Incentives and Organizations

Solution Sketch

Question 1 (overall weight = 30%)
Consider the following principal-agent model with one principal, P, and a risk-neutral agent, A. The agent chooses an effort level, $e \geq 0$. The output produced by the agent, y, is the sum of the agent's effort and an exogenous noise term, ε:

$$y = e + \varepsilon.$$

ε is drawn from a normal distribution with mean 0 and variance $\sigma^2 > 0$. Exerting effort level e causes effort costs $C(e) = \frac{1}{4} ce^2$.

The agent is paid according to a linear incentive contract such that her income is $w = s + by$. Her utility is given by $u(w,e) = w - C(e)$. Finally, suppose that her utility from an outside option is 0.

The principal P is risk neutral and maximizes her expected profit, $E(\pi) = E(y - w) = e - s - be$

a) What is A's optimal effort choice e^* for a given s and b?

The agent maximizes his utility w.r.t. e:

$$\max_{e} u(w, e) = s + be - \frac{1}{4}ce^2$$

$$\text{FOC (incentive constraint, IC): } b - \frac{1}{2}ce = 0$$

The agent's optimal effort is thus $\qquad e^* = 2\frac{b}{c}$

b) Derive the parameters of the optimal incentive pay contract b^* and s^* that P should offer to the agent to maximize P's profit.

The principal maximizes her payoff subject the incentive constraint (IC) and the participation constraint (PC):
$$\max_{e,s,b} e - s - be$$
$$\text{subject to (IC): } b - \frac{1}{2}c\,e = 0$$
$$\text{and (PC): } s + be - \frac{1}{4}e^2 \geq 0$$

Solving the constrained optimization problem, e.g., via Lagrange method (omitted here; see lecture notes for detailed derivation) yields
$$b^* = 1, s^* = -1/c$$

c) Show that the optimal incentive contract from part b) elicits the socially optimal (i.e., "first-best") level of effort.

From part a), b) it follows that   *e* = 2b*/c = 2/c*

Social optimum (maximize sum of agent's + principal's payoff):

$$\max_{e} s + be - \frac{1}{4} e^2 + e - s - be$$
$$FOC: 1 - \frac{1}{2} ce = 0$$
$$e^{FB} = 2/c$$

d) Assume now that the principal interacts with another agent, agent B, who is risk averse. Explain why the optimal linear incentive contract in this case is generally not "first-best" anymore (i.e., the optimal contract for a risk-averse agent does not elicit the socially optimal level of effort).
   - NOTE: You don't need to derive the optimal contract formally. Explain verbally, building your arguments on the "incentive-insurance trade-off".

The linear incentive contract that elicits the first-best effort level involves a commission rates of b=1: To have first-best incentives, the agent needs to reap all the gains from his production, i.e., the firm is "sold" to the agent and the commission rate is set to b=1. Under this contract, however, the agent also bears 100% of the risk from random output fluctuations.

If the principal is risk neutral and the agent is risk averse, this risk sharing of is not optimal. Instead, the principal is better off when offering the agent some "insurance" through a higher fixed salary and a lower commission rate. The optimal contract balances this incentive-insurance tradeoff. But due to the lower commission rate, it elicits less effort than socially optimal.

Question 2 (weight = 35%)
The following questions are based on the study "Performance Pay and Multidimensional Sorting: Productivity, Preferences, and Gender" by Dohmen and Falk (2011).

a) Explain briefly what "worker sorting" and the selection effects of compensation schemes mean.

- *Workers differ in terms of personal characteristics such as productivity, personality, or preferences (e.g., risk preferences, social preferences, competitive inclination).*
- *Because of these differences, different types of workers might find different compensation schemes more/less attractive.*
- *For examples, a compensation scheme with strong focus on individual performance pay might be particularly attractive for more productive / less risk averse / more competitive agents. Other types of workers might feel more attracted to different compensation schemes, e.g., with stronger focus on fixed salary or group-level pay.*
- *The characteristics of the compensation scheme therefore affects what type of workers want to take up a given job, i.e., which type of worker "sorts" or "selects into" a given job.*

b) How do Dohmen and Falk test for sorting effects in their experiment?

- Describe the setup and the authors' empirical strategy to identify sorting effects.
- Restrict your attention to the "Piece Rate Treatment" and focus on the key aspects of their design that allow them to test for sorting effects.

They use a lab experiment to study sorting. Key ingredients of their empirical strategy to analyze sorting (see lecture notes for details):
- o *First, measure productivity for all participants under the same incentive scheme*
- o *Second, measure sorting decision: each worker can decide between a piece-rate scheme and a fixed-wage scheme. The available schemes are exogenously given by the experimenters.*
- o *Third, measure performance of workers under the selected incentive scheme: measure incentive effects, conditional on sorting.*

c) Discuss the role of productivity and preferences in employee sorting, using the following estimation table:
- Sketch briefly (!) how the authors measured individuals' productivity and the different preferences/attitudes.
- Explain the effects presented in the table and discuss whether they are in line / in conflict with the predictions of the standard principal-agent model.

Measures:
- *DF measure risk attitudes, social preferences (trust and reciprocity), and beliefs about one's own ability (self-assessment) with various incentivized experiments (e.g., lottery choices for risk attitudes). See Slides 10-11 in Section 3 for details.*
- *DF measure individual productivity with 3 different productivity indicators that are related to the work task used in the main experiment (but measured before / independently of the work phase after the sorting decision). The productivity indicator 3 used in the estimation table measures how many tasks individuals solve while working for 5 minutes under a piece-Rate with 10 P per correct answer.*

Outcomes:
- *Subjects with higher productivity are significantly more likely to sort into piece-rate scheme*
- *More risk tolerant subjects are significantly more likely to sort into piece-rate scheme*
- *Subjects with higher trust level are marginally more likely to sort into PR scheme*
- → *All these results hold in a specification that controls for all the other factors / attitudes depicted in the table*
- *Similarly, gender, reciprocity and relative self-assessment have no significant influence, once controlling for productivity, risk attitudes, etc.*

Interpretation:

- *Effects of productivity and risk attitudes are consistent with principal agent model → See slides from Sections 1, 2, 3 for details*
- *Standard PA model is silent on trust, so influence of trust is neither in line nor in conflict with the model*
- *For the same reason, none of the other (non-)results are in conflict with PA model*

Table: Determinants of Sorting

Dependent variable	1 if piece rate (1)
Productivity indicator 3	0.044***
	[0.009]
Risk attitude	0.053***
	[0.015]
Relative self-assessment	0.003
	[0.015]
Trust (amount sent)	0.002*
	[0.001]
Reciprocity	0.006
	[0.041]
1 if female	0.029
	[0.121]
Pseudo R^2	0.410
Observations	120

Notes: Probit estimates. Marginal effects (evaluated at the mean of independent variables) reported; * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors clustered for sessions are reported in brackets below the marginal effects estimates. The smaller the value of the self-assessment variable is, the more productive a subject thinks he is relative to others.

d) Are women more or less likely than men to choose the performance-dependent piece-rate scheme in Dohmen and Falk's experiment? Substantiate your response using the table from part c) as well as further evidence discussed in the paper.

Overall, women are significantly less likely to choose the PR scheme (see paper). After controlling for differences in productivity and preferences (i.e., conditional on differences in these factors), the gender effect vanishes (see table above). Further evidence from the paper indicates that the gender differences in choosing the PR scheme is primarily driven by gender differences in risk attitudes (women are more risk averse).

e) Why is it important for firms to consider sorting effects when designing their compensation schemes? Please explain.

- *Firms can try to strategically use sorting effects to attract specific types of workers (type often unobservable, incentives might be used as screening device)*
- *Avoid "accidental" sorting effects (e.g., attracting "wrong types", increasing dissatisfaction and turnover after change in compensation scheme)*

Question 3 (weight = 20%)

Consider the following figure, which is based on the study "A Fine is a Price" by Gneezy and Rustichini (2000).
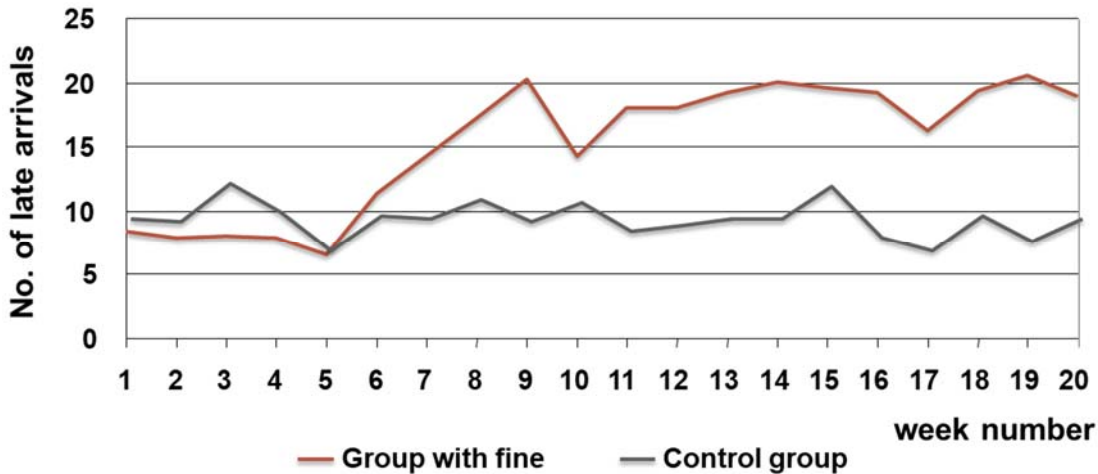
a) In the paper, the authors study how fines for coming late in child care centers affect parents' behavior. Discuss in detail how the authors test for the impact on fines (i.e., describe their empirical strategy).

See slide 46-47 of lecture notes on "Recprocity and instrinsic Motivation" for design sketch

b) What should the effect be of a fine according to standard economic arguments? Please also explain *why* there should be an effect / no effect.

Costs for coming late increases → should c.p. lead to reduction in frequency of late arrivals

c) Are the findings in line with the idea that extrinsic incentives crowd out of intrinsic motivation? Explain what parts of the findings are consistent with the crowding-out hypothesis, and how Gneezy and Rustichini's findings have contributed to earlier findings in the psychology literature.

Increase in late-coming parents both during *incentive phase and* after *fine has been removed is in line with crowding out of intrinsic motivation. Contributions:*
  - *Effects observed during incentivized period. Additional persistent effect after incentive has been taken away (in line with Deci's evidence)*
  - *Effects also observed for "negative" incentives (i.e., monetary fines instead of rewards)*

d) Are there also potential other explanations for the observed effects? Discuss at least 1 alternative explanation that is consistent with the empirical results depicted in the figure.

Different alternative interpretations possible
  - *Negative reciprocity*
  - *Information / signaling (about appropriate behavior or value / costs of late-arrivals)*
  - *Deterioration of social norms*

(for full credit, answer needs to explain how alternative mechanism can explain both immediate and long-run/persistent effect after fine has been taken away)

Question 4 (weight = 15%)

a) Give at least one reason for, and one against, strong performance-related incentives. Explain using theories and empirical findings learned in the course.

Different replies possible. See lecture notes for detailed explanations and examples. Examples:
+ incentive / performance effects
+ / - Sorting effects
+/ - Fairness/ social preferences (equitable pay inequality vs. performance pay not necessary if agents reciprocal)
- *Gaming / multitasking effects*
- *Crowding out of intrinsic motivation*
- *Monitoring costs*
- *Repeated game incentives might make performance pay unnecessary*
- *Sabotage / deterioration of team-work*

…

b) Give at least two distinct reasons why workers may exert more than the minimum required / contractually enforceable effort.

Different replies possible. See lecture notes for detailed explanations and examples. Examples:
- *Reciprocity*
- *Repeated-game incentives (prospect of earning future rents)*
- *Intrinsic motivation*
- *Career concerns (signalling of ability to other employers)*
- *…*