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A discount factor and the ratchet effect: An experiment*

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Abstract

The ratchet effect is an economic phenomenon where agents strategically restrict their effort to conceal information on their characteristics under the dynamic setting. The occurrence of the ratchet effect depends on a discount factor. This study experimentally examines the effect of a discount factor on ratcheting behavior. We find evidence that a discount factor affects agents' decision-making. For a small discount factor, highly skilled agents tend to make higher efforts.

JEL Classification: C91, D01, J41
Keywords: the ratchet effect, a discount factor, a laboratory experiment

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1 Introduction

The ratchet effect is considered a serious problem in several contexts, such as labor contracts, nonlinear income taxation, and environmental regulation. It indicates that in a long-term relationship between a principal and an agent, the agent loses his/her rent by being efficient. An agent's level of effort indicates his or her characteristics to a principal. A principal has an incentive to offer a contract that requires greater output to productive agents. When agents are aware that a principal can offer such a contract, they may adjust their efforts to avoid revealing their own characteristics, which is called ratcheting behavior. This behavior does not appear if a principal commits to ignore an agent's characteristics. However, this commitment is incredible. Laffont and Tirole (1988, 1993) have discussed the consequences of these behaviors and equilibrium.

A discount factor determines outcomes under repeated relationship in short-term contracts. For a large discount factor, agents attach importance to future rent value and have an incentive to conceal their own types. Hence, they are wary of the ratchet effect. For a small discount factor, it is not costly for agents to reveal their types. Therefore, agents choose an appropriate level of effort (See Proposition 9.9 in Laffont and Tirole (1993)).

This experimental study examines the effects of a discount factor on ratcheting behavior. Following Charness et al. (2011), laboratory experiments were conducted where subjects played a simple game of principal agent relationship under two-type and two-stage settings. Types are agent's cost of effort, differentiated by high and low skilled. At each stage, a principal can offer a rent to an agent, and the agent chooses the level of effort. If the agent chooses a high level of effort in the first stage, the principal infers that choosing a high level of effort is easy and thus offers a higher level of effort in the second stage. Choosing a low-level of effort by a highly skilled agent in the first stage is seen as a ratcheting behavior. In our experiment, the probability of the game continuing to the second stage is seen as a discount factor.

Our main findings are as follows. A discount factor affects the choice of highly skilled agents. The choice of efforts by highly skilled agents in the first stage when the game continues to the second with the probability 1 varies when that probability is smaller than 1. Moreover, when the probability is smaller than 1, the choice of high effort by a highly skilled agent emerges stronger and quicker. It implies that for a small discount factor, highly skilled agents choose higher levels of effort.

Empirical studies measuring agents' performance are limited. Several studies use experiments as empirical strategies. Chaudhuri (1998) made the first experimental contribution but found little evidence of ratcheting. Cooper et al. (1999) found clear evidence of the ratchet effect. In their experiment, subjects included not only university students but also old and young managers in an actual firm. Their results have shown that a highly productive agent chooses a lower output level during the first period. Charness et al. (2011) designed laboratory experiments with asymmetry in numbers of

principal and agents and found that the ratchet effect is nearly eliminated by the market competition for agents and principal. Bellemare and Shearer (2015) conducted field experiments and proved that workers' outputs decrease owing to a lack of commitment by a principal. Cardella and Depwe (2018) experimented with a real-effort task and found strong evidence of the ratcheting effect. No studies have examined the effect of a discount factor on ratcheting behavior.

This study is presented as follows. Section 2 describes the theoretical framework. Section 3 presents the experimental design and derives predictions. Section 4 reports the results of the experiment and section 5 presents the conclusions.

2 Theoretical framework

This section presents the principal-agent framework based on Charness et al. (2011). There are two types of workers: a highly skilled worker with a proportion of $\frac{1}{3}$ and a low-skilled worker with a proportion of $\frac{2}{3}$. They choose a level of effort e as an input. An output y is determined by a linear production function $y = e$. Their net income w_t in stage t is a wage offered by a firm, $w_t = y - \alpha_t$, where α_t is a firm's margin in stage t ($t = 1, 2$). In the context of Charness et al. (2011), α_t is seen as a rental fee. The worker's utility function is given as follows:

$$U^i = w_1 - \gamma^i e^2 + q w_2$$

where q is a discount factor and γ^i is an effort cost, $\gamma^H = 0.005 < \gamma^L = 0.01$. The firm's profit in stage t is given by $\pi_t = y - w_t$ ($t = 1, 2$).

The timing of this game is as follows: At first, the nature determines the type of worker. In the first stage, the firm only posts $\alpha_1 = 15$ to the worker, and then the worker decides whether to accept it. If the worker accepts it, he or she chooses either low output, 50, or high output, 100. At the end of the first stage, the firm can observe the worker's level of effort. This information allows the firm to then infer the identities of the worker, and charge a higher rental fee in the second stage. Considering that the firm can offer higher rental fee, a highly skilled worker may choose a low output in the first stage to conceal information about his or her productivity, which is called the ratchet effect. In the second stage, the firm learns about the worker's decision-making in the previous stage and choose either $\alpha_2^H = 66$ or $\alpha_2^L = 30$. Similar to the first period, if the worker accepts the offer, she or he chooses either low output, 50, or high output, 100 without its cost of effort.

We consider two scenarios: the complete separation case and the complete pooling case. Let p be the probability that the worker is highly skilled. In the complete separation case, both the types of workers choose their type-appropriate output in the first stage. Thus, the firm updates its belief that a worker who has chosen high output is highly skilled worker, that is, $p = 1$. In the second stage, the firm offers α_2^H to a

highly skilled worker and α_2^L to a low-skilled worker, then both the types of workers choose their type-appropriate output in the second stage. However, in the complete pooling case, both types of workers choose the low output, 50, in the first stage. The firm cannot update its belief on the worker's type, that is, $p = \frac{1}{3}$. Consequently, the firm offers α_2^L to a worker, then a highly skilled worker chooses the high output, 100.

In the second stage, a highly skilled worker accepts both α_2^H and α_2^L, yielding a profit to the firm equal to α_2^H and α_2^L, respectively. A low-skilled worker only accepts α_2^L. The firm's expected profit is $66p$ if it charges α_2^H and 30 if it charges α_2^L. These mean that a firm offers α_2^H to a worker at the beginning of the second stage if and only if $p > \frac{5}{11}$. In the complete separation case, the firm's offer is α_2^H because of $p = 1$, and then the highly skilled worker's payoff is $-15+100-0.005\times100^2+q(-66+100)$. On the other hand, in the complete pooling case, the firm charges α_2^L due to $p = \frac{1}{3}$, and then a highly skilled worker's payoff in the complete pooling case is $-15+50-0.005\times50^2+q(-30+100)$. These imply that complete separation will occur if the discount factor q is $q < \frac{12.5}{36}$.

3 Experimental Design

Our experiment was conducted at the Center for Experimental Economics, Kansai University, Japan, in January 2017. Overall, 56 subjects participated in the baseline treatment. Moreover, 40 also participated in two additional treatments. All participants were students of Kansai University from various fields of study[1]. The computerized experiment was programmed and conducted with z-Tree (Fischbacher, 2007).

Each session consisted of 20 or 16 subjects. Each was assigned the role of the firm (15 or 12) or highly skilled worker (5 or 4). The other 10 or 8 low-skilled workers were the computer that always chose a low level of effort. Each subject who acted as the firm was matched with a worker. The pair of participants played the game in two-periods, as mentioned earlier. The game was repeated 20 times. The group randomly re-matched during each new period.

We used an experimental currency unit ("Point"). After each round, the subjects' payoffs were added to their account. The total payoff plus a 1000 yen show-up fee was disbursed to them in cash (1 Point = 1 yen). Each session lasted between 80 and 90 minutes. The subjects were paid about 2800 yen on average.

Subjects were informed that they must play the game in the first stage to continue to the second stage, with a probability q. Similar to experiments on repeated games, the probability of proceeding to the second stage is seen as the discount factor. In the baseline treatment, suppose the discount factor q is unity. Hereafter, this treatment is called "q-1 treatment." The other two treatments introduce the effect of the discount factor on the determination of workers' level of effort in the first stage. In the treatment assuming that $q = 0.5$ and $q = 1$, theoretical model suggests that no separation occurs.

[1]All students at that university were eligible, and there was no selection rule.

However, the separation occurs in the treatment with $q = 0.2$. Thus, the former treatment is called "q-0.5 treatment," and the latter "q-0.2 treatment." Following the theoretical analysis and experimental setting, the following qualitative predictions are made.

Prediction 1. *If a discount factor q is 1 or 0.5, the complete pooling case occurs, that is, the highly skilled worker chooses low output, 50 in the first stage and the firm offers a low-rental fee, α_2^L in the second stage.*

Prediction 2. *If a discount factor q is 0.2, the complete separation case occurs, that is, the highly skilled worker chooses high output, 100 in the first stage, and the firm offers a high-rental fee, α_2^H in the second stage.*

4 Experimental Results

Table 1 summarizes the participants' decisions for each treatment. In the q-0.5 and q-0.2 treatments, there are fewer observations in the second stage because the probability that participants will continue to the second stage is less than 1.

Table 1: Summary Statistics

	q-1 treatment	q-0.5 treatment	q-0.2 treatment
First stage, worker's choices:			
Accepted contracts	280/280 (100.0)	200/200 (100.0)	200/200 (100.0)
High output	176/280 (62.9)	192/200 (96.0)	190/200 (95.0)
Second stage, firm's offers:			
High fee after low output	60/664 (9.0)	24/120 (20.0)	13/83 (15.7)
High fee after high output	143/176 (81.3)	43/60 (71.7)	31/37 (83.8)
Second stage, worker's choices:			
Accepted contracts	261/280 (93.2)	54/60 (90.0)	40/40 (100.0)
High output	255/261 (97.7)	54/54 (100.0)	39/40 (97.5)

Note. Percentages are in parentheses. The table only reports agents' decisions for the high-talent (human) agents. In q-0.5 and q-0.2 treatments, we can only observe the actions when the participants continue to the second stage.

4.1 Effort Decisions

The effort decisions in the first stage are considered, which reveals the workers' ratcheting behavior. In all observations, workers always accepted firm's offer in the first stage across all treatments.

Result 1. *In the q-1 treatment, a low output is chosen in 37.1% of observations. A substantial number of workers engaged in ratcheting behavior, as indicated by Prediction 1, but not a majority.*

The experimental results show that workers chose a high output in 176 of 280 observations (62.9%), while several chose a low output 104 of 280 (37.1%) in the q-1 treatment. This result implies that, in less than half of observations, the workers conceal their skills to induce a low fee from the firm, later described in the pooling equilibrium. The percentage of workers who chose a low output is lesser than that in Charness et al. (2011), which shows the percentage is 62.1%.

Result 2. *In the q-0.5 treatment, a high output is chosen in almost all observations, which means that workers did not conceal their type to induce a low fee in stage 2, as described in Prediction 2.*

In the q-0.5 treatment, almost all workers chose a high output in the first stage (192 of 200 observations; 96.0%), while chose few chose a low output (only in 8 of 200 observations; 4.0%). This result contradicts Prediction 2, which predicts that workers choose a low output to conceal their type.

Result 3. *In the q-0.2 treatment, a high output is chosen in almost all observations, consistent with Prediction 3.*

In q-0.2 treatment, almost all workers chose a high output in the first stage (190 of 200 observations; 95.0%), while few chose a low output (only in 10 of 200 observations; 5.0%). This result is consistent with Prediction 3, which predicts that workers choose a high output.

Result 4. *A discount factor affects the choices of highly skilled workers. The choices are significantly different between q-1 and q-0.5 treatments, and between q-1 and q-0.2 treatments.*

Mann-Whitney rank-sum test, which treats individuals as a unit of observations, shows that effort decisions are significantly different between q-1 and q-0.5 treatments ($p = 0.059$) and q-1 and q-0.2 treatments ($p = 0.064$), but not different between q-0.5 and q-0.2 treatments ($p = 0.914$).

Figure 4.1 plots the effort decisions over time. In the q-1 treatment, most participants choose high output first, and, as the time evolves, the ratio slightly decreases. In q-0.5 and q-0.2 treatments, most of the participants choose a high output, and the ratio is stable throughout the period.

Table 2 shows the regression results of the effort decision. A linear probability model with individual random effects is used, where the dependent variable is an indicator of a high output choice. Standard errors are clustered by participants. Column 1 only includes treatment dummies, where the baseline is the q-1 treatment. It shows that the participants significantly chose a high output in q-0.5 and q-0.2 treatments than in the q-1 treatment. Column 2 adds the period for each treatment as independent variables. No significant effects are observed on the output choices, although Figure 4.1 shows a decline in the choice of high output in the q-1 treatment. Column 3 controls

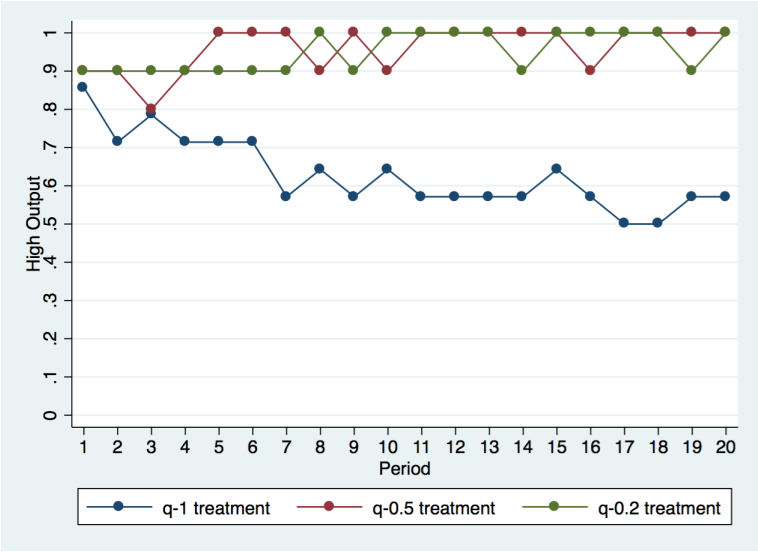

Figure 1: Effort decisions in the first stage

two individual characteristics: a female dummy[2] and a subjective math ability (from 1 to 5)[3] obtained by a post-experimental questionnaire. No significant gender differences are observed, while there is a negative estimate of the coefficient of subjective math ability. The latter result implies that participants with high math skills choose a low output to conceal their type. This result suggests that ratchet behaviors are related to cognitive abilities.

Further, the effort decisions of the workers in the second stage are discussed. Table 1 shows that almost all workers accepted the contracts and chose high output. In the second stage, the theory predicts that all workers accept contracts and choose a high output because it yields a higher payoff (and does not affect employers' payoff). Most participants behave according to this prediction, but some behave strangely despite the absence of a (direct) strategic consideration.

4.2 Choice of Rental Fees

The firm's behaviors are analyzed further. In the second stage, each firm chooses whether he or she offers a high or a low fee. The firm's decision would reflect its belief on the worker's type: if a worker chooses a high output, the firm would assume that he or she is highly talented; if a worker chooses a low output, the firm cannot update its belief on worker's type.

[2]20 participants out of 34 (58.8%) are female.

[3]The average is 3.56, and the S.D. is 1.19.

Table 2: Effort Decisions in the First Stage

Dep. var.: Choice of a High Output	(1)	(2)	(3)
q-0.5 treatment	0.331**	0.134	0.129
	(0.113)	(0.140)	(0.131)
q-0.2 treatment	0.321**	0.127	0.136
	(0.115)	(0.144)	(0.132)
Period * q-1 treatment		−0.013	−0.013
		(0.007)	(0.007)
Period * q-0.5 treatment		0.006	0.006
		(0.005)	(0.005)
Period * q-0.2 treatment		0.005	0.005
		(0.005)	(0.005)
Female			0.030
			(0.107)
Math			−0.098**
			(0.038)
Constant	0.629***	0.767***	1.098***
	(0.110)	(0.117)	(0.166)
Observations	680	680	680

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Result 5. *The firm's choice of rental fees in the second stage is significantly affected by the worker's behavior in the first stage. The choice is not affected by the discount factor (the probability proceeding to the second stage).*

Table 1 shows the firm's choice of a rental fee in the second stage. In the q-1 treatment, the firm offered a high fee only in 9.0% of all observations when he or she observes the low output produced by the worker, while the firm offered a high fee in 81.3% of all observations when a worker produces a high output. Mann-Whitney rank-sum test, with each of the 42 individual firms treated as individual observation, indicates that the difference is statistically significant ($p < .001$). This result proves that firms change their belief regarding worker's type based on their output in the first stage.

Similar results were observed in q-0.5 and q-0.2 treatments. In the q-0.5 treatment, the firm offered a high fee only in 20.0% of all observations when she observes the low output produced by the worker, while the firm offered a high fee in 71.7% of all observations when he or she observes a high output. Mann-Whitney rank-sum test with each of the 28 individual firms[4] treated as an individual observation indicates that the difference is statistically significant ($p < .001$). In the q-0.2 treatment, the firm offered a high fee in only 15.7% of all observations when he or she observes the low output produced by the worker, while the firm offered a high fee in 83.8% of all observations when he or she observes a high output. Mann-Whitney rank-sum test with each of the 21 individual firms[5] treated as an individual observation indicates that the difference is statistically significant ($p < .001$).

This behavior is consistent with the separation case, as suggested by that the theoretical model. When the separation case is the equilibrium, the choice of rental fees depends on the workers' effort output decision in the first stage; a firm chooses a high fee when he or she observes a high output and chooses a low fee on observing a low output. In this experiment, firms chose a rental fee that was highly dependent on the workers' effort decision, and this fact supports the separation case.

[4]Two individual firms are excluded from the analysis because they choose rental fees only when they observe a low output in the first stage.

[5]Eight individual firms are excluded from the analysis because they choose rental fees only when they observe a low output in the first stage. One individual firm is excluded from the analysis because they choose rental fees only when they observe a high output in the first stage.

Table 3: Firm's Decision in the second stage

	(1)	(2)	(3)	(4)
High output in Stage 1	0.657***	0.655***	0.656***	0.701***
	(0.045)	(0.045)	(0.045)	(0.056)
High output in Stage 1 × q-0.5 treatment				−0.200
				(0.115)
High output in Stage 1 × q-0.2 treatment				−0.064
				(0.092)
q-0.5 treatment	0.052	0.052	0.057	0.118*
	(0.047)	(0.047)	(0.046)	(0.060)
q-0.2 treatment	0.054	0.047	0.055	0.071
	(0.048)	(0.049)	(0.047)	(0.051)
Period		−0.004	−0.004	−0.003
		(0.002)	(0.002)	(0.002)
Female			−0.044	−0.043
			(0.036)	(0.036)
Math			0.030*	0.028
			(0.015)	(0.015)
Constant	0.104***	0.142***	0.052	0.046
	(0.022)	(0.037)	(0.065)	(0.068)
Observations	1140	1140	1140	1140

Note. Dependent variable is a dummy variable that takes value 1 if the firm chooses a high fee and takes 0 if chooses a low fee. Standard errors clustered by participants are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 shows the result of regressions that analyzes firms' behaviors. A linear probability model with individual random effects is used, where the dependent variable is an indicator of a high fee choice. Standard errors are clustered by participants. Column 1 includes an indicator variable that takes the value 1 if the matched worker chooses a high output in the first stage as an independent variable and treatment dummies. The coefficient of the high output dummy is positively significant, which implies that the firm chooses its fee based on worker's behaviors. The coefficients of treatment dummies are insignificant. Column 2 controls the period number, but it does not have a significant effect. Column 3 controls two individual characteristics: a female

dummy[6] and a subjective math ability[7]. The coefficient of subjective math ability is positive and weakly significant. Column 4 includes the interaction terms between high output dummy and each treatment dummy. These interaction terms are negative but insignificant. This result means that the effect of worker's behavior on firms' decisions does not differ between treatments.

5 Discussion and Conclusion

This experimental study tested how a discount factor affects ratcheting behaviors, which refers to an agent's behavior concealing information for later profits. The theoretical model shows that the ratcheting behavior is observed only when the discount factor is high. In other words, when the discount factor is high, the equilibrium would be the pooling case, where the agents conceal their type. When the discount factor is low, the equilibrium would be the separation case, where the agent does not conceal their type. Specifically, in our experiment, we hypothesize that ratcheting behaviors are observed in our q-1 and q-0.5 treatments, but not in the q-0.2 treatment.

The experimental results have shown that the ratcheting behaviors displayed by agents in the q-1 treatment accounted for about 40% of observations. A substantial number of agents engaged in ratcheting behavior, as indicated by a theory, but not a majority. The ratcheting behavior was almost nonexistent in the q-0.5 treatment, which means there has been a separation case has occurred, contrary to the theory. In the q-0.2 treatment, the ratcheting behaviors were absent, as predicted by theory. These results showed that an agent's behavior is affected by the probability of progressing to stage 2, that is, the discount factor. When the discount factor is high, agents benefit from hiding their type, but hiding their type becomes costlier when the discount factor is low. [8]

The percentage of low output chosen is low even for the q-1 treatment and is lower than that of Charness et al. (2011), which is about 60%. Our experimental settings were similar and both included university students as participants. Therefore, participants' attributes might lead to differences in the results.

In the study by Charness et al. (2011), the students' were engineering and business majors, while those in our experiment were varied. Thus, participants in the Charness et al. (2011) study may have experiment had higher math skills. Our experiments show that participants with higher math skills have more ratcheting behaviors. Besides, especially in business majors, students may have learned about strategic thinking.

[6] 48 participants out of 102 (41.2%) are female.

[7] The average is 3.60, and the S.D. is 1.12.

[8] Charness et al. (2011) conducted a treatment with single-stage periods. In the context of our experiment, this is seen as "q-0 treatment." Their results report that 95.36 % of highly skilled workers choose high-output, which is consistent with our experimental results.

The nationality of the participants too differed. In our experiments, participants were mainly Japanese, although this information was not directly sought, and thus may have influenced the results. Although behavioral economics studies have not found significant differences among developed countries (e.g., Pascual-Ezama et al. 2015; Hugh-Jones 2016), the interaction of culture and context may have produced this result (e.g., Gelfand et al. 2013). Given that the experiment was conducted in the context of a firm-worker relationship, the context and nationality may relate to our results.

Behavioral factors not considered in the theoretical model may have affected the results. The first possibility is risk aversion. The choice of a low output at the first stage is related to the risk of higher gains at the second stage. In particular, the q-0.5 and q-0.2 treatments would probabilistically determine whether the participant advances to the second stage. A risk-averse agent might choose a high output to avoid potential risk in the second stage. Although there are no significant differences in risk appetite among developed countries (e.g., L'Haridon and Vieider 2019), there may be cultural differences in risk perception (Weber and Hsee 1998).

In the present experiment, for a pair of a principal and a highly talented agent, the sum of their payoffs was always higher when a high output is chosen in the first stage and was constant in the second stage. [9] Therefore, if an agent considers the sum of their payoff, high output is more likely to be chosen. Falk et al. (2018) investigated global variations in economic preferences and showed that other-regarding preferences are strong in Asia, including Japan. The higher other-regarding preferences may lead participants to choose a high output.

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[9] Here, the sum of a principal and high-skilled worker's payoff is defined as $w_1 - \gamma^H e^2 + \pi_t + q(w_2 + \pi_2)$. In the complete pooling case, we get $37.5 + 100q$. Similarly, in the complete separation case, we get $50 + 100q$. It implies that the complete pooling case is never optimal.

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Appendix

This section provides the experimental instruction.

Experimental Instruction (English Translation)

1. We thank you for participating in the experiment on decision-making. During this session, you can earn money. The amount of your earnings depends on your decisions and those of the other participants. During the session, your earnings will be calculated in your Points, as follows:

   $$1 \text{ Point} = 1 \text{ Yen}$$

   The session consists of two stages, each including 20 periods. Your earnings during the two stages will be added up and converted into yen. Note that a fraction smaller than 10 yen of your earnings is rounded up. In addition, you will receive 1000 yen for participating in the experiment. Your earnings will be paid to you in cash in private.

2. Your decisions are anonymous and confidential.

3. There are three categories of players:

   Firm, High-productivity worker, Low-productivity worker

   The number of firms is equal to that of workers. The high-productivity workers represent one-third of the total number of workers. For example, as in this session, 15 participants are firms, 5 participants are high-productivity workers, and 10 participants are low-productivity workers. The low-productivity workers are not human-subjects but computer-subjects.

4. During each period, a firm is matched with one randomly chosen worker. Firms do not know this worker's productivity. The chances are 33% that they are matched with a high-productivity worker. The chances are 67% that the firms are matched with a low-productivity worker. At each new period, firms and workers are re-matched randomly.

5. You are allocated the role of either a firm or a high-productivity worker at random. You will be informed of your role at the beginning of the session, and you will maintain the same role throughout 20 periods.

Stage 1

1. Each one of the firm is the owner of a food concession stand on a university campus. They are willing to rent their stands to the worker for one week. The firm charged a rental fee of 15 Points to use the stand. The rental fee is the only source of earnings of the firm.

   - If the worker rejects an offer, the firm and the worker earn 0 Point.

- If the worker accepts an offer and rents a stand, he or she buys all his supplies for the week and keeps all the proceeds from sales.

2. The worker who rents the stand chooses to deliver either a low output (i.e., serving a low number of customers) or a high output in the week (i.e., serving a high number of customers).

3. As mentioned earlier, the low-productivity workers are computers in this experiment. They always accept an offer from a firm, and choose the low output. Therefore, the firm who rents the stand to a low-productivity worker earns automatically 15 Points.

4. A high-productivity worker earns 22.5 Points net if he or she chooses the low output and he or she earns 35 Points net if he or she produces the high output. In both cases, the firm that rents the stand to a high-productivity worker earns 15 Points.

5. The net payoff in Point associated with possible decisions of the participants are summarized in the following table:

High-productivity worker's choice	Firm's payoff	High-productivity worker's payoff
Rejects the offer	0	0
High output	15	35
Low output	15	22.5

Low-productivity worker's choice	Firm's payoff	Low-productivity worker's payoff
Low output	15	-

6. The timing of decisions is as follows:

   - The firm offers to rent the stand to a worker for 15 Points.
   - If the worker is a low-productivity worker (i.e., a computer-worker), it accepts the offer of one firm chosen randomly and it chooses the low output.
   - If the worker is highly productivity, he or she chooses between accepting and rejecting the offer. If he or she accepts the offer, he or she chooses between the low and the high output.
   - Decisions by a worker are displayed.
   - One's own payoff is displayed and the stage 1 ends.

Stage 2

1. In this session, the probability of proceeding to stage 2 is 50%. It displays whether this period continues to stage 2 or not. If this period does not continue to the stage 2, the period ends, and continues to the next period automatically.

2. For the right to use their concession stand for the next two weeks, the firm chooses to charge a rental fee of either 30 or 66 Points.

   - If the worker rejects the offer, the firm and the worker earn 0 Points in stage 2.
   - If the worker accepts the offer, he or she chooses to deliver either a low output or a high output in the next two weeks.

3. The low-productivity computer-worker always rejects the high rental fee offer of 66 Points. It always accepts the low rental fee offer of 33 Points and chooses the low output. A firm who is matched with a low-productivity worker earns 30 Points if he or she chooses the low rental fee and 0 if he or she chooses the high rental fee.

4. The net payoffs in Point associated with each possible decision of the participants in stage 2 if the firm charges the low rental fee (30 Points) are summarized in the following table. Note that the payoffs are just two times the payoffs in stage 1.

High-productivity worker's choice	Firm's payoff	High-productivity worker's payoff
Rejects the offer	0	0
High output	30	70
Low output	30	45

Low-productivity worker's choice	Firm's payoff	Low-productivity worker's payoff
Low output	30	-

5. The net payoffs in Point associated with each possible decision of the participants in stage 2 if the firm charges a high rental fee (66 Points) are summarized as follows:

High-productivity worker's choice	Firm's payoff	High-productivity worker's payoff
Rejects the offer	0	0
High output	66	34
Low output	66	9

Low-productivity worker's choice	Firm's payoff	Low-productivity worker's payoff
Rejects the offer	0	-

6. Timing of decisions in the stage 2 is the following:
   - It is displayed whether this period continues to stage 2. If this period does not continue to stage 2, the firm and the worker earn 0 Point. If this period continues, then the timing in stage 2 is as follows.
   - The firm chooses between a low rental fee (30 Points) and a high rental fee (66 Points). The worker receives the offer.
   - If the worker is a low-productivity computer-worker, it rejects the offer if the firm proposes the high rental fee. It accepts the offer if the firm offers a low rental fee. If it accepts this offer, it chooses the low output.
   - If the worker is a high-productivity worker, he or she chooses between accepting and rejecting the offer. If he or she accepts the offer, he or she chooses between low and high output.
   - The firm is informed of the worker's choice. The firm is not informed whether he or she is matched with a high-productivity or a low-productivity worker.
   - Own payoffs in the stage 2 and for the whole period are displayed. The payoff of the period is the sum of the payoffs of each stage.
7. A new period starts automatically at the end of a period. Each period is independent. Firms and workers are re-matched randomly at the beginning of each new period.