The Sure-Thing Principle and Critiques to Expected Utility

Ricard Torres

ITAM

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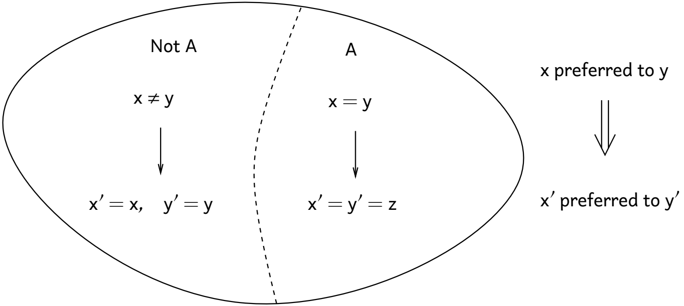
Savage's Approach to Decision Under Uncertainty

Savage's theory takes as primitive the preferences of the individual over contingent plans, and imposes over those preferences some requirements that will allow to derive a subjective probability, and other requirements that will allow to derive an expected utility representation, most notably the:

- Sure thing principle: Let x be a contingent plan that is strictly preferred to another plan y. Suppose that both plans coincide over a given set of states, say A. Let z be an arbitrary plan, and consider new plans x' and y' that coincide with x and y (respectively) over the states not in A, and coincide with z over the states of A. Then we impose the requirement that x' must be strictly preferred to y'.

Sure thing principle



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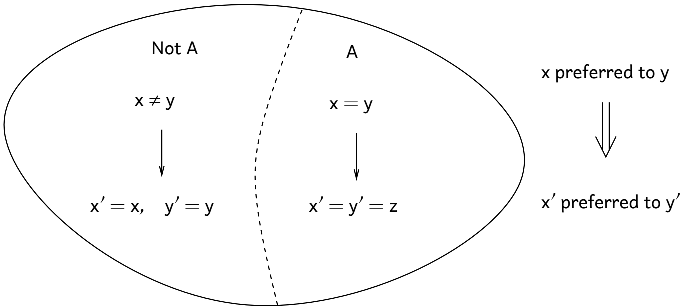

The idea of Savage's Sure Thing Principle is that our preference of x over y must depend solely on those states in which they differ, ie, in those states not in A. The way in which both plans coincide over A should not matter.

Critiques of the Expected Utility Theory

- This theory has been strongly criticized as being a very bad prediction of people's behavior under uncertainty, ie, as being a bad positive theory.
- Many experiments have shown that the behavior of people under uncertainty does not conform to the theory.
- Daniel Kahneman received the Nobel Prize in Economics mostly due to his experimental work in this area.

Framing Effects

- Kahneman and Tversky have shown in experiments that framing effects are very important in predicting individuals' behavior. Consider the following example:
- We are analyzing measures to combat an epidemic. If nothing is done, it is estimated that it will cause 600 deaths. Two public health programs are proposed that will have the following consequences:
  - A: 200 people will be saved with certainty.
  - B: with probability 2/3 nobody will be saved, and with probability 1/3 all possible 600 potential victims will be saved.

Framing Effects: Example

- In a subsequent choice, we are asked to evaluate two alternative programs that would have the following consequences:
  - C: 400 people will die with certainty.
  - D: with probability 2/3 600 will die, and with probability 1/3 nobody will die.

Framing Effects: Example

- In a subsequent choice, we are asked to evaluate two alternative programs that would have the following consequences:
  - C: 400 people will die with certainty.
  - D: with probability 2/3 600 will die, and with probability 1/3 nobody will die.
- Kahneman and Tversky found that 72% of Harvard Public Health students preferred A over B, whereas 78% preferred D over C.

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- In a subsequent choice, we are asked to evaluate two alternative programs that would have the following consequences:
  - C: 400 people will die with certainty.
  - D: with probability 2/3 600 will die, and with probability 1/3 nobody will die.
- Kahneman and Tversky found that 72% of Harvard Public Health students preferred A over B, whereas 78% preferred D over C.
- It's not difficult to see that the A and C, as well as B and D, are different ways to describe the same choices, though they are framed differently: in the first case specifying how many people will be saved, and in the second how many will die.

The Allais Paradox

- Another famous example is the Allais Paradox, created by the French economist Maurice Allais, who was also awarded a Nobel Prize in Economics.
- In the first place, we are asked to choose between the following lotteries:

  Lottery 1. We obtain \$ 5 million with certainty.

  Lottery 2. We obtain \$ 25, 5 or 0 million, with respective probabilities 0.1, 0.89 and 0.01.

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- Next we are asked to choose between:

  Lottery 3. We obtain either \$ 5 million or 0, with probabilities 0.11 and 0.89.

  Lottery 4. We obtain either \$ 25 million or 0, with probabilities 0.1 and 0.9.

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  Lottery 4. We obtain either \$ 25 million or 0, with probabilities 0.1 and 0.9.

- A vast majority of people prefer 1 to 2 and 4 to 3. But these choices are incompatible with an expected utility.

The Allais Paradox

☞ In order to justify why we should want to choose according to the Sure Thing Principle (ie, expected utility), Savage wrote the choices in the following way:

	# balls		
	1	10	89
Lottery 1	5	5	5
Lottery 2	0	25	5

	# balls		
	1	10	89
Lottery 3	5	5	0
Lottery 4	0	25	0

- For the last 89 balls, the two lotteries yield the same result for both choices.
- What makes a difference between the two lotteries is what you get for the first 11 balls, but this is the same in both choices.