Imperfect Information in Health Care Markets

Exercise Session 9 - Genetic Tests, Premium Risk and Risk Adjustment

Exercise 17 c)

Consider now a profit maximizing insurance monopolist. How does your answer in a) and b.1) and b.2) change?

Exc. 17c)

Remember from a): $RP = \frac{1}{4}$ without the test

expected costs

the insurance monopolist will offer full insurance contracts at premium $p^{mon} = \underbrace{\alpha \cdot L}_{\text{fair premium under perfect competition}} + RP$

maximal amount the monopolist can extract

$= 0{,}5 \cdot 5 + \frac{1}{4} = 2{,}75$

in b.1): $RP = \frac{3}{16}$ for both types

$\Rightarrow$ the monopolist will offer the contracts

$p_h^{mon} = 0{,}75 \cdot 5 + \frac{3}{16} = \frac{63}{16}$, $q_h^{mon} = 1$ for the high type

and $p_e^{mon} = 0{,}25 \cdot 5 + \frac{3}{16} = \frac{23}{16}$, $q_e^{mon} = 1$ for the low type

in b.2): profits of the monopolist from each contract are $\pi = \overset{RP}{\frac{3}{16}} < \frac{1}{4} = \pi_{\text{without tests}}$

exp. utility of the high type: $E_h(u) = \sqrt{9 - \frac{63}{16}} = \sqrt{\frac{81}{16}} = \frac{9}{4}$

— " — low type: $E_e(u) = \sqrt{9 - \frac{23}{16}} = \sqrt{\frac{121}{16}} = \frac{11}{4}$

$\rightarrow$ on average, $E(u) = \frac{10}{4} = 2{,}5$, the same utility consumers had without the test

Exercise 18

In Germany (private) health insurers are required to charge a constant premium over the life cycle. We use the premium risk model from the lecture: 2 periods, income W in each period, everyone has low risk α_l of a loss L in period 1, probability $1 - \lambda$ of an increase of risk to α_h in period 2, perfect competition, $0 < \lambda < 1$.

a) Calculate the constant premium that yields zero expected profits to insurers under the assumption that no one switches insurers in period 2.

Exc. 18 a)

What are the expected costs for the insurance in period 1 and 2?

In period 1: $\alpha_e \cdot L$

In period 2: $(\lambda \cdot \alpha_e + (1-\lambda) \cdot \alpha_h) \cdot L$

$\Rightarrow$ to make exactly zero profits, insurances will charge the constant premium

$$P = \underbrace{\frac{\alpha_e + \lambda \cdot \alpha_e + (1-\lambda) \cdot \alpha_h}{2} \cdot L}_{\text{average expected costs per period}}$$

Exercise 18 b)

Given the premium from the previous subquestion, what would happen if consumers could switch insurers in period 2?

Exc. 18 b)

low risk types would want to switch insurers as $\alpha_l < \frac{\alpha_l + \lambda \alpha_l + (1-\lambda)\alpha_h}{2}$

in period 2

and insurances would offer them contracts at premium α_l due to perfect competition.

Exercise 18 c)

Compare the premium of the first subquestion with the premiums under "guaranteed renewal". What are the implications?

Exc. 18c)

guaranteed renewal: the insurance guarantees the same premium in the second as in the first period for some fee the consumer pays in the first period (additional to his premium)

→ consumer pays for the risk of an increase in risk level in period 2 already in period 1, hence no one has an incentive to switch in period 2

premia under guaranteed renewal:

$$p_1^g = \alpha_e \cdot L + \underbrace{(1-\lambda)(\alpha_h - \alpha_e) \cdot L}_{\text{fee for premium guarantee}}$$

fair insurance premium

= expected added cost for insurancer in period 2

$$p_2^g = \alpha_e \cdot L$$

implications: now, the consumer pays in total a higher amount in period 1 and a lower amount in period 2. This might lead to budget constraints.

Exercise 18 d)

Suppose now that in period 2 everyone's health deteriorates. More precisely, assume that the risk is $\alpha_m > \alpha_l$ with probability λ and $\alpha_h > \alpha_m$ with probability $1 - \lambda$.

1. Calculate the constant premium that yields zero profits to insurers (without switching).
2. Compare it to the premiums with "guaranteed renewal".

Exc. 18d)

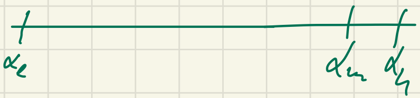
1. constant premium that yields zero profits to insurers:

$$p^{const} = \frac{\alpha_l + \lambda \alpha_m + (1-\lambda)\alpha_h}{2} \cdot L$$

2. guaranteed renewal: (where the lower premium $\alpha_m \cdot L < \alpha_h \cdot L$ is guaranteed for period 2)

$$p_1^g = \alpha_l \cdot L + (1-\lambda)(\alpha_h - \alpha_m) \cdot L$$

$$p_2^g = \alpha_m \cdot L$$



– note: for $\alpha_m \approx \alpha_h$ being very large compared to α_l,

$p^{const} < p_2^g$ is possible. So you would pay more in the second period

$\Rightarrow$ in general, it is not so clear whether budget constraints are relaxed more by the constant premium

Exercise 20

Suppose the population consists of two types *l* and *h* with the expenditure distribution for each type as in the table below. In this exercise we measure the incentive of an insurance to engage in risk selection by the difference in expected expenditures.

a) Calculate the expected expenditures per risk type and the incentives to engage in risk selection.

risk/expenditure	0	10	30
l	40%	10%	50%
h	10%	50%	40%

Exc. 20 a)

Expected expenditures

for the l-type: $0{,}4 \cdot 0 + 0{,}1 \cdot 10 + 0{,}5 \cdot 30 = 1 + 15 = 16$

for the h-type: $0{,}1 \cdot 0 + 0{,}5 \cdot 10 + 0{,}4 \cdot 30 = 5 + 12 = 17$

incentive to only insure the low risk types (= incentive to engage in risk selection) is small since $17 - 16 = 1$.

Exercise 20 b)

Consider a risk adjustment scheme that covers all expenditures above 20 (i.e. all expenditures above 20 are covered by some common fund to the extent that they exceed 20). Calculate the expected expenditures per risk type that an insurer has to cover himself and the incentives to engage in risk selection. What is the idea behind such a risk adjustment scheme?

risk/expenditure	0	10	30
l	40%	10%	50%
h	10%	50%	40%

Exc. 20 b)

idea behind such a scheme: Take away incentives to not contract high risk types

exp. expenditures with this scheme:

because 10 are covered by common fund when expenditures are 30

$$l\text{-type: } 0{,}1 \cdot 10 + 0{,}5 \cdot 20 = 11$$

$$h\text{-type: } 0{,}5 \cdot 10 + 0{,}4 \cdot 20 = 13$$

$\Rightarrow$ higher incentives to engage in risk selection $(13 - 11 = 2)$

Exercise 20 c)

Consider a risk adjustment scheme that covers all expenditures up to 8 (i.e. all expenditures up to 8 are covered by some common fund). Calculate the expected expenditures per risk type that an insurer has to cover himself and the incentives to engage in risk selection.

risk/expenditure	0	10	30
l	40%	10%	50%
h	10%	50%	40%

Exc. 20 c)

expected expenditures:

$$\text{l-type:} \quad 0{,}1 \cdot \underset{}{\overset{10-8}{2}} + 0{,}5 \cdot \overset{30-8}{22} = 11{,}2$$

$$\text{h-type:} \quad 0{,}5 \cdot 2 + 0{,}4 \cdot 22 = 9{,}8$$

$\Rightarrow$ incentives to engage in risk selection are reversed and bigger than in a).

$(11{,}2 - 9{,}8 = 1{,}4)$

Exercise 20 d)

Consider expenditure distributions that satisfy the following conditions: $p_h^{30} > p_l^{30}$ and $p_h^{10} + p_h^{30} \geq p_l^{10} + p_l^{30}$ where p_h^{30} is the probability that a high risk type has expenditures 30 and so on.

- Show that the incentives to engage in risk selection are decreased by a risk adjustment scheme as in b) for all such distributions.
- Show that the incentives to engage in risk selection are decreased by a risk adjustment scheme as in c) for all such distributions.

risk/expenditure	0	10	30
l	40%	10%	50%
h	10%	50%	40%

Exc. 20 d)

First note: The expenses for the high type will be always bigger than those for the low type with such expenditure distributions:

for both schemes in b) and c)

$$\text{expected exp. for h-type:} \quad p_h^{10}\cdot 10 + p_h^{30}\cdot 30 = \underbrace{(p_h^{10}+p_h^{30})}_{}\cdot \overset{2}{10} + p_h^{30}\cdot \overset{10}{20}$$

$$\vee$$

$$\text{expected expenditure for l-type:} \quad p_l^{10}\cdot 10 + p_l^{30}\cdot 30 = (p_l^{10}+p_l^{30})\cdot \underset{2}{10} + p_l^{30}\cdot \underset{10}{20}$$

scheme of b)

Scheme of c)

→ expenditures for high type are bigger by assumption

- in a risk adjustment scheme as in b), the h-type gets subsidized more since there is a higher share of people causing expenditures above 20 ($p_h^{30} > p_l^{30}$)
  $\Rightarrow$ lower incentives to engage in risk selection, as the difference in exp. expenditures decreases

- also in a risk adjustment as in c), the h-type gets subsidized (weakly) more, since $p_h^{30} + p_h^{10} \geq p_l^{30} + p_l^{10}$.
  $\Rightarrow$ lower incentives to engage in risk selection

Exercise 19

Discuss the advantages and disadvantages of using "last year health care expenditures of insured" as an explanatory variable in a risk adjustment scheme.

Exc. 19

advantages: - reduces the incentives for insurances to engage in risk selection (but this might be achieved with other measures as well)

- in theory, much higher prediction power as health care expenditures tend to be serially correlated

disadvantages: - reduced incentives for insurers to cut costs (high expenditures today lead to high payments next year)
  => more waste has to be expected

- variable not available for new inflow (kids, people from abroad, ...)
- different insurances have different age distributions in their insurance pools. These might be affected differently one year later.

Conclusion: - expenditure should not include administrative costs or costs of bonus benefits (gym subscription, ...)

- HCC might be a better measure since it is harder for the insurance to misrepresent it
  ↳ "hierarchical coexisting conditions"

Exercise 21

Compare adverse and advantageous selection.

Exc. 21

Adverse Selection: People have and use private information about their own risk

⇒ people who buy insurance have higher risk on average (compared to whole population)

Advantageous Selection: There is a variable (e.g. risk aversion) that is positively correlated with the probability to buy an insurance and negatively correlated with risk

⇒ people who buy insurance have lower risk on average

Comparison: Both are about <u>selection</u> (who buys insurance)

⇝ risk selection (adverse) vs. risk aversion selection (advantageous) : different implications for the correlation of insurance purchase and expected health care expenditures

⇝ reality seems to be a mix of both

⇝ differ in welfare implications: under adverse selection, too few people buy insurance and this is not necessarily true under advantageous selection