Imperfect Information in Health Care Markets

Exercise Session 9 - Risk Adjustment and Advantageous Selection

Questions about the lecture

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

h-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:

$10-8$ $30-8$

l-type: $0{,}1 \cdot 2 + 0{,}5 \cdot 22 = 11{,}2$

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

$\Rightarrow$ 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))

expected exp. for h-type: $p_h^{10} \cdot 10 + p_h^{30} \cdot 30 = (p_h^{10} + p_h^{30}) \cdot 10 + p_h^{30} \cdot 20$ (2 / 10) scheme of b)

expected expenditure for l-type: $p_l^{10} \cdot 10 + p_l^{30} \cdot 30 > (p_l^{10} + p_l^{30}) \cdot 10 + p_l^{30} \cdot 20$ (2 / 10) scheme of c)

$\vee$ → 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 ($p_h^{30} > p_l^{30}$)
  => 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 $p_h^{30} + p_h^{10} \geq p_l^{30} + p_l^{10}$.
  => lower incentives to engage in risk selection

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

~> 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

Exercise 22

greek "eta"

Let consumers have the utility function $u(x) = -e^{-\eta x}$. Each consumer faces a loss L of his initial wealth W with probability α. While W and L are the same for all consumers, consumers differ in η and α. Let $W = 10$ and $L = 5$.

a) Compare the willingness to pay for a full coverage insurance contract of two consumers: Consumer A has risk $\alpha_A = 0.3$ and risk aversion $\eta_A = 1$. Consumer B has risk $\alpha_B = 0.2$ and risk aversion $\eta_B = 1.5$.

b) Using otherwise the same parameters as in a), who would have the higher willingness to pay if η_B was 1 as well?

c) Using otherwise the same parameters as in a), who would have the higher willingness to pay if α_B was 0.3 as well?

Exc. 22

a) Recall WTP for a full coverage insurance contract:

$$u(W - WTP) \overset{!}{=} u(\text{no insurance})$$

$$\Rightarrow -e^{-(10-WTP)\eta} = u(10-WTP) \overset{!}{=} \alpha \cdot (-e^{-5\eta}) + (1-\alpha)(-e^{-10\eta})$$

$$\Leftrightarrow e^{-(10-WTP)\eta} = \alpha \cdot e^{-5\eta} + (1-\alpha) \cdot e^{-10\eta}$$

$$\Rightarrow -(10-WTP)\eta = \ln\left(\alpha \cdot e^{-5\eta} + (1-\alpha) e^{-10\eta}\right)$$

$$\Leftrightarrow -10 + WTP = \frac{1}{\eta} \ln\left(\alpha \cdot e^{-5\eta} + (1-\alpha) e^{-10\eta}\right)$$

$$\Leftrightarrow WTP = 10 + \frac{1}{\eta} \cdot \ln\left(\alpha \cdot e^{-5\eta} + (1-\alpha) e^{-10\eta}\right)$$

Recall exponential functions as well as the natural logarithm

$\alpha_A = 0{,}3,\ \eta_A = 1 \Rightarrow WTP_A \approx 3{,}812$

$\alpha_B = 0{,}2,\ \eta_B = 1{,}5 \Rightarrow WTP_B \approx 3{,}929$

b) $WTP_B(\eta_B = 1) \approx 3{,}417 < WTP_A$

c) $WTP_B(\alpha_B = 0{,}3) \approx 4{,}198 > WTP_A$

Exercise 22

d) (PC exercise in spread sheet application or Julia) Let there be a continuum of consumers whose risk α is uniformly distributed on $[0.5, 0.75]$. Assume that $\eta(\alpha) = 3 - \alpha$ and consider a full coverage insurance contract. Is this a case of adverse or advantageous selection? Repeat with $\eta(\alpha) = 3 - 3.75\alpha$.

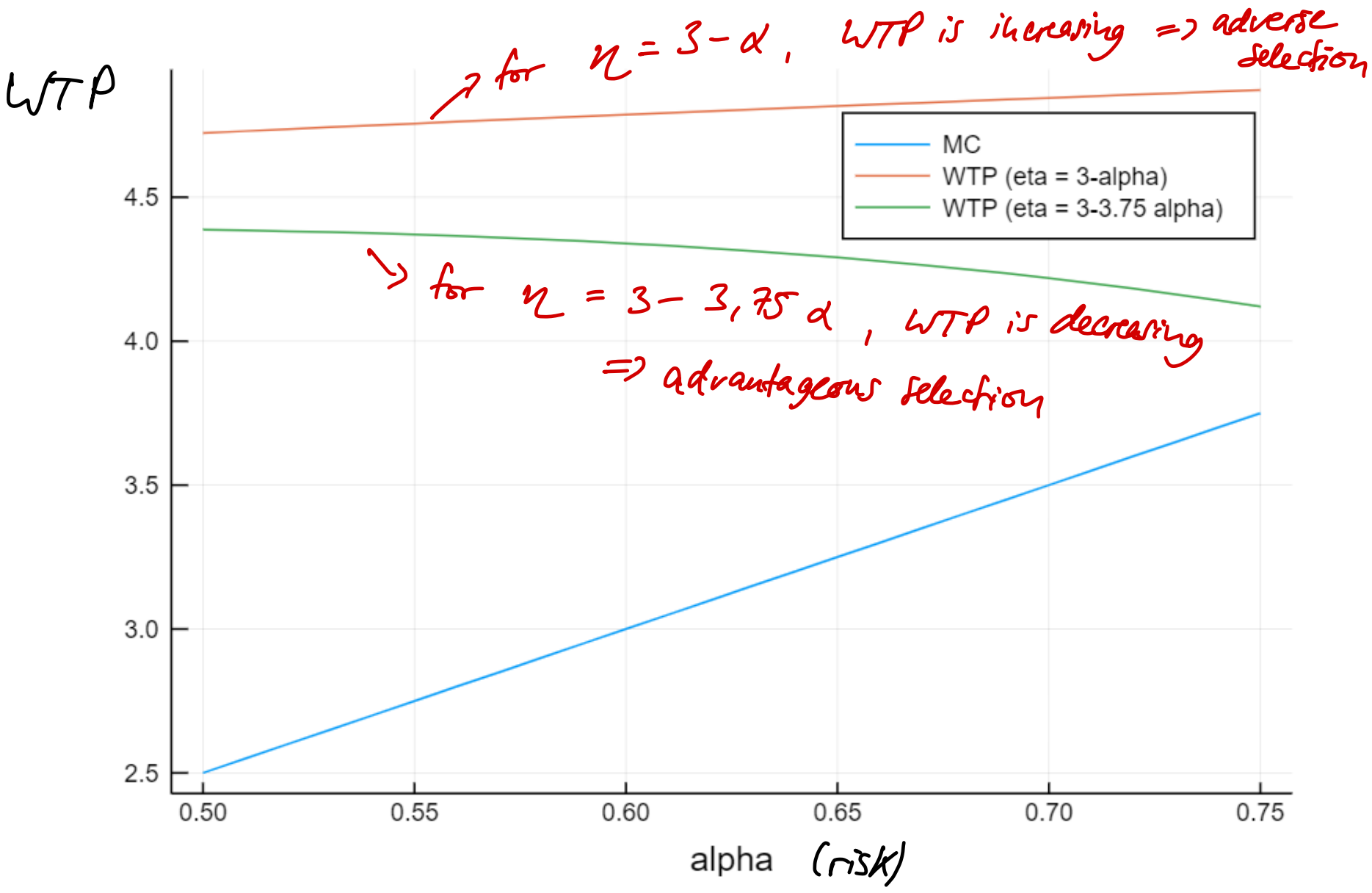
Q: How does the WTP depend on α?
(this is another way to put the question)

d)

analytical way to solve this: plug in $\pi(\alpha)$ in the term defining the WTP and then take the first derivative with respect to α

=) If $WTP'(\alpha) > 0$, high risk types will buy more insurance than low risk types => adverse selection

If $WTP'(\alpha) < 0$, low risk types will buy more insurance => advantageous selection


WTP
↗ for $\eta = 3 - \alpha$, WTP is increasing ⇒ adverse selection
MC
WTP (eta = 3-alpha)
WTP (eta = 3-3.75 alpha)
↘ for $\eta = 3 - 3{,}75\,\alpha$, WTP is decreasing
⇒ advantageous selection
4.5
4.0
3.5
3.0
2.5
0.50
0.55
0.60
0.65
0.70
0.75
alpha (risk)

Exercise 23

Consider the fixed coverage model with perfect competition and no administrative costs for insurance companies. Assume that all consumers are risk averse.

a) How do the marginal cost, average cost and demand curve look in case of advantageous selection?

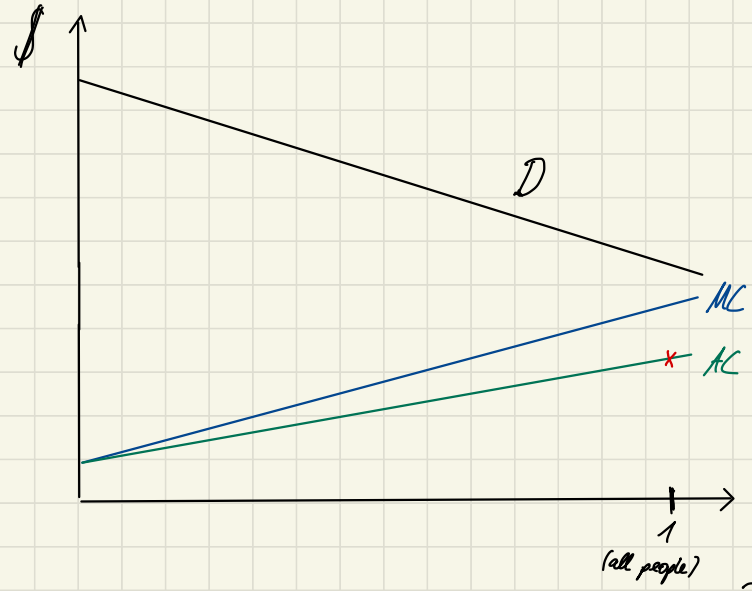
b) Is the market equilibrium efficient?

c) Consider now insurance companies with contracting and claim handling costs, i.e. each sold contract leads to expected administrative costs $c > 0$. What is the market equilibrium and is it efficient?

d) For the case with administrative costs, consider a tax on insurance premia (to be paid by consumer). What is the impact of this tax on welfare?

Exc. 23

a)



⇝ think of the consumers being ordered according to their WTP

b) By assumption, everyone is risk averse ⇒ WTP > MC everywhere / for everyone

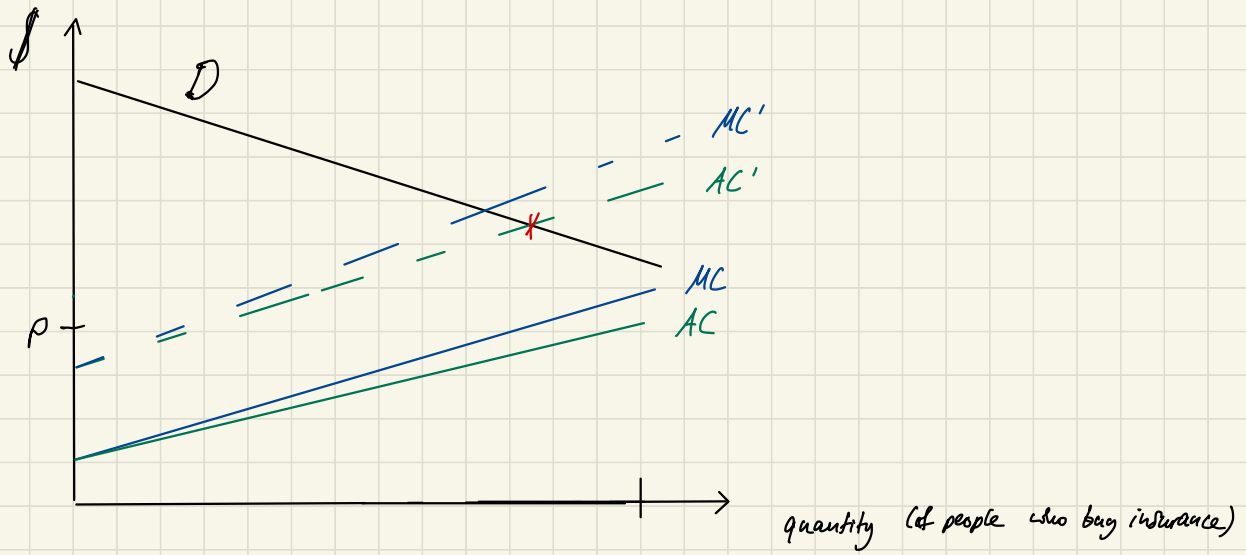
Therefore also WTP > AC

⇒ equilibrium is that everyone is insured at a premium that equals population AC.

This is efficient. ✓

Exc. 23

c)



Admin costs shift MC and AC parallelly up by C.

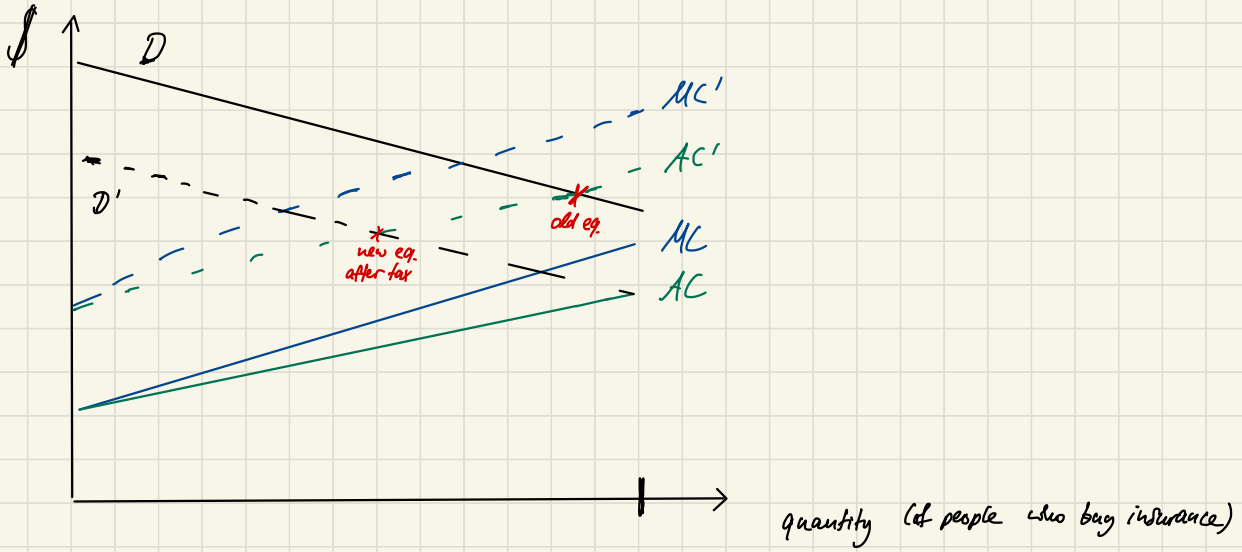
Equilibrium is at the intersection of D and AC'.

As D and MC' also intersect on the left side of this point, this means that there are some people for which insurance is inefficient.

⇝ too much insurance in equilibrium

Exc. 23

d)



The tax t parallelly shifts demand down to D'. In case there was over-insurance in equilibrium before, this can reduce the amount of over-insurance and can therefore be welfare-enhancing (if the collected tax is used for something useful)

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