Health Economics
Economics 156
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Problem Set 1 Solutions

A. Risk Aversion

Consider a risk averse consumer with probability p of becoming sick. Let I_s be the consumer's income if he becomes sick, and let I_{ns} be his income if he does not become sick, with $I_s < I_{ns}$.

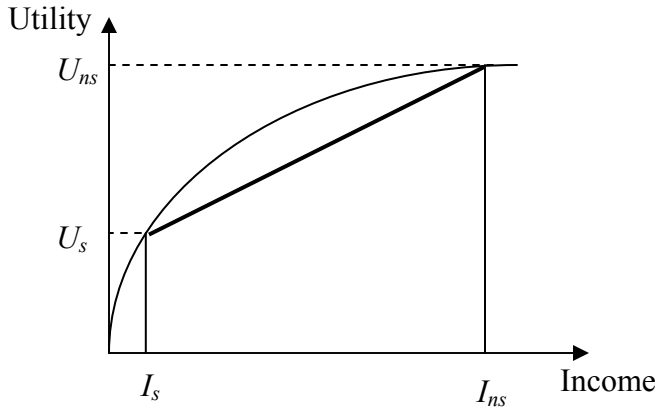
Suppose the consumer cares only about his expected utility of income, which is given by:

$$\textit{Expected Utility} = pU(I_s) + (1-p)U(I_{ns})$$

1. What does risk aversion imply about the consumer's marginal utility of income, $\partial U / \partial I$?

Risk aversion implies declining marginal utility of income (and vice versa). With declining marginal utility of income, the extra income gained in the healthy state over average income, $EI = pI_s + (1\text{-}p)I_{ns}$, is not as valuable as the income lost in the sick state relative to EI.

Draw the consumer's utility curve, showing how utility changes with income.



On this same graph, show the consumer's utility when he is sick and when he is well.

U_s is the consumer's utility when sick, while U_{ns} is the consumer's utility when not sick.

Finally, show the consumer's expected utility at different levels of p (the probability of becoming sick).

The dark line connecting (I_s, U_s) and (I_{ns}, U_{ns}) shows the consumer's utility at different levels of p. If p=1, the consumer will certainly be sick, will earn I_s and utility U_s. If p=0, the consumer will certainly be well, will earn I_{ns} and utility U_{ns}. For levels of p in between zero and one, the consumer will earn I_s with probability p and I_{ns} with probability 1-p, so his expected utility will be a linear combination of U_s and U_{ns}, where the weights are p and 1-p (see the equation for expected utility above). Consequently, the consumer's expected utility will fall on the dark line connecting (I_s, U_s) and (I_{ns}, U_{ns}).

2. Since the consumer is risk averse, presumably he could raise his expected utility by buying an insurance plan.

   Actuarially fair plans are those insurance plans where the insurance company makes no profit. Full insurance in this case means the consumer has the same income whether or not he is sick.

   Let r be the payment from the insurance company to the consumer in the sick state and let q be the premium paid whether the consumer is sick or well. Since there is full insurance, the insurance plan must fully make up the difference in income between the sick and well states; thus $r = I_{ns} - I_s$.

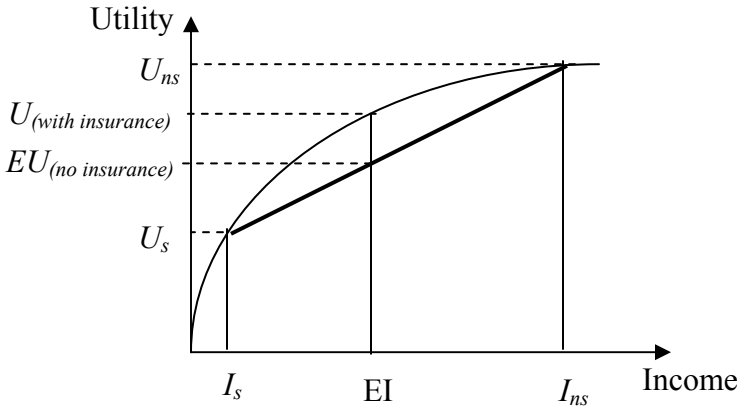
   What is the premium that the consumer pays for an actuarially fair full insurance plan?

   The insurance company's profits equal revenues (from the policy premiums) minus costs, which equal payouts to sick people. Since p percent of the population is sick, the company's expected payouts per policy are $pr = p(I_{ns} - I_s)$, while revenues equal q. In a competitive situation, profits = $q - pr$ will equal zero, so premiums will equal $p(I_{ns} - I_s)$.

   What is the payment by the insurance company when the consumer is sick? What is the payment if he is well?

   The consumer receives ($I_{ns} - I_s$) when sick and nothing when well.

3. Show the consumer's gain in expected utility from buying an actuarially fair full insurance plan on a copy of your graph from question one.



With insurance, the consumer receives EI with certainty, and hence will have utility U(with insurance). We have seen in the answer to the previous question that the consumer will receive EU(no insurance) without insurance. The gain in utility from purchasing insurance is the difference U(with insurance) – EU(no insurance).

What happens to this gain in utility as the probability of illness approaches zero (the consumer is certainly well)?

As the probability of illness approaches zero, the EI line shifts to the right toward I_{ns}. The gap between U(with insurance) and EU(no insurance) will disappear as p approaches zero, so the welfare gain from insurance will also approach zero.

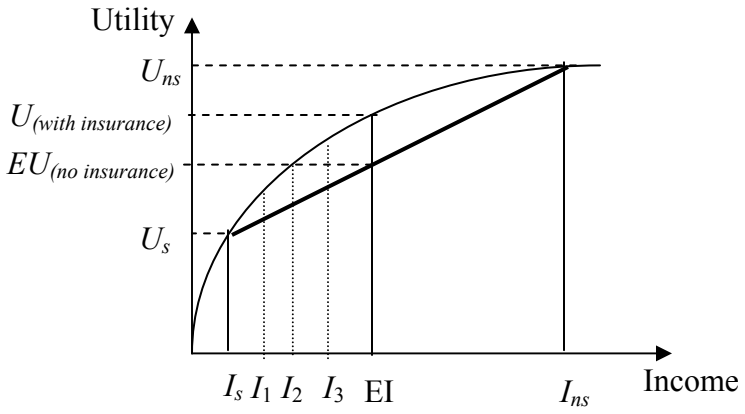
What happens to this gain in utility as the probability of illness approaches one (the consumer is certainly sick)?

As the probability of illness approaches one, the EI line shifts to the left toward I_s. Just as before, the gap between U(with insurance) and EU(no insurance) will disappear as p approaches zero, so the welfare gain from insurance will also approach zero.

4. Given your answer to the previous question, would consumer welfare be enhanced by a government requirement that everyone buy insurance against lost income due to the common cold, which everyone gets at some time in their life?

No, since in this model, there is no welfare gain from insurance against certain illness. This counterintuitive result arises because insurance premiums rise to reflect the certainty of illness.

5. Show on your graph the highest premium consumers would be willing to pay for insurance (extra credit if you can show all this using algebra).



Instead of offering a certain income of EI, suppose the insurance company offered a certain income of I_3 instead. The consumer's utility $U(I_3)$ would be less than he would receive from actuarially fair full insurance U(EI) = U(with insurance), but he would still be better off than without insurance since $U(I_3) > EU$(no insurance). On the other hand, if the insurance company offered a certain income of I_1, then the consumer would be better off without insurance, since $U(I_1) <$ EU(no insurance). In the insurance company offers I_2, the consumer is indifferent between being insured and not being insured. Hence, the most that consumers would be willing to pay for full insurance is when premiums are set such that the consumer receives I_2 as a certain income.

Algebraically, at I_2, we have that $U(I_2) = EU$(without insurance) $= pU(I_s) + (1-p) U(I_{ns})$, so $I_2 = U^{-1}[pU(I_s) + (1-p) U(I_{ns})]$. Consumers pay a premium equal to the actuarially fair premium for full insurance $p(I_{ns}-I_s)$ plus the difference between EI and I_2, so the total consumer payments are $p(I_{ns}-I_s)+(EI-I_2)$.

What would the insurance company's profits be if they charged this premium, and consumers bought it?

The insurance company pays out full insurance $(I_{ns}-I_s)$ when the consumer is sick, and since this happens with probability p, the company's costs are p(Ins-Is). Their revenues per policy equal consumer premium payments $p(I_{ns}-I_s)+(EI-I_2)$. The company's profits equal revenues minus costs which are simply $EI-I_2$.

What might constrain insurance companies from charging this maximum premium?

Competition. Insurance companies that charge such a high premium run the risk of being undercut by other insurance companies charging lower premiums. Any insurance company that charges more than actuarially fair premiums run this risk.

B. Positive vs. Normative

For each of the following statements, indicate whether the statement is making a positive point or a normative point. For each statement, suggest some government policy that someone who believes in the statement would probably support, if any. Limit your answer to one or two sentences per statement.

1. It is wrong for anyone to be denied health care, even if they cannot pay for it.

Normative statement. A person who believes this might support universal government provided health care.

2. Raising the marginal tax rate on the rich will make health insurance cheaper for them.

Positive statement. A person who believes this might support removing preferential tax treatment for employer provided health insurance purchases.

3. Sanitation is more important than health care in promoting the average health of the population.

Though the statement is vague, it is most likely a positive statement since it is possible in principle that it could be proven false (given suitable definitions for "more important" and "average health"). A person that believes this might support government projects designed to improve the quality of the water supply at the expense of health insurance provision.

4. People should be allowed to see the doctor of their choice.

Normative statement. A person who believes this might support restrictions on the ability of health insurance plans to restrict the set of doctors that enrollees can see.

5. Doubling the price of a doctor visit reduces the demand for doctor visits by 10%

Positive statement. Someone who believes this might support the introduction of copayments in insurance plans to limit moral hazard.

6. The government should not subsidize health insurance for people who have more than $1 million dollars in savings.

Normative statement. Someone who believes this might support denying Bill Gates Medicare when he turns 65.

7. My utility function has the following elements: health, video games, health care.

Positive statement. Someone who believes this might support supplying me with a fresh new copy of Warcraft III.

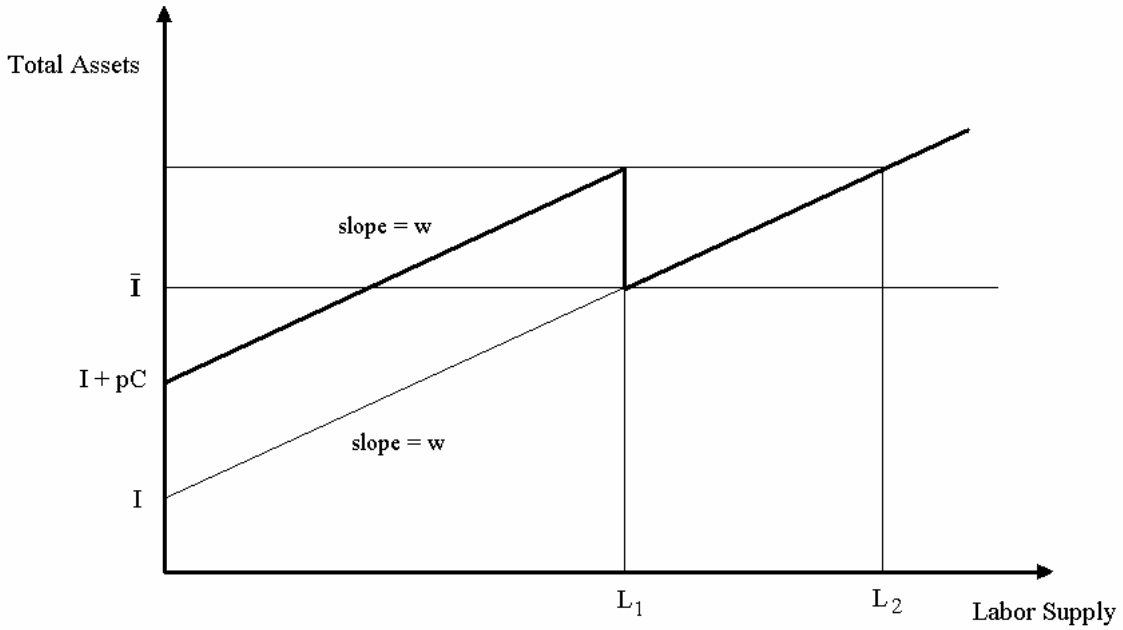
C. Labor Market Disincentives of Medicaid

Let

$\bar{I}$ = the Medicaid income-eligibility threshold
I = non-earnings income
p = price of health care
C = quantity of health care transferred
w = wage
L = hours of work per year

Consider the following figure, which we used in class to discuss the labor market disincentive effects of the Medicaid program:

Figure 1: Labor Market Disincentives of Medicaid

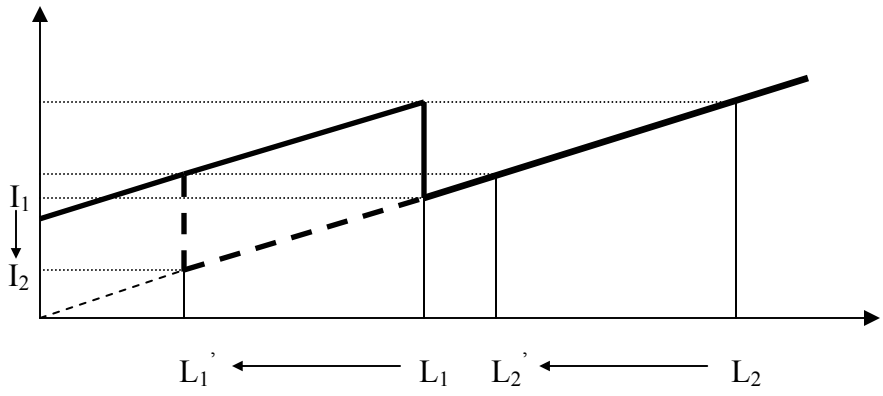


When income from earnings plus non-earnings income is above $\bar{I}$ (that is, $I + wL > \bar{I}$), eligibility for Medicaid (and the transfer of C) is lost. When hours of work are between L_1 and L_2 hours, the worker's total assets is less than when hours of work is less than L_1 or greater than L_2. Thus, workers have no incentive to work between L_1 and L_2 hours.

1. Suppose the state reduces the Medicaid income eligibility threshold, $\bar{I}$.
   a. Would this make it easier or harder for people to qualify for Medicaid?

Reducing $\bar{I}$ would make it harder to qualify for Medicaid. A numerical example might help here. Suppose I make $9,500 per year. If the Medicaid threshold is $10,000, then I would qualify, but if the threshold were reduced to $9,000, I would no longer qualify.

   b. What would happen to the size of the region where workers have no incentive to work?

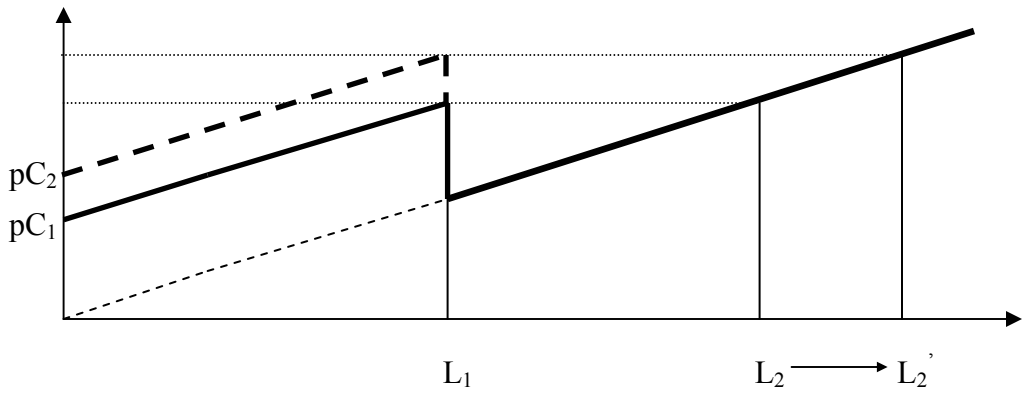


As the Medicaid threshold is reduced from I_1 to I_2, the size of the region where workers have no incentive to work stays exactly the same, but shift to the left. (Note in this figure, initial income I is set to zero). The dark solid line represents the old budget constraint, while the dark dashed line represent how this constraint changes as the Medicaid threshold is reduced.

   c. Would L_1 increase, decrease or stay the same? What about L_2?

L_1 and L_2 would both shift to the left (decrease) by the same amount.

2. Suppose the state makes Medicaid more generous. That is, it increases C.
   a. What would happen to the size of the region where workers have no incentive to work?



As Medicaid is made more generous (moves from pC_1 to pC_2), the budget constraint shifts upward so that the new portion of the budget constraint is represented by the dark dashed line. The size of the region where workers have no incentive to work increases.

   b. Would L_1 increase, decrease or stay the same? What about L_2?

L_1 would stay the same, while L_2 would increase.