Imperfect Information in Health Care Markets

Exercise Session 12 - Utilization management, Supplier induced demand

Exercise 31

Assume for simplicity that a consumer needs to go to hospital exactly once per year. When he goes to hospital, a *long stay* is appropriate with probability $1/2$ and a *short stay* is appropriate with probability $1/2$. The costs of a long (short) stay are c_l (c_s) with $c_l > c_s$. The hospital has idle capacity and prefers if the consumer stays long. The consumer cannot judge whether a short or a long stay is more appropriate but the hospital knows this perfectly. Assume that there is perfect competition on the insurance market, i.e. insurance premia equal expected costs, that only full coverage contracts are allowed and that insurers have no administrative costs.

a) Assume that the hospital determines the length of the stay. What is the equilibrium on this market, i.e. how long will the consumer stay and what is the insurance premium?

Exc. 31

The hospital will always enforce a long stay (by assumption). This leads to a premium of c_ℓ.

Exercise 31 (cont.)

b) Now assume that the insurer engages in utilization management, in particular assume that the insurer decides whether the stay is short or long. Assume that the insurer does not know which length of stay is appropriate but he has some information on this: More precisely, assume that the insurer's perception of which length of stay is appropriate is correct with probability $\alpha > 1/2$. What is the equilibrium insurance premium if the insurer uses his perception?

c) Assume that the consumer has utility 1 if the length of his stay is at least as long as appropriate but 0 if he has a short stay and a long one would have been appropriate. The consumer maximizes expected utility from health minus the insurance premium. Is the consumer better off with or without utilization management? Reconsider what the equilibrium is when utilization management is possible.

Exc. 31 b)

The premium depends on the probability of a long stay if the insurer uses his perception.

This probability is: $\underbrace{\frac{1}{2}}_{\text{long stay appropriate}} \cdot \alpha + \underbrace{\frac{1}{2}}_{\text{short stay appropriate}} \cdot (1-\alpha) = \frac{1}{2}$

⇝ premium is $p = \frac{1}{2} \cdot c_\ell + \frac{1}{2} \cdot c_s$

c) Expected utility of the consumer depends on who decides about the length of the stay:

- if the hospital decides: $E_h(u) = 1 - c_\ell$
- if insurer decides: $E_i(u) = \underbrace{\frac{1}{2}}_{\text{long stay necessary}} (\alpha \cdot 1 + (1-\alpha) \cdot 0) + \underbrace{\frac{1}{2}}_{\substack{\text{short stay}\\ \text{necessary}}} \cdot 1 \underbrace{-}_{\substack{\text{consumer cannot}\\ \text{stay too shortly}}} \left(\frac{1}{2} c_\ell + \frac{1}{2} c_s\right) = \frac{1}{2}(1 + \alpha - c_\ell - c_s)$

$$\left(E_h(u) \geq E_i(u)\right) \Leftrightarrow \left(2 - 2c_\ell \geq 1 + \alpha - c_\ell - c_s\right)$$

$$\Leftrightarrow \left(1 + c_s - c_\ell \geq \alpha\right)$$

Might want to recall: Inequalities, equivalence sign

⇝ If α is sufficiently large, then UM is beneficial for the consumer.

If UM is allowed but not optimal for the consumer, then the equilibrium is that insurers do not use UM.

Exercise 32

In the ”first wave” model of the lecture, consider the case where marginal utility of income is constant, i.e. $u(y, t, s) = y - t - \gamma s$.

a) How much demand will the physician induce in this case?

b) Plot billed services per patient as a function of δ.

c) Consider now that inducing an additional unit of demand may be a lot harder if you already induce a lot compared to the situation where you only induce little. Use $u(y, t, s) = y - t - 0.5\gamma s^2$ to capture this situation. How does this change your answer to the previous two questions?

d) How does the shape of billed services per patient as a function of δ differ from that in the lecture where we assumed decreasing marginal utility of income?

Exc. 32 a)

Recall the variables of this model from the lecture:

a number of physicians

n number of patients

$\sigma = \frac{a}{n}$ physician density

M = "desired" average amount of treatment

t working time of a physician, which can be 1 at most, more concretely:

$$t = \min\left\{\frac{M}{\sigma} + s,\ 1\right\}$$

$$\frac{M}{\sigma} = \frac{M \cdot n}{a} + s$$

$y(p \cdot t)$ disposable income, $y' > 0$, $y'' \leq 0$

↳ we assume: $y(p \cdot t) = p \cdot t$

p price per unit of medical care

s induced demand by physician

$u(y,t,s)$ utility function of the physicians, assume $u(y,t,s) = y - t - \gamma s$

So, here the utility function looks like $u(y,t,s) = y - \min\left\{\frac{M}{\sigma} + s, 1\right\} - \gamma s$

There are two cases: (as $\frac{M}{\sigma} + s < 1$ for $s \leq 1 - \frac{M}{\sigma}$)

2. case: $\frac{M}{\sigma} < 1$. $\Rightarrow u(y,t,s) = y - \left(\frac{M}{\sigma} + s\right) - \gamma s = \underbrace{p\left(\frac{M}{\sigma} + s\right)}_{= y} - \frac{M}{\sigma} - s - \gamma s$

FOC: $\frac{du}{ds} = p - 1 - \gamma$

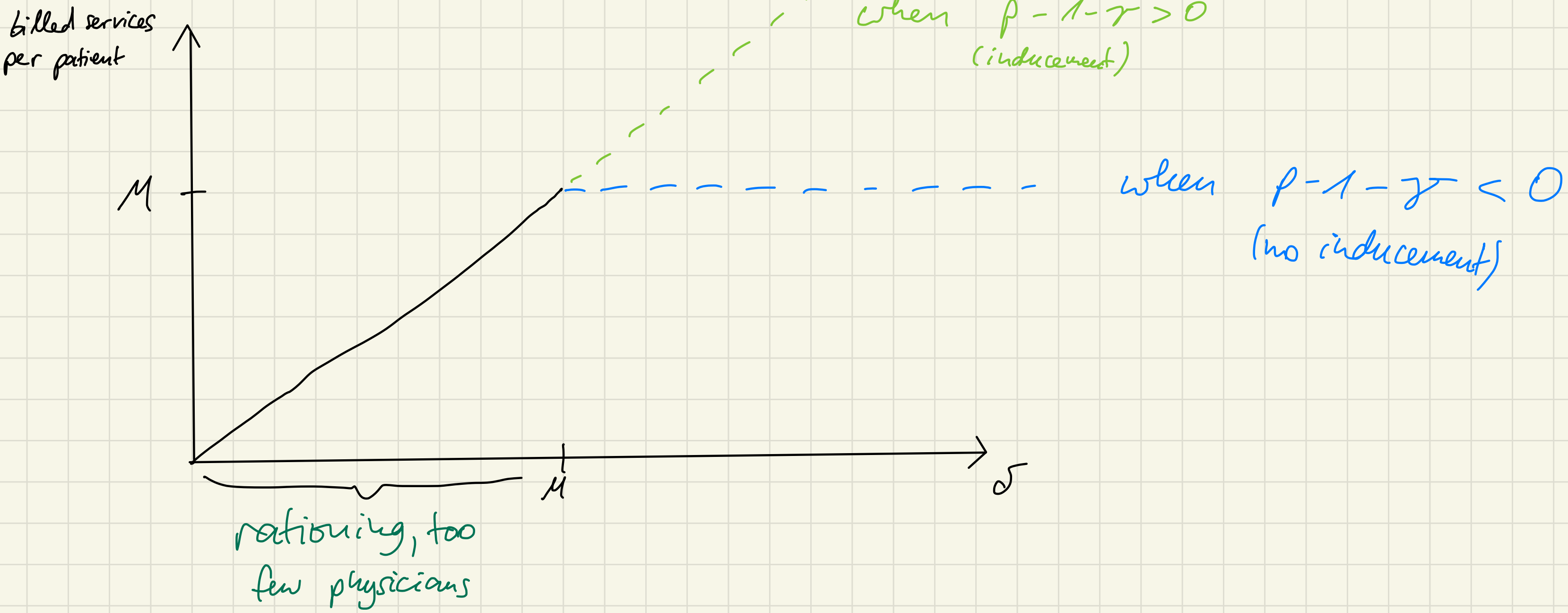
→ if this is < 0: more inducement gives less utility $\rightarrow s = 0$

→ if this is > 0: more inducement gives more utility $\Rightarrow s = 1 - \frac{M}{\sigma}$ (to make sure that $\frac{M}{\sigma} + s \leq 1$)

1. case: $\frac{M}{\sigma} \geq 1$ $\Rightarrow u(y,t,s) = y - 1 - \gamma s$

FOC: $\frac{du}{ds} = -\gamma \leq 0$ $\Rightarrow$ always induced $s = 0$ (induce nothing)
choose

b)



with inducement, everyone gets $\mu + \delta \cdot s = \mu + \frac{a \cdot s}{n}$

on average

$$\rightsquigarrow \mu + \delta \cdot \left(1 - \frac{\mu}{\delta}\right) = \mu + \delta - \mu = \delta$$

c) $u(y,t,s) = y - \underbrace{\min\left\{\frac{\mu}{\sigma}+s, 1\right\}}_{t} - 0{,}5\,\gamma s^2$

1. case : $\frac{\mu}{\sigma} \geq 1 \Rightarrow u(y,t,s) = y - 1 - 0{,}5\,\gamma s^2$

$\rightsquigarrow \frac{\partial u}{\partial s} = -\gamma s \leq 0 \Rightarrow s = 0$ is optimal

2. case : $\frac{\mu}{\sigma} < 1 \overset{\text{for } s \leq 1-\frac{\mu}{\sigma}}{\Longrightarrow} u(y,t,s) = p\left(\frac{\mu}{\sigma}+s\right) - \frac{\mu}{\sigma} - s - 0{,}5\,\gamma s^2$

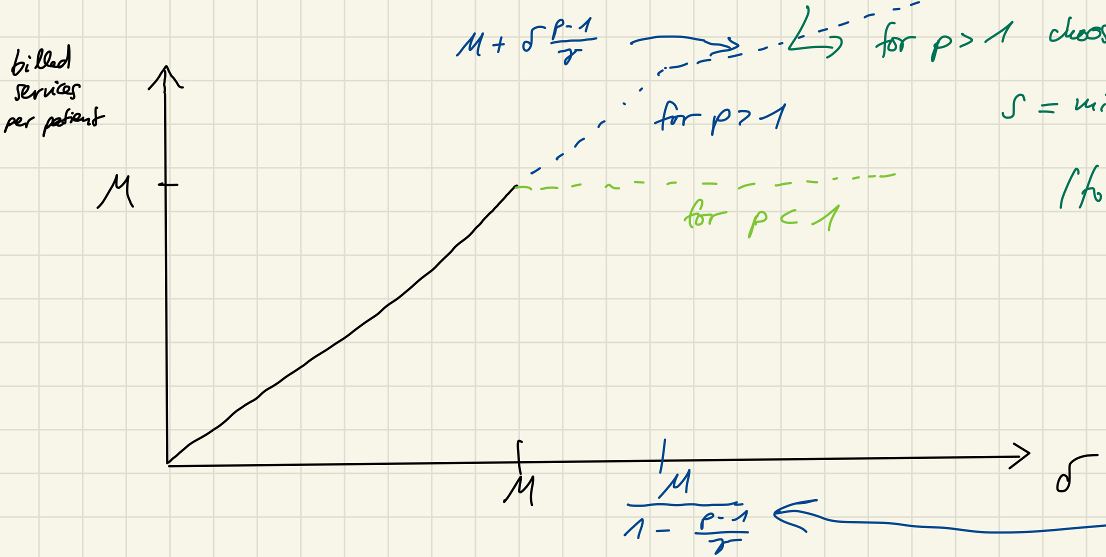
$\rightarrow \frac{\partial u}{\partial s} = p - 1 - \gamma s \overset{!}{=} 0$

$\Leftrightarrow s = \frac{p-1}{\gamma}$ (for $p<1$, this is negative, hence choose $s=0$ in this case)

for $p>1$ choose inducement

$s = \min\left\{\underline{\frac{p-1}{\gamma}}, \underline{1-\frac{\mu}{\sigma}}\right\}$ are equal for the below value of σ

(to make sure that $\frac{\mu}{\sigma}+s \leq 1$)



d) That pattern of an increasing, then flat, then increasing shape of the graph from the lecture is not possible with constant marginal utility of income ($\frac{\partial u}{\partial y} = 1$ as opposed to $\frac{\partial u}{\partial y} = \frac{1}{2\sqrt{y}}$ in the lecture)
Reason for this: The tradeoff between moral disutility from inducing and utility from income is always the same. In the lecture, it was possible since on the flat part, income was so high that inducement was not optimal but as delta increased further, income went so much down that MU of income became high enough to make inducement rational.

↓
marginal utility