

Written Exam at the Department of Economics winter 2016-17

**Incentives and Organizations**

Final Exam

December 20, 2016

(3-hour closed book exam)

Note: The following illustrations are a sketch of how to solve the exam questions, rather than a full-fledged "solution manual". Some derivations of results are omitted for brevity and some responses only exemplify possible solutions to the questions (in both cases, further details can be found in the lecture notes of the respective sections).

**Question 1: (overall weight = 30%)**

- a) What is a "self-enforcing relational contract"?
- *Not a formal contract, but rather an informal agreement:*
  - *although it is based on outcomes that are non-verifiable, agreement is "self-enforcing". That is, the "contracting" parties do have incentives to stick to the agreement,*
  - *typically because of long-run incentives in repeated games (e.g., future benefits from cooperation, threat of punishment)*
- b) Describe an empirical regularity that is puzzling from the perspective of the static (one-shot) principal-agent model, but could be explained as the outcome of a relational contract.
- *Prevalence of simple fixed-wage / salary contracts, even in situations where performance pay would be feasible.*
  - *Prevalence of informal agreements in organizations, like subjective performance evaluation, voluntary discretionary bonuses, etc.*
- c) The presence of future rents is important to prevent shirking in relational contracts. Provide two examples of what may give rise to such rents in employer-employee relationships.
- *Agents: earn high wages in future periods.*
  - *Agents: qualify for new, better paid job within organization (promotions) or elsewhere (career concerns)*
  - *Agents: avoid loss of job if currently paid high wages*
  - *Principals: stick to voluntary bonus promise to avoid discouragement and shirking of workers*
  - ...

d) Discuss the following statement:

*"To successfully establish relational contracts, it is crucial that the relationship has an infinite duration (i.e., that the contracting parties play an infinitely repeated game)."*

Do you agree with the statement? Why / why not?

- *Relational contracts also feasible in finite games...*
  - o *...with uncertain duration (e.g., relationship dissolving probabilistically because of exogenous shocks)*
  - o *...with fair-minded / reciprocal agents (voluntary cooperation of reciprocal types may generate final-period rents and thus performance incentives for all types in pre-final periods).*
- *But: possibility of infinite relationship duration (as well as high levels of patience) indeed facilitate emergence of cooperative outcomes, enforced by long-run / future rents (part c)*

e) Why is difficult to demonstrate empirically that relational contracting is the driving force behind individuals' behavior in an employer-employee relationship or other organizational settings?

- *Relational contracts are based on informal, non-verifiable outcomes: by definition, these are hard to observe empirically.*
- *Observational equivalence: outcomes that are consistent with relational contracting can also arise due to other motives. E.g., prevalence of fixed-wage contracts can be "explained" by relational contracting, but also by gift exchange / reciprocity, or (avoidance of) multi-tasking problems.*
- *Repeated games often give rise to multiple equilibria: unclear whether parties do not use relational contracting, or simply play a different equilibrium.*

**Question 2: (35%)**

Consider the following rank-order tournament with two risk-neutral agents ( $i = A, B$ ) who produce output  $y_i$  by individually and independently exerting effort  $e_i$ .

The output produced by agent  $i$  is the sum of the agent's effort and an idiosyncratic noise term,  $\varepsilon_i$ :

$$y_i = e_i + \varepsilon_i$$

Assume that  $\varepsilon_A, \varepsilon_B$  are drawn independently from a uniform distribution  $\varepsilon_i \sim U[-q, q]$  with  $q=5$ .

Agents  $A, B$  are rewarded based on the following rank-order "tournament" reward scheme:

$$w_A = \begin{cases} W = 25 & \text{if } y_A > y_B \\ w = 15 & \text{if } y_A < y_B \end{cases}$$
$$w_B = \begin{cases} w = 15 & \text{if } y_A > y_B \\ W = 25 & \text{if } y_A < y_B \end{cases}$$

That is, the agent who produces more output than the other agent receives a "winner prize" of  $W=25$ , whereas the agent with the lower output receives a "loser prize" of  $w=15$ . (For sake of completeness, assume that prizes are awarded randomly in case of a tie, i.e., if  $y_A = y_B$ )

Both agents are risk-neutral and maximize a utility function of the following form:

$$u_i = E[w_i] - C(e_i),$$

where  $E[w_i]$  is the expected reward received by agent  $i$ , and

$$C(e_i) = \frac{1}{10}e_i^2$$

is agent  $i$ 's effort-cost function.

- a) Write down the agents' maximization problem and derive the first-order conditions for agents A and B.

*Agent A:*

$$\begin{aligned} \max_{e_A} E(u_A) &= \text{Prob}\{y_A > y_B\}[W - C(e_A)] + \text{Prob}\{y_A < y_B\}[w - C(e_A)] \\ &= \text{Prob}\{\epsilon_B - \epsilon_A < e_A - e_B\}[W - C(e_A)] + [1 - \text{Prob}\{\epsilon_B - \epsilon_A < e_A - e_B\}][w - C(e_A)] \\ &\equiv G(e_A - e_B)[W - C(e_A)] + [1 - G(e_A - e_B)][w - C(e_A)] \\ &= w + G(e_A - e_B)[W - w] - C(e_A) \end{aligned}$$

$$\text{FOC: } g(e_A - e_B)[W - w] = C'(e_A)$$

$$\text{Analogous derivation for Agent B yields FOC: } g(e_A - e_B)[W - w] = C'(e_B)$$

- b) Solve for the symmetric equilibrium in pure strategies (i.e., assume that  $e_A = e_B = e^*$  in equilibrium and solve for  $e^*$ ).
- Note: Remember that  $g(0) = \frac{1}{Z}$  for a symmetric triangular distribution with density  $g$  and support  $[-Z, Z]$ .

$$\begin{aligned} g(0)[W - w] &= C'(e^*) = \frac{2e^*}{10}, \text{ with } g(0) = 1/2q \\ \implies e^* &= \frac{[W - w]5}{2q} = 5 \end{aligned}$$

- c) How does the agents' effort in the symmetric equilibrium change if  $q = 4$  instead of  $q = 5$ ? What is the intuition behind this result?

$$e^* = \frac{[W - w]5}{2q} = \frac{50}{8} = 6.25$$

- With  $q = 4$  instead of  $q = 5$ , the tournament is "less noisy".

- *The relative importance of the agents' effort in determining the tournament outcome thus increases.*
- *Holding prize structure and effort-cost functions constant, this increases agents' incentives to provide high efforts in equilibrium.*

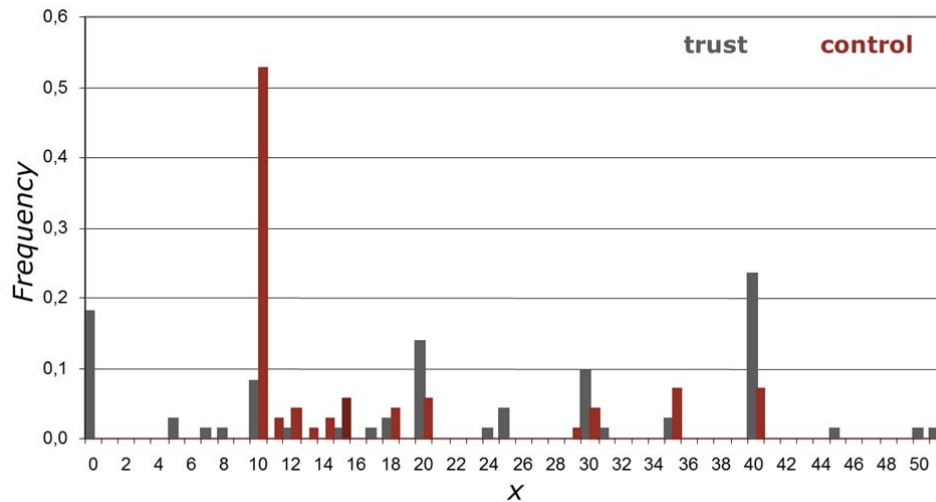
d) What are practical advantages and potential problems of rank-order tournaments in organizations, compared to compensation systems that rely on individual performance pay (e.g., piece rates)? Describe at least 2 advantages and 2 potential problems.

- + *only ordinal information needed / individual output does not need to be verifiable*
- + *Principal knows wage costs ex-ante*
- + *Selection effects (well-designed tournament may pick most able contestants as winners)*
- + *Filtering out of common shocks*
- *Risk of collusion among agents*
- *Sabotage between agents*
- *Selection on basis of "wrong" / unintended variables (e.g., competitiveness rather than ability)*
- *Some tournaments may induce excessive risk taking*

→ see lecture notes to Section 9 for further examples and explanations

**Question 3 (25%):**

Consider the following figure, taken from the paper "The Hidden Costs of Control" by Armin Falk and Michael Kosfeld (2006 AER).



a) What is the research question of the paper?

- *How do agents perceive the principal's decision to control, and how does this affect the agents' behavior? In particular: does control entail a "hidden cost" of reducing the agents' willingness to (voluntarily) act in the principal's interest?*

b) Sketch the design of the experiment from which the figure above was taken. How does this experiment allow the authors to answer their research question (i.e., what is the authors' identification strategy)?

- *Note:* restrict your discussion to the key qualitative / strategic features of the basic game and to the experimental procedures that are crucial for understanding the paper's main results. You don't need to summarize the detailed parameter values of the experiment.

See Lecture notes of Section 7 for solution. Key points to include in reply:

- *Principal decides whether ("control") or not ("trust") to restrict the agent's choice set (ruling out most opportunistic choices of  $x$  by the agent, by ensuring minimum level of  $\underline{x}$ )*
- *Agent decides on level of  $x$ . Higher levels of  $x$  are*
  - o *efficiency-enhancing and*
  - o *beneficial for the principal, but*
  - o *costly for the agent.*
- *Procedures:*
  - o *Players choose independently, without knowing the opponent's decision.*
  - o *Strategy method for the agent. I.e., before agent knows decision of the principal, (s)he takes a decision  $x$  for each of the two possible contingencies (trust/control).*
  - o *As both contingencies might actually occur, the agent has incentives to truthfully reveal her preferred level of  $x$  in both situations.*
- *Comparing the agents' choices of  $x$  in the case of "trust" vs. "control" allows to identify whether there is a "hidden cost" of control (on both the aggregate level and for each individual agent).*

c) What is depicted in the figure? Based on these findings, what is the answer to the research question from part a)?

- *Figure depicts histograms of agents' choices of  $x$  in response to "trust" and "control" decision of the principal, for the case of  $\underline{x}=10$ .*
- *20-25% of agents (have to) increase choice from  $x < 10$  to  $x \geq 10$  when principal exerts control (i.e., imposes minimum of  $\underline{x}=10$ ).*
- *High fraction of agents decreases  $x$  when principal exerts control. E.g., fewer people choose  $x=40$  in response to "control" than in response to "trust"*  
     *→ control indeed has a "hidden cost" of reducing (some) agents' choice of  $x$*
- *On average, agents choose a higher level of  $x$  under "trust" than under "control".*

d) Summarize the behavior of principals in the experiment. Do the results indicate that some of them behave in an irrational manner?

- *In the depicted treatment with  $\underline{x}=10$ , the majority (~ 70%) of principals "trust" and the remaining 30% of principals "control".*
- *Given the empirically realized distribution of agents' behavior, "trust" yields a higher expected payoff for principals than "control"*
- *However, this does not imply that "controlling" principals are acting irrationally:*
  - o *They might be risk averse*

- *Further data from the experiment shows that "controlling" principals hold systematically more pessimistic beliefs about agents' reactions. So their choices can be rational, given their subjective beliefs.*

**Question 4: (10%)**

Consider the following statement by Bengt Holmström, taken from an interview that he gave briefly after he had been announced as winner of the 2016 Nobel Prize in Economics:

*"So the issue of motivation is hugely broader than just asking [...] how should people get the CEO to behave in a particular way, and financial monetary incentives are in some sense too effective often. They are very powerful in sending signals as well as, of course, rewarding financially. And so one has to be very careful in their use."*

What could Holmström mean with the statement that monetary incentives can be "too effective"? Provide two examples where we have seen that this can be the case. Explain.

*Examples (see lecture notes and references for Section 4 for further examples and explanations)*

- *Non-linear incentives giving rise to gaming responses: e.g., sales agents "pulling / pushing" purchasing orders around the cutoff date for lump-sum bonus payments.*
- *Multi-tasking: agents focusing primarily on task that increases their performance pay, and neglecting other tasks that are not (as directly) incentivized: e.g., excessive focus on work quantity over quality in case of simple piece-rate scheme, teachers "teaching students to the test" instead of focusing on broader educational goals, etc.*