Lecture Notes: Uncertainty and Risk

Intermediate Microeconomics

Spring 2012

1 Attitudes Towards Risk

We classified agents by the kind of attitudes that they have towards risk. This particular characteristic of agents is given by their utility function which determines whether they are risk averse, risk neutral, or risk loving.

1. Risk Averse:
    - Diminishing marginal utility of income.
    - When facing two lotteries with the same expected value, these agents prefer the less risky one.
    - Example: $u(I) = \sqrt{I}$
2. Risk Neutral:
    - Linear utility of income.
    - When facing two lotteries with the same expected value, these agents are indifferent between them even if one is more risky than the other.

- Example: $u(I) = I$

3. Risk Averse:

   - Increasing marginal utility of income.
   - When facing two lotteries with the same expected value, these agents prefer the riskier one.
   - Example: $u(I) = I^2$

2 Risk Premium

What amount would a risk averse person be willing to pay in order to avoid risk? Consider the following example:
An agent faces the following two lotteries:

1. Lottery 1: Get income of \$9 with probability 0.5 or an income of \$25 with probability 0.5.

2. Lottery 2: Get income of \$16 for sure.

The utility function of the agent is $u(I) = \sqrt{I}$. First, let's calculate the *expected payoff* of each of the lotteries:
Expected payoff of lottery 1:

$$\begin{aligned} E(I) &= 0.5 \times 9 + 0.5 \times 25 \\ &= 17 \end{aligned}$$

Expected payoff of lottery 2:

$$E(I) = 16$$

Now let's calculate the *expected utility* of each of these lotteries:

Expected utility of lottery 1:

$$\begin{aligned} E(u(I)) &= 0.5 \times u(9) + 0.5 \times u(25) \\ &= 4 \end{aligned}$$

Expected utility of lottery 2:

$$\begin{aligned} E(u(I)) &= u(16) \\ &= 4 \end{aligned}$$

We can see that even though lottery 1 offers the agent a higher *expected payoff*, he is actually indifferent between getting lottery 1 or lottery 2 (we get that he is indifferent from the fact that the two lotteries give the same expected utility to the agent). Why? This is because the agent faces a tradeoff between the expected payoff and the risk factor of each lottery (remember that this agent does not like risk, given his utility function). While lottery 1 offers a higher expected payoff ($17), it is associated with higher risk. On the other hand, lottery 2 offers a lower expected payoff ($16), with no risk. In this case, we say that this agent is willing to give up $1 from the expected payoff of lottery 2 in order to avoid the risk of lottery 2. In other words, you will be taking $1 from him but giving him less risk so that in the end, he will be indifferent between lottery 1 and lottery 2. This amount that the agent is willing to pay in order to avoid risk, is called *risk premium*. See your textbook for more examples on the calculation of the risk premium.