Critiques of Expected Utility Theory

14.123 Microeconomic Theory III

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Allais Paradox

- Choose A or B, then C or D.

  (A) Win $1 million for sure.

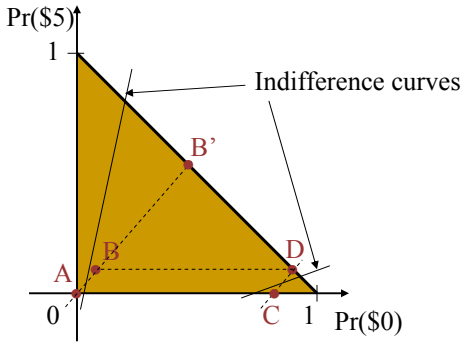
  (B) Win $5M with 10% chance, $1M with 89%, nothing with 1%.

  (C) Win $1M with 11% chance, nothing with 89%.

  (D) Win $5M with 10% chance, nothing with 90%.

- Choice of A and D violates expected utility:

Allais Paradox, Graphically



"Common consequence" paradox: $A \succ B$ but $D \succ C$.

"Common ratio" paradox: $A \succ B'$ but $D \succ C$.

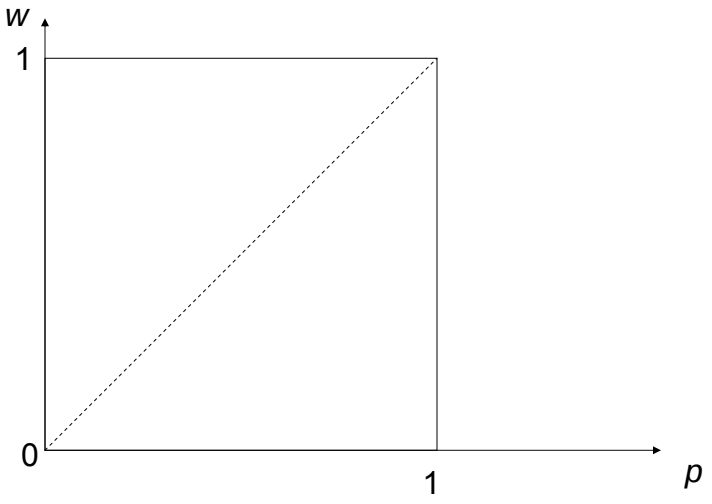
Resolutions

- indifference curves *fan out*.
- Betweenness without Independence
- Weighted Expected Utility:

  $W(p) = \sum_{x \in X} \gamma(x)p(x)u(x)/[\sum_{x \in X} \gamma(x)p(x)]$.
- Rank-Dependent Expected Utility

  $R(p) = \int u(x)\, dw(p(x))$.
- And many others

Probability Weighting Function



Ellsberg Paradox

- An urn contains 99 balls, colored, Red, Black and Green
- There are 33 Red balls;
- the combination of the other colors is not known.
- You choose a color and we draw a ball.
- If the ball is of the color chosen, you win $1. What color would you choose?
- If the ball is **not** of the color chosen, you win $1. What color would you choose?

Resolution: Ambiguity Aversion

- Compounded lotteries are not reduced to simple lotteries
- Ambiguity aversion:

$$\max_a \min_p E_p[u(a)]$$

- Smooth ambiguity aversion:

$$\max_a E[v(E_p[u(a)])]$$

Framing

- "Outbreak of disease is about to kill 600 people. Choose treatment program A or B; then C or D."

  (A) 400 people die.

  (B) Nobody dies with 1/3 chance, 600 people die with 2/3 chance.

  (C) 200 people saved.

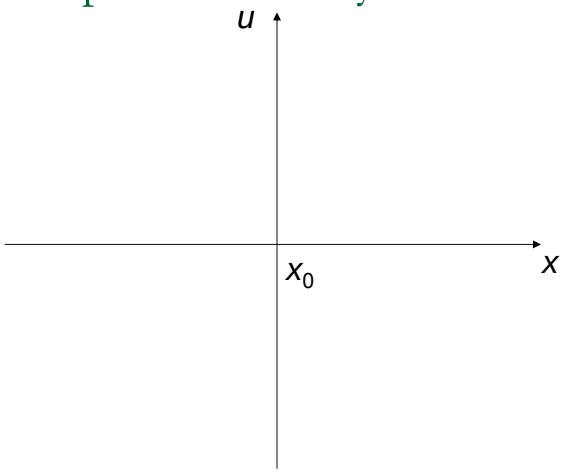
  (D) All saved with 1/3 chance, nobody saved with 2/3 chance.

- 78% of subjects pick B, 28% of subjects (in different group) pick D. But A is equivalent to C, B is equivalent to D (apart from wording).

Prospect Theory

- "Edit the decision problem"
- Distort the probabilities using inverted S shape
- Apply a reference-dependent S shaped utility function
  - Risk aversion towards gains
  - Risk taking towards losses
  - "Loss aversion"

Prospect Theory
Reference-dependent Utility Function



Prospect Theory Formula

- $U(x|w,x_o) = \int u(x|x_o)dw(F(x))$
- Properties & Problems:
  - What is reference point?
  - Framing
  - Dynamic Programming

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