Introduction

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Outline

1. Course information
2. Economic modeling: Choice under certainty
3. Economic modeling: Choice under uncertainty
4. Economic modeling: Welfare
5. Economic modeling: Why mathematical models?

Section 1

Course information

Course information

- website: `https://github.com/schottmueller/infohealthecon/blob/master/plan.org`
  - information
  - plan
  - reading
    - Zweifel, Breyer, Kifmann "Health economics"
  - exercises
- exam
  - date: to be announced on course website later
  - registration via KLIPS

Goal and content

- introduce basic concepts and models of information economics applied to health care markets
  - asymmetric information
    - own characteristics → "selection" (e.g. is diabetes prevalent in my family?)
    - own actions → "moral hazard" (e.g. am I driving carefully?)
    - state of the environment (e.g. how ill is the patient?)
  - how does asymmetric information impact behavior and market outcomes?
  - how does the institutional environment affect behavior and outcomes?
- tools
  - decision and game theoretic models
  - some empirical evidence testing and illustrating the theory

Section 2

Economic modeling: Choice under certainty

Choices and trade-offs

- economics is about the allocation of *scarce* ressources (time, capital, slots etc.)
- individuals make economic decisions all the time
  - come to the early lecture or sleep longer
  - what to buy for dinner?
- choices in health care
  - patients: pick up a prescription medicine (and pay your copayment) or not
  - doctors: which test? which treatment?
  - insurers: what to cover? what to charge?
  - politicians and regulators:...

(Hypothetical) Choice

- primitive of economic modeling: (hypothetical) choice
  - what would person i choose if he had to choose among alternatives $x_1, x_2, \ldots, x_n$?
  - (hypothetically) chosen alternative is *best* (for i)

Example (Hypothetical choice)

- Should a health care system offer a new treatment that costs 100€ more than the old treatment?
- Would those that can be treated with the new treatment prefer (i) old treatment and a payment of 100€ or (ii) the new treatment?

Preference representation

- convenient notation for "person i would choose x_1 if he had to choose one among the two alternatives x_1 and x_2": $x_1 \succeq_i x_2$ (read: "i prefers x_1 to x_2")
- few choices are observed
  - make *assumptions* to infer preferences for not observed choices
    - completeness: for each pair of alternatives x_1, x_2, either $x_1 \succeq_i x_2$ or $x_2 \succeq_i x_1$
    - transitivity: if $x_1 \succeq_i x_2$ and $x_2 \succeq_i x_3$, then $x_1 \succeq_i x_3$

Utility representation

- even more convenient than preferences
  - can we find a function $u_i(x)$ such that $u_i(x_1) \geq u_i(x_2)$ if and only if $x_1 \succeq_i x_2$? (if yes, we say "u_i represents i's preferences")
  - if yes, person i's choice behavior (in all possible choice situations!) will then be *as if person i maximized the function u_i by his choice*

Theorem (Representation)

If the number of alternatives is finite and person i's preferences are complete and transitive, then there exists a function u_i representing i's preferences.

- utility representation allows us to use mathematical maximization techniques for economic analysis!

Remarks on utility

- utility has nothing to do with happiness!
- utility (maximization) is not (necessarily) egoistic!
- there are also representation theorems for infinite choice sets
- completeness and transitivity are necessary assumptions for a meaningful analysis but not totally innocent

Section 3

Economic modeling: Choice under uncertainty

Decision making under uncertainty

- "alternatives" will often be uncertain

Example (Uncertainty)

outcome/treatment	treatment x_1	treatment x_2
healthy	0.4	0.5
ill	0.4	0.25
dead	0.2	0.25

Table gives probability for three outcomes given each treatment. Alternative x_1 is a lottery $(0.4, 0.4, 0.2)$ over the three outcomes. Alternative x_2 is the lottery $(0.5, 0.25, 0.25)$.

- it would be very convenient if preferences over lotteries could be represented by a utility function u_i that can be written as

$$u_i((\alpha, \beta, \gamma)) = \alpha u_i^{healthy} + \beta u_i^{ill} + \gamma u_i^{dead}$$

- preferences over all kind of treatments/lotteries could then be described by just 3 numbers: $u_i^{healthy}$, u_i^{ill}, u_i^{dead}

von Neumann - Morgenstern expected utility theorem

- von Neumann and Morgenstern have proven that such an "expected utility" representation is possible under one additional assumption called "independence"
- independence (roughly):
  - take our two lotteries $x_1 = (0.4, 0.4, 0.2)$ and $x_2 = (0.5, 0.25, 0.25)$
  - suppose $x_1 \succeq_i x_2$
  - take some other (hypothetical) treatment x_3 and consider the 2 options
    1. toss a coin, if heads take treatment x_1 if tails take x_3
    2. toss a coin, if heads take treatment x_2 if tails take x_3
  - independence states that i must prefer the first over the second option

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- we will assume throughout the course that the choices of the players in our models are such that transitivity, completeness and independence are satisfied, i.e. players choose as if they maximized a utility function in expected utility form

Section 4

Economic modeling: Welfare

Welfare

- what is good for a group of people/society?
- choices of society can be represented by a utility function called *welfare function* if they satisfy the same assumptions as before
- minimum standard for good societal decisions:
  - if all people prefer x_1 to x_2 (and someone does so strictly), then society as a whole should prefer x_1 to x_2 (Pareto criterion)
    - we say: "x_1 Pareto dominates x_2" or "x_1 is Pareto superior to x_2" or "x_2 is Pareto inferior to x_1"
  - all alternatives that are not Pareto inferior to some other alternative are called Pareto efficient
    - usually there are a lot of Pareto efficient alternatives
  - good societal choices should be Pareto efficient!

Example (Splitting a euro)

2 people, who like more money better, have to split 1€. Each cent has to be given either to one of them or be destroyed. What are the feasible alternatives? Which are Pareto efficient?

Interpersonal utility comparison and willingness to pay

- which of many Pareto efficient allocations should society choose?
  - (simple) utilitarian approach: $\max_x \sum_i u_i(x)$
    - why is this potentially problematic?

- willingness to pay
  - consider two alternatives: good treatment but you have to pay t, bad treatment and you have to pay nothing
  - for which value of t are you indifferent betwen the two options?
- willingness to pay is in euros $\rightarrow$ can be aggregated
  - developing the new treatment costs c (the treatment itself is then costless), when is it worthwhile to invest c and develop the treatment?

Section 5

Economic modeling: Why mathematical models?

Maps and Models

- stylized representation of reality
- abstract from most of reality (”unrealistic on purpose”)
- depending on your needs/problems, different maps/models of the same reality are useful
- if you know how to use it, immensely helpful

Mathematical models

- explicitly stated assumptions
- logical reasoning leads to conclusion/result
- goals depend on context, e.g.
  - clarify a logic/mechanism (minimal ingredients)
  - produce testable predictions
  - explore implications of some (additional) feature
  - get rough forecasts (when the model is paired with data)

Example (The need for models)

- Why are people at a high health risk overrepresented among the uninsured in the US?
- How will physician's prescription behavior change if the number of physicians increases?
- Who will benefit (or be harmed) from the availability of genetic tests?
- An insurance considers offering a supplementary insurance package (e.g. covering all dental care) and wonders what premium to charge for this package.