Sample Medical Insurance Questions
Econ 155, Fall 2007
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Question 1: Imagine that everyone faces medical risk distributed according to the exponential distribution. There are two kinds of people in this problem: the young and the old. Assume that the young require less medical treatment in a year; ergo, $\lambda_{young} > \lambda_{old}$. The population is y percent young, and $1 - y$ percent old.

- Suppose there is a loading cost of ϕ associated with setting up an insurance company. If insurance companies could observe the age of an individual, what are the prices of insurance offered by an insurance company in a competitive market, a^*_{young} and a^*_{old}
- Now suppose that the federal government has made it illegal for insurance companies to discriminate between the young and the old. What is the price of insurance if the both the young and the old buy insurance.
- Under which conditions does the hidden information lead to adverse selection—that is, the young choose not to buy medical insurance? Use the Arrow-Pratt approximations of willingness to pay, with CARA preference parameter r.

Answer: In competitive markets, the price for insurance is equal to its expected payout, plus loading costs. Thus, $a^*_{young} = E[\widetilde{cost}_{young}] + \phi = \lambda^{-1}_{young} + \phi$ and $a^*_{old} = E[\widetilde{cost}_{old}] + \phi = \lambda^{-1}_{old} + \phi$.

If both age groups pool together, the price of insurance is equal to the expected payout, plus loading costs:

$$\begin{aligned} a^*_{all} &= y \cdot E[\widetilde{cost}_{young}] + (1-y) \cdot E[\widetilde{cost}_{old}] + \phi \\ &= y\lambda^{-1}_{young} + (1-y) \cdot \lambda^{-1}_{old} + \phi. \end{aligned}$$

In order for the young to participate, the price of insurance when all are insured must be less than the young's willingness to pay for insurance, $\pi_{young} \approx E[\widetilde{cost}_{young}] + \frac{r}{2} Var(\widetilde{cost}_{young})$:

$$\lambda^{-1}_{young} + \frac{r}{2}\lambda^{-2}_{young} > y\lambda^{-1}_{young} + (1-y) \cdot \lambda^{-1}_{old} + \phi$$

If the math of this example is confusing, review the examples in class. You can change the numbers in different ways, to see for which numbers risk sharing across types can be supported, and others where it cannot. It can also be useful to recall the graph I used in class on Monday. Mark on the graph when the equilibrium price of insuring all is too large for the young to participate; alternatively, when it is small enough that they will.

Question 2: Suppose that John is considering knee replacement surgery. The surgery costs \$2,000, though he would be willing to pay \$1,900 to have the surgery done.

- If John's insurance does not have a deductable, what is the coinsurance rate at which John is indifferent between having the surgery and not?
- If John's insurance does not have coinsurance, but just a deductable, then

- The question this far has discussed the existence of ex-post moral hazard. What decisions in John's life (i.e., the health of his knee) might have different if he did not insurance.
- Why might we question the validity of this second kind of moral hazard? What quantitative information (e.g., an elasticity) would we need in order to evaluation the sensibility of the first?
- An insurance company executive is looking over your notes, and decides that it should offer full coinsurance—i.e, the individual pays the full cost of medical goods and services provided. What is the flaw in this executive's reasoning.

Answer:

If the deductable for insurance is more than \$1900, John will not have the surgery, because its cost to him is greater than it. Likewise, if the coinsurance rate is more than 95%, John will forgo the surgery. If John faced the full price for his knee surgery, he would have taken less risks on the health of his knee.

That said, knee surgery is painful, so it may not be likely that John acted recklessly regarding his knee—the non-pecuniary costs of injury (e.g., pain of injury, surgery and rehabilitation) could outweigh the incentive to behave with more risk. This is an evaluation of ex-ante hidden action. In order to evaluate ex-post hidden action, we need to know the price elasticity of demand for medical goods and services—how responsive is the quantity of medical goods and services demanded to their price. In this example, if John opts for more and more expensive treatment because he is paying only part of the bill (i.e., quantity demanded is responsive to price), then concerns about ex-post hidden action are valid. However, the most often cited estimates of this elasticity are small.

Question 3: You are advising an economist who is estimating a linear probability model of private insurance coverage of children, $I_i = 1$ if insured, as a function of the child having asthma, H_i, the child's body mass index, BMI_i, and eligibility for SCHIP, $MD_i = 1$ if *not* eligible:

$$I_i = H_i\alpha + BMI_i\beta + MD_i\theta + \varepsilon_i$$

- The economist finds that $\alpha > 0$. What does that mean?
- What value would you expect for θ?
- It has been argued that there is an ex-ante hidden action problem with BMI and private insurance with children. What does this mean? How does limit our ability to claim that β is a causal relationship?

Answers: $\alpha > 0$ suggests that children with asthma are more likely to have private medical insurance than children without asthma. We would expect $\theta > 0$—children with access to SCHIP ($MD_i = 0$) should be less likely to have private medical insurance, because public medical insurance crowds it out.

An ex-ante hidden action problem is when individuals engage in more risky behavior because they do not pay the full social cost of their actions. Here, children would be more likely to be obese, because insurance pays for much of the medical costs associated with childhood obesity.