ECON4260 Behavioral Economics

1st lecture
Introduction, Markets and Uncertainty

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Practical matters.

- Most lectures here at this time (Wednesday 12-14)
  - Lecture 2 and 4 in Auditorium 6
  - Lecture 3 on Tuesday 12-14, Auditorium 4
- Curriculum
  - Papers are linked up in the schedule
  - Chapters form Colin Camerer (2003) are in a Kompendium

Three main topics

- Decision theory (Lectures 1-4)
  - Decisions under uncertainty
- Time preferences (Lectures 5-8)
  - 10$ today versus 11$ tomorrow
  - 10$ ten days from versus 11$ after 11 days
- Justice / Non-selfish behavior (L 9-13)
  - Share 100 kroner with a recipient/responder
  - Dictators share
  - Responders reject unfair offers
- But we will also discuss experimental markets today.

Time preferences / Self control

- It is a good idea to read the papers before the lectures, and to allocate work evenly over the semester
  - Most students know
  - Some lack the **self control** to do it.
- But then:
  - Who is the 'self' if not the student?
  - If it is the student, who is the 'self' controlling?

Study pre-commitment technique

- Suppose at the start of the semester you decide to
  - Solve all seminar exercises in advance
  - Read all relevant papers on the reading list before each lecture
  - Attend all lectures and seminars
- But you know that you (maybe) will not follow through
  - And that you will regret as exams are approaching
- Make a contract with another student
  - Attend at least 90% of lectures and seminars – have someone to sign.
  - Have written answers to 80% of all seminar problem (signed)
- If the contract is not met – give 1000 kroner to an organization that you disagree strongly with.
- Homo oeconomicus would not need this contract
  - Why do we need it?

Social preferences

- When you watch someone in pain and when you yourself is in pain, some of the same neurons light up in your brain.
- Old wisdom: We share others pain, sorrow, happiness.
  - But may enjoy their pain if they have done us wrong
- Is it then reasonable to assume my utility only depend on my own consumption?

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Experimental economics

- Nobel Price in economics 2002
- Daniel Kahneman: “For having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty”
- Vernon L. Smith: “For having established laboratory experiments as a tool in empirical economic analysis, especially in the study of alternative market mechanisms".
- This course – my part in particular – mainly in the Kahneman tradition.
  - A brief visit to the Smith tradition.

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Experiment

- http://veconlab.econ.virginia.edu/da/da2.php
- http://veconlab.econ.virginia.edu/admin.htm

- kab1
- Students will need to use this session name to join *your* experiment.
  They can log in
  from **veconlab.econ.virginia.edu/login.htm**

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Information

- Note that you only know your own payoff
- The equilibrium can only be computed if you knew everybody's payoff.
- The market reveal this information
- In some experiment the value of an item is unknown and depend on the state.
  - If two players know the state other not, then everybody learn the state within seconds.
  - You cannot make a profit from knowing that the state is high without making a bid, thus revealing that you know the state is good.

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Induced values

- The payoff is controlled by experimenter.
- You where told how much the item was worth/cost
  - No social construction of values
  - No fashion
- Still, we do not have perfect control of the utility function.
  - Some players may prefer to leave the lab with 50 kroner less but a better conscience
  - This will in particular be the case in the experiments discussed in the last part of the course.

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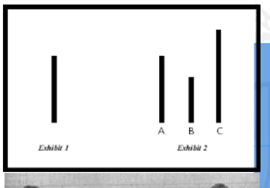
Experiments in Economics

- They are always paid.
- Deception is not allowed
  - Deception is used in psychology
  - E.g. The Asch experiment.
- Lab experiment with students dominates
  - But an increasing amount of field experiment.



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Back to decision theory

- Use your smartphone or PC
- If you do not have one join one who does have.

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Linda

"Linda is 31 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations."

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The dice with 4 green faces

- We roll a dice with 4 green (G) and 2 red (R) faces
- Write R on the board if face is Red and G if Green.
- Rolled 20 times, produce a sequence of 20 letters, R or G
- Choose one of three sequences,
  - If your sequence appear you win $25
- The three sequences are:
  1. RGRRR
  2. GRRRRR
  3. GRGRRR

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Conditional probability

- Suppose HIV-test has the following quality
  - Non-infected have 99.9% probability of negative
  - Infected always test positive
- Base rate:
  - It is known before the test is done
  - only 1 out of 1000 of those who take the test, are infected.

- Bill did a HIV-test and got a positive. What is the probability that Bill are in fact infected?

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Fundamental law of statistics

- If the event A is contained in B then
  $Pr(A) \le Pr(B)$
- Example: An urn contains Red, Blue and Green balls. A ball is drawn at random
  $Pr(Red\ OR\ Blue) \ge Pr(Red)$
- Conjunctions: A&B is contained in B
  $Pr(A\&B) \le Pr(B)$
- Applies to all alternatives to probability, like Belief functions and non-additive measures

Bill

- *Bill is 34 years old. He is intelligent but unimaginative, compulsive, and generally lifeless. In school he was strong in mathematics but weak in social studies and humanities.*
  - Bill is a physician who play poker for a hobby
  - Bill is an architect
  - Bill is an accountant (A)
  - Bill plays jazz for a hobby (J) [Rank 4.5]
  - Bill surfs for a hobby
  - Bill is a reporter
  - Bill is an accountant who play jazz for a hobby (A & J) [Rank 2.5]
  - Bill climbs mountains for a hobby.

Indirect and Direct tests

- Indirect versus direct
  - Are both A&B and A in same questionnaire?
  - Paper show that direct and indirect tests yield roughly the same result.
- Transparent
  - Argument 1: Linda is more likely to be a bank teller than she is to be a feminist bank teller, because every feminist bank teller is a bank teller, but some bank tellers are not feminists and Linda could be one of them (35%)
  - Argument 2: Linda is more likely to be a feminist bank teller than she is likely to be a bank teller, because she resembles an active feminist more than she resembles a bank teller (65%)

Sophistication

- Graduate student social sciences at UCB and Stanford
- Credit for several statistics courses
  - ”Only 36% committed the fallacy”
  - Likelihood rank T&F (3.5) < T (3.8) ”for the first time?”
- But:
  - Report sophisticated in Table 1.1, no effect

As a lottery

- ”If you could win $10 by betting on an event, which of the following would you choose to bet on? (check one)”
  - ”Only” 56 % choose T&F over F

How to make the optimal decision in theory

- For each alternative action:
  - Make an assessment of the probability distribution of outcomes
  - Compute the expected utility associated with each such probability distribution
  - Choose the action that maximize expected utility
- How do people make probability assessment?

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Extensional versus intuitive

- Extensional reasoning
  - Lists, inclusions, exclusions. Events
  - Formal statistics.
    - If $A \subset B$, Pr(A) ≥ Pr (B)
    - Moreover: $(A \& B) \subset B$
- Intuitive reasoning
  - Not extensional
  - Heuristic
    - Availability
    - Representativity.

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Representative versus probable

- ”It is more representative for a Hollywood actress to be divorced 4 times than to vote Democratic.” (65%)
- But
- ”Among Hollywood actresses there are more women who vote Democratic than women who are divorced 4 times.” (83%)

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Representative heuristic

- While people know the difference between representative and probable they are often correlated
- More probable that a Hollywood actress is divorced 4 times than a the probability that an average woman is divorced 4 times.
- Thus representativity works as a heuristic for probability.

Availability Heuristics

- We assess the probability of an event by the ease with witch we can create a mental picture of it.
  - Works good most of the time.
- Frequency of words
  - A: _ _ _ _ ing (13.4%)
  - B: _ _ _ _ _ n _ (4.7%)
  - Now, $A \subseteq B$ and hence Pr(B)≥Pr(A)
  - But ….ing words are easier to imagine

Predicting Wimbledon.

- Provided Bjørn Borg makes it to the final:
  - He had won 5 times in a row, and was perceived as very strong.
- What is the probability that he will (1=most probable)
  - Lose the first set (2.7)
  - Lose the first set but win the match (2.2)
- It was easier to make a mental image of Bjørn Borg winning at Wimbledon, than losing.

We like small samples to be representative

- Dice with 4 green (G) and two red (R) faces
- Rolled 20 times, and sequence recorded
- Bet on a sequence, and win $25 if it appear

1. RGRRR 33%
2. GRGRRR 65%
3. GRRRRR 2%

- Now most subject avoid the fallacy with the transparent design

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More varieties

- Doctors commit the conjunction fallacy in medical judgments
- Adding reasons
  - NN had a heart attack
  - NN had a heart attack and is more than 55 years old
- Watching TV affect our probability assessment of violent crimes, divorce and heroic doctors. (O'Guinn and Schrum)

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The critique from Gigerenser et.al

- The Linda-case provide lots of irrelevant information
- The word 'probability' has many meanings
  - Only some corresponds to the meaning in mathematical statistics.
- We are good at estimating probabilities
  - But only in concrete numbers
  - Not in abstract contingent probabilities.
  - Of 100 persons who fit the description of Linda.
    - How many are bank tellers?
    - How many are bank tellers and active in the femininist movement?
  - Now people get the numbers right

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More on Linda

- In Kahenman and Tversky's version even sophisticated subject violate basic probability
- The concrete number framing removes the error
- Shleifer (JEL 2012) in a review of Kahneman's recent book (Thinking fast and slow.)
  - «This misses the point. Left to our own devices [no-one reframes to concrete numbers] we do not engage in such breakdowns»

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The base rate fallacy

- Bill and The HIV-test
  - Non-infected have 99.9% probability of negative
  - Infected always test positive
  - 1 out of 1000 who are tested, are infected.
- A representative population of 1001 persons tested
  - 1000 are not infected, on average 1 test positive
  - 1 person is infected and test positive
  - Thus 2 persons test positive and one of them are infected.
- Conditional probability: 50% probability that Bill is infected

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Suppose we test 1001 persons

- Statistically 1 will be infected and test positive
- Of the 1000 remaining, 99,9% will test negative, and one will test positive. (on average)
- If Bill did a HIV-test and got a positive. What is the probability that Bill is in fact infected?
  - Write down your answer.

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An advise

- If you want to learn statistical theory, especially understand contingent probabilities and Bayesian updating:
  - Translate into concrete numbers
- This will enhance
  - Your understanding when you study it, and
  - Your ability retain what you have learned 10 years from now.

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For the seminar

A dice has four Green (G) faces and two Red (R) faces. The dice will be rolled 20 times, and the result (R or G) will be written down. This will produce a sequence of 20 letters.

You can choose one of the three short sequences below:

1. RGRRR
2. GRGRRR
3. GRRRRR,

Suppose that if your chosen sequence appears in the sequence of 20 letters, you would win 500 kroner. Which one of the sequences 1.-3. would you prefer? "

- Ask 4 students each, two sophisticated and two non-sophisticated.
- You may collaborate and attend lectures for first year students and students at intermediate/advanced courses in statistics at the math department.
- Send me the results prior to 3rd lecture.

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Probabilities

- In a text over 10 standard novel-pages, how many 7-letter words are of the form:
  1. _ _ _ _ _n_
  2. _ _ _ _ _ ly
  3. _ _ _ _ ing

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Expected utility

- This is a theory for ranking lotteries
  - Can be seen as normative: This is how I wish my preferences looked like
  - Or descriptive: This is how people actually choose between lotteries
- A litle note showing some basic ideas of a proof will be provided, but I will here only:
  - Explain what expected utility is
  - Discuss the basic axiom – the independence axiom
  - The note try to present the basic intuition on why expected utility follows from this axiom

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What is a lottery?

- A list of possible outcome: x1,x2,x3…,xn
- Associated probabilities p1,p2,…pn
  - Probabilities add to one.
- Example1: 100 kroner with 40% probability and -20 koner with 60% probability
- A lottery can have only one outcome:
  - 70 kroner with 100% probability – that is 70 kroner for sure.

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Notation

- $(x_1,p_1;\ldots;x_n,p_n)$ means
  - x_1 with probability p_1;
  - … and
  - x_n with probability p_n
- Null outcomes not listed:
  - (x_1,p_1) means x_1 with probability p_1 and 0 with probability $1\text{-}p_1$
- (x) means x with certainty.

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As usual – a utility function can represent reasonable preferences

- $(x_1, p_1; x_2, p_2;\ x_3, p_3) \succcurlyeq (y_1, q_1; y_2, q_2;\ y_3, q_3)$,
- If and only if
- $\mathrm{U}(x_1, p_1; x_2, p_2;\ x_3, p_3) \succcurlyeq U(y_1, q_1; y_2, q_2;\ y_3, q_3)$
- Expected utility claim that the utility function has a particular form, e.g. linear in probabilities
- $U = \sum_{i=1}^{n} p_i u(x_i)$

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Independence Axiom

- Consider a lottery, L_X, where you get something, X, with probability p and 0 otherwise (probability 1-p)
- Suppose that there are two lotteries, call them A and B that are equally good: A ~ B
  - Now it will not matter if X is lottery A or B
  - That is $L_A \sim L_B$
- Why is this called independence
  - The ranking of A and B is independent of context. If they are equally good when they stand alone they are equally good in a lottery.

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The independence axiom in action

- Consider the lotteries
  - A: 3000 for sure
  - B: 4000 with 80% probability
  - C: 3000 with 25% probability
  - D: 4000 with 20% probability
- If A is better than B, then C is better than D
- Why?
  - Let L be the lottery X with 25% probability and 0 otherwise
  - If X=A we get C
  - If X=B we get D

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A theorem proven by von Neuman and Morgenstern (1944)

- Take the independence axiom
- Add continuity:
  if B(est) > x > W(orst) then there is a probability p such that (B,p;W,1-p) ~ (x)
- Standard assumptions like complete and transitive.
- It follows that lotteries should be ranked according to Expected utility
  Max $\sum p_i u(x_i)$
- In the following we will focus on alternative theories
  - And the evidence for these

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Positive linear transforms - we may choose u(0)=0

- Consider two utility functions u and v such that
  - $v(x)=au(x)+b, \quad a>0$
- They yield the same ranking of lotteries:

$E\,v(x) = \sum p_i v(x_i)$

$\quad = \sum p_i au(x_i) + \sum p_i b = a\,Eu(x) + b$

- Maximizing Ev isequivalent to maximizing Eu

- Start with any $u(x)$ and use $v(x)=u(x)-u(0)$
  - Note that $v(0)=0$

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Next week: Prospect theory

- Based on Kahneman and Tversky (1979)
  - The most cited paper in Econometrica
  - A major part of why Kahneman got the Nobel Price in 2002
    - Tversky died in 1996

- Prospect theory is an alternative to expected utility
  - It is easiest to discuss in contrast to expected utility

- Key concepts
  - Loss aversion and the reference point
  - Decision weight (as opposed to probabilities)

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