Exam

Economic Analysis 3: Innovation Economics

(Ekonomisk analys 3: Innovationsekonomisk analys)

IOE011 for I3

Saturday, October 25, 2014

14.00–18.00

Place: V building

Examiner: Marcus Holgersson

**Questions will be answered by Marcus Holgersson on 0739-431121.
Marcus will visit the exam room at (roughly) 15.15 and 16.30.**

**Language dictionary and calculator as approved by
Chalmers are allowed (i.e. with no notes, no formulas and no memos)**

N.B. Answers may be given in Swedish or English.

- The exam can give max. 100 points. Note that some questions give more points than others.
- **Give brief and concise answers. Note that time is short.**
- **IMPORTANT!**
  – Write (*legibly)* your exam code on each answer page and number all pages.
  – Max. one answer per page. Please, do not write on the back.
  – This is vital as the separate questions are split up for correction and then sorted back again into the exam cover before breaking the anonymity seal.
- Ordinary language dictionary (**without notes**) and Chalmers-approved calculator are allowed to be used.
- Please write legibly.
- Please note and remember your exam code.

Q1 (10p)   What is meant by the following concepts? Explain very briefly.

a) Innovation
b) Sunk cost
c) Two-sided market
d) Invention
e) Customer value distribution
f) Exclusive license
g) Progressive royalties
h) Patent
i) Cob-web model
j) Tragedy of the commons

Q2 (9p)   What is meant by the following concepts and what is the distinction/relation between the concepts in each pair? Explain very briefly.

a) User innovation / open innovation
b) Economic success / commercial success
c) Logistic diffusion model / Fisher-Pry model

Q3 (10p)   Are the following statements **true** or **false**? (The latter alternative – false – should also be used if the statement makes no sense.) No motivation is needed. Indicate for each statement the most correct answer, true or false. A correct answer gives +1p, an incorrect answer gives -1p, and no answer at all gives 0p. The total number of points given from this question will however not be lower than 0p.

1. With the linear inverse demand curve $p = -aq + b$, the function for the *price elasticity of demand* can be written as $\varepsilon = \frac{p}{p-b}$.

2. *Expected maximum value* is always less or equal to *maximum expected value* in calculating the expected value of information.

3. The optimal investment in the Nordhaus model of a minor process innovation depends *only* on the exponent in the invention possibility function.

4. With a fixed cost $FC = 10$, and a marginal cost for the n:th unit produced $MC(n) = 3 - 0.1n$ for $n < 20$, and $MC(n) = 1$ for $n \geq 20$, the total cost for producing quantity q is $TC = 10 + 3q - 0.05q^2$ for $0 < q \leq 20$.

5. Independent of your answer above, given a total cost function $TC = 10 + 3q - 0.05q^2$, there are static economies of scale.

6. A small firm that for a given quantity sells its products at a price equal to the average total cost (ATC) will not make any profits.

7. Thomas Hedner (guest lecturer) argued that more power needs to be transferred to the management teams of Big Pharma companies in order to improve the innovativeness of the industry.

8. When making an investment evaluation and realizing that the payback method and the IRR indicate that an investment should be made, while the NPV is negative, you should make the investment since two out of three evaluation methods give positive indications.

9. An investment project with a negative cash flow (-5) in year 0 and a positive cash flow (+7) in year 1 (no other cash flows) has an internal rate of return equal to 40%.

10. In the classic linear case as presented in the course literature, minor process innovations always lead total revenues that are larger or equal to pre-innovation total revenues, both short- and long-term.

Q4 (12p)   Assume that you are the CEO of a firm considering whether to invest $5M in R&D to develop a new product that would generate a gross value of $8M (i.e. the net value would be $3M). However, you know that your main competitor is also considering investing in this area, in that case roughly $4M for a product that would generate $6M in gross value. In case either of you imitate the other's innovation, the gross value generated would be shared equally between you while the innovator would carry the entire investment. If both would invest the total generated gross value would be $18M (the innovations are partly complements). If both firms aim to imitate nothing will be invested and no value will be generated.

a) (4p) Create a 2x2 matrix illustrating the innovation/imitation game above.

b) (3p) Identify the Pareto optimums and Nash equilibria, if any. Motivate your answer.

c) (2p) Discuss whether the situation above would lead to a waiting game or a racing game in innovation.

d) (3p) How could a government impact the situation to increase economies of speed in cases like this?

Q5 (20p)   a) (7p) The text below is taken from the webpage of Johnson Matthey, a technology-based firm established in 1817 that focuses on sustainable technologies. The text describes the firm's business model. Analyze this business model **briefly** by applying the *business model canvas*. Which blocks of the canvas are covered by this business model and which blocks need to be strengthened according to your analysis? [Maximum 1 page of text.]

b) (3p) How can an innovation-based firm like Johnson Matthey benefit from applying the *customer development model*?

c) (5p) When applying the customer development model for new innovation-based businesses, it might be necessary to consider the

dissociation of purchasing roles. Discuss **briefly** why that is important and which the standard purchasing roles are, as described in the course literature.

d) (5p) Innovation and business development takes time. Discuss (using both words and graphs) the balance between investing time and money to get a high return to adoption for the first buyer vs. getting to the market early in cases where a product innovation is based on a systems technology with increasing returns to adoption and when there is a competing incompatible system being developed in parallel.

The Johnson Matthey business model

Our business model is to create value from applying our expertise in advanced materials and technology to innovate and improve solutions that are valued by our customers, optimise the use of natural resources and enhance quality of life.

Inputs

There are three inputs to our business model: Our people, our operations, and innovation. These align with the nine aspects of our strategy and support the long term creation of value adding sustainable technologies.

Our people

We rely on the ability of our people to innovate and to collaborate with each other and our customers to develop and bring value adding sustainable technologies to market.

We hire the best people with the right skills and support them with a culture that engenders innovation and encourages them to develop and grow.

Our people are motivated by working for a company that is 'doing the right thing' – and this is an important differentiator in attracting and retaining top talent in an increasingly diverse business.

Our operations

Around three quarters of the value we create comes from physical products, such as our emission control catalysts or active pharmaceutical ingredients, which we manufacture at our facilities around the world. Efficient and responsible manufacturing is critical to our economic and environmental performance and we have programmes in place to optimise our operations.

Our Manufacturing Excellence programme is driving efficiency improvements and innovation in manufacturing. This is complemented by Sustainability 2017 which is focused on reducing emissions and minimising resource use.

We invest in our manufacturing capacity to ensure we can meet customer demand and have the ability to flex our cost base if our markets slow. We demand high returns from our investments, with a target of at least 20%, which drives continued improvement in operational efficiency.

Approximately one quarter of the value we create comes from the provision of specialist services such as the refining and recycling of precious metals, process technology used to design chemical plants or diagnostics that improve efficiency in the oil and gas industry.

Collaboration and strong relationships with our customers are crucial in providing a high quality tailored service. Know how and a strong reputation underpin success and we perpetually build on these through continued investment in R&D and our people.

Innovation

Innovation fuels the continuous development of new and higher performance products and this, together with our know how in advanced materials and, where appropriate, intellectual property protection, underpins our ability to maintain technology leadership positions.

We partner with our customers, industry experts and academics to spark further ideas. Innovation isn't just confined to new product development; it is harnessed throughout our business processes.

Q6 (10p) a) (5p) Show with graphs the difference between the social cost curve and the (private) supply curve in cases of negative and positive production externalities, respectively. Also show the difference between the equilibrium quantity and the socially optimal quantity in both these cases, given a specific demand curve.

b) (5p) Describe qualitatively what Coase Theorem says, and how it relates to your response above.

Q7 (29p) A social planner wants to eliminate profits in the pharma industry by means of price control. Suppose a monopolistic product innovator in that industry has developed a major new drug innovation with approximately linear cost and demand and a substantial investment fixed cost FC (this is the only fixed cost). Let the product innovation be characterized in the standard way by the positive parameters a, b, c, and FC as in the course literature. The tax rate and discount rate is zero, and it is a one-period case. [Throughout this question you need to motivate by clearly showing your calculations.]

a) (4p) What price p_m would the innovator use for the product innovation if aiming to maximize profit, and what would the resulting profit π_m be, if the social planner is not involved (i.e. in the standard profit-maximizing case)?

b) (4p) What regulated prices p_r would eliminate the innovator's profits (i.e. would give $\pi = 0$)? **Hint:** Start with expressing profits π as a function of price p rather than as a function of quantity q. Remember that solutions to an equation on the form $x^2 + ax + b = 0$ are given by $x = -\frac{a}{2} \pm \sqrt{\left(\frac{a}{2}\right)^2 - b}$.

c) (2p) Which profit-eliminating price p_r in b) should the social planner choose in order to maximize welfare (as defined in the course literature)? Motivate.

d) (2p) Express the social planner's chosen price in c) as a function of the monopolistic price p_m and monopolistic profit π_m.

e) (3p) A representative from the pharmaceutical industry association now suggests that the price should be set in a more fair way in the sense that the fair price p_f should generate a consumer surplus CS that is equal in size with operating profits $\pi_{op} = \pi + FC$. What price p_f accomplishes this?

f) (3p) If the price is set equal to p_f as in e), how much would the profit maximizing innovator then lose in profits compared to the case with a monopolistic price p_m? Do you see this as a major or minor loss for the innovator? Motivate very briefly.

g) (3p) A risk capitalist now enters the debate and argues that price should be set so that the rate of return on investment for the entire society is equal to the private rate of return on investment for the innovator. Is this feasible? Motivate your answer and make necessary assumptions, if any. The innovator's investment FC in innovation is the only investment related to the innovation.

h) (8p) The article below ("De bråkar om procenten" in Dagens Industry, October 16, 2014) outlines a policy debate about the proper level of rate of return on investment for "welfare companies", possibly like the company described above. Considering what you have learnt about entrepreneurial financing and innovation investments in this course, what effects from limiting/capping the rate of return on investment do you foresee with regards to the type of investments that are/will be made in these firms? How could this impact the innovativeness of a "welfare industry" as a whole? Motivate your answer by utilizing financial concepts from the course. [Maximum 1.5 pages of text.]

Civilminister Ardalan Shekarabi, ansvarig för vinsterna i välfärden, säger att regeringen och V inte har kommit överens om en maximal vinstuttagsnivå i välfärdsbolag.

Men Vänsterpartiets ekonomisk-politiska talesperson Ulla Andersson säger att de visst har gjort det.

I tisdags sa civilminister Ardalan Shekarabi till Di att regeringen och Vänsterpartiet inte har kommit överens om en särskild vinstuttagsbegränsning i välfärdsbolag.

"Överenskommelsen är offentlig och där kan man se hur formuleringen ser ut. Pengarna ska gå till vad de är ämnade för och det innebär en vinstbegränsning. Men vi går inte in på några siffror", sa Ardalan Shekarabi.

En fråga om procenten

Det går på tvärs mot Vänsterpartiets ekonomisk-politiska talesperson Ulla Anderssons uttalanden förra måndagen i samband med Vänsterpartiet och regeringens offentliggörande av en överenskommelse om vinster i välfärden.

Ulla Andersson specificerade då hur stora uttag ur välfärdsbolag de kan tänka sig att acceptera.

"Insatt kapital och låg ränta på detsamma behöver inte återinvesteras eftersom insatt kapital då urholkas. Med låg ränta har vi gemensamt sagt ett ensiffrigt belopp i den nedre delen av den ensiffriga

skalan", sa Ulla Andersson bland annat då.

Ulla Andersson säger fortsatt att hennes uttalande visst är en del av överenskommelsen med regeringen:

"I vår överenskommelse med regeringen har vi vid förhandlingsbordet haft en samsyn kring vad låg ränta på insatt kapital innebär."

"I förhandlingsgruppen diskuterade vi olika begrepp. Men vi bestämde oss för att skriva låg ränta, även om vi har haft en samsyn på att det ska

vara i den lägre skalan på det ensiffriga beloppet", säger hon.

Men hur kommer det sig att civilminister Ardalan Shekarabi säger att någon mer specifik begränsning inte är överenskommen?

"Det får du fråga regeringen om", säger Ulla Andersson.

Är ni verkligen överens om att räntan på insatt kapital ska vara ett ensiffrigt belopp i den nedre delen av skalan?

"Vi har haft en samsyn vid förhandlingsbordet och nu ska vi tillsätta en utredning tillsammans."

Ardalan Shekarabi står fast vid sin ståndpunkt, när Di konfronterar honom med Ulla Anderssons övertygelse.

"Vi utgår från det som står i den skriftliga överenskommelsen", säger han.

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Di den 14 oktober i år.