

Adding a Stick to the Carrot?
The Interaction of Bonuses and Fines
Supplementary Material: Experimental Procedures and Instructions

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This file describes the experimental procedures and contains the instructions for employers of the experiments reported on in our paper. The employee instructions are very similar and available from the authors upon request.

The experiments were conducted in Munich in November 2001. The subjects were undergraduate students of the natural sciences, engineering, law, political science and mathematics from the University of Munich and the Technical University of Munich. We did not use subjects from economics, business administration and psychology.

The roles of employer and employee were assigned randomly such that no subject interacted more than once with any other subject. Employers and employees were sitting in two different rooms, each subject at a separate table. The subjects were asked to read the instructions and to solve the exercises, which lasted for 30-40 minutes. If they had any questions they could privately ask the experimenter. We did not allow for any public communication. After each period, the subjects had to compute their own payoff and that of their partner. The outcome of each period remained strictly confidential in order to rule out the possibility of reputation building, that is, each principal-agent pair only observed what happened in their own relationship. They did not observe the contracts offered by the other subjects in the room, nor did they observe their current partner's past behavior. After the experiment subjects left the laboratory one after the other and collected their payoffs individually in a separate room without meeting any other subject.

Each subject received an initial endowment of €10 (\approx US \$12.5 at the time of the experiment). The experimental (token) payoffs were converted into real money at the rate of 1 token = €0.1. The average payoff was about €30.75 (US \$38.44). The highest total income was €53 (US \$76.25). However, the subjects could also incur substantial losses. In order to avoid the possibility of having a subject finish with negative earnings, he was expelled from the experiment if his accumulated earnings fell below €2.50 (US \$3.12); this happened to one principal who could not complete the last period for this reason. Each session lasted between 2 and 2½ hours.

Employer Instructions:

Introductory Remarks

The experiment you are participating in today is part of a research project financed by the Deutsche Forschungsgemeinschaft. Its purpose is to analyze economic decision making. Your income consists of an initial endowment of DM 20 that every participant gets, and a sum of money you can earn during the experiment, depending on your and your decision and the decisions of the other participants. During the experiment, your income is calculated in tokens. DM are converted into tokens by the following rate:

$$1 \text{ token} = 0.20 \text{ DM}$$

Your endowment of 20 DM corresponds to 100 tokens. In addition you get an additional endowment of 25 tokens, so that you have **125 tokens** altogether to cover potential losses. If your losses exceed 115 tokens, you have to quit the experiment. **However, you can always avoid losses with certainty if you wish to do so.**

At the end of the experiment all gains resulting from your decisions during the experiment will be added and, in addition to the endowment, paid to you in cash immediately.

First of all you should now carefully read these instructions. After having done so, please answer the control questions, which you find at the end of these instructions. After all participants have answered the questions correctly, the experiment begins.

Without any exception, all written information you received from us is for your private use only. You are not allowed to pass over any information to other participants in the experiment. Talking during the experiment is also not permitted. Violations of these rules would force us to stop the experiment. If you have any questions, please ask us.

General Information

0. The participants are split up in employers and employees. **During the whole experiment, you are playing the role of an employer.** The experiment lasts for **10 periods**. In each period each employer is matched with a different employee. The employer has to make an offer to the employee, who can accept or reject this offer. In every period a new employee is matched to the employer in order to ensure that the same employer and employee are matched together only once in the experiment. No employer gets to know the identity of the matched employees, nor do the employees know with whom they are dealing. Your decisions in one period are transmitted only to the employee matched with you in that period. No one else is informed about your decisions.

In the following instructions we use male and female terms in an alternating fashion in order to indicate that both, employer and employee may be of female or male gender.

1. Every period consists of **3 stages**. At **stage 1** every employer has to decide which type of offer to make to her employee. She can choose between a **bonus offer** and an **offer with potential wage deduction and bonus**.

A **bonus offer** consists of 3 components:

- a fixed wage w ,
- a demanded level of effort e^* and
- an announced bonus b^* , which could be given to the employee as an additional grant.

An **offer with potential wage deduction and bonus** consists of 4 components:

- a fixed wage w ,
- a demanded level of effort e^* ,
- a potential wage deduction z , which has to be paid by the employee with some probability if his effort falls short of the demanded effort
- an announced bonus b^* , which could be given to the employee as an additional grant.

If the employer chooses an offer with potential fine and bonus, then she has to set a fixed wage w , a potential wage deduction z , and an announced bonus b^* , while if she chooses a bonus offer, she has to set only a fixed wage w and an announced bonus b^* . If the employer chooses an offer with potential wage deduction and bonus and if this offer is accepted, the employer has to incur a **fixed cost of 10 tokens**. No such fixed cost has to be incurred with a bonus offer. After all employers have come to a decision, the offers are transmitted to the employees.

2. At **stage 2**, every employee has to decide whether to accept or reject the offer. The decision has to be written on the employee's decision sheet.

If an offer is rejected, this period is over for the respective employer and his employee. They both earn 0 tokens in this period.

If the employee **accepted the offer**, he has to decide how much he actually wants to work. He does so by writing the **actual effort level e** on the decision sheet.

The actual e is allowed to differ from the demanded effort level e^* , i. e., it may be higher, lower or equal to e^* . Effort is costly to the employee. By choosing e , he has to incur a certain cost c . After the employees have chosen their effort levels, this information is transmitted to the corresponding employers.

3a. **Stage 3** (if an **offer with potential wage deduction and bonus** was accepted): The employer chooses, after observing the actual effort level of the agent, which actual bonus b to pay. The actual bonus may be larger, equal, or smaller than the announced bonus b^* . Thereafter, the employer has to throw a dice.

If the employee chose an actual effort level that *equals the demanded effort level or is even higher* then **no wage deduction occurs**.

If the employee worked **less** than was demanded, and the dice showed the numbers **1 or 2**, then the employee has to **incur the wage deduction** that was set at stage 1.

If the employee worked **less** than was demanded, and the dice showed the numbers **3, 4, 5 or 6**, **no wage deduction occurs**. On average if the employee worked less than was demanded, he has to pay the fine in 1 out of 3 cases.

3b. **Stage 3** (if a **bonus offer** was accepted): In this case the employer also has to throw a dice in order to not let the other employers know what kind of offer was chosen. We want the employers to be absolutely unaffected by the other employers' decisions. The result of the throw of the dice is of course completely meaningless. After that the employer has to choose the level of the actual bonus. The actual bonus b is allowed to differ from the announced bonus b^* , i. e., b may be lower, equal or higher than b^* .

- After the experimentors have informed all employees about the results of the dice throw and the actual bonus payments of their employers, stage 3 is over. After that a new period begins.

Detailed information for employers

Please keep to the following rules and orderings:

1. The employer's decision about the type of offer and the details of that offer are made by writing the corresponding information on the decision sheet of the current period.
2. Some remarks about the **demanded effort level**: there are 10 possible effort levels, the lowest possible effort level is 1, the highest is 10. Your profit depends on the effort level e , which the employee actually chooses, it does not depend on the demanded effort level e^* . You earn 10 tokens per actually spent effort unit. If the employee works 1, you earn 10 tokens. If the employee decides to work 5, you earn 50 tokens etc. Effort is costly for the employee. By choosing a certain effort level the employee has to incur a cost c . The higher the actual effort level is, the higher is the cost for the employee. **You find a table showing the possible effort levels and the corresponding cost for the employee on an extra sheet, on which we summarized the rules of**

the experiment. All employees have exactly the same costs of effort and therefore an identical table.

3. Rules concerning the bonus offer:

- The fixed wage w has to cover the cost of the demanded effort level e^* . If you demand e. g. an effort level of 5, the wage has to be at least 6, because an effort level of 5 implies a cost of 6 for the employee, as you can see from the table.
- The sum of fixed wage w and announced bonus b^* must not be greater than 100 tokens.
- The sum of fixed wage w and actual bonus b must not be greater than 100 tokens.

4. Rules concerning the offer with potential fine and bonus:

- The fixed wage w has to cover the cost of the demanded effort level e^* . If you demand e. g. an effort level of 5, the wage has to be at least 6, because an effort level of 5 implies a cost of 6 for the employee.
- The fixed wage w must not exceed **100 tokens**.
- The potential wage deduction must not exceed **13 tokens**.

Calculation of profit and income at the end of a period

At the end of a period, several different situations are possible:

1. Your employee **rejected** your offer. In this case your profit in this period is **0 tokens**.
2. If an offer was accepted, the calculation of profit and income depends on the kind of offer you made to the employee. If you choose a **pure bonus offer** you don't have to incur any fixed cost. In this case, your and your employee's earnings are calculated in the following way:

$\begin{aligned} \text{Your profit } P &= 10 \times \text{actual effort level } (e) - \text{fixed wage } (w) - \\ &\quad - \text{actual bonus } (b) \end{aligned}$

$\begin{aligned} \text{Employee's income } I &= \text{fixed wage } (w) + \text{actual bonus } (b) - \\ &\quad - \text{cost of actual effort level } c \end{aligned}$

3. If an offer with potential wage deduction and bonus was accepted you have to incur a fixed cost of 10 tokens in any case. 3 cases have to be distinguished, depending on whether the employee has to pay the fine or not.
 - (a) **The employee worked more than or exactly what was demanded.** In this case, the employee never has to incur the wage deduction. Your profit and the employee's income are calculated in the following way:

Your profit P	=	10 x <i>actual</i> effort level (<i>e</i>) – fixed wage (<i>w</i>) – actual bonus (<i>b</i>) - fixed cost (<i>10</i>)
Employee's income I	=	fixed wage (<i>w</i>) + actual bonus (<i>b</i>) – cost of actual effort <i>c</i>

- (b) **The employee worked less than was demanded and the dice shows the numbers 1 or 2.** In this case, the employee has to incur the wage deduction. Profit and income are calculated in the following way:

Your profit P	=	10 x <i>actual</i> effort level (<i>e</i>) – fixed wage (<i>w</i>) – – actual bonus (<i>b</i>) - fixed cost (<i>10</i>) + wage deduction (<i>z</i>)
Employee's income I	=	fixed wage (<i>w</i>) + actual bonus (<i>b</i>) – wage deduction (<i>z</i>) – cost of actual effort <i>c</i>

- (c) **The employee worked less than was demanded and the dice shows the numbers 3, 4, 5 or 6.** In this case, the employee does not have to incur the wage deduction. Profit and income are calculated in the following way:

Your profit P	=	10 x <i>actual</i> effort level (<i>e</i>) – fixed wage (<i>w</i>) – actual bonus (<i>b</i>) - fixed cost (<i>10</i>)
Employee's income I	=	fixed wage (<i>w</i>) + actual bonus (<i>b</i>) – cost of actual effort <i>c</i>

Every participant knows all the details of the profit and income calculation. So every employer can not only calculate her own profit but also her employee's income. In addition, your employee is able to calculate your profit.

Please remember that you have to calculate your own profit and your employee's income on your decision sheet at the end of each period.

If you have any questions, please ask us.

Control questionnaire

Please calculate your profit in tokens and, if asked for, also the employee's income. Missing answers lead to the loss of all profits you'll earn during this experiment. Wrong answers have no consequences for you. Please write down the complete calculation, not only results.

1. Your offer was rejected. What's your profit and your employee's income?

Your profit:

Employee's income:

2. You choose a demanded effort level of 7.

- (a) What is the highest allowed wage?
- (b) What is the minimum wage you have to set?
- (c) What is the highest possible potential wage deduction?
- (d) What is the highest allowed sum of fixed wage and announced bonus?

3. You chose the following pure bonus offer:

fixed wage = 20

demanded effort level = 8

announced bonus = 25

- (a) Your employee chose an actual effort level of 8 and the actual bonus payment is 25.
What is your profit?
What is your employee's income?
- (b) Your employee chose an actual effort level of 8 and the actual bonus payment is 18.
What is your profit?
What is your employee's income?
- (c) Your employee chose an actual effort level of 2 and the actual bonus payment is 5.
What is your profit?
What is your employee's income?
- (d) Your employee chose an actual effort level of 2 and the actual bonus payment is 0.
What is your profit?
What is your employee's income?

4. You chose the following **offer with potential wage deduction and bonus** that is identical to the pure bonus offer of exercise 3 except for the potential fine.

fixed wage = 20

demanded effort level = 8

potential wage deduction = 13

announced bonus = 25

- (a) The employee chose an actual effort level of 8, the actual bonus is 25, and you have thrown number 1.
What is your profit?
What is your employee's income?
- (b) The employee chose an actual effort level of 8, the actual bonus is 18, and you have thrown number 6.
What is your profit?
What is your employee's income?
- (c) The employee chose an actual effort level of 2, the actual bonus is 5, and you have thrown number 1.
What is your profit?
What is your employee's income?
- (d) The employee chose an actual effort level of 2, the actual bonus is 0, and you have thrown number 5.
What is your profit?
What is your employee's income?

5. You chose the following pure bonus offer:

fixed wage = 6

demanded effort level = 5

announced bonus = 14

- (a) Your employee chose an actual effort level of 5 and the actual bonus payment is 14.
What is your profit?
What is your employee's income?
- (b) Your employee chose an actual effort level of 7 and the actual bonus payment is 30.
What is your profit?
What is your employee's income?
- (c) Your employee chose an actual effort level of 5 and the actual bonus payment is 0.
What is your profit?
What is your employee's income?
- (d) Your employee chose an actual effort level of 1 and the actual bonus payment is 0.
What is your profit?
What is your employee's income?

6. You chose the following **offer with potential fine and bonus** that is identical to the pure bonus offer of exercise 5 except for the potential fine.

fixed wage = 6

demanded effort level = 5

potential fine = 9

announced bonus = 14

- (a) The employee chose an actual effort level of 5, and the actual bonus is 14.
What is your profit?
What is your employee's income?
- (b) The employee chose an actual effort level of 7 and the actual bonus is 30.
What is your profit?
What is your employee's income?
- (c) The employee chose an actual effort level of 5, the actual bonus is 0, and you have thrown number 2.
What is your profit?
What is your employee's income?
- (d) The employee chose an actual effort level of 1, the actual bonus is 0, and you have thrown number 3.
What is your profit?
What is your employee's income?
- (e) The employee chose an actual effort level of 1, the actual bonus is 0, and you have thrown number 1.
What is your profit?
What is your employee's income?

After you answered all questions correctly, please take a look at all questions and results again in order to get an overview over the structure of the experiment

Thereafter, think carefully about your decisions in the first period.