**Exam August 2013, Mikro B**
**Guide to answers**[1]

Problem 1

A newspaper columnist is highly critical of the high level of taxes in Denmark and claims the following: "Whenever we triple a tax, the harm in terms of distorting the markets is increased ninefold". Please comment on this claim.

*Answer: The columnist is thinking of the point made clear in Nechyba (p. 682): Because (from a first-order approximation consideration) the change in price and quantity are both proportional to the tax change, the area of the deadweight-loss triangle is changed by the factor squared.*

Problem 2

Consider the situation where an insurance customer, by behavior that involves some effort and discomfort, is able to reduce the probability of an accident occurring. However, the insurance company cannot control which action the customer chooses once the insurance contract has been signed.

Please comment on the following statement:

"The insurance company must always design the insurance contract such that the customer is, to some extent, punished when the accident occurs, and, likewise, rewarded when it does not".

*Answer: The claim is true if P wants to give A an incentive to choose careful behavior, as the claim reflects the state-difference in income-utility needed in the IC in order not to tempt the agent to avoid the disutility associated with careful behavior. However, it may be more profitable for P to offer full insurance and accept careless behavior if careful behavior (for which A must be compensated (reducing P's expected profits), according to IR) is costly in terms of disutility and/or careful behavior reduces the risk of accident only marginally.*

Problem 3

In the market for artificially dyed jeans, the supply side is characterized by marginal (private) production costs being $MC(x) = x$, where x is the quantity of jeans. Demand for the good is $D(p) = \text{Max}\{300 - p, 0\}$ when the price is p.

However, the dye process causes pollution of the local river. The social (external) costs of neutralizing this is $x^2/4$ when output is x.

- 3a) What will output and price be in the jeans market (which is characterized by perfect competition)?
- 3b) Comment on the claim: "In a competitive market, the outcome will always be efficient", illustrating the points you make in a diagram

*Answer: The market outcome is found by equalizing the demand side price (inverse demand curve) with the marginal production costs, finding an output of 150 and a price of 150. The efficient outcome is found by equalizing the marginal social costs (production and clean-up costs) of* $(3/2) \cdot x$

[1] Note that this guide is only indicative, not providing a full answer to the problems, but outlining the correct results, and the most important points to be made.

*with the demand side price, giving us an output of 120. The outcome is clearly not efficient, and the diagram should clearly depict the DWL triangle.*

Problem 4

Consider a risk-averse von Neumann-Morgenstern-agent with Bernoulli utility u(x) of income, where $u'(x) > 0$, $u''(x) < 0$. The agent has the income M. There is an accident probability $\pi$, $0 < \pi < 1$. The accident causes a loss of $L < M$.

The insurance company, Monopol-Insure Inc., which is risk-neutral, considers offering the agent a contract implying that the agent pays the amount $\Gamma$ in both states of the world and receives the insurance sum K when the loss occurs. There are no other companies the agent can turn to; however, the agent may simply turn down the offer.

- 4a) What is the level of reservation (expected) utility for the agent?
- 4b) Specify the Lagrangian problem the insurance company need to consider in order to maximize its expected profits
- 4c) Show that the first-order-conditions will be satisfied if K = L
- 4d) Is the contract actuarially fair?

*Answer:* $\underline{u} = (1-\pi)\cdot u(M) + \pi\cdot u(M-L)$. *The Lagrange problem becomes*
"Max. $\Gamma - \pi\cdot K - \lambda\cdot[(1-\pi)\cdot u(M-\Gamma) + \pi\cdot u(M-\Gamma-L+K)-\underline{u}]$ *wrt.* $\Gamma, K, \lambda$".
*The two crucial FOCs are:*
$1+\lambda\cdot(1-\pi)\cdot u'(M-\Gamma)+ \lambda\cdot\pi\cdot u'(M-\Gamma-L+K) = 0$ *and*
$\pi + \pi\cdot u'(M-\Gamma-L+K) = 0$.
*Setting K = L, the two marginal utilities become identical, and these two FOCs are satisfied (with* $\lambda = -[(u'(M-\Gamma)]^{-1}$*). The intuition is that the risk-neutral company can make profits from lifting the risk off the agent's shoulders. The contract is not actuarially fair but implies a positive expected profit level because the insurance company is a monopoly, able to force the agent to accept having only his reservation utility level* $\underline{u}$.

Problem 5:

Please present Arrow's Impossibility Theorem, including its assumptions and implications.

*Answer: The student should express Arrow's idea rather clearly: Is it possible to aggregate individual preferences into social preferences in a "sensible" way, i.e. meeting his five requirements: Totality, turning total pre-orders into a total pre-order, the Pareto Principle, Independence of irrelevant alternatives, non-dictatorshop? Arrow proved this Impossible.*

Problem 6:

Consider two monopolistically competing coffee sellers, Allan's Coffee and Billy's Beans, both having marginal costs of 2 \$ pr. cup of coffee (for simplicity, we think of it as a continuous good).There are no fixed costs.

The demand side, students buying coffee, is described by the demand function, $D(p) = 200 - 10\cdot p$.

- 6a) What will be the market outcome (for both of the firms: the price charged, the quantity produced, the profits earned), when they compete á la Cournot?
- 6b) Similarly, what will the market outcome be, when they compete á la Bertrand?

- 6c) What happens in the Cournot case if Billy has marginal costs of 5 $?

*Answer: We have the inverse demand function* $p(x) = 20 - 0{,}1 \cdot x$*. Both Cournot response functions are* $R_j(x_i) = 90 - \frac{1}{2} \cdot x_j$*. The Cournot Nash equilibrium has* $q_A = q_B = 60$*, both charging the price 8, both earning 360. The Betrand Nash equilibrium has* $q_A = q_B = 90$*, both charging the price 2 $, both earning 0.*
*With B having higher costs, we get* $R_A(x_B) = 90 - \frac{1}{2} \cdot x_B$ *,* $R_B(x_A) = 75 - \frac{1}{2} \cdot x_A$ *so the new Cournot equilibrium has* $q_A = 70$*,* $q_B = 40$*, both charging the price 9 $, A earning 490, B earning 160.*

Ref.: mtn, 5. juni 2014