Microeconomics: BSc Year One

Uncertainty

Many decisions are made in uncertain circumstances. Any uncertain choice is called a ***gamble***, the choice made is an *action*; the result (the *outcome*) depends not only on this but on the state of nature, which is a collection of external and uncontrollable factors.

A *prospect* is the set of possible outcomes from an action, with (subjective) probabilities. Choosing an action is choosing between prospects; people will choose depending on what they think the state of nature will be.

It is useful to distinguish between risk and uncertainty; risk occurs if probabilities are roughly known, such as in the case of insurance; uncertainty is defined by anything being completely random. To get around this, we look at subjective prospects – that is, what individuals predict.

We can use expected utility in current theories;

$$U_e = \sum \text{(utilities of the outcomes multiplied by the respective probability)}$$

$$U_e = \sum pu(c)$$

where p is the probability of each outcome, and c is the wealth from each outcome.

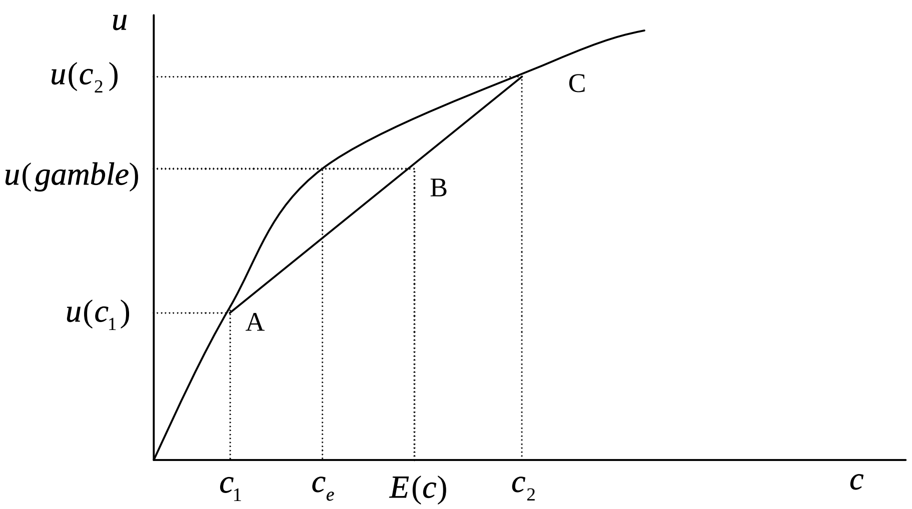
There are several assumptions on how people must behave to lead to this concept. This does change utility theory a little; without uncertainty theory we can only look at utility in an ordinal way, but the adding of uncertainty makes the arguments used stronger.

We assume:

- people only care about the outcomes
- outcomes can be measured in money (wealth)
- only two states of nature exist

Risk aversion

A risk averse individual has a concave utility function:



The gambler here has different outcomes in two states of nature – 1 and 2 – which correspond to the points A and C. B is the point on AC such that $\frac{AB}{BC} = \frac{p_2}{p_1}$ (so it is closer to A is state 1 is more likely, and central if the two states are equally likely). Given this definition, $E(c)$ is the expected value of *c*, since it is equal to the sumproduct of probabilities and outcomes. c_e is the *certainty equivalent* of the gamble – that is, the certain value of *c* which has the same utility to the gambler as the gamble.

This individual is risk averse, because this certainty equivalent is lower than $E(c)$.

To illustrate this with an example, suppose this individual was invited to play a game:

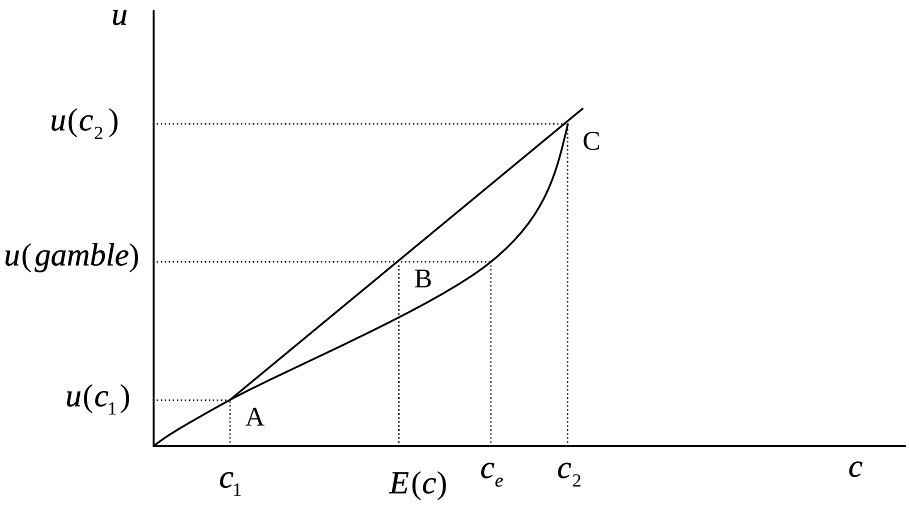
- It costs £2 to enter
- A coin is flipped
- If it lands on heads, you win £4
- If it lands on tails, you win nothing

The expected value of this game is zero. However, a risk averse individual would have a certainty equivalent less than zero – and be willing to pay some sum to not gamble. Risk averse indivuals therefore will pay insurance against losses.

The shape of this graph implies that if you are poor, an extra pound means a lot to you, and you get far more utility from it. Losses hit harder than increases in wealth.

Risk loving

Risk loving individuals are the opposite to risk averters.



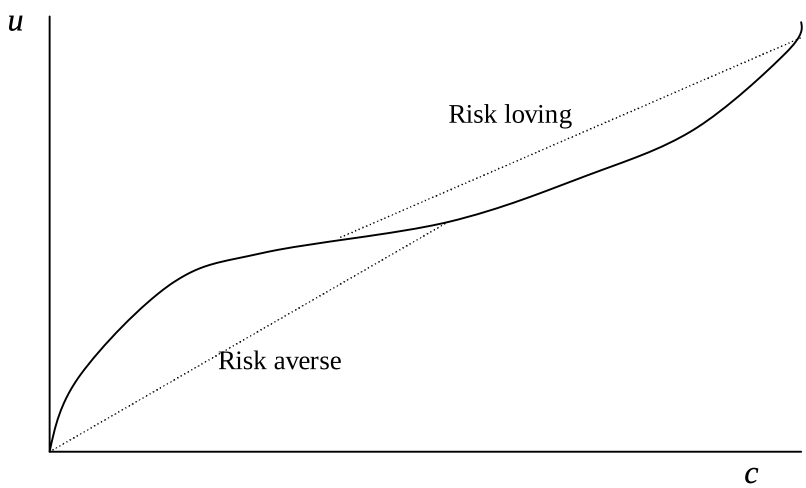
Here, $c_e > E(c)$, so the gambler will be willing to pay extra in order to take the gamble.

Insurance companies insure against some risk. The insurance company offers certainty – for fisk averse individuals, it will move wealth to c_e with insurance policies (in a perfect world, they would offer the expected value of wealth $E(c)$). Risk lovers will not insure, as it would cost more than the expected cost of the gamble.

Risk neutral

Risk neutral individuals have no preference between gambling with an expected outcome of *x* or receiving *x* definitely. Their utility function is a straight line.

Some people both insure and gamble. While this could be explained by risk neutrality, Friedman and Savage suggest this is because of strangely shaped utility functions:



It is suggested that small losses and gains don't really matter, large gains are great, and large losses are catastrophic, leading to the graph above. This is summarised in Brewer's Theory – people overlook small probabilities.