Module 1: Health Insurance

Demand for health insurance

Ian McCarthy | Emory University
Econ 372

Quick summary

Let's quickly revisit the main things from last class:

1. Motivating story: Humana leaving the exchanges due to poor risk pool.
2. Preliminary things: Calculate expected values and expected utilities

Why purchase health insurance?

Say your utility function is $u(w) = \sqrt{w}$ and that you're starting with $w =$ \$100. I propose a lottery in which I flip a coin...heads you win \$20 and tails you lose \$20.

1. What is the expected monetary value of this lottery?

2. What is your utility at this expected value?

3. What is the expected utility from this lottery?

Answer

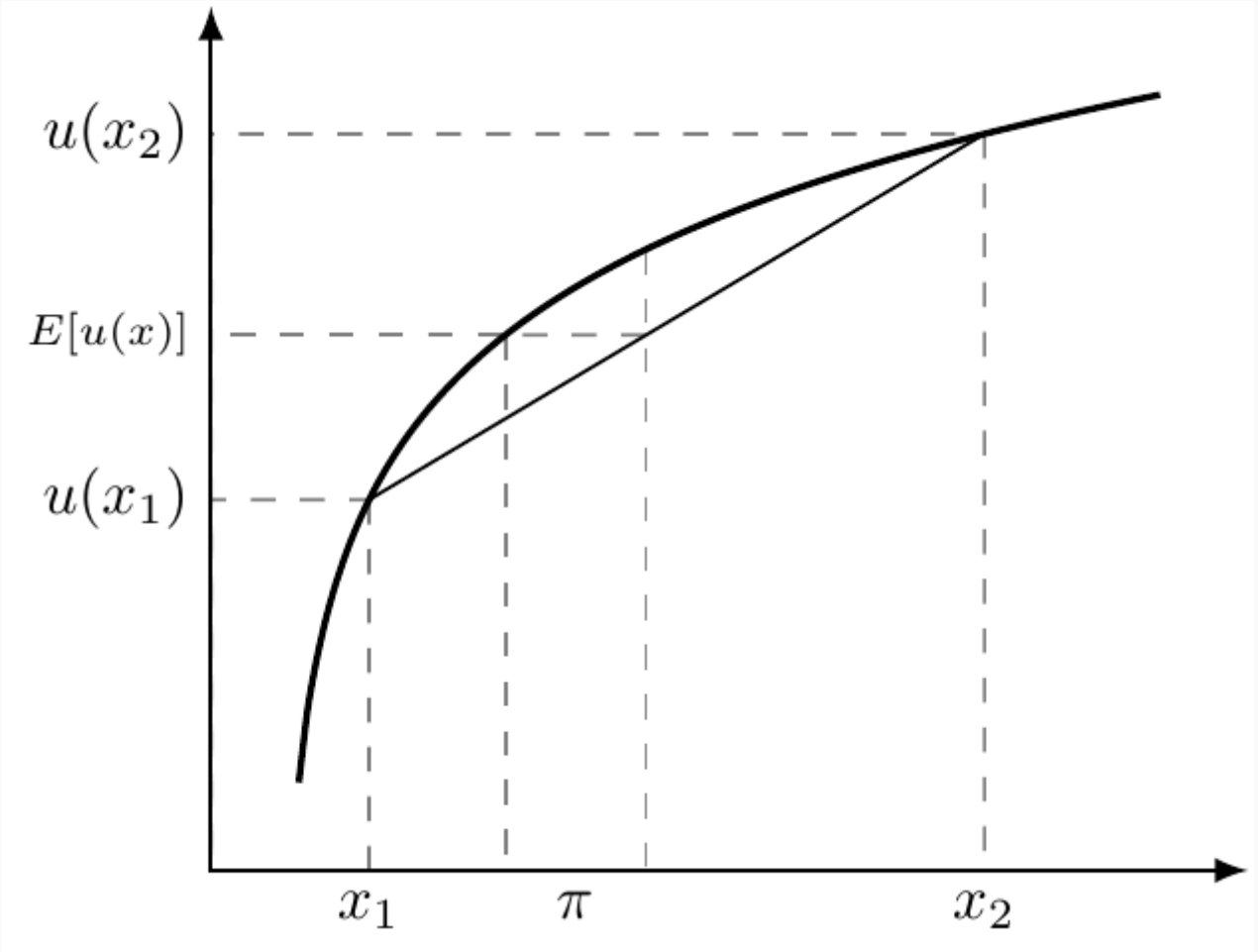
Expected wealth is simply $\frac{1}{2} \times 80 + \frac{1}{2} \times 120 = 100$, which yields a utility of $u(w) = 10$. But your expected utility is $\frac{1}{2} \times u(w_{heads}) + \frac{1}{2} \times u(w_{tails}) = \frac{1}{2} \times \sqrt{80} + \frac{1}{2} \times \sqrt{120} = 9.95$.

Risk premium

The maximum amount of money that a risk-averse person is willing to pay to avoid the risky scenario. In other words, the amount of money that makes a person indifferent between the certain and uncertain situations.

This is part of how we measure willingness-to-pay for health insurance.

Risk premium



Example

Consider the utility function, $u(w) = \ln(w)$. An individual starts with a wealth of \$100,000. With probability 0.25, this person will get sick and incur a cost of \$20,000. Their wealth in the sick state is therefore \$80,000. What is the maximum amount this person is willing to pay for health insurance?

1. Calculate expected wealth, $E[w]$.
2. Calculate expected utility, $E[U(w)]$.
3. Calculate value of wealth that gives you $u = E[U(w)]$ (based on the utility function).
4. Calculate the risk premium as the difference between (1) and (3).
5. Calculate maximum willingness to pay by adding the risk premium and the expected cost.

Answer

We're asked to find some wealth level, y, such that the person is indifferent between y with certainty versus the risky wealth levels, $w_h =$ \$100,000 with probability 0.75 or $w_s =$ \$80,000 with probability 0.25.

The person's expected utility with uncertainty is: $E[u] = 0.75 \times \ln(100000) + 0.25 \times \ln(80000) =$ 11.4571396. We therefore need to find y such that $u(y) =$ 11.4571396. Given our utility function, this is satisfied for $y =$ \$94,574. Since the person starts with \$100,000, they are willing to pay a maximum of \$100,000 $-$ \$94,574 $=$ \$5,425.8 for health insurance.

Finally, since the expected cost of care is \$5,000, we can break this \$5,425.8 into its actuarily fair premium of \$5,000 plus the loading factor or risk premium of \$425.84.

In-class Problem: Demand for insurance

Assume that utility takes the log form, $u(x) = ln(x)$. If someone is healthy, they maintain their current wealth of $100, and if they become ill, they must incur a cost of $50. Answer the following questions based on this setup.

1. Calculate the risk premium and willingness to pay based on a probability of illness of 0.1.
2. Repeat part (1) using a probability of illness of 0.2.
3. Repeat part (1) using a probability of illness of 0.5.
4. Explain how these values differ and why. What might this say about the profitability of insurance in a market with many sick people?

What affects the risk premium?

Based on the graph, what do you think are some things that might affect the risk premium?

1. Curvature of the utility function
2. Probability of illness
3. Cost of illness

High risk pools

- A "high-risk pool" is a way to put people that are more likely to incur high medical costs all in one plan.
- Recalling the curvature of demand function, probability of illness, and cost of illness...do you think a high-risk pool is sustainable (think about the profit to the insurer)?

Let's look at this in practice, KFF High-risk Pools

Other reasons to buy health insurance

1. Increase bargaining power with providers

2. Manage where care is delivered (due to information problems in health care decisions)

Main takeaways

1. Explain and show graphically how changes in the utility function, probability of illness, and the cost of illness affect the risk premium

2. Calculate amount of insurance individuals would purchase under given assumptions