Imperfect Information in Health Care Markets

Exercise Session 14 - Q&A, Mock Exam

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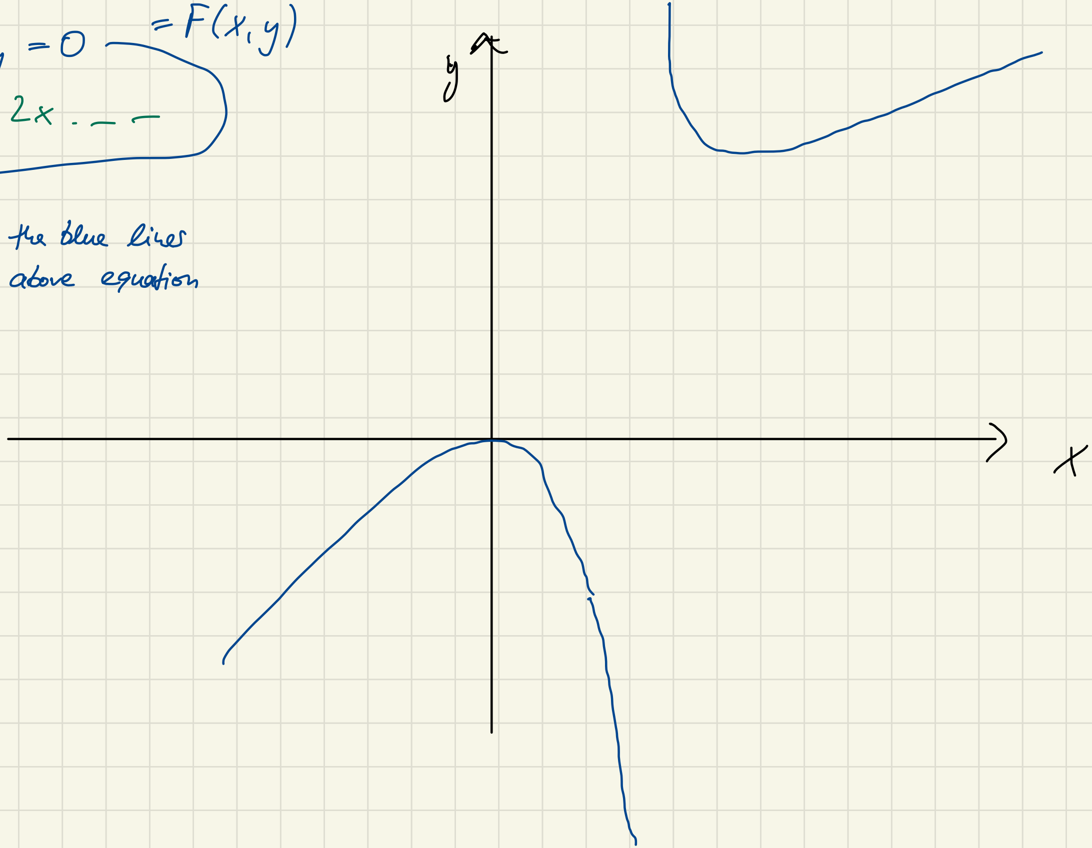
Q1 - Implicit Function Theorem (Insurance Demand S. 10)

What does it state?

$x^2 - x \cdot y + 5y = 0 = F(x,y)$

$y = f(x) = x^2 - 2x \dots$

all point on the blue lines satisfy the above equation



Q2 - Concerning Exercise 20 d) (Session 9)

i) Why does $p_h^{10} * 10 + p_h^{30} * 30 = (p_h^{10} + p_h^{30}) * 10 + p_h^{30} * 20$ hold?

ii) Why did you choose costs of 10 in b)? Shouldn't it be 20 since all costs above 20 are covered?

iii) Why did you choose costs of 2 and 20 in c)? Shouldn't it be 2 and 22?

iv) Could you explain the implications again?

v) Why are there lower incentives to engage in risk selection due the risk adjustment scheme in b and c?

A2

i)

$$(p_h^{10} + p_h^{30}) * 10 + p_h^{30} * 20 = p_h^{10} * 10 + p_h^{30} * 10 + p_h^{30} * 20$$
$$= p_h^{10} * 10 + p_h^{30} * (10 + 20) = p_h^{10} * 10 + p_h^{30} * 30$$

ii) ~~10 is less than 20~~. Because 10 + 10 = 20

iii) ~~It should and this is also what we wrote down in the session~~. Because 2+20 = 22

iv) We should have in mind that different ways of designing these risk adjustment schemes result in different incentives for insurances to insure high/low risk people. Optimally, we would like to find a risk adjustment scheme that leads to the incentive to engage in risk selection being very low (so that everyone will easily get an insurance and nobody is left out).

v) Because the difference in expected costs between the two groups decreases.

Q3 - Further Exercises

How or where can we get further exercises?

A3

- You can consult the book by Zweifel, Breyer and Kifmann. You will find many exercises there. Keep in mind that they might use a notation different from the one in the lecture.
- Also, you can take the exercises you have and solve them for different parameters. For example, you could change the utility function and use a utility function given in another exercise.
- Try to fully understand how to solve the exercises and why the solution presented is actually a solution to the problem (as opposed to just try and learn the presented solution by heart). Useful exercise: Look at a specific exercise from the lecture and cover the solution given in the exercise session. Think about how you would approach solving this exercise and maybe start to actually solve it on an empty page. Only AFTER you have settled on your approach, compare your idea with the solution. This gives you a good indication of how much of the material you actually understood.

Q4 - Exercise 13 b) (Session 6)

Can you show the whole calculation method?

$$\bar{u} = \frac{1}{2}\left(-\frac{1}{2}\left(9-p-(1-q)5\right)^2 + 10\cdot\left(9-p-(1-q)5\right)\right) + \frac{1}{2}\left(-\frac{1}{2}(9-p)^2 + 10(9-p)\right)$$

$$\Leftrightarrow 4\bar{u} = \left(-(9-p-5+5q)^2 + 20(9-p-5+5q)\right) + \left(-(9-p)^2 + 20(9-p)\right)$$

$$\Leftrightarrow 4\bar{u} = -(4-p+5q)^2 + 20\cdot(4-p+5q) - (81-18p+p^2) + 180 - 20p$$

$$\Leftrightarrow 4\bar{u} = -\left(16 - 4p + 20q - 4p + p^2 - 5qp + 20q - 5qp + 25q^2\right) + 80 - 20p + 100q - 81 + 18p - p^2 + 180 - 20p$$

$$\Leftrightarrow 4\bar{u} = -\left(16 - 8p + 40q + p^2 - 10qp + 25q^2\right) + 179 - 22p + 100q - p^2$$

$$\Leftrightarrow 4\bar{u} = -16 + 8p - 40q - p^2 + 10qp - 25q^2 + 179 - 22p + 100q - p^2$$

$$\Leftrightarrow 4\bar{u} = 163 - 14p + 60q - 2p^2 + 10qp - 25q^2$$

Q5 - Exercise 32 (Session 12)

- Can you show the whole calculation method as well as the derivative?
- Why is s minimized?
- For $p > 1$, why don't we always choose $(p-1)/\gamma$?
- b): Why is the average cost calculation important?
- c) why looks the plot you draw like this? Why is there a third part which is defined by $M + \delta p - 1/y$?

A5

- I did not leave anything out in this exercise. You should definitely know that the derivative of a polynomial of the form $a * x^n$ is given by $a * n * x^{n-1}$.
- Because in case 1 in c), more s is always worse for the physician (derivative negative) $\rightarrow$ So it maximizes utility in this case
- The physician has only time 1 available to work. If she already works full time, no more inducement is possible.
- In order to know how the line continues after $\delta = M$ is reached
- This is after the point where the minimum switches from one value to the other (s will take the value $\frac{p-1}{\gamma}$ from there on).

Q6 - Exercise 26 (Session 10)

- a): Why do we assume M=0? We don't.
- c): You got 2,875 + 5/2 as a result. In our learning group, we got 2,625 + 5/2. Can we calculate this together? ✓

Q7 - Fixed coverage model

Can we discuss the derivation of MC and AC again?

→ Questions about the lecture can be asked in the last lecture (February 2, 2022)

Q8 - Advantageous Selection and Adverse Selection

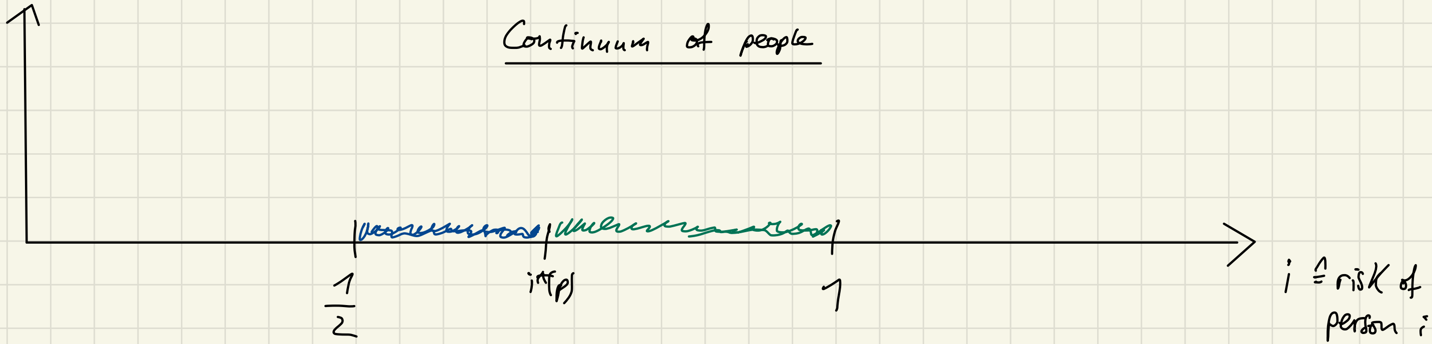
- How to compute who will buy insurance in both cases? Lower limit vs. upper limit of the continuum?!
- How to distinguish between adverse and advantageous selection?
- Underinsurance with advantageous selection possible? No.
- With adverse selection and administrative costs, the MC and AC curve are shifted upwards, leading to less insured people. Can we say that the situation with administrative costs is less efficient than without because less people are insured?

  It is efficient to insure a person whenever her WTP is above the social costs of insuring.

$\Rightarrow$ eventhough less people are insured, the situation could still be efficient

(So answer is: No.)

Continuum of people



low risk ⟶ high risk

adverse selection: low WTP ⟶ high WTP

advantageous selection: high WTP ⟶ low WTP

People will buy an insurance if their WTP is above the premium.
Let $i^*(p)$ be the person that is exactly indifferent between buying and not buying insurance at price p.

Amount of people who buy insurance:

Adverse selection: upper boundary of interval $- \; i^*(p)$

Advantageous selection: $i^*(p) -$ lower boundary of interval

Q9 - RS Model

1. RS-candidate no equilibrium because there is profitable pooling contract

2. This pooling contract can also never be an equilibrium (you saw this in the lecture/screencast)

- For small γ and when pooling improves on the RS solution candidate, why can't we have an equilibrium?
- When genetic tests are available and results can be used, why can the low type get a full coverage contract?

↳ Because in this case, the insurance can stop the high risk types from buying the low risks' contract

(you need a low-risk-test to buy them)

Q10 - First model of SID (Slide 8)

Why does $\frac{\partial\sqrt{p*(M/\delta+s)}}{\partial s} = \frac{\sqrt{p}}{2\sqrt{M/\delta+s}}$ hold?

$$\sqrt{p\cdot\left(\frac{M}{\delta}+s\right)} = \sqrt{p}\cdot\sqrt{\frac{M}{\delta}+s}$$

$$\Rightarrow \frac{\partial\sqrt{p\left(\frac{M}{\delta}+s\right)}}{\partial s} = \sqrt{p}\cdot\frac{\partial\sqrt{\frac{M}{\delta}+s}}{\partial s} = \sqrt{p}\cdot\frac{1}{2\sqrt{\frac{M}{\delta}+s}} \checkmark$$

Q11 - Exc. 10 c) (Session 5)

Why are marginal costs defined by the integral?

The comment on this slide was ONLY addressed to those people who were surprised by the term "marginal cost" in this setting. Otherwise, this comment can be ignored!

Q12 - Exc. 12

What is the difference between positive profits and a contract that is profitable in the RS equilibrium?

A contract is always profitable with respect to some other contract. When this contract in question yields zero profits, then there is no difference.

Q13 - Lecture on Genetic Tests (Selection S. 26)

$\hat{=}$ "extreme case"

What does it mean that on a benchmark tests are impossible and why are tests impossible?

Q14 - Exc. 22 d) (Session 9)

With the help of a computer program (or much time)

How can you build the derivative of WTP? And why is it now that with adverse selection WTP is increasing and for advantageous selection WTP is decreasing ? I tought it is like the opposite that with adverse selection it is decreasing and for advantageous it is increasing ... No! It is correct in the drawing.

Q15 - Exc 26 a) (Session 10)

Why dont you include the cons in the partial derivative for the marginal benefit?

As $cons = 4 - t$ and $\frac{\partial\, cons}{\partial t} = -1$, the cost of treatment is 1 and is included in the calculation.

Q16 - Exc. 31 (Session 12)

prob. long stay = 1 − prob. short stay, they depend on each other and therefore you only need to compute one

- b) Why does the premium depend on the probability of a long stay and not of a short stay? And why is the equation for prob. of long stay like you write it in the solution for b) ?
- c) Why do we have to resolve to alpha here ?

The probability might a priori depend on the insurer's perception / expertise. This is why we use this in the calculation.

Q17 - Lecture on Moral Hazard, S. 18

We wrote down that some people are forward looking. What does it mean? What was the point?

These people anticipated that they will remain in the deductible region of the contract for the remaining year (these people = those that enrolled late in the year), and due to Moral Hazard, their initial claims were low in these remaining months.

$\Rightarrow$ forward-looking

General exam questions

- Can we use a dictionary? Ask the examination office.
- Can we write our answers in german? No.
- Round results on how many decimal places? 3 places
- In the exercise session, some tasks were set, to which the answer required a mathematical proof. In the exam, would an answer that paraphrases the logic of the argument but does not present the mathematical proof still be a valid answer with full points? No

Mock Exam, Exc. 2 b) - Moral Hazard

A consumer behaves as if maximizing the utility function $u(t) = consumption(t) - (s-t)^2$, where $s \in [0,5]$ is the health state of the consumer and $t \in [0,s]$ is the money amount spent on treatment. The consumer has an insurance that has a zero copayment rate up to treatment expenditures of 2 and a copayment rate of 0.5 for treatment expenditures above 2, i.e. the insurance pays t to the consumer if $t \leq 2$ and $2 + \frac{1}{2}(t-2)$ if $t > 2$. Assume that the initial wealth of the consumer is 10 and the insurance premium is 4. *consumption* is all the money the consumer has left over (after paying his insurance premium and his contribution to the treatment expenses), i.e. $consumption = 10 - 4$ if $t \leq 2$ and $consumption = 10 - 4 - \frac{1}{2}(t-2)$ if $t > 2$.

i) Determine the optimal treatment choice as a function of the health state. *(12 points)*

Mock Exam, Exc. 2 b) - Moral Hazard (cont.)

ii) Why can insurance contracts like the one above be used to empirically test whether moral hazard is relevant? (Also explain why this does not depend on the specific functional form of the utility function.) *(7 points)*

Solution to i) - Alternative 1: Heuristic Approach

Marginal utility of treatment is $2(s-t)$ (given $t \leq s$) or zero (for $t > s$). Marginal out of pocket expenses (=marginal costs of treatment) are either 0 (for $t < 2$) or $1/2$ (for $t > 2$). At the optimal treatment choice, marginal utility has to equal the marginal cost of treatment. Solution candidates are therefore $t = s$, $t = 2$ and $t = s - 1/4$. For $s \leq 2$, $t = s$ is clearly optimal ($u(t) = consumption(t) - (s-t)^2$ and $consumption(t)$ is weakly decreasing in t and the costs are zero for $s = t$). For $s \in (2, 2.25]$, 2 is closer to s than $s - \frac{1}{4}$, making the choice of 2 optimal in this case. This yields

$$t(s) = \begin{cases} s & \text{if } s \leq 2 \\ 2 & \text{if } s \in (2, 2.25] \\ s - 1/4 & \text{else.} \end{cases}$$

Solution to i) - Alternative 2: Mathematical Approach

We can also just take the standard approach and maximize the utility function with respect to t. However, we have to note that the utility function looks different for $t \leq 2$ and $t > 2$ and there might be corner solutions. Hence, we have to solve the following two problems:

1. for $t \leq 2$: $\max_t 10 - 4 - (s-t)^2$

$$FOC: -2(s-t) * (-1) = 2(s-t) \stackrel{!}{=} 0$$
$$\Leftrightarrow t = s \quad \text{(only consistent for } s \leq 2\text{)}$$

2. for $t > 2$: $\max_t 10 - 4 - \frac{1}{2}(t-2) - (s-t)^2$

$$FOC: -\frac{1}{2} + 2(s-t) \stackrel{!}{=} 0$$
$$\Leftrightarrow s = \frac{1}{4} + t \Leftrightarrow t = s - \frac{1}{4} \quad \text{(only consistent for } s > 2.25\text{)}$$

Solution to i) - Alternative 2: Mathematical Approach (cont.)

But what happens for $s \in (2, 2.25]$?! To answer this, we have to compare the utilities from the two solution candidates from above **and the corner solution t=2** in these cases.

$$u(t = s) = 6 - \frac{1}{2}(s - 2) - 0 = 6 - \frac{s-2}{2}$$

$$u(t = s - \frac{1}{4}) = 6 - (\frac{1}{4})^2$$

$$u(t = 2) = \underline{6 - (s - 2)^2}$$

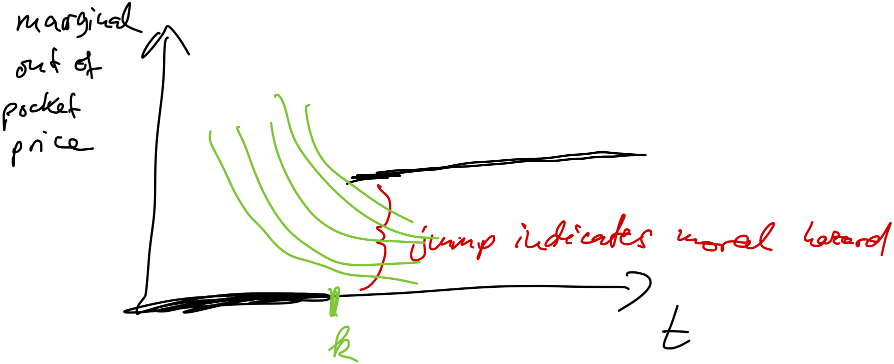
optimal

for $s \in (2; 2{,}25]$

Solution to ii)

The model underlying moral hazard, i.e. a consumer chooses treatment to maximize expected utility taking financial consequences explicitly into account, predicts bunching at the kink. More precisely, suppose health states are distributed with some density. Then the distribution of treatment choices will spike at $t = 2$ (and follow a continuous distribution for other values) because all patients with $s \in [2, 2.25]$ choose this treatment level. If there was no moral hazard, i.e. if treatment choice was only driven by medical necessity and did not depend on payments, then there should not be spikes at kink points of the insurance tariff. The functional form of the utility is irrelevant because at a kink point k the marginal out-of-pocket-price jumps up (say from 0 to c) and therefore all consumers whose marginal utility of treatment at k is between 0 and c will consume treatment equal to k. This is a mass while for all other treatments it is not.

Solution to ii) - Graphical intuition



Mock Exam - Exc. 1 c)

Discuss the welfare implications of genetic tests for insurance markets.

Points you could mention here:

Arguments on welfare reduction

- The risk of having bad genetics can not be insured anymore

Arguments on an increase in welfare

- People might change their behavior when they learn their high risk (stop smoking, ...)
- Tests could allow treatment before the disease breaks out

Some conclusion weighing the pros and cons