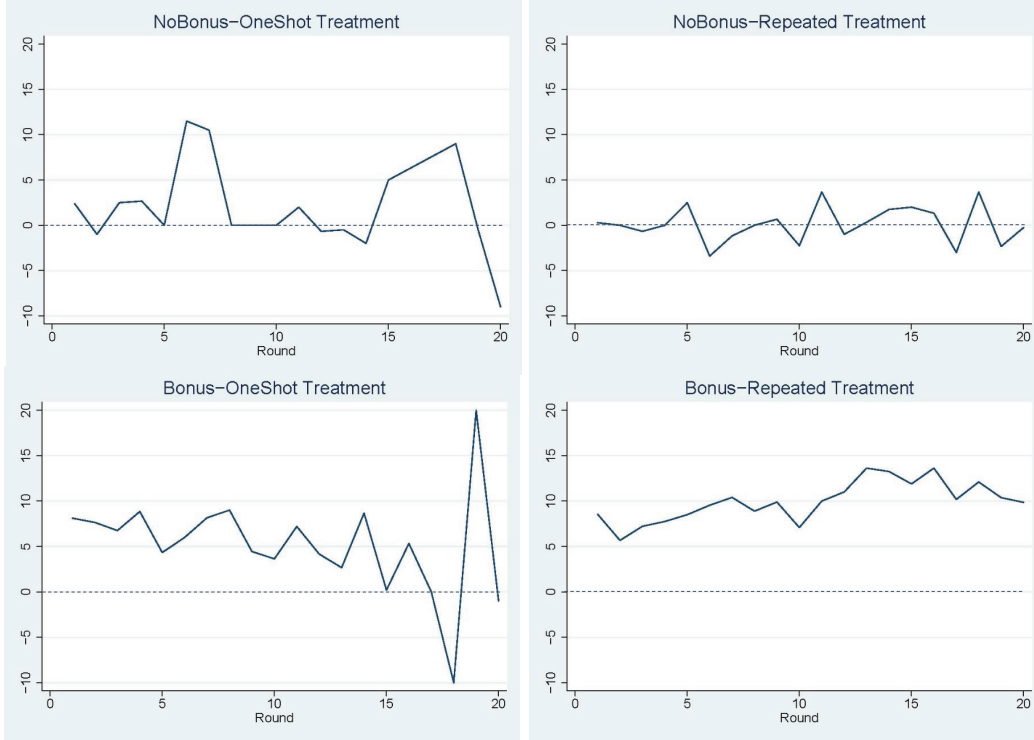


Figure 5: Agents' Reciprocity by Treatment

treatment learn gradually that principals may not offer a high bonus even if they exert high effort, and consequently, adjust down their effort level in later rounds. To further confirm this conjecture, we calculate agent effort relative to the upfront wage offered in each treatment, which indicates agents' "reciprocity" level.<sup>11</sup>

Figure 5 shows agent effort in response to the upfront wage offer in each treatment. In no-bonus treatments, agents are the last mover, and they actually can take away the upfront wage and pay zero effort. Yet, it is not what we observed. As can be seen from the upper two panels, agent effort fluctuates around the level of upfront wage. It suggests that agents generally behave fairly. In bonus treatments (the lower two panels), effort is generally higher than the upfront wage, suggesting that agents exert additional amounts of effort in anticipation of being rewarded a bonus. Furthermore, agents' reciprocity in the Bonus-OneShot treatment (lower left panel) declines over time and even turns to negative in later periods. This pattern is consistent with our conjecture. Different from the declining trend in the Bonus-OneShot treatment, the effort relative to the upfront wage in the Bonus-Repeated treatment increases over time.

<sup>11</sup>We acknowledge that this reciprocity measure carries different meanings for bonus and no-bonus treatments. Compared to no-bonus treatments, this measure also includes an anticipation for a bonus in bonus treatments.

## 6. Discussion and Conclusion

Using a real-effort experiment, we examine both the relational effect and the bonus effect on principals and agents' behavior. Our main findings include: first, the presence of bonus option decreases the likelihood of principals choosing piece-rate, although piece-rate is the optimal contract under the assumption of self-interested players for both one-shot and repeated games. Nevertheless, the dynamics in choosing the bonus contract are different for principals under the one-shot game and repeated game. Specifically, the bonus in repeated games helps develop mutual trust between principals and agents by lowering the cost of trust. That is, principals could offer a relatively lower upfront wage but reward high effort with a high bonus. In the long run, the bonus contract choice sustained. In comparison, the bonus may serve as a potential instrument for principals to take advantage of agents in one-shot games in the sense that principals choose the bonus contract and agents respond by investing in high effort, yet principals failed to offer a high bonus. When agents realize it and gradually lower their effort in response, it is no longer profitable for principals to choose the bonus contract, and hence they dominantly choose piece-rate in later rounds.

Second, with respect to wage offers, we find a positive relational effect on the total wage under bonus treatments, which is consistent with our theoretical prediction. Furthermore, the higher total wage offer observed in the repeated game is mainly driven by the higher bonus, while the upfront wage is not significantly higher than that in one-shot games. This finding points to an important difference in principals' wage offers between one-shot and repeated games: principals in one-shot games may not honor their promise of offering a high bonus; however, to induce agent effort, principals cannot offer a too low upfront wage in one-shot games. Moreover, the experimental results show that the total wage offer is marginally significantly higher under the bonus than no-bonus treatment in the repeated game, and the relational effect is insignificant under no-bonus treatments, suggesting that FRE provides a plausible account for individual behavior in the long-term setting.

Last, we find both a positive bonus effect on agent effort, and a positive relational effect on agent effort in bonus treatments. We also notice that regardless of treatments, agent effort under piece-rate is higher than that under the trust contract. Nevertheless, in the bonus-repeated game treatment, the average effort level under the bonus contract is almost as high as that under piece-rate. Our theory considers FRE in the repeated setting, assuming that agents fully cooperate in FRE by engaging in the first-best effort level, while the first-best effort level should be higher than the optimal effort level under piece-rate. Our experimental results show the effort level in the bonus-repeated game treatment is close to but does not exceed the effort level under piece-rate. It could be because in practice, unlike FRE, players engage in partial cooperation where the effort



level does not reach the first best level, but such an effort level is still regarded as being cooperative enough by principals, which induces the principals to continue choosing the bonus contract.

In conclusion, our study is motivated by the observation of the increasing number of temporary workers in the labor force and also by the survey evidence that firms offered different pay contracts to temporary and regular workers. Temporary workers are more likely to be offered piece-rate, while regular workers are offered with fixed wage and bonus. These observations motivate us to study an employer's pay contract choice and temporary and long-term workers' reaction to the contract choice in terms of the effort level. We attempt to understand whether or not the long-term relationship or bonus option affects the contract choice, wage offers, and agent effort.

Temporary and regular workers may be offered different pay schemes because they work on different jobs, and for some jobs piece-rate may not be implementable. To disentangle this effect, we design an experiment in which temporary and regular workers work on the same job, and the job can be paid by piece-rate. Given the assumption of self-interested and rational individuals, piece-rate should be a dominant strategy such that in a one-shot or repeated game, piece-rate should be chosen over the fixed-wage contract with or without bonus. We examine whether in the experiment principals would actually behave this way or whether they deviate from piece-rate (i.e. choosing the trust or bonus contract) under different treatments.

Our experimental results have some managerial implications. Piece-rate provides a strong incentive on workers' effort and productivity, as shown by our study and many previous field and experimental studies. However, piece-rate is not implementable in some circumstances. In such a case, the bonus contract provides an alternative method to motivate workers. It is effective on long-term workers, but may not be as effective on short-term workers. For long-term workers, the bonus contract could achieve the effort level almost as high as that under piece-rate. With the findings obtained from our experimental study, our paper may shed light on firms' pay-scheme design and employee motivation.

The limitations of our study include but are not restricted to the following: although we used a real-effort task, aiming to simulate a real-life work environment, we could not estimate the cost function or other social preference parameters because of complexity of the setting. Likewise, our theoretical analysis provides a simplified characterization of the research setting and obtains several predictions regarding the bonus and relational effect, but it does not allow the estimation of the parameters in the utility function. These limitations suggest future research directions.

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## Appendix A: Proofs

### Proof of Lemma 1.

Given piece-rate, agents' payoff is always lower than principal. Therefore,  $M_A = U_A = e - \frac{1}{2}ke^2$  and both type of agents choose  $e_f^* = \frac{1}{k}$ . Additionally, their payoff (utility) on the equilibrium is  $\frac{1}{2k}$ .

Using backward induction, the selfish principal's expected payoff is  $M_P^* = qe_f + (1 - q)e_s = \frac{1}{k}$ . The fair principal's expected utility is  $U_P^* = q\left(e_f - \frac{1}{2}\rho ke_f^2\right) + (1 - q)\left(e_s - \frac{1}{2}\rho ke_s^2\right) = \frac{2-\rho}{2k}$ .

### Proof of Lemma 2.

Because the wage  $w$  is paid up-front, the selfish agent chooses  $e_s^* = 0$  to maximize her monetary payoff.

For a fair agent, it is easy to show that the optimal effort must guarantee that  $M_A \geq M_P$ . If  $M_A < M_P$ , the optimal effort is zero and  $M_A > M_P$ , which is a contradiction. Therefore, the fair agent's decision is as follows:

$$\begin{aligned} \max_e U_A &= \rho M_P + (1 - \rho) M_A = \rho(2e - w) + (1 - \rho) \left( w - \frac{1}{2}ke^2 \right) \\ \text{s.t. } M_A &= w - \frac{1}{2}ke^2 \geq M_P = 2e - w. \end{aligned}$$

We obtain the fair agent's optimal effort below,

$$e_f^*(w) = \begin{cases} \frac{2(\sqrt{kw+1}-1)}{k} & \text{If } w \leq \frac{\rho(2-\rho)}{k(1-\rho)^2} \\ \frac{2\rho}{(1-\rho)k} & \text{If } w > \frac{\rho(2-\rho)}{k(1-\rho)^2} \end{cases}.$$

When  $w > \frac{\rho(2-\rho)}{k(1-\rho)^2}$ , the fair agent's optimal effort is the interior solution and it is independent with  $w$ . In contrast, when  $w \leq \frac{\rho(2-\rho)}{k(1-\rho)^2}$ , her optimal effort is the corner solution which is increasing in  $w$ . Altogether, a principal has no incentive to offer  $w$  higher than  $\frac{\rho(2-\rho)}{k(1-\rho)^2}$ .

Furthermore, using backward induction, the principal expects that her payoff is always less than or equal to agent's payoff. Therefore, the maximization problem for both types of principal is

$$\begin{aligned} \max_w M_P(w) &= q(2e_f(w)) - w = 2q \frac{2(\sqrt{kw+1}-1)}{k} - w \\ \text{s.t. } 0 &\leq w \leq \frac{\rho(2-\rho)}{k(1-\rho)^2}. \end{aligned}$$

The optimal wage is

$$w^* = \begin{cases} \frac{4q^2-1}{k} & \text{If } q > \frac{1}{2} \\ 0 & \text{If } q \leq \frac{1}{2} \end{cases}.$$

### Proof of Lemma 3.

We first show there is no separating equilibrium by contradiction.

Suppose that the two types of principals choose different upfront wages.  $\bar{w} > \underline{w}$ , are fair and selfish principal's wage choices respectively. First, if the selfish principal offers  $\underline{w}$ , the agent updates his beliefs to  $\hat{q} = 0$  and expects that  $b^* = 0$ . Therefore, it is equivalent to the trust contract discussed above. Based on Lemma 2, when  $q \leq \frac{1}{2}$ , the selfish principal will choose  $\underline{w} = w_s = 0$  and  $M_{P_s}(e^* = 0) = 0$ . When  $q > \frac{1}{2}$ ,  $\underline{w} = w_s = \frac{4q^2-1}{k}$  and  $M_{P_s}(e^* = \frac{2(2q-1)}{k}) = \frac{(2q-1)^2}{k}$ .

Second, if the principal offers  $\bar{w}$ , the agent updates her beliefs to  $\hat{q} = 1$ . The fair principal will offer  $b^*$  such that  $2e - w - b^* = w + b^* - \frac{1}{2}ke^2$ . Therefore,  $w + b^* = e + \frac{1}{4}ke^2$  and  $w + b^* - \frac{1}{2}ke^2 = e - \frac{1}{4}ke^2$ . Moreover,  $e^{FB} = \arg \max_{e \geq 0} (2e - \frac{1}{2}ke^2) = \frac{2}{k}$  is the first-best efficient effort level

We first show that  $\bar{w} \leq e^{FB} - \frac{1}{4}k(e^{FB})^2 = \frac{1}{k}$  always hold by contradiction. Suppose that  $\bar{w} > \frac{1}{k}$ , the selfish agent will choose  $e_s^* = 0$ , and the fair agent will choose  $e_f^* = e^{FB} = \frac{2}{k}$ . The fair principal's utility  $U_{P_f}^* = q(\frac{1}{k}) - (1-q)\bar{w}$  which is strictly decreasing in  $\bar{w}$ . Therefore, the fair principal has incentive to deviate from  $w = \bar{w} > \frac{1}{k}$ .

Next, conditional on  $\bar{w} \leq \frac{1}{k}$ , we show that the selfish principal has incentive to mimic the fair principal by choosing  $w = \bar{w}$ . First, when  $\bar{w} \leq \frac{1}{k}$ , both types of agent choose  $e_s^* = e_f^* = e^{FB}$ . Thus, if the selfish principal offers  $w = \bar{w}$  and  $b = 0$ , her monetary payoff is  $2e^{FB} - \bar{w} \geq \frac{3}{k} > \frac{(2q-1)^2}{k} > 0$ .

Altogether, there is no separating equilibrium in which the selfish principal's wage offer differs from that of the fair principal's offer. Now we characterize the pooling equilibrium in which both fair and selfish principal offer the same upfront wage  $w$ .

At bonus stage, the selfish principal always chooses  $b = 0$ ; and the fair principal chooses  $b$  so as to achieve  $M_P = 2e - w - b = w + b - \frac{1}{2}ke^2 = M_A$ , if  $2e - w > w - \frac{1}{2}ke^2$ . Otherwise,  $b(e) = 0$ . Altogether,  $b(e) = \max\{e - w + \frac{1}{4}ke^2, 0\}$ .

At the second stage, the selfish agent believes that she faces a fair principal with probability  $q$  and maximizes her expected monetary payoff below.

$$M_A(e) = \begin{cases} q(e - \frac{1}{4}ke^2) + (1-q)(w - \frac{1}{2}ke^2) & \text{if } b(e) > 0 \\ w - \frac{1}{2}ke^2 & \text{if } b(e) = 0 \end{cases}.$$

Differentiating with respect to  $e$  yields

$$\frac{\partial M_A}{\partial e} = \begin{cases} q - (1 - \frac{q}{2})ke & \text{if } e + \frac{1}{4}ke^2 > w \Leftrightarrow e > \frac{2(\sqrt{kw+1}-1)}{k} \\ -ke & \text{if } e + \frac{1}{4}ke^2 \leq w \Leftrightarrow e \leq \frac{2(\sqrt{kw+1}-1)}{k} \end{cases}.$$

Thus,  $M_A(e)$  has two local maximums at  $e = 0$  and  $\frac{2q}{(2-q)k}$ . It is easy to show that the global maximum is at  $e = \frac{2q}{(2-q)k}$  for  $w \leq \frac{q}{(2-q)k}$ , and  $e = 0$  for  $w > \frac{q}{(2-q)k}$ . Hence, the selfish agent

chooses

$$e_s^*(w) = \begin{cases} \frac{2q}{(2-q)k} & \text{if } w \leq \frac{q}{(2-q)k} \\ 0 & \text{if } w > \frac{q}{(2-q)k} \end{cases}.$$

The fair agent's utility is

$$U_A(e) = \begin{cases} q(e - \frac{1}{4}ke^2) + (1-q)(w - \frac{1}{2}ke^2) & \text{if } b(e) > 0 \\ (1-\rho)(w - \frac{1}{2}ke^2) + \rho(2e - w) & \text{if } b(e) = 0 \end{cases}.$$

Differentiating with respect to  $e$  yields

$$\frac{\partial U_A}{\partial e} = \begin{cases} q - (1 - \frac{q}{2})ke & \text{if } e + \frac{1}{4}ke^2 > w \Leftrightarrow e > \frac{2(\sqrt{kw+1}-1)}{k} \\ 2\rho - (1-\rho)ke & \text{if } e + \frac{1}{4}ke^2 \leq w \Leftrightarrow e \leq \frac{2(\sqrt{kw+1}-1)}{k} \end{cases}.$$

We obtain the fair agent's optimal effort

$$e_f^*(w) = \begin{cases} \frac{2q}{(2-q)k} & \text{if } w \leq \frac{q(4-q)}{(2-q)^2k} \\ \frac{2(\sqrt{kw+1}-1)}{k} & \text{if } \frac{q(4-q)}{(2-q)^2k} \leq w \leq \frac{\rho(2-\rho)}{(1-\rho)^2k} \\ \frac{2\rho}{(1-\rho)k} & \text{if } w \geq \frac{\rho(2-\rho)}{(1-\rho)^2k} \end{cases}.$$

Since the selfish agent chooses  $e_s = 0$  when  $w > \frac{q}{(2-q)k}$ , increasing wage beyond  $\frac{q}{(2-q)k}$  doesn't pay off for the fair principal. Therefore,  $w > \frac{q}{(2-q)k}$  cannot be part of a pooling equilibrium. However, for all  $0 \leq w \leq \frac{q}{(2-q)k}$ , the outcomes can be sustained as pooling equilibrium outcomes.

### Proof of Proposition 3.

We first show that there is no FRE when the contract choice is between piece-rate and trust contract by contradiction. Suppose there is a FRE, it indicates that selfish players imitate fair ones in every period before the last, and the belief about players' type will not be revealed until the end of the entire time horizon. That is,  $q_i = q$  for all  $i \in \{1, \dots, T\}$ . From Propositions 1 and 2, in the last period  $T$ , for any prior belief  $q \in [0, 1]$ , the selfish principal's expected monetary payoff by using piece-rate contract is always higher than or equal to that with trust contract. Therefore, the selfish principal will always choose piece-rate in the last period, which is a contradiction.

Considering the second case where principals choose between piece-rate and bonus contract, we expect that in the full reputation equilibrium, in every period except the last one, both agents choose the first-best effort level,  $e_t = e^{FB}$ , and both principals pay to equalize the payoffs between two parties,  $w_t + b_t = \frac{v(e^{FB}) - c(e^{FB})}{2} = \frac{3}{k}$  which maximizes the utility for the fair type. We can therefore restrict attention only to the selfish players including both selfish principals and agents.

In period  $t \in \{1, \dots, T-1\}$ , both types of principal offer wage  $w_t$ , both types of agent choose first-best effort level  $e_t = \frac{2}{k}$ , and both types of principal offer bonus  $b_t$ . Because the belief about

player's type will be not revealed until the end of the entire time horizon. That is, in every  $t$  the prior on player  $q_t = q$  for all  $t \in \{1, \dots, T\}$ . And the in the last period  $T$ , the principals and agents play a one-shot game with prior belief  $q_T$  where only the fair principal pays the bonus at the end.

In period  $T$ , both types of principals choose bonus contract only if the selfish principal's payoff and the fair principal's utility under bonus contract are higher than those under piece-rate contract. That is,  $\frac{3q_T}{(2-q_T)k} > \frac{1}{k}$  and  $\frac{q_T(4-3q_T)}{(2-q_T)^2k} > \frac{2-\rho}{2k}$ . They yield

$$q = q_T > \max\left\{\frac{1}{2}, 2 - \frac{1}{1 - \frac{1}{2}\sqrt{\frac{\rho}{2}}}\right\}.$$

In period  $t \leq T - 1$ , after a bonus contract is chosen, there are three substages. Firstly the principal offers an upfront wage; secondly the agent chooses an effort level; and thirdly the principal decides on bonus size. In the following, we characterize the Incentive Constraint (IC) for the selfish players at each substage.

1) IC for selfish principal at the stage of offering bonus:

$$\left(2 * \frac{2}{k} - w_t - b_t\right) + \frac{T-t-1}{k} + \frac{3q}{(2-q)k} \geq \left(2 * \frac{2}{k} - w_t\right) + \frac{T-t}{k}.$$

The LHS is her expected equilibrium payoff from period  $t$  to  $T$ . The first term:  $2\frac{2}{k} - w_t - b_t$  is the equilibrium payoff in period  $t$ , the second term is the total payoff from period  $t+1$  to  $T-1$ , and the last term is the expected payoff in the last period  $T$ . The RHS is the expected payoff if she defects by not paying the bonus in period  $t$ . Because the defection of not paying bonus reveals her type, and the agent will not invest in positive effort in the following periods. Then the principal should choose piece-rate instead of bonus contract from period  $t+1$  to the last period  $T$ , and get payoff  $\frac{1}{k}$  in all subsequent periods. The above condition is simplified as

$$b_t \leq \frac{2(2q-1)}{k(2-q)}.$$

2) IC for selfish agent at the stage of choosing effort:

$$\left(w_t + b_t - \frac{1}{2}k(e_t)^2\right) + \frac{T-t-1}{k} + \frac{q}{(2-q)k} \geq w_t + \frac{T-t}{2k}$$

where  $e_t = e^{FB} = \frac{2}{k}$ . The LHS is her expected equilibrium payoff from investing in first-best effort from period  $t$  to  $T$ . The first term:  $w_t + b_t - \frac{1}{2}k(e_t)^2$  is her payoff in period  $t$ , the second one is the total payoff from period  $t+1$  to  $T-1$ , and the last one is her expected payoff in period  $T$ . The RHS is the expected payoff if she invests in no efforts. Because the defection reveals her type, and the principal will not pay bonus in period  $t$  and the piece-rate contract will be used in all following  $T-t$  periods. Reorganizing the terms, we obtain

$$b_t \geq \frac{(6-T+t)(2-q) - 2q}{2(2-q)k}.$$



3) IC for selfish principal at the stage of offering wage:

$$\frac{T-t}{k} + \frac{3q}{(2-q)k} \geq q(2e_f(w)) - w + \frac{T-t}{k} \text{ for all } w \neq w_t,$$

The LHS is her expected equilibrium payoff from period  $t$  to  $T$ . The first term:  $\frac{T-t}{k}$  is the total payoff from period  $t$  to  $T-1$ , and the second one is the expected payoff in the last period  $T$ . The RHS is her expected payoff from period  $t$  to the end by offering a wage  $w \neq w_t$ . Because such defection will reveal her type and the agents will know a bonus will not be awarded at the end of period  $t$ , thus the agent will behave as that under the trust contract. As shown in the proof of Proposition 2,  $q(2e_f(w)) - w$ , is the principal's expected payoff in a one-shot game with trust contract. Furthermore, we also showed that  $q(2e_f(w)) - w$  is maximized at  $w = \frac{4q^2-1}{k}$ , and  $\max_w [q(2e_f(w)) - w] = \frac{(2q-1)^2}{k}$ . In addition, the second term,  $\frac{T-t}{k}$ , is her expected payoff from period  $t+1$  to the last period  $T$  after the defection. Altogether, the above inequality is simplified as

$$\frac{3q}{(2-q)k} \geq \frac{(2q-1)^2}{k} \Rightarrow 2q^3 - 6q^2 + 6q - 1 \geq 0$$

In summary, a FRE described here requires that for  $t < T$

$$\begin{aligned} e_t &= \frac{2}{k}, \\ w_t + b_t &= \frac{3}{k}, \\ \frac{(6-T+t)(2-q) - 2q}{2(2-q)k} &\leq b_t \leq \frac{2(2q-1)}{k(2-q)}. \end{aligned}$$

To sustain such equilibrium, we need  $\frac{(6-T+t)(2-q) - 2q}{2(2-q)k} < \frac{2(2q-1)}{k(2-q)} \Rightarrow q > 2 - \frac{16}{16-T+t}$  for all  $t \leq T-1$ . Therefore,  $q > \frac{14}{15}$ .

Combining with inequality (1), a FRE also requires

$$q > \max\left\{\frac{14}{15}, 2 - \frac{1}{1 - \frac{1}{2}\sqrt{\frac{\rho}{2}}}\right\} \text{ and } 2q^3 - 6q^2 + 6q - 1 \geq 0.$$

It is easy to verify that the second inequality holds for all  $q > \max\left\{\frac{14}{15}, 2 - \frac{1}{1 - \frac{1}{2}\sqrt{\frac{\rho}{2}}}\right\}$ .

## Appendix B: Experiment Instructions

This is an experiment in decision-making. You will make a series of decisions in the experiment, followed by a post-experiment questionnaire. Please note that you are not being deceived and everything you are told in the experiment is true.

Each of you has been assigned an experiment ID, i.e. the number on your index card. The experimenter will use this ID to pay you at the end of the experiment.

**Rounds:** The experiment consists of 21 rounds of games including one practice round. After the practice round, the payment you earn in each round will cumulate toward your final payment.

**Roles:** This experiment has 12 participants, six of whom are player As and the others are player Bs. Your assigned role will be the same for all rounds. Therefore, if you are a player A, you will always be a player A. Similarly, if you are a player B, you will always be a player B.

**Grouping:** At the beginning of the experiment, a player A is randomly grouped with a player B in the room. Each player A will play with the same player B until the end of the experiment (for the repeated game treatment; and this sentence changes to ‘in each round followed, a player A and B will be randomly re-matched).

**Player B’s Task:** In each round, all players B need to undertake an identical task described below.

The task lasts 120 seconds and consists of a screen with 48 sliders. As shown below, each slider is initially positioned at 0. The slider can be moved as far as 100. The number to its right shows its current position. You can use the mouse in any way you like to move the slider, and re-adjust the position of the slider as many times as you wish. You may now practice by moving the slider below.



To complete one piece of the slider task correctly, you will need to position the slider at exactly 50, as shown in the example below. Note the number to its right shows the correct position “50”. Each time that you undertake the task, the “number of sliders completed” will be the number of sliders correctly positioned at exactly 50 at the end of the 120 seconds. Are there any questions?



Before we start experiment, please look at a sample screen-shot below. The screen shot contains 48 sliders. The upper right corner shows the remaining time is 104 seconds. Three sliders are

currently positioned at 50. So the box on the top of the screen shows that “currently, number of sliders completed is 3”.



Additionally, for every slider that player B finishes, player A will receive 1.5 tokens.

**Player A’s Choice:**

In each round, player A first chooses the amount of tokens given to B. Player B will be told A’s choice before she starts the slider task. A can choose between the following two schemes:

Option 1: Player A first chooses a fixed amount X, and after B finishes the slider task, then chooses another fixed amount Y. Note, B will only be informed of the amount of X before task but not Y.

Option 2: For every slider B finishes, she gets 1 token.

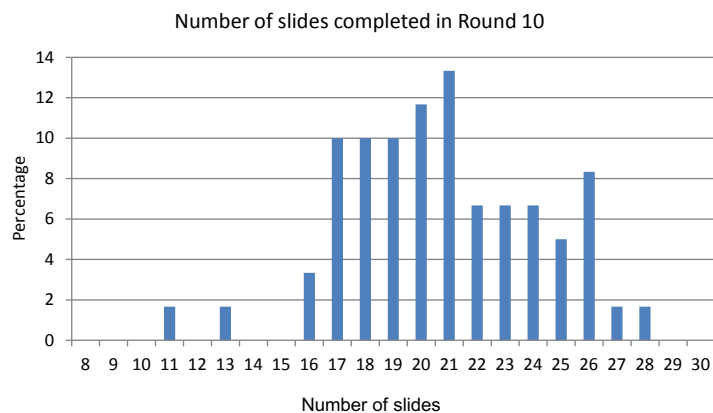
To help Player A to evaluate player B’s relative skill in the task. We previously ran sessions in which 60 participants undertook the same slider task for 20 rounds and earned 1 token for each completed slider - the same as Option 2 above. The average number of finished sliders across 20 rounds is 20.

Table below presents summary statistics in each round.

We also provide you with the histogram below. It shows the distribution of the numbers of sliders completed by those participants in round 10. The horizontal axis represents the number of sliders completed. The height of each column indicates the percentage of participants who completed a particular number of sliders in round 10. The higher the column, the more the number of completed sliders. For instance, 13% participants completed 21 sliders.

**Payoffs:** Assuming the number of sliders that player B finishes is Z, each player’s payoff in each round is below:

Round	1	2	3	4	5	6	7	8	9	10
Median	12.5	16	17	18	18	19.5	19	20	20	20.5
Min	1	8	7	10	11	5	7	11	12	11
Max	23	23	24	26	28	27	31	27	28	28
Round	11	12	13	14	15	16	17	18	19	20
Median	20	21	20	21	21	21.5	21	22	23	23
Min	11	13	13	11	9	11	15	14	15	14
Max	29	31	29	30	31	35	34	30	32	29



1. When player A chooses Option 1

$$\text{A's payoff} = Z^2 - X - Y$$

$$\text{B's payoff} = X + Y$$

2. When player A chooses Option 2

$$\text{A's payoff} = Z^2 - Z = Z$$

$$\text{B's payoff} = Z$$

**Cumulative Payoff:** Your cumulative payoff will be the sum of your payoff in all rounds.

**Feedback:** At the end of each round, you will receive the following feedback on your screen about the round including (1) player A's decision; (2) player B's number of completed sliders; (3) your payoff this round, and (4) your cumulative payoff up to this round.

**History:** Player A's decision, Player B's number of completed sliders, your payoff in each round and your cumulative payoff will be displayed in a history box.

**Exchange Rate:** At the end of the experiment, the tokens you earned will be converted to RMB yuan at the rate of 1 yuan = 6 tokens.

Please do not communicate with each another during the experiment or use your cell phone. No food is allowed in the lab either. If you have a question, feel free to raise your hand, and an experimenter will come to help you.

## Appendix C: Post-Experiment Survey

1. Gender :
  - A. Male
  - B. Female
  
2. Ethnic Background :
  - A. Han
  - B. Others
  
3. Age : \_\_\_\_\_.
  
4. College Grade/ Year :
  - A. Freshman Year
  - B. Sophomore
  - C. Junior
  - D. Senior
  - E. Undergraduate with more than 4 years
  - F. Graduate
  
5. Would you describe yourself as (Please choose one) :
  - A. Optimistic
  - B. Pessimistic
  - C. Neither of above
  
6. Which of the following emotions did you experience during the experiment? (Select all those apply).
  - A. Anger
  - B. Anxiety
  - C. Confusion
  - D. Contentment
  - E. Fatigue

- F. Happiness
- G. Irritation
- H. Mood swings
- I. Withdrawal

7. In general, do you see yourself as someone who is willing, even eager, to take risks, or as someone who avoids risks whenever possible? \_\_\_\_\_ [7 point likert] 1 I avoid risks as much as possible ... 7 I am very willing to take risks.
8. Under the circumstance that the risks bring the same amount of income and loss, do you think the negative effect of loss is larger than the positive effect of income? \_\_\_\_\_ [7 point likert] 1 Equally large ... 7 The negative effect is far larger than the positive effect.
9. In general, how competitive do you think you are? \_\_\_\_\_ [7 point likert] 1 I am not competitive at all ... 7 I am very competitive.
10. When you use computer in daily life, which of the following statements is true?
- A. I use mouse and touchpad equally often.
  - B. I use mouse more often than touch pad.
  - C. I use touchpad more often than mouse.

If you are player A, please answer questions 11-12. If you are player B, please answer question 13.

11. If you are player A, and you chose the plan “Pay X tokens to B before the task and Y tokens after the task”, please choose the possible reasons why you chose this plan (Select all those apply).
- A. this plan is easier
  - B. this plan provide more incentive to B
  - C. this plan is fairer for B
  - D. this plan is more challenging for B
  - E. under this plan, there is less risk of my income
  - F. other reason

12. If you are player A, and you chose the plan “For each slider that player B finishes, she will get 1 token ”, please choose the possible reasons why you chose this plan (Select all those apply).

- A. this plan is easier
- B. this plan provide more incentive to B
- C. this plan is fairer for B
- D. this plan is more challenging for B
- E. under this plan, there is less risk of my income
- F. other reason

13. If you are player B, please choose the effort under different pay plans. Please choose a number between 0-100 (0 is the lowest, and 100 is highest) to represent your effort level.

When A chose plan “Pay X tokens to B before the task and Y tokens after the task”, your effort is \_\_\_\_\_.

When A chose “For each slider that player B finishes, she will get 1 token”, your effort is \_\_\_\_\_.