

Final Exam

23.7.2012

1. General information:

- a. Make sure that your final exam is complete. The final exam consists of 4 problems.
- b. Only use the provided sheet of paper. Write your matriculation number immediately and clearly on each page!
- c. Please do not remove the staples from the provided sheet of paper.
- d. Allowed items at your workplace: Student ID, writing utensils (no red pen, no ink eraser, no pencil case), ruler, set square, non programmable calculator, food and drinks.
- e. Use a permanent pen (no pencil).
- f. Mobile phones have to be turned off and removed from your place!

2. Hints about doing the exam:

- a. Read each task carefully. The tasks could be extended over several pages.
- b. Please work on all tasks and state each on a new page. Please write your answers in a readable way.
- c. You may write your answers in English or in German.
- d. Label the axes of your illustrations.
- e. The exam lasts 90 minutes!

We wish you every success!

1. Incentives to innovate: monopoly vs duopoly

Assume a market for a homogeneous product with inverse demand function $p = 20 - q$. Marginal cost of the firms active in the market are $c = 11$ without process innovation. By spending on R&D firms can innovate (process innovation). If they spend k^2 on R&D marginal cost are reduced to $\max\{0; c^*\}$, where $c^* = 11 - k$.

- a. Which value of k does a monopolist choose? What is her profit gain?
- b. Assume a Bertrand-dupoly.
 - i. Which value of k does a firm choose, who is the single innovator, i.e. the only firm which has access to the R&D project?
 - ii. Which value of k would be required to realize a drastic innovation? Does the innovator actually realize a drastic innovation? What is her profit gain?
- c. Assume a Cournot-dupoly.
 - i. Calculate the Cournot equilibrium (prices and quantities) for the case, where firm 1's costs are c^* and the costs of firm 2 are c . Show that the profit of firm 1 is $(9 + 2k)^2 / 9 - k^2$ in this case.
 - ii. Which value of k would firm 1 choose if it were the single innovator? What is the firm's profit gain?
- d. Now allow for licensing of the new technology with a per unit license fee $L = c - c_1^*$. Could the innovator increase its profit by licensing in the Bertrand case (item b.)? How about the Cournot case (item c.). By how much would profit increase in the respective cases?
- e. Starting from your results in the above problems a. – c. explain how and why the incentives to innovate differ for the various market structures. Briefly discuss (verbally) how and why the R&D efforts in the different market solutions might differ from the socially optimal one.

2. Riskiness of projects

There are two ex ante identical firms, which may choose one out of two R&D-projects. The time horizon is two periods and there is no discounting.

Project 1 is successful in period 2 with certainty. Project 2 is successful in period 1 with probability $\frac{1}{4}$, successful in period 2 with probability $\frac{1}{2}$, and not successful at all with probability $\frac{1}{4}$. If both firms are successful at the same time, they share the profit otherwise the first innovator obtains the whole profit. Total profit of project 1 is 10. Total profit of project 2 is 20 if an innovation is realized in period 1 and 10 if realized in period 2. Project 1 causes costs of 1, project 2's cost are 2.

- a) Which of the two projects would a social planner choose if she could realize only one project?
- b) Which projects will the two firms choose?

3. Incumbent vs entrant

Suppose there is an industry with one incumbent firm and one (potential) entrant. Discuss and explain which of the two firms will have the higher incentive to invest in R&D and therefore is more likely to realize and introduce, respectively, an innovation.

4. Patents and patent protect

Discuss the importance of patent protection for the innovative activities of firms. Comment on the determinants of the socially optimal length of patent protection as well as on other dimensions of patent protection.