ECN 119: Psychology and Economics
Choice

Jim Campbell

UC Berkeley

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Choice

Why do we choose what we choose? Standard economic theory models us as if we simply choose what we most prefer of the options that are available. Evidence shows us that things are a little more complicated than that.

In this section we will introduce the key assumptions and modeling approach of traditional choice theory, and then investigate evidence for how people *actually* go about choosing things. Some of the things we highlight here will show up again and again throughout the course, so we will also take a look at some overviews and taxonomies of what the field of behavioral economics is all about.

Choice

In this section:

1. Preferences, constraints, and choice
2. Utility functions and indifference curves
3. The Independence of Irrelevant Alternatives and WARP
4. The endowment effect
5. Status quo bias
6. Narrow bracketing and mental accounting
7. The attraction and compromise effects
8. Satisficing and the optimal stopping model
9. Rational inattention
10. Choice overload
11. Multiple selves and multiple rationales

Choice

The basic building block of microeconomic theory is **choice**

- Of the available options, what will the decision maker pick?
- From this single question we can build and build to a model of a whole economy
- Better understanding and better predicting people's choices ought to help us to do better economics

A model of choice

The key idea of the bedrock model of microeconomics is this:

A decision maker will choose so as to best achieve her objectives, given the constraints that she faces

Our to-do list for a quick refresher on Econ 100-esque choice:

1. Modeling the objectives
2. Modeling the constraints
3. Putting them together to model optimal choice

Stuff

What is the consumer choosing among?

- Consumers choose among *bundles* of *goods*
- A good is something that the consumer values
  - A pinball machine
  - An apple
  - Clean air
  - Leisure time
- Depending on what choice we are thinking about modeling (what story we are telling), we might also want to specify goods according to time or space
  - A pinball machine in Providence vs. a pinball machine in Scotland
  - An apple today vs. an apple tomorrow
- For now, we'll keep it simple and think of a good as just a thing

More stuff

What is a *bundle*?

- A bundle of goods is just a collection of goods
  - A coffee and a donut
  - 3 apples, 4 bananas
  - \$1000 and 3 days in Vegas
- Typically we use x_i to denote the amount of good i, and so a bundle of goods looks like this:

$$x = (x_1, x_2, ..., x_{n-1}, x_n) \tag{1}$$

- Here there are n different types of good
- Very often we think about bundles of two types of good, particularly so we can draw helpful pictures
- A common trick to help with this is to divide the world into "the good we want to tell a story about" and "everything else"

What consumers want

What is the consumer's objective?

- The fundamental concept of choice theory is that people have *preferences* over bundles
- Imagine a really long list of all conceivable bundles of goods
  - Stop for a second... this really means **all** conceivable bundles... the list will be **really, really long**
- A consumer's *preference* is an ordering of this list
- If the consumer *prefers* one bundle over another, it appears higher up on her list
- Always remember that preferences are completely personal to the decision maker

What consumers want

Notation:

- $x \succ y$
  - Bundle x is *strictly preferred* to bundle y
  - The consumer 'likes' x more than y
- $x \sim y$
  - The consumer is *indifferent* between bundles x and y
  - The consumer 'likes' x and y exactly the same
- $x \succsim y$
  - Bundle x is *weakly preferred* to bundle y
  - The consumer 'likes' x at least as much as y

Utility

- If we had to model consumers just by comparing bundles two at a time, it would take quite a while
- It would be nice to have a tool to compare many bundles at once
- Let's think about using a number to represent the amount that the consumer likes a bundle
- We'll call this number *utility*
  - Utility is a completely abstract concept (this is a story, remember)
  - But if it helps, you can think of it as satisfaction, happiness, well-being, usefulness, or some other more concrete concept
- In the two good case:

$$u(x_1, x_2) = f(x_1, x_2) \tag{2}$$

- The utility function is a function that takes a bundle as an input and returns a single number, utility

Structure on preferences

Consider two **assumptions** about a consumer's preferences:

1. *Completeness*: either $x \succsim y$ or $y \succsim x$ or both, for all x and y
   - The consumer can successfully compare all pairs of bundles, and never says 'I don't know how I feel about x relative to y'
   - This also implies $x \succsim x$ (*reflexivity*): every bundle is at least as good as itself
2. *Transitivity*: for all triples x, y, and z:

   i. if $x \succ y$ and $y \succ z$, then $x \succ z$
   ii. if $x \sim y$ and $y \sim z$, then $x \sim z$
   iii. if $x \succ y$ and $y \sim z$, then $x \succsim z$
   iv. if $x \sim y$ and $y \succ z$, then $x \succsim z$

   - If the consumer prefers x to y and y to z, she must prefer x to z

- What do you think of these assumptions? Try to stress-test them with examples
- We call a preference relation that satisfies these a *rational preference relation*

Utility functions

Utility representation theorem

Any preferences that satisfy completeness and transitivity can be represented by a *utility function* $u(\cdot)$, so that

$$x \succsim y \text{ if and only if } u(x) \geq u(y)$$

- We can use a function $u(\cdot)$ to take each bundle of goods and assign a utility number to it
- The consumer likes a bundle more than another if she gets a higher utility number from it
- And is indifferent between two bundles if she gets the same utility number from both

Utility functions

So a decision maker's *utility function* assigns numbers to bundles

- Utility functions are *ordinal*, not *cardinal*
  - Ordinal: only the relative magnitudes matter ('the Giants are better than the Dodgers')
  - Cardinal: the size of the numbers matters and can be compared ('the Giants have won 3 of the last 10 World Series and the Dodgers have won 0')
- For example, imagine that there are three possible bundles, x, y and z. The three utility functions below are equivalent:

Utility function	x	y	z
$u_1(\cdot)$	1	2	3
$u_2(\cdot)$	0.01	98	101
$u_3(\cdot)$	-10	0	65

- So *order-preserving transformations* of a utility function still represent the same preferences; we will sometimes make use of this to make the math easier in our examples

Indifference curves

Now that we have a utility function, we can draw it

- An *indifference curve* joins up all bundles that have the same utility number
- Equivalently, all the bundles that the decision maker is indifferent among
- We will work in two dimensions (two goods)
- Think of an *indifference map* made up of *indifference curves*
- The indifference map is just like a relief map in geography: a line represents the 'height' of the utility function, and 'higher' means 'better'
- That is: each indifference curve is a level set of the utility function

The space

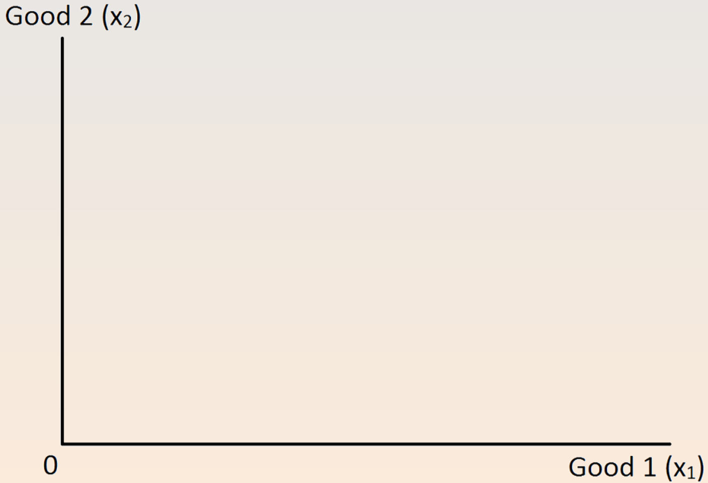


Figure: The space of all possible combinations of the two goods

Drawing pictures

We often make two more assumptions about preferences:

1. *Monotonicity*: more of a good is better than less
   - If bundle x has more of one good and at least as much of all goods compared to bundle y, x is preferred to y
2. *Convexity*: average consumption bundles are preferred to extremes
   - If the amounts of each good in bundle z are 'in between' the amounts in x and y, z is most preferred of the three

We call preferences *well-behaved* if they satisfy these assumptions

An indifference curve

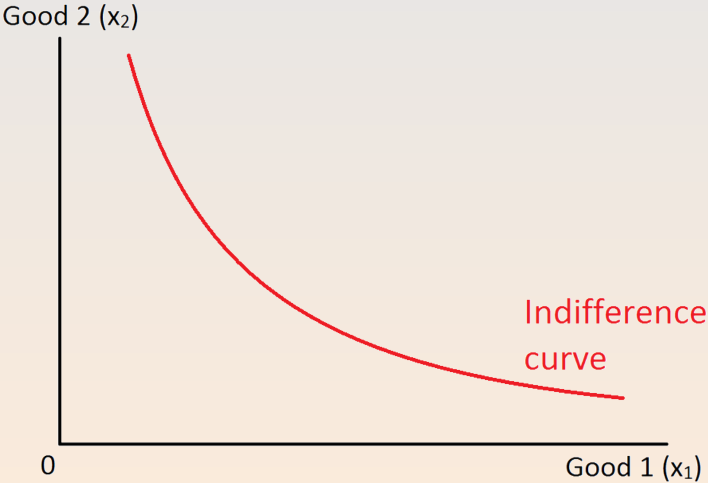


Figure: An indifference curve satisfying monotonicity and convexity

An indifference curve

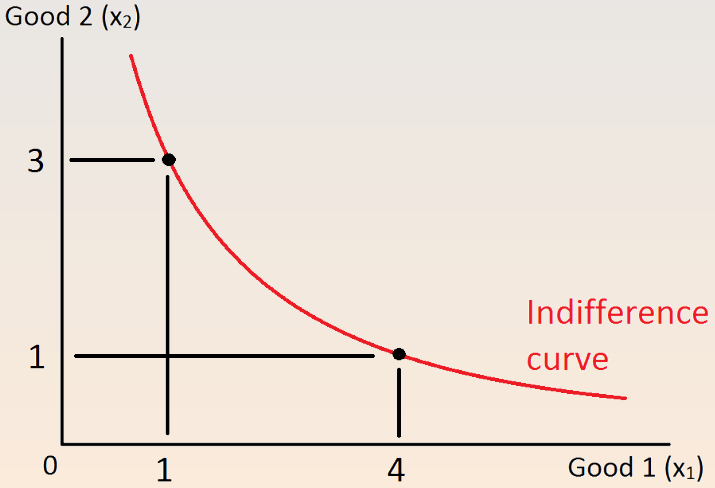


Figure: Bundles $(1, 3)$ and $(4, 1)$ give the same utility

An indifference map

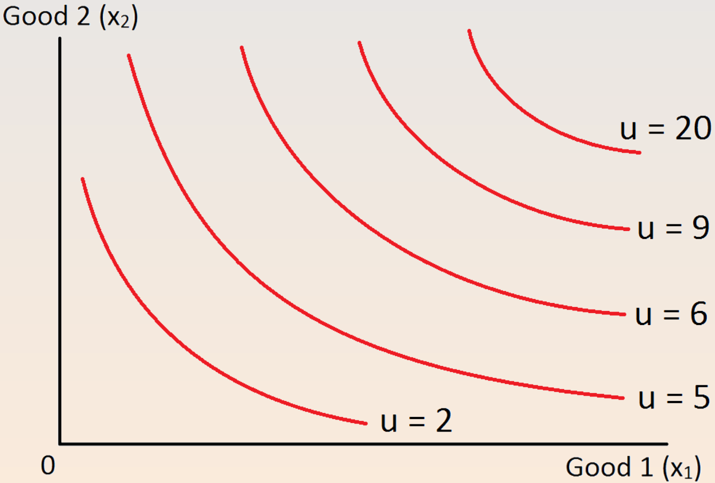


Figure: A difference curve for each utility number

Indifference curves cannot cross

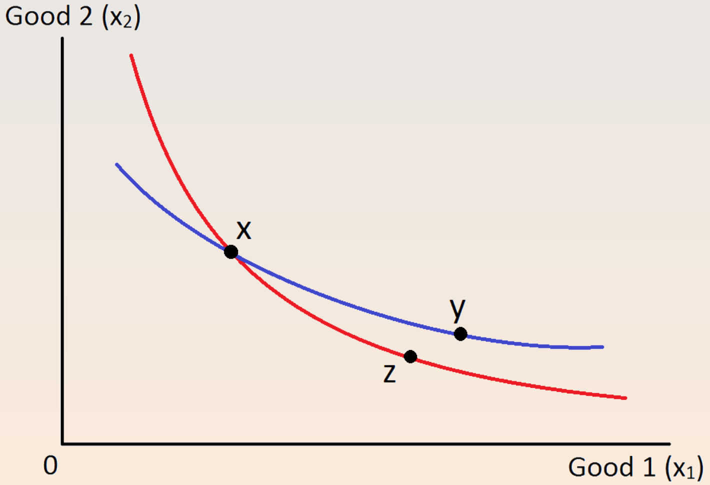


Figure: $x \sim y$ and $x \sim z$, but $y \nsim z$: a contradiction

Monotonicity

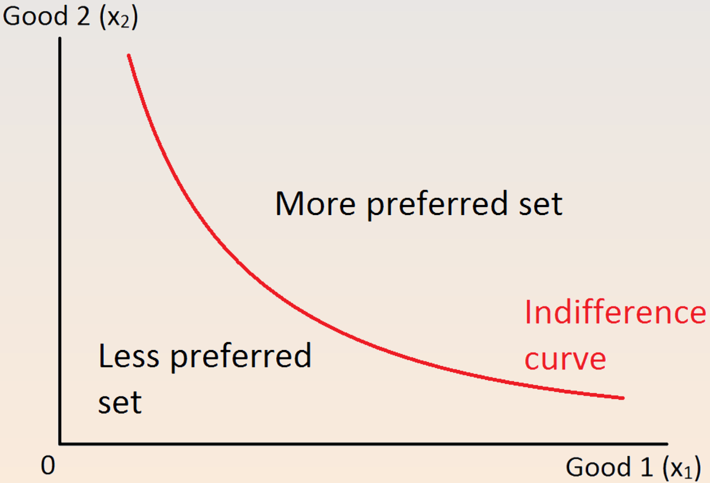


Figure: The space is divided in two: more is better: monotonicity

Convexity

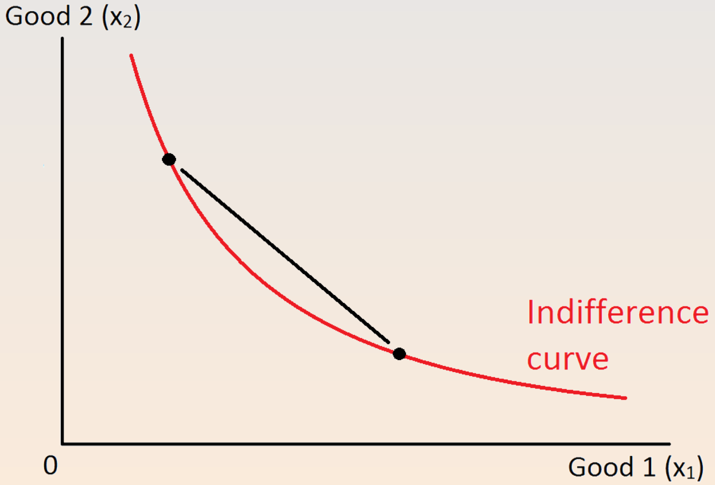


Figure: A weighted average is preferred to either bundle: convexity

Drawing pictures

Are monotonicity and convexity sensible?

- Violations of monotonicity:
  - You don't like something
  - You don't care about something
  - You've got enough of something
- Violations of convexity:
  - You'd rather consume two goods separately, not in combination
- So there are lots of situations in which we might want *not* to make these assumptions
- The more generally we define 'goods', the more these assumptions will be valid

Marginal rate of substitution

A key concept is the *marginal rate of substitution* (MRS)

- It is the rate at which the consumer would be willing to trade one good for another
- How much of one good would you be willing to give up in exchange for more of another good?
- How much of one would would you need to get in exchange for giving up some of another good?
- The MRS is the slope of an indifference curve, which is a level set of the utility function

Marginal rate of substitution

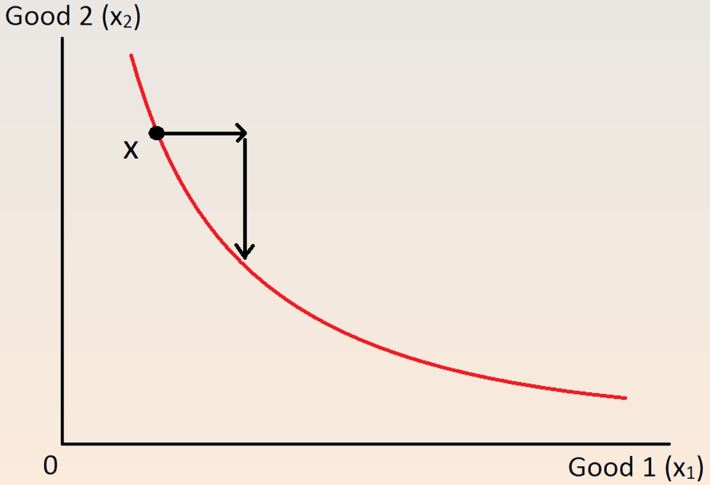


Figure: From x, how much good 2 would you give up for more good 1?

Convexity implies *diminishing* MRS

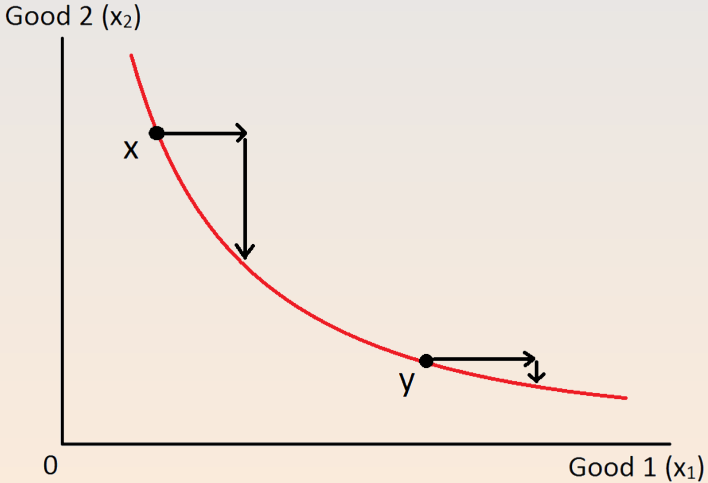


Figure: The more of good 1 I have, the less good 2 I'm willing to give up

Marginal rate of substitution

A useful switch—and the reason for the *rate* in the name—is to think not of an amount of compensation, but a ratio

- As the changes in the amounts of good 1 and good 2 that we're thinking about get small, this ratio is precisely the slope of the indifference curve
- Under the monotonicity assumption, indifference curves slope down, so we say that the *marginal rate of substitution of good 2 for good 1* is

$$MRS = \lim_{\Delta x_1, \Delta x2 \to 0} -\frac{\Delta x_2}{\Delta x_1} \tag{3}$$

- That is, negative 1 times the slope of the indifference curve
- (An annoying problem is that whether MRS is exactly the slope of the indifference curve or the negative of the slope of the indifference curve is an issue that different textbooks take different views on)

The gradient of an IC is related to MRS

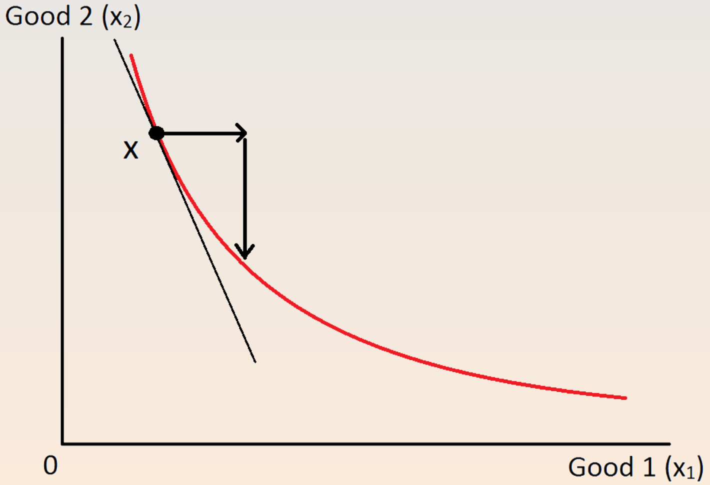


Figure: As amounts approach zero, MRS is -1 times the slope of the tangent line

Marginal utility

The easiest way to calculate MRS is by using *marginal utility* (MU)

- The marginal utility of a good for the consumer is how much extra utility they'd get from a little more of the good, holding the amount of every other good fixed
- Mathematically, this is the partial derivative. For the two good case:

$$MU_1 = \frac{\delta U}{\delta x_1} \tag{4}$$

$$MU_2 = \frac{\delta U}{\delta x_2} \tag{5}$$

- Of course, this depends on the consumer's current bundle
    - For example, how much happier a copy of Mario Kart 8 makes Jim depends on how many Wii Us he has, how many copies of it he has already, how much free time he has, how many other games he has...
- So remember that each point in the indifference map in general has different MU for each good

A formula for MRS

From MU to MRS:

- Think of a small movement along an indifference curve from some starting point
- The amounts of each good have changed a little, but by definition utility is the same

$$\begin{aligned} MU_1 \Delta x_1 + MU_2 \Delta x_2 &= \Delta U && (6) \\ &= 0 && (7) \end{aligned}$$

- Which we can rearrange into a formula:

$$\begin{aligned} -\frac{\Delta x_2}{\Delta x_1} &= \frac{MU_1}{MU_2} && (8) \\ MRS &= \frac{MU_1}{MU_2} && (9) \end{aligned}$$

A very simple example

Let's end with a very simple example of all of this stuff

A story

Jim likes to play pinball. He is at the Musée Mécanique in San Francisco, where he can play on two pinball tables, Addams Family and Indiana Jones. He always likes to play more games of pinball, but he gets bored of always playing on the same table and so if he's going to play a few games he would rather play some on each table rather than all on one.

- What do his indifference curves look like?
- How can we represent Jim's preferences with a utility function?
- What might his marginal rate of substitution be?

Pinball wizard

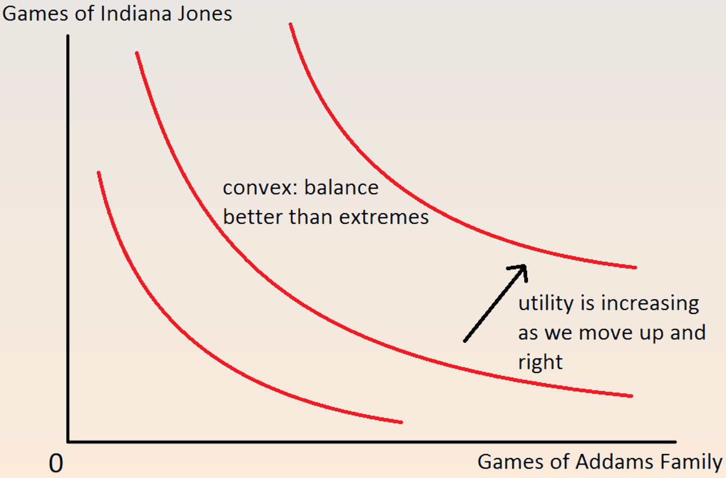


Figure: Indifference curves consistent with the story

Pinball wizard

A utility function consistent with this shape:

$$u = x_1 x_2 \tag{10}$$

Which has MRS:

$$MRS = \frac{MU_1}{MU_2} \tag{11}$$

$$= \frac{x_2}{x_1} \tag{12}$$

- When x_2 is big and x_1 is small, MRS is big
- This captures the story: at that point, Jim would be willing to give up a lot of games of x_2 in exchange for just a few more games of x_1

A very simple example

Questions to think about:

- What if Jim only cares about the total number of games he plays, and doesn't mind how those games are distributed across tables?
- What if Jim hates playing the Indiana Jones table but loves playing on the Addams Family table?
- What if Jim likes both tables, but prefers to focus on one rather than balance his time between the two?

Cash

The constraints we'll focus on are *budgets*

- The consumer is choosing among bundles of goods
- Recall that a bundle is an amount of each available good
- These are costly: for each unit of a good the consumer chooses, she must pay a *price*
- In the two-good case, to consume some bundle (x_1, x_2) costs

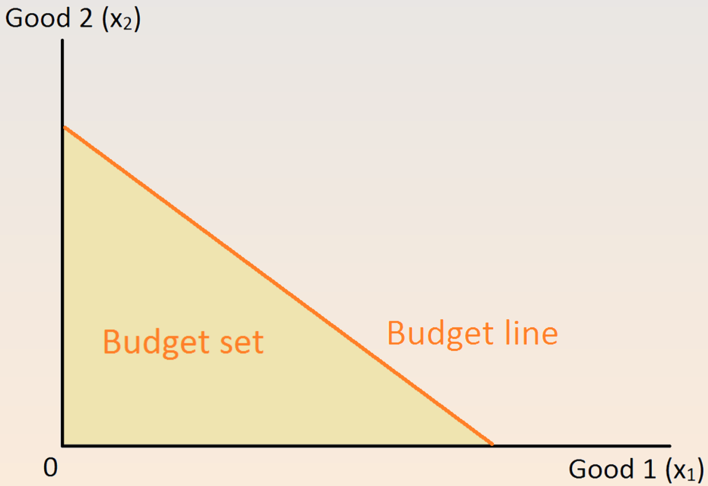
$$p_1x_1 + p_2x_2 \tag{13}$$

- p is for price; expenditure on a good is price times quantity
- The consumer's *budget constraint* is that she cannot spend more than she has:

$$p_1x_1 + p_2x_2 \leq m \tag{14}$$

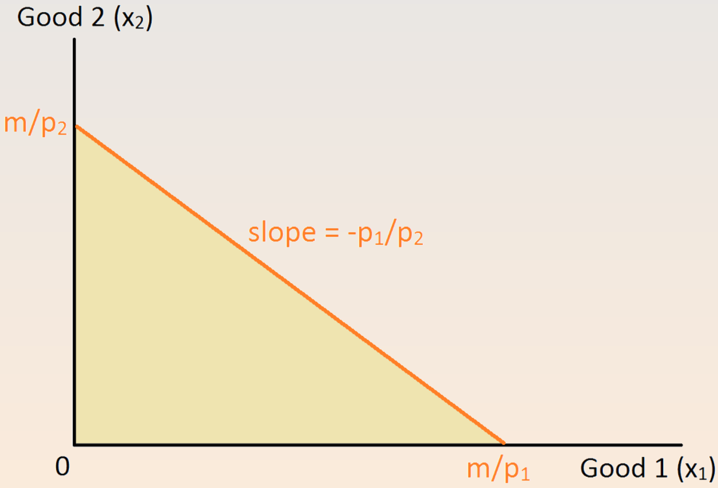
- m is for money, or *income*

Graphing the budget constraint



The budget set is all the affordable bundles

Graphing the budget constraint



Some useful labels

The slope of the budget line

- The intercepts of the budget line are how much of each good the consumer could afford if she spent all of her money on just one good
- Another way to say this is that these are two affordable bundles:

$$(x_1, x_2) = (\frac{m}{p_1}, 0) \tag{15}$$

$$(x_1, x_2) = (0, \frac{m}{p_2}) \tag{16}$$

- We can get the slope of the line by rearranging the equation of the budget line to get x_2 as a function of x_1:

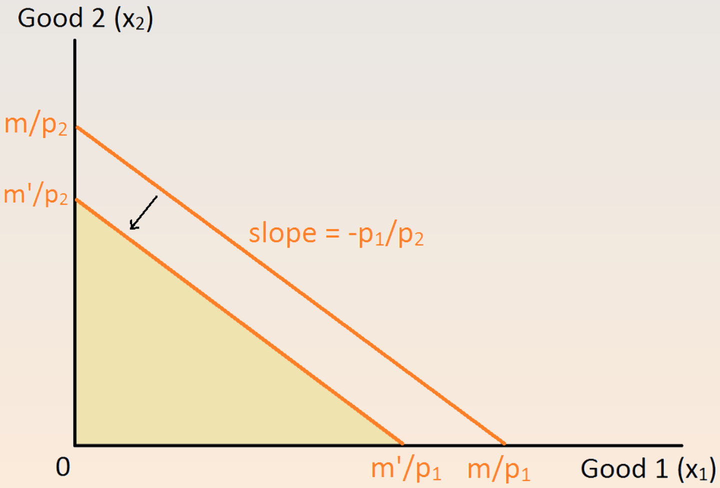
$$p_1 x_1 + p_2 x_2 = m \tag{17}$$

$$x_2 = \underbrace{\frac{m}{p_2}}_{\text{intercept of the line}} - \underbrace{\frac{p_1}{p_2}}_{\text{slope}} x_1 \tag{18}$$

The slope of the budget line

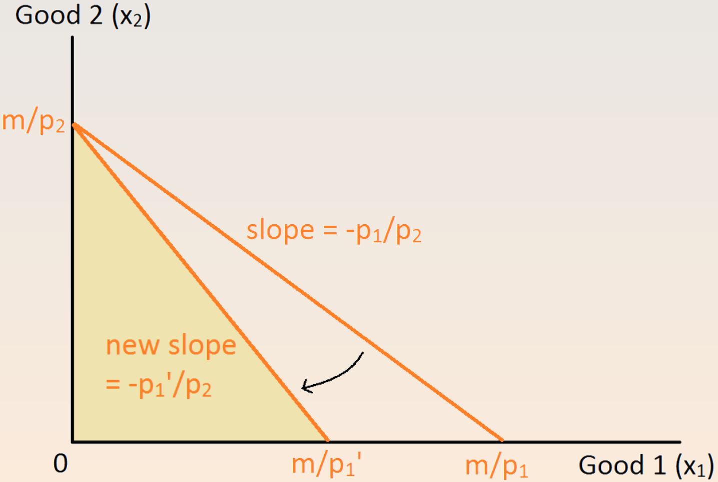
- The slope of the budget line is the *market rate of exchange* between the two goods
- It's also the *relative price* of good 1
- That is: how much of good 2 must you give up to be able to afford a little more good 1?
- The budget line for a consumer is defined by her income and the prices she faces
- So if m, p_1, or p_2 change, the shape of the budget set will change

An income change



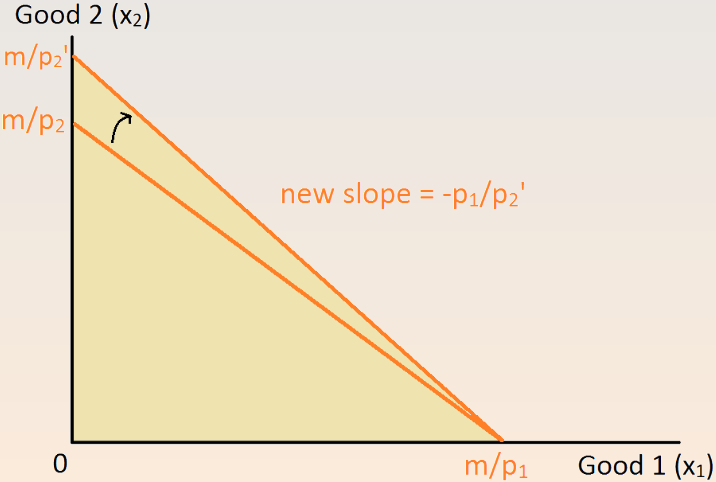
If income falls, the budget set shrinks but slope is the same

A price change



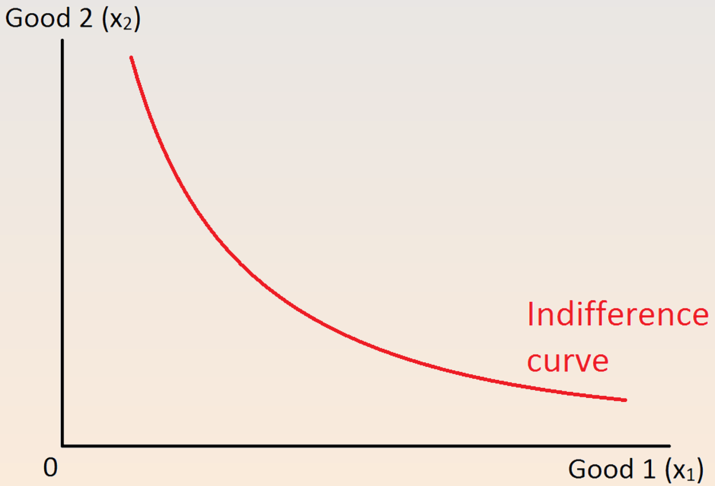
If a price changes, the budget line pivots: slope and one intercept change

A price change



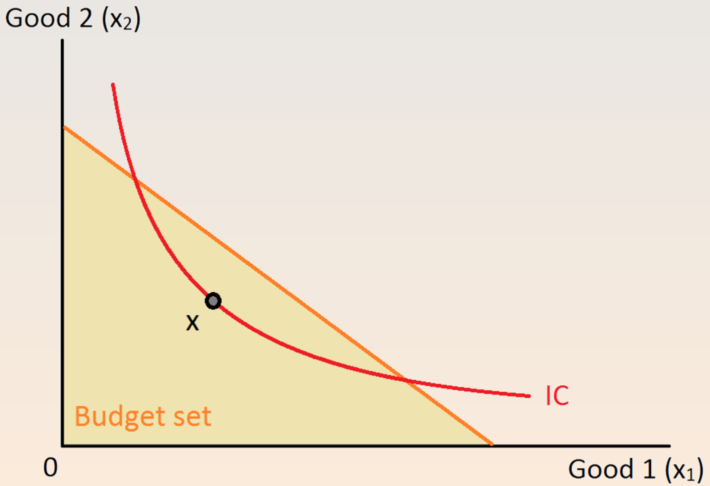
Another price change: here, p_2 falls

Optimal choice in pictures



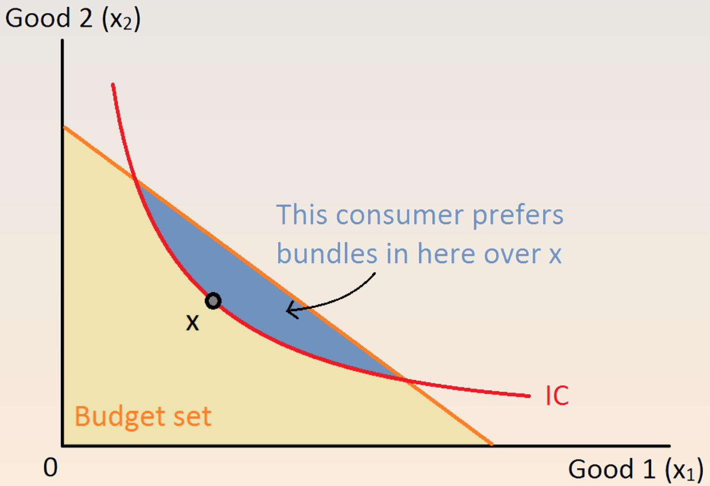
First let's consider well-behaved preferences

Optimal choice in pictures



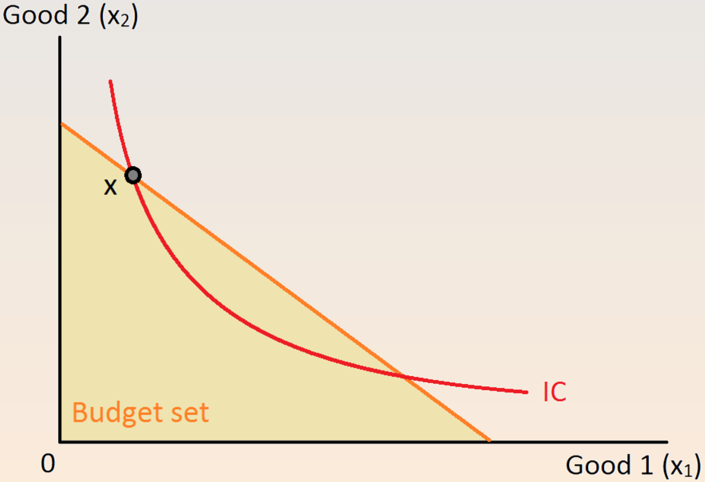
Bundle x is suboptimal as long as preferences are monotonic

Optimal choice in pictures



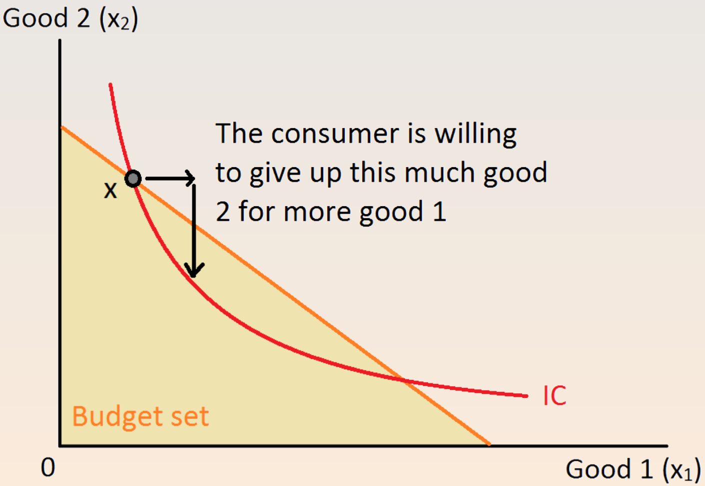
So for monotonic preferences, optimal choice is on the budget line

Optimal choice in pictures



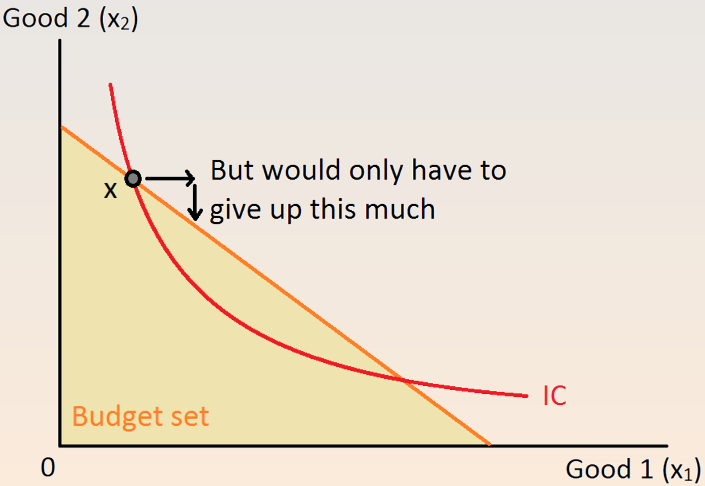
Bundle x is on the budget line but still suboptimal

Optimal choice in pictures



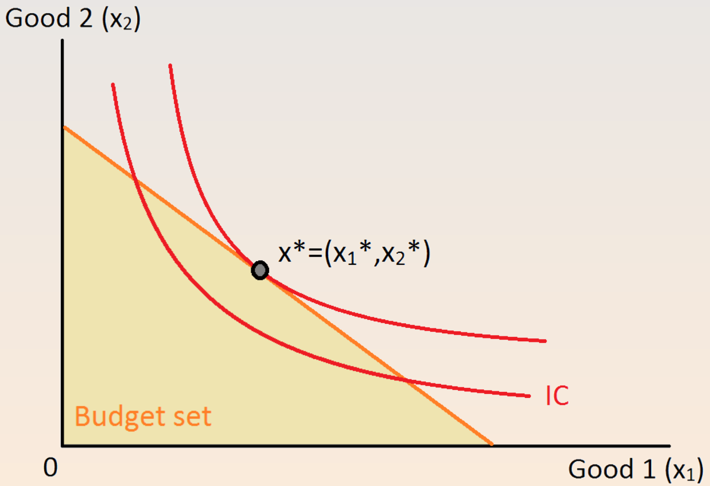
The consumer's *MRS* is not equal to the price ratio

Optimal choice in pictures



The market is offering terms that the consumer is willing to accept

Optimal choice in pictures



Everything in the more preferred set is unaffordable: x^* is optimal

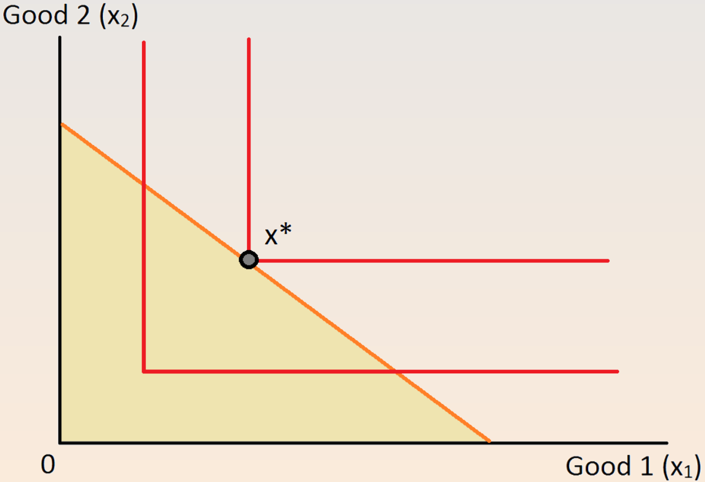
Optimal choice

- Optimal choice for well-behaved preferences is characterized by tangency
- The absolute value of the slope of the consumer's indifference curve is the same as the absolute value of the slope of the budget line:

$$MRS = \frac{p_1}{p_2} \tag{19}$$

- The market rate of exchange (what rate the consumer **can** swap one good for another) is equal to the consumer's private rate of exchange (what rate the consumer **is willing to** swap one good for another)
- At tangency, no swap the consumer is willing to make is available
- Exactly the same graphical principles work for preferences that are not-well behaved, but the solution in those cases won't involve tangency

If goods are perfect complements



Optimal choice here is the point on the budget line where $x_1 = x_2$

If goods are perfect substitutes

Optimal choice here is to spend all of the budget on the cheaper good

Test yourself

Some questions to think about:

- There are two goods; the price of each good is \$1; I have \$10 to spend; my utility function is $u = -x_1 - x_2$. What is my optimal choice?
- There is only one thing in the world that I like; I have income m and all goods cost \$2 per unit. What is my optimal choice?
- There are n goods in the world; the price of good i is p_i; I have income m; my utility function is $u = 1$. What is my optimal choice?
- Say that a person spends all of their budget on good 1. Suggest three different utility functions, representing three different preference orderings, that can rationalize this choice.

Utility maximization

The analog of the graphical argument we just made is *utility maximization*:

$$\max u(x_1, x_2) \text{ subject to } p_1x_1 + p_2x_2 \leq m \tag{20}$$

- This is a constrained optimization problem, the basic building block of microeconomics
- Note that if preferences are monotonic, the constraint will bind with equality at the optimum
- The solution to this problem is (x_1^*, x_2^*), the optimal choice
- As we saw in the pictures, it depends on preferences: when facing the same options, different people choose different things
- If you're trying to predict choice, your challenge is to understand the preferences and constraints of the decision-maker

Four approaches to the problem

How can we solve the constrained optimization problem?

1. Brute force
   - Rearrange the constraint to solve for one of the variables
   - Plug that into the utility function
   - And then maximize the utility function, which now has just one variable
2. The tangency condition
   - For well-behaved preferences and triangular budgets, the solution is the tangency point we saw earlier
   - We can therefore invoke $MRS = \frac{p_1}{p_2}$ in these cases
3. The Lagrange function method
   - This is the math method for solving a constrained maximization problem with an equality constraint (so this requires monotonicity to be reliable)
4. Draw a picture
   - Sometimes it's just easier to sketch the situation
   - This is particularly true if preferences aren't well-behaved and when you suspect the optimal choice might be a corner solution

Pinball wizard II

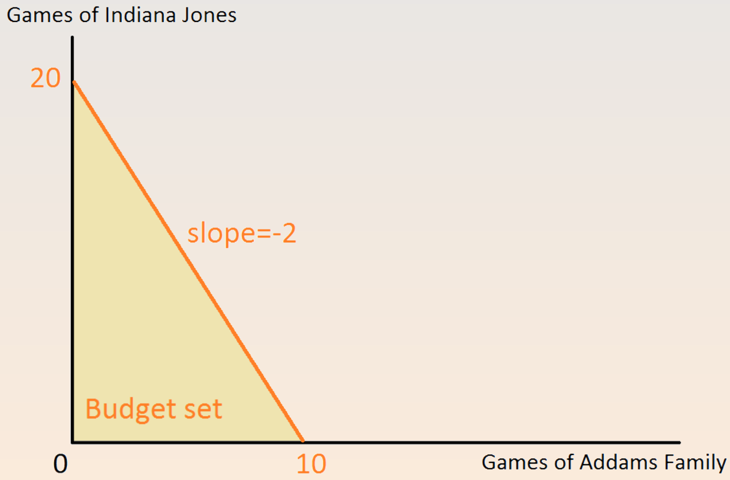
Let's go back to the story from before, but add some new structure:

A story

Jim likes to play pinball. He is at the Musée Mécanique in San Francisco, where he can play on two pinball tables, Addams Family and Indiana Jones. He always likes to play more games of pinball, but he gets bored of always playing on the same table and so if he's going to play a few games he would rather play some on each table rather than all on one. The Addams Family machine costs \$2 per play, and the Indiana Jones machine costs \$1 per play, and Jim has \$20.

- What does Jim's budget set look like?
- Given the utility function we decided on last time, what is Jim's optimal choice?

Pinball wizard II



The budget set given the prices and Jim's money

Pinball wizard II, brute force

Recall that we suggested $u = x_1 x_2$ last time as a utility function consistent with the story, so the utility maximization problem is:

$$\max x_1 x_2 \text{ subject to } 2x_1 + x_2 \leq 20 \tag{21}$$

- First let's try the brute force method

Pinball wizard II, brute force

- Since preferences are monotonic, we know that the constraint will hold with equality at the optimum:

$$2x_1 + x_2 = 20 \tag{22}$$
$$x_2 = 20 - 2x_1 \tag{23}$$

- Substitute this into the utility function:

$$u = x_1 x_2 = x_1(20 - 2x_1) = 20x_1 - 2x_1^2 \tag{24}$$

- The first order condition:

$$\frac{du}{dx_1} = 20 - 4x_1 = 0 \tag{25}$$
$$\Rightarrow x_1 = 5, x_2 = 10 \tag{26}$$

- And since the second derivative is always negative, we know that we have found a maximum

Pinball wizard II, tangency

- The tangency method makes use of our knowledge that these preferences are well-behaved; the tangency point is given by:

$$MRS = \frac{p_1}{p_2} \tag{27}$$

$$\frac{MU_1}{MU_2} = \frac{2}{1} \tag{28}$$

$$\frac{x_2}{x_1} = 2 \tag{29}$$

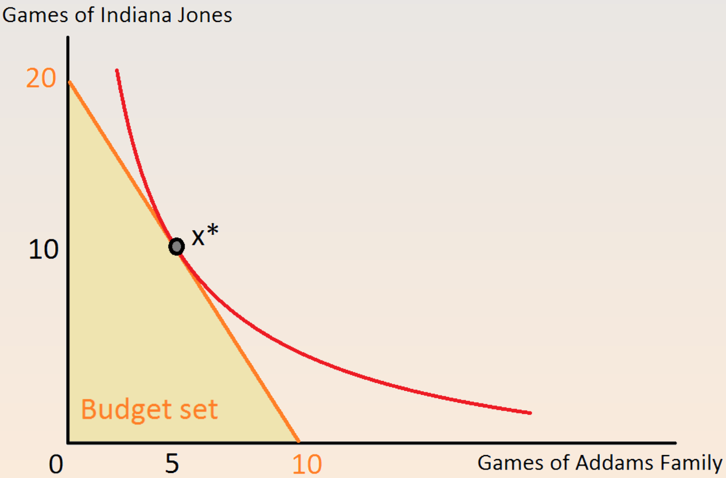
$$x_2 = 2x_1 \tag{30}$$

- We can combine this relationship with the budget constraint equation to find the optimal choice:

$$2x_1 + x_2 = 2x_1 + 2x_1 = 20 \tag{31}$$

$$\Rightarrow x_1 = 5, x_2 = 10 \tag{32}$$

Pinball wizard II, pictured



The budget set given the prices and Jim's money

Preferences

Preferences are a powerful and dangerous tool—use caution

1. Any economic model that includes a DM with preferences has an auxiliary hypothesis problem: when you test it you are simultaneously testing the model and the assumption you made on preferences
2. A recurring theme in our course will be to ask: what preferences can rationalize the patterns of behavior we observe?
3. This is one of the most fundamental ways to incorporate evidence on behavior into the economic framework

A recurring question: what can you infer from what you observe?

- The auxiliary hypothesis problem makes this question difficult
- What exactly are you observing about the DM? How many observations do you have? Are the observations comparable or one-off?
- How much structure are you willing to put on your model? The more structure you impose, the more you can infer
- Flip the question: what data would you need to observe in order to falsify your model?

Independence of irrelevant alternatives

A rational preference relation has a key property:

The independence of irrelevant alternatives (IIA)

If

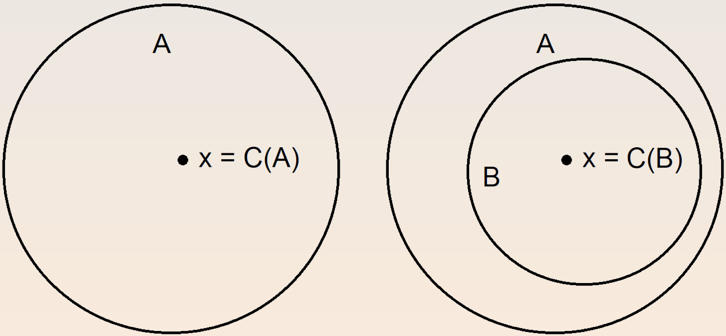
- x is chosen from a set of alternatives A, and
- B is a subset of A that also contains x,

then x must be chosen from B.

A utility maximizer must satisfy IIA: if x has the highest utility in A, it must also have the highest utility in B

Independence of irrelevant alternatives

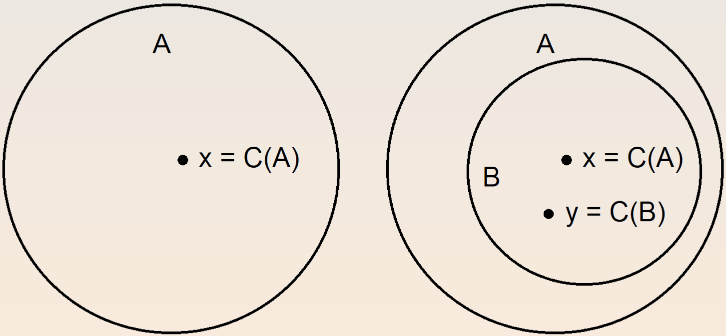
This pattern of choices satisfies IIA:



x is chosen from the set A and it is available in B, a subset of A, so it must be chosen in B too for IIA to hold

Independence of irrelevant alternatives

But this pattern of choices violates IIA:



x is chosen from the set A and it is available in B, a subset of A, but it is not chosen from B

Weak axiom of revealed preference

Closely related is another consistency condition that you may have seen before in microeconomics class:

Weak axiom of revealed preference (WARP)

If x is chosen when y is available, then there is no set of alternatives containing both x and y for which y is chosen but x is not.

WARP can be decomposed into two components, sometimes known as Sen's α and Sen's β

1. Sen's α: if $x \in B \subset A$ and $x \in c(A)$ then $x \in c(B)$
2. Sen's β: if $x, y \in c(A)$, $A \subset B$ and $y \in c(B)$ then $x \in c(B)$

Sen's α is simply IIA; notice that Sen's β is giving us something that allows for the choice from a set to be non-unique

WARP in a two good model

Choosing y from orange budget and z from blue budget violates WARP

A philosophical problem

WARP and conditions like it give us consistency conditions on choices

1. Any single choice is rationalizable by arbitrarily many preference orderings
2. For a sequence of choices, WARP appears to give us something that we could test: a DM who is optimizing must satisfy WARP
3. But if I see a DM make a sequence of choices, to what extent are they comparable in the way that WARP requires?
4. If we take seriously that objects that arrive at different times or different locations are meaningfully different goods, what must a set of choice data look like for the choices to be comparable?
5. This is an issue we will come back to when we think about multiple rationales

Aggregating preferences

By the way, aggregating rational preference relations can sometimes have some weird consequences; let's say we want to understand the 'collective will' in the following situation:

- Three people and three possible allocations, a, b and c. Say each agent's preference ordering is like so:

Agent 1	Agent 2	Agent 3
a	b	c
b	c	a
c	a	b

- If you are in charge, which allocation do you implement?

Aggregating preferences

Agent 1	Agent 2	Agent 3
a	b	c
b	c	a
c	a	b

- Say we use simple majority voting over pairs of alternatives as an *aggregation mechanism*
- a beats b, b beats c and c beats a: the social preferences is intransitive!
- This is *Condorcet's paradox*

The endowment effect

Standard theory typically assumes negligible differences between a person's willingness to pay and their willingness to accept for a good

- Implies that compensating and equivalent variations are equivalent
- Implies that indifference curves can be drawn 'in a vacuum' without reference to what the person currently has
- Thaler (1980) introduced the term '**endowment effect**' to describe situations in which a person's valuation of a good increases when they own it
- This is an example of **loss aversion**, the idea that losses weigh heavier in a decision maker's mind than gains
- Let's look at some experiments in which behavior is consistent with the endowment effect

The endowment effect

- Under the standard model, a consumer's indifference map does not change if we move the endowment
- But the endowment effect creates 'gravity' in the indifference map
- Convincing such a consumer to accept a trade now involves dragging them up the gravity well
- (Note that there are some implications here for the Second Theorem of Welfare Economics—to salvage any practical meaning from that result becomes even trickier)

Endowment effect: gambles

Knetsch and Sinden (1984) is an early example

- Participants given either a lottery ticket or $2
- Later they had the chance to switch what they chose for the other option
- Very few participants chose to switch
- Let's return to this in the 'risk' section of our course...
- But an objection to the first wave of experiments was that they weren't being demonstrated in a market setting, where it might be learned away

Endowment effect: coffee cup experiments

Kahneman, Knetsch, and Thaler (1990)

- Subjects: 44 students in an undergraduate law and econ class at Cornell
- First: three markets run for induced value tokens
- Half of participants were 'sellers' who got a token with a given value between \$0.25 and \$8.75
- Half of participants were 'buyers' who got no token but were told they had the opportunity to buy one with a given value
- Each were asked to fill out a response form saying whether they would like to sell their token / buy a token at each of a list of prices
- After each market, three buyers and three sellers selected at random to be paid according to their responses and the market clearing price
- As expected, the median buying and selling prices were identical—participants simply offered to pay / receive prices that would net them a profit

Endowment effect: coffee cup experiments

Kahneman, Knetsch, and Thaler (1990)

- Subjects: same subjects as the induced value experiments, immediately afterwards
- Subjects in alternating seats got Cornell coffee mugs, cash value \$6 at the bookstore
- Instructed to examine the mug, and told that four markets would be run and one selected at random to be the 'true' one whose trade would be executed
- Allows for learning but still makes each market potentially binding
- Then, the same thing done for four more markets using a box of ballpoint pens (\$3.98 at the bookstore) given to those who were buyers in the mug market
- Median selling prices in pen and mug markets were more than twice the median buying prices

Dean and Ortoleva (2019)

Dean & Ortoleva (2019): analysis of correlations between various measures of DM behavior; had working paper versions for a few years that were more detailed

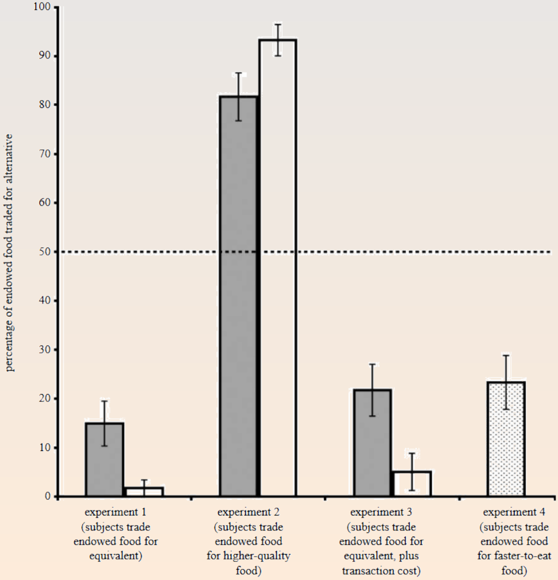
- Relevant to our interests here: WTP/WTA gap for buying vs. selling a lottery ticket that paid \$10 with 50% chance and \$0 with 50% chance
- Subjects' average WTP: \$3.76
- Subjects' average WTA: \$4.59
- Again we will return to this in 'Risk' once we have the machinery to properly analyze choices in that context

Endowment effect in capuchin monkeys

Lakshminaryanan, Chen, and Santos (2008)

- Subjects: 5 capuchin monkeys
- Baseline: subjects got 12 tokens and trained that token could be traded for different foods by placing it in different experimenter's hand
- Continue and change food types until two preferred about equally
- Experiment 1: endowed with one food type and could eat it freely or trade for another
- Experiment 2: test whether subjects understood that food rewards could be traded by offering a highly valued treat in exchange
- Experiment 3: check whether endowment effect persists after compensating for transaction costs
- Experiment 4: check whether endowment effect persists after accounting for time it takes to trade

Endowment effect in capuchin monkeys



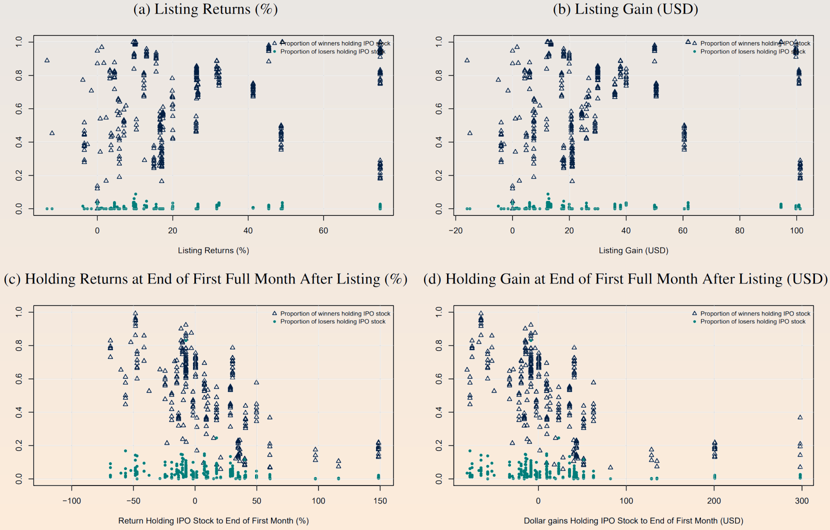
Endowment effect in stock ownership

Anagol, Balasubramaniam, and Ramadorai (2018): field experiment in India; shares randomly allocated by lottery for oversubscribed IPOs

- Random assignment here provides a convenient quasi-experiment
- After assignment everyone has the same chance to trade as usual; standard prediction would be convergence of ownership of the stock by the two groups in short amount of time
- Main findings:
  - Winners of IPO lotteries significantly more likely to hold the shares
    - After 1 month: 62.4% of winners hold the stock; 1% of losers
    - After 6 months: 46.6% of winners hold the stock; 1.6% of losers
    - After 24 months: 37-38% of winners hold the stock; 1.5-1.7% of losers
  - True even for the most frequent traders: gap narrows but very slightly
  - Gap is lower for most experienced traders but still a 20% to 7% gap
- Authors consider many possible explanations for the effect (cost of trading, effect of wealth shock when getting the share, inertia, and so on) but endowment effect survives the analysis

Anagol, Balasubramaniam, and Ramadorai (2018)

Figure 1: Proportion of Investors Holding IPO Stock and Returns Experience



Panels (a) and (b) present estimates at the end of the first day on the y-axis and Panels (c) and (d) present estimates at the end of the first full month on the y-axis.

Eliciting valuation of an object

While we are on this subject, a typical way to elicit a person's willingness to pay for an object is the Becker-DeGroot-Marschak (1964) method

- BDM works like this:
  1. Subject is asked for WTP
  2. A price is randomly determined
  3. If reported WTP is greater than the price, they pay the price and get the item; if reported WTP is less than the price, nothing happens
- Notice we can do the same in the opposite direction to get WTA
- BDM is incentive compatible: can't do any better than by reporting true WTP
- Note that this claim is not without some mild controversy (see e.g. Horowitz 2006)

Emotional reference points

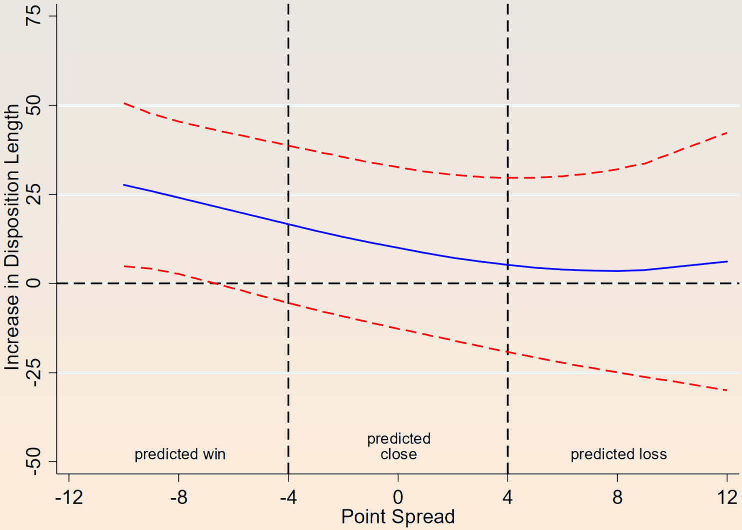
Eren and Mocan (2018): Louisiana juvenile sentencing and LSU football

- Upset loss for LSU increases average length of juvenile sentences by 35 days (7%)
- Close losses and upset wins have insignificant effects
- Effect persists for a week after the game

By the way, a famous example from the literature is illustrative because it has not help up well to criticism and re-analysis

- Danziger et al. (2011) found that ‘hungry judges’ (time since last meal) were harsher in parole board hearings
- Weinshall-Margel and Shapard (2018) find that case ordering is not random: prisoners without counsel tend to go last

Eren and Mocan (2018)



Status quo bias

Status quo bias is the idea that a person is more likely to choose something if it's the way things currently are

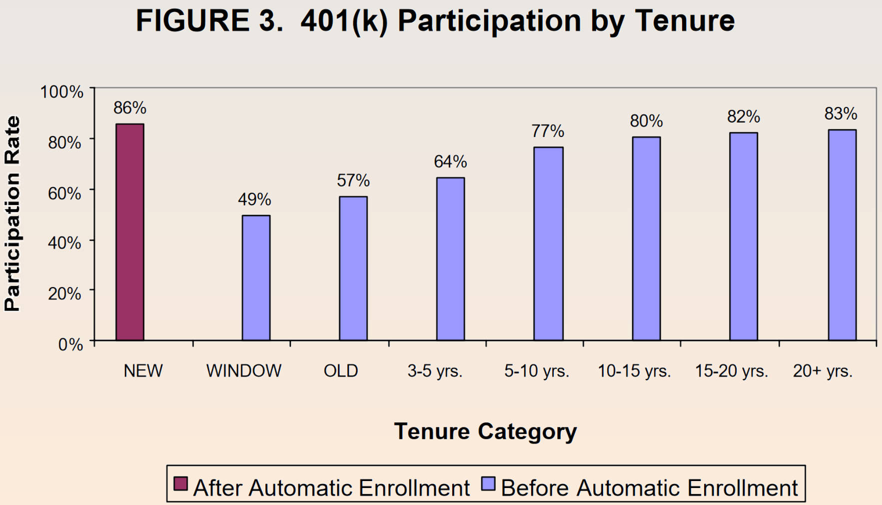
- Later in the course we will go in to more detail on the idea of **time inconstency**
- What does that mean? One possible reason for status quo bias is procrastination: you put off a decision because it is difficult or takes time or is boring...
- So you end up sticking with the way it is at the moment
- The status quo could also apply to a repeated choice: you stick with the thing you usually pick rather than considering other options

Pensions and status quo

A famous example of evidence for status quo bias is from Madrian and Shea (2001) about workers' contributions to 401(k) retirement accounts

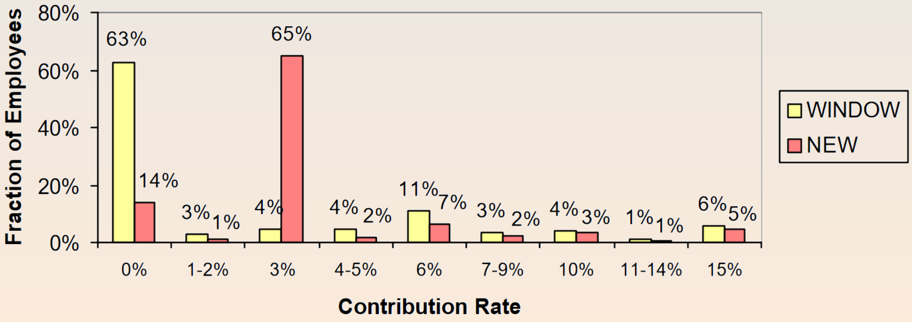
- Before: employees had to opt in to participate in the 401(k) plan
- After: employees were automatically enrolled unless they chose to opt out
- 401(k) participation is significantly higher under automatic enrolment
- A substantial proportion of participants who are automatically enrolled stick with the default contribution rate and fund allocation, despite not many people choosing this before automatic enrollment
    - The authors here suggest two possible reasons for the 'default option' behavior:
        1. Inertia: just sticking with the default option
        2. Advice: interpreting the default as a recommendation
- This all matters because life cycle consumption models are a mainstay of standard theory (i.e. how a person saves and borrows at different points in their life)

Madrian and Shea (2001)



Madrian and Shea (2001)

FIGURE 4C. Distribution of 401(K) Contribution Rates for the WINDOW and NEW Cohorts Including Non-Participation



Framing effects and sunk costs

A **framing effect** is when the way a question is posed affects how it is answered

- Closely related to the central idea that reference points matter
- Framing effects can be viewed as priming or manipulating the DM's reference point
- Suggestive of some processing phase in the DM's procedure
- This will crop up again and again in different sections of our course

Narrow bracketing and mental accounting

Two related applications of framing:

1. Narrow bracketing
   - "[a] decision maker who faces multiple decisions tends to choose an option in each case without full regard to the other decisions and circumstances that she faces." (Rabin & Weizsäcker 2009)
   - A narrow bracketer separates a complex decision into smaller, simpler parts and makes decisions about each part separately
2. Mental accounting
   - "[c]onsumers form mental budgets to organize their financial decisions." (Abeler & Marklein 2017)
   - For example, household expenditure separated into 'food money', 'gas money', 'rent money' and so on
   - Question: if a tenant aims to spend \$1,000 a month on rent and gets a \$200 housing benefit, do they treat the housing benefit as if it was cash or as if the label on it was binding?

Narrow bracketing (Kahneman & Tversky 1981)

Problem 3 [$N = 150$]: Imagine that you face the following pair of concurrent decisions. First examine both decisions, then indicate the options you prefer.

Decision (i). Choose between:

A. a sure gain of $240 [84 percent]

B. 25% chance to gain $1000, and 75% chance to gain nothing [16 percent]

Decision (ii). Choose between:

C. a sure loss of $750 [13 percent]

D. 75% chance to lose $1000, and 25% chance to lose nothing [87 percent]

Problem 4 [$N = 86$]. Choose between:

A & D. 25% chance to win $240, and 75% chance to lose $760. [0 percent]

B & C. 25% chance to win $250, and 75% chance to lose $750. [100 percent]

Kahneman & Tversky 1981

- In problem 3 we see evidence consistent with risk attitudes changing depending on whether DM is considering gains or losses
  - Majority in (i) chose the riskless option
  - Majority in (ii) chose the risky option
  - They were presented together to subjects; 73% chose both A and D, while only 3% chose B and C
  - We will return to this extensively in the 'Risk' topic
- But compare with problem 4: the payoff amounts in the two options are exactly the combination of A and D in the first case and B and C in the second case
  - Clearly A and D is dominated by B and C
  - All subjects chose B and C in the combined problem 4
  - The 'combined' versus 'separate' framing has a noticeable effect

Mental accounting (Kahneman & Tversky 1981)

Problem 8 [$N = 183$]: Imagine that you have decided to see a play where admission is \$10 per ticket. As you enter the theater you discover that you have lost a \$10 bill.

Would you still pay \$10 for a ticket for the play?

Yes [88 percent] No [12 percent]

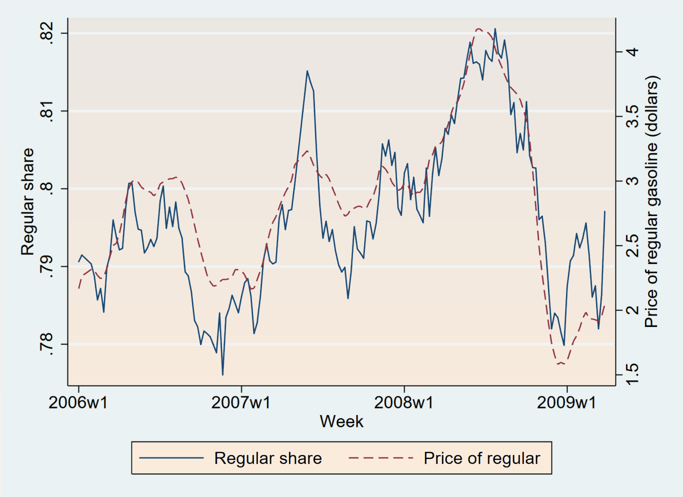
Problem 9 [$N = 200$]: Imagine that you have decided to see a play and paid the admission price of \$10 per ticket. As you enter the theater you discover that you have lost the ticket. The seat was not marked and the ticket cannot be recovered.

Would you pay \$10 for another ticket?

Yes [46 percent] No [54 percent]

Mental accounting (Hastings & Shapiro 2013)

FIGURE II: Regular share and the price of regular gasoline (retailer data)



Notes: Data are from the retailer. The plot shows the weekly share of transactions that go to regular gasoline and the weekly average transaction price of regular gasoline (in current US dollars).

Fungibility of money

Abeler & Marklein (2017): field 'experiment' and lab experiment to investigate whether DMs treat money as fungible

- Field study: customers of a wine restaurant in southern Germany
  - On arrival, surprised with an 8 euro voucher in honor of the restaurant's 4th anniversary
  - Cash treatment: "gourmet voucher" that could be spent on food or drink
  - Label treatment: "gourmet beverage voucher" restricted to be spent on drinks
  - Since the vast majority of customers consume more than 8 euro worth of drinks, the beverage voucher 'should' be nondistortionary of their choices
  - Receiving a voucher per se doesn't have a statistically significant effect on drinks spending
  - But receiving a beverage voucher increases drinks spending by a statistically significant 3.84 euros on average

Abeler & Marklein (2017)

- Lab experiment: two subsequent consumption decisions
  - Both stages: subjects had a cash budget to allocate on two goods framed as 'housing' and 'clothing'
  - Payoff function defined to map consumption choices to money payoffs to subjects; total payoff was the sum of payoffs to the two goods
  - Stage 1 (baseline): cash budget of 50 units to allocate freely
  - Stage 2 (grant stage): 50 money units plus a 30 unit grant
    1. Cash treatment: grant framed as an unconditional cash grant
    2. Label treatment: grant given as in-kind and had to be spent entirely on 'housing'
  - Parameters on the payoff function were chosen to make the grant non-distortionary in both cases: optimal consumption bundle that could be reached was the same in both treatments
  - Lots of robustness checks (ordering effects, experience effects, size of stakes, transparency of randomization)

Abeler & Marklein (2017)

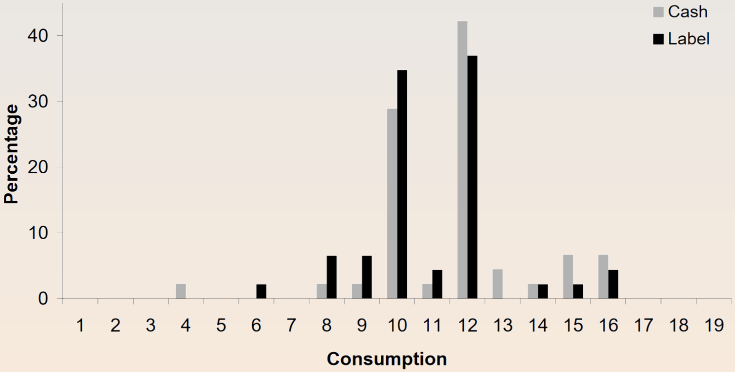


Figure 2: *Consumption of the subsidized good in the reference stage. A consumption of 12 units maximizes payoff.*

Abeler & Marklein (2017)

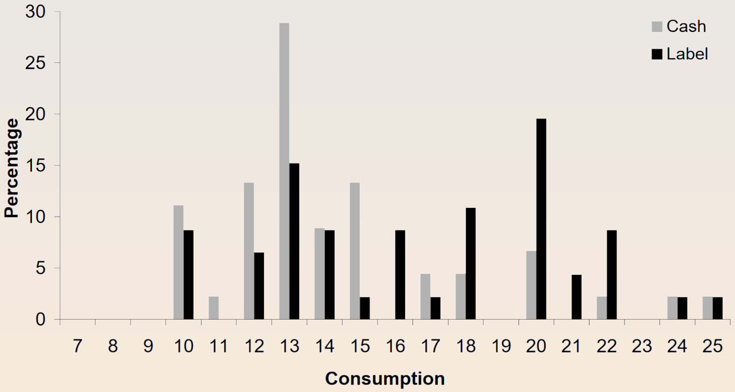


Figure 3: *Consumption of the subsidized good in the subsidy stage. A consumption of 13 units maximizes payoff.*

Abeler & Marklein (2017)

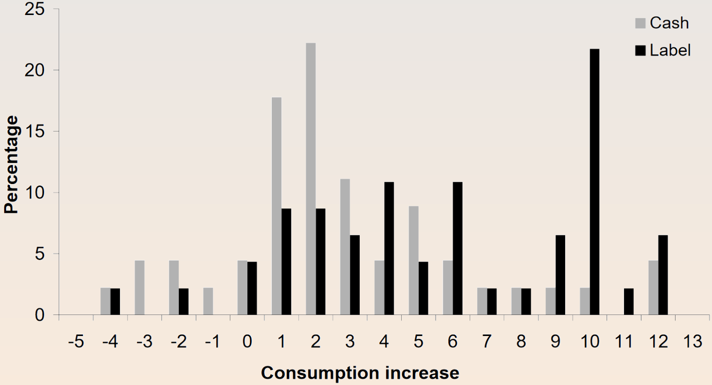


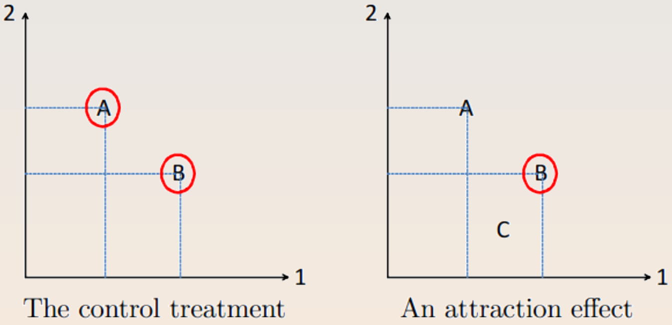
Figure 4: *Consumption increase of the subsidized good from reference stage to subsidy stage. The subsidy is worth 10 units of the subsidized good.*

Reason-based choice

Next we will turn to a couple of famous examples of reason-based choice

- The attraction effect
  - Add a clearly inferior option to give the target a reason to pick the 'clearly better' option
- The compromise effect
  - Add an extreme option to give the target a reason to pick the 'middle option'

Attraction effect



- Figure from de Clippel and Eliaz (2012)
- Options A and B differ on dimensions 1 and 2
- Adding option C can increase the proportion of people who choose B
- C is clearly dominated by B, and so DM has a ready reason to pick B

Attraction effect

The **attraction effect** was first shown in Huber et al. (1982)

- The option that is added is asymmetrically dominated: it's worse than B on both dimensions, but worse than A on one dimension and better than A on the other
- So while there is no clear-cut way to compare A and B, or to compare A and C, it is easy to see that B beats C
- If there is an attraction effect, some DMs seem to use this dominance as a reason to pick B
- This is a violation of IIA / WARP: adding C to the choice set changes the proportions choosing A versus B

Attraction effects

A neat example from Dan Ariely: the Economist magazine used to offer three subscription options:

1. Online only: \$59
2. Print only: \$125
3. Print and online: \$125

What gives? Why bother with that print only option?

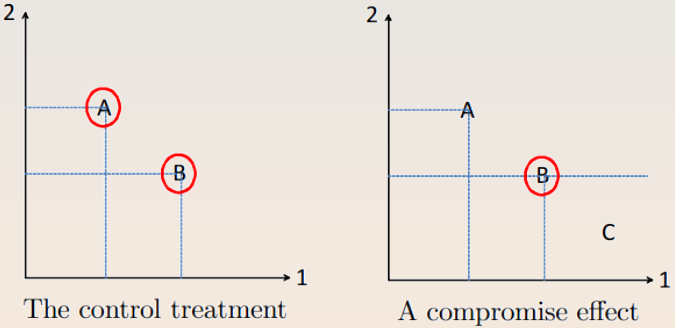
- Ariely reports a survey of students: 84% preferred print and online, 16% preferred online only, and no-one preferred print only
- But in another survey with 'print only' left out: 32% preferred print and online, 68% preferred online only
- This is a 'range increasing' decoy option (in the language of Huber et al.) and the attraction effect in action

The Overton window

There is a possible connection here with the idea of the **Overton window** in politics

- This is the idea that advocating very extreme positions makes positions that are only mildly extreme seem totally reasonable by comparison
- See also old sayings like 'if you need five, don't ask for three, ask for ten'
- Can you think of more examples where reference points of this kind matter?

Compromise effect



- Figure from de Clippel and Eliaz (2012)
- Options A and B differ on dimensions 1 and 2
- Adding option C can increase the proportion of people who choose B
- B is ‘in between’ A and C, and DM has a ready reason to pick B

Compromise effect

The **compromise effect** was first shown in Simonson (1989)

- The option that is added is extreme: it is even better than B on the dimension that B beats A, but even worse than B on the dimension that A beats B
- So while there is no clear-cut reason to prefer A or B, when we add C the 'in between' option B seems like a reasonable compromise
- This is again a violation of IIA / WARP: adding C to the choice set changes the proportions choosing A versus B
- 'Super size' as a decoy to make 'large' seem like a compromise?
- Sheng, Parker, and Nakamoto (2005) suggest 'expected loss minimization' as a rationalization of the compromise effect

Cognition and the attraction and compromise effects

Noguchi and Stewart (2014) conduct an eye-tracking study to investigate how subjects compare alternatives

Noguchi and Stewart (2014) intro:

"In the domain of choice between multiple alternatives, the attraction, compromise, and similarity effects demonstrate some puzzling behaviours. Together these effects demonstrate that an individual does not choose by selecting the alternative with the highest value or utility. Instead, an individual chooses as if the value or utility of an alternative is temporarily affected by the other alternatives in the choice set they face. This is puzzling because how much an individual enjoys the car she or he buys, for example, should be independent of the cars he or she does not buy. These context effects are often interpreted as indicating that a choice is reached by comparing available alternatives. This study investigated how alternatives are compared, using eye movement data collected while people make a series of three-alternative choices."

Cognition and the attraction and compromise effects

Noguchi and Stewart (2014) conduct an eye-tracking study to investigate how subjects compare alternatives

- 100 subjects at University of Warwick
- Compares three models:
  1. Attribute-wise comparison: one attribute dimension considered at one moment and all alternatives simultaneously considered
  2. Alternative-wise comparison: all attributes are integrated by the DM for each of two alternatives, then the integrated values for the pair are compared
  3. Attribute-and-alternative-wise comparison: one attribute dimension and one pair are considered at one moment and the two alternatives are considered on that attribute
- The challenge is figuring out what type / proportion of eye movements one would expect under each model
- The model most consistent with the eye-tracking data is the attribute-and-alternative-wise comparison model

Satisficing

Substantive rationality: attempts to further achievement of given goals within limits of given constraints

Procedural rationality: the outcome of a process of deliberation

e.g. a "satisficing" procedure (Simon 1955)

- Maximizing is complicated
- Attach "satisfactory" or "unsatisfactory" to each outcome; rational to choose anything that guarantees a satisfactory outcome
- Also works as a "stopping rule" on long lists: rather than comparing each alternative to all others, just stop at the first one that's "good enough"
- For example in a situation where you know nothing about the quality of an object until you look at it and learn exactly how good it is, but with a cost of looking at each object

Optimal stopping model

A model to capture the 'optimal stopping' aspect of satisficing:

- Set A with M items
- Value of each option from utility function $u : X \rightarrow \mathcal{R}$
- Probability distribution f capturing beliefs about the value of each option bet
- Cost k of inspecting the next item
- At each moment DM must either
    1. stop inspecting items and choose the best one so far, or
    2. look at another item at cost k
- We will start at the last step: DM has searched $M - 1$ items
- Best item so far has value $\bar{u}$
- Compare the value of looking at the last item vs. stopping now

Optimal stopping model: last period

After $M-1$ items inspected:

- Stop: get $\bar{u}-(M-1)k$
- Continue: total search costs now Mk, and benefit depends on the value u of the last item
- If it's better, get u, and if it's worse, get $\bar{u}$
- Value of continuing is $\int_{-\infty}^{\bar{u}} \bar{u} f(u) du + \int_{\bar{u}}^{\infty} u f(u) du - Mk$
- So it all depends on the chance it'll be better weighed against the extra cost

$$\int_{-\infty}^{\bar{u}} \bar{u} f(u) du + \int_{\bar{u}}^{\infty} u f(u) du - Mk \geq \bar{u} - (M-1)k \tag{33}$$

$$\int_{-\infty}^{\bar{u}} \bar{u} f(u) du + \int_{\bar{u}}^{\infty} u f(u) du - \bar{u} \geq k \tag{34}$$

$$\int_{\bar{u}}^{\infty} (u - \bar{u}) f(u) du \geq k \tag{35}$$

Optimal stopping model: last period

$$\int_{-\infty}^{\bar{u}} \bar{u} f(u) du + \int_{\bar{u}}^{\infty} u f(u) du - \left(\int_{-\infty}^{\bar{u}} \bar{u} f(u) du + \int_{\bar{u}}^{\infty} \bar{u} f(u) du \right) \geq k \tag{36}$$

$$\int_{\bar{u}}^{\infty} (u - \bar{u}) f(u) du \geq k \tag{37}$$

- LHS is smaller when $\bar{u}$ is larger: the better the best thing so far is, the less value you'd expect to gain from inspecting the last item
- This generates a **reservation stopping rule**: stop if the best thing so far is better than u^*

$$k = \int_{u^*}^{\infty} (u - u^*) f(u) du \tag{38}$$

Optimal stopping model: the whole list

- It turns out that this is the optimal stopping rule at each moment, not just going in to the last item
  1. If best $\bar{u}$ is less than u^*, we know that it's worth inspecting at least one more item
  2. If best $\bar{u}$ is more than u^*, we know that it's not worth inspecting even one more item
- Both are true for all moments back to the top of the list
- That is: satisficing
  - Keep searching until you find something better than u^*, and if you never do then just pick the best one
  - We found that threshold u^* as a function of parameters
  - (It is important that you don't learn new information about f along the way, only the value of the current item)

Optimal stopping model: comparative statics

$$k = \int_{u^*}^{\infty} (u - \bar{u}) f(u) du \tag{39}$$

In our simple model, the threshold u^* is

- higher when the cost of inspecting an item is higher,
- higher when the variance of f is higher,
- higher when the mean of f is higher, and
- doesn't depend on the number of items that are available

Can you think of interesting variations you could introduce to the model to capture different possible aspects of sequential search?

Satisficing

Caplin, Dean, and Martin (2011) conduct a search-theoretic choice experiment, find that the satisficing model explains the choices of most subjects

- Options for subjects to choose from are arithmetic problems so it takes time and effort to search
- Size and complexity of choice set can be varied
- Effects of the order of options can be studied
- Subjects can select a 'provisional' choice and then change their mind, and either click 'finished' or have their last choice apply if time runs out
- So the order of their 'switches' is informative—can say something about what 'direction' they searched in
- And when they stop is informative—can say when they felt an option was 'good enough'

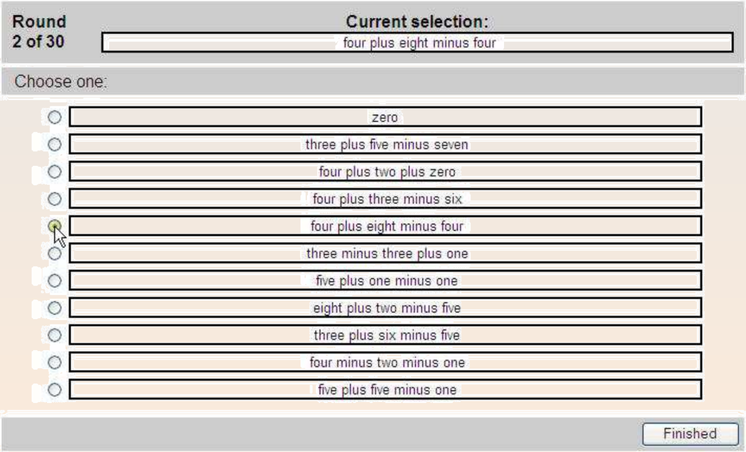
Caplin, Dean, and Martin (2011)

Four experiments; in all cases 2 practice rounds and 27-40 real rounds of which 2 drawn at random to pay out

1. Standard choice: vary complexity of arithmetic and number of alternatives in different treatments; value 0 option initially selected; only final choice is payoff relevant and subjects can switch any time; no time constraint; can press submit any time
2. Choice process: can select any alternative at any time, changing allowed any time, but actualized choice is recorded at a random point in time; incentive to always select the option currently perceived as best
3. Varying complexity: size 20 choice sets with objects ranging in complexity from 1-9 operations; complexity, screen position, and object value independent of one another
4. Time constraint: same as standard choice, but with a 2 minute time limit

Caplin, Dean, and Martin (2011)

Figure 1: A typical choice round



Caplin, Dean, and Martin (2011)

Some key findings:

- Size and complexity of choice set increases the chance of failing to choose the highest value, and increases the average loss; across all treatments \$3.12 is left on the table on average, increasing to \$7.12 in the size 40, complexity 7 case
- Assuming subjects' utility is always increasing with more money, sequential search would be suggested by 'switches' that always move to higher values; 68 of 76 total subjects seem to be sequential searchers by this criterion
- Choice process experiment shows results consistent with continuing to search just below and stopping just above a reservation level estimated from the data
- Subjects typically look for a reservation utility not a reservation time for stopping
- Reservation utility seems context-dependent; higher in larger choice sets (despite being informed about the distribution of values! Does it just 'feel' like there are more better options?)

Bounded rationality

Another response to ‘maximizing is complicated’ is to maintain substantive rationality and model the DM as approximating the problem and then solving the approximation

- Constraints could include:
  - Memory
  - Cognition
  - Time
  - Energy
  - Attention
- Whether something ‘should’ be part of the constraint or the objective function is a matter of perspective
- In the econ world of ‘as if’ rational choice, you can typically get to the same theoretical place either way

Rational inattention

An example is the rational inattention model

- You can gather information with costly effort (time, brainpower, cash, energy)
- More information means better choices
- How much information should you gather, and of what type?
- One way to model (DellaVigna 2009): good has value V made up of visible (v) and opaque (o) components

$$\hat{V} = v + (1 - \theta)o \tag{40}$$

- θ capturing the amount of inattention

Taxes in the store

Chetty, Looney, and Kroft (2009) studies the effect of pre- versus post-tax price posting in a grocery store

- Demand depends on the visible part, price, and the opaque part, state tax
- Field experiment: change price tags of some items to show post-tax price as well as pre-tax price
- Makes the post-tax price salient and visible
- Can compare sales during the three week experiment period to
    1. Sales of the same items in the previous week
    2. Sales for other items that didn't have the change in price tags
    3. Sales from other stores
- Average quantity sold declines by 8.8%
- Inattention to tax could lower deadweight loss of taxation and be welfare-enhancing...

Taxes in the store

Ashton (2014) finds that the leading digit of the price is driving the effect

- Reanalyzes the Chetty et al. data
- The effect of changing the price tag on sales comes from situations where it changes the dollar figure
- Inattention to cents:

$$V(x) = 2 + (1 - \theta)0.99 \tag{41}$$
$$V(y) = 3 \tag{42}$$

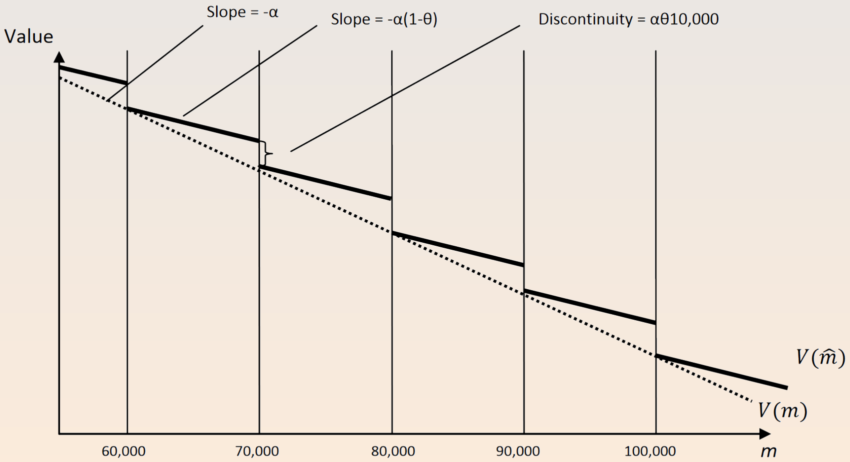
- Higher θ (more inattention) makes the prices look more dissimilar
- Rationalizes prevalence of .99 prices in stores
- Anecdotal aside: British commercials of my childhood would read out, for example, a price of a car of 19,999 as "nineteen nine nine nine"

Odometer effect in used car sales

Lacetera, Pope, and Sydnor (2012) look at the effect of round numbers on the odometer on used car sales (27m used car auctions)

- Say that $\hat(V) = K - \alpha\hat{m}$, where $\hat{m}$ is perceived mileage
- $\hat{m} = floor(m, 10k) + (1-\theta)mod(m, 10k)$
- That is: perceived mileage is the true thousands part and then some inattentive weight on the remainder
- At round 10,000 increments $\hat{V}$ jumps by $-\alpha\theta 10k$
- And the slope of $V(m)$ is $-\alpha(1-\theta)$
- More inattention means less sensitivity to mileage in between 10k increments and a big adjustment when a 10k threshold is crossed
- Busse et al. (2013) show that this effect is present in sales prices at the retail level too

Lacetera, Pope, and Sydnor (2012)

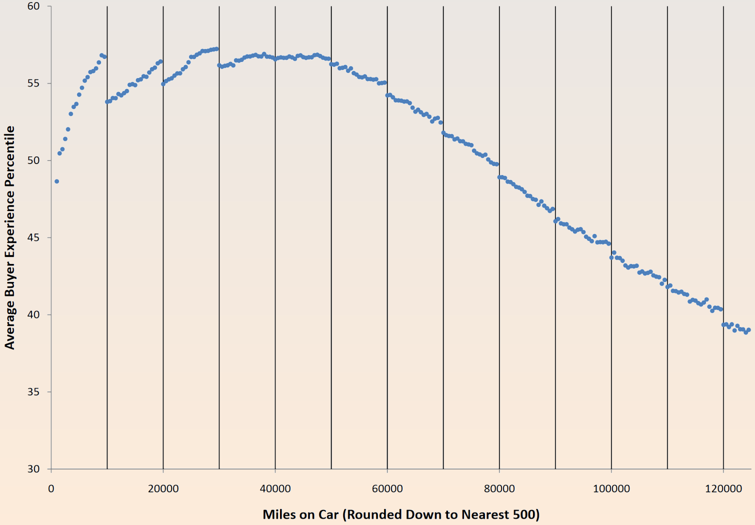


Lacetera, Pope, and Sydnor (2012)

Figure 2 - Raw Price. This figure plots the raw average sales price within 500-mile bins for the more than 22 million auctioned cars in our dataset.

Lacetera, Pope, and Sydnor (2012)

Figure 11 - Experience Percentile. Each buyer in the dataset is given a experience percentile rating based on total volume of purchases (the 1% of buyers with the highest volume receive a percentile score of 99%). This figure plots the average buyer experience percentile for each 500-mile bin.



Too much choice

There is some evidence that larger choice sets can be demotivating to a DM

- Standard theory predicts larger choice sets must be weakly better for the DM
- But we have several examples of people being less likely to consume something when there are more options on the table
- Bertrand et al (2005): 60,000 letters to clients offering loans in South Africa; fewer loans described increased take-up by 0.6 percentage points, the same effect as a 2.3% lower monthly interest rate
- Boatwright and Nunes (2001): removing poorly selling items from supermarket shelf can increase aggregate sales by 11% on average
- Iyengar, Jiang, and Huberman (2004): more 401(k) participation when fewer than 10 plans are offered
- Iyengar and Lepper (2000) ‘the jam paper’: consumers buy more jam when the free sample table has 6 than when it has 24

Too much choice

Salgado (2006) uses an experiment to try to disentangle two possible explanations:

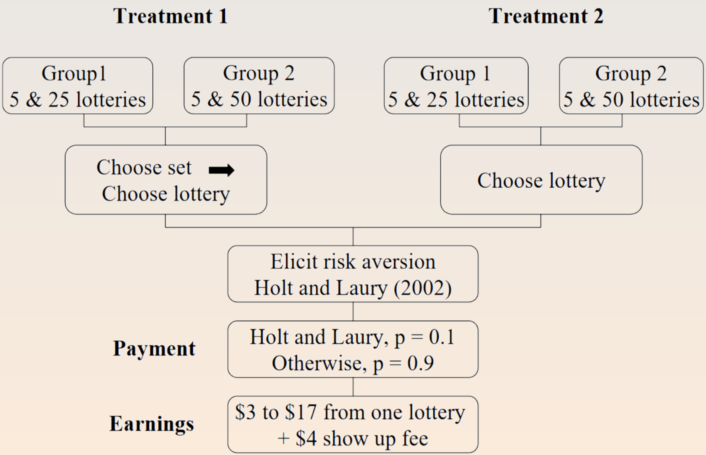
1. Value of information
    - Fewer alternatives could be interpreted as curation that has winnowed down the choice set
    - e.g. recommendations from friends, investing in mutual funds
    - Probably requires some degree of trust in how the options were selected (real or mistaken)
2. Cognitive overload
    - More options means it's harder to think through them all
    - Might then prefer fewer alternatives even if they were themselves a random subset of a larger set
    - Could be consistent with things like satisficing if it is cognitively costly to eliminate options

There are other possibilities (regret / rejoice feelings, temptation concerns) that we will return to in the 'time' and 'risk' sections of our course...

Salgado (2006)

- 232 Northwestern students, average earnings \$12.50
- Two treatments (different subjects):
  1. Do subjects prefer a subset of a larger set and is this consistent with either value of information or cognitive overload?
     - Subjects choose small or large set of lotteries to choose among, then choose a lottery from their chosen set
     - The way that the lotteries are chosen varies: randomly, chosen by students, chosen automatically as the best (undominated by any other)
  2. Do subjects who select large sets do so because of overconfidence or true higher ability?
     - Subjects just choose a lottery for each of the small and large sets
     - Can compare their level of success to the level of success among treatment 1 choosers
- Each treatment has two groups, group 1 with choices involving sets of 5 and 25 lotteries; group 2 sets of 5 and 50 lotteries

Salgado (2006)



Salgado (2006): treatment 1

1. "This group of 5 lottery tickets was randomly selected from the group of 25 shown in (b). This was done by having a computer program randomly select 5 numbers from 1 to 25, corresponding to the 5 lotteries. If you want more details about how this was done, or what computer program was used, please ask the experimenter."

2. "This group of 5 lotteries was selected from the group of 25 in (b) by 10 economics and Kellogg graduate students. These students have extensive training in statistics, and solve these kinds of problems all the time. Here are some details: 10 students were given the set of 25 lotteries in (b) and asked to choose the 5 within the group which they thought were the best. This group contains 5 of the lotteries most frequently chosen by these 10 econ and Kellogg graduate students. If you need more details on this procedure or if you want to know more about who are the graduate students involved, please ask the experimenter."

3. "This group of 5 lottery tickets was selected by taking the 5 best lotteries in the group of 25 shown in (b). This means that the lotteries in the small group will give you at least the same amount of money as the lotteries in the large group, and possibly more. Alternatively, for each lottery in the large group, there is a lottery in the small group that will give you at least the same amount of money, and possibly more."

Chose small set in all 3 cases: 'cognitive overload' type; chose small set in 2 and 3: 'value of information' type; chose small set only in 3 or never: 'more is better' type

Salgado (2006)

Proportion of types:

	5 x 25	5 x 50
Cognitive Overload	0.20	0.33
Value-of-information	0.43	0.22
More is Better	0.19	0.15
Sum All	0.82	0.70

- The paper has some really fascinating quotes from 'debriefing' of subjects about why they chose the way they did...
- 32% in the 25 lottery case chose the small set under random selection; 48% in the 50 lottery case
- Men more likely to choose a large set than women
- More risk-averse participants were less likely to choose randomly selected small sets, but more likely to choose small sets for the other methods
- Some evidence from treatment 2 that self-selection on higher ability is going on

Flat-rate bias

In a similar spirit to choice overload is that people might prefer simplicity

- McFadden, Train, and Ben-Akiva (1987) found that home telephone customers (back when that was still a thing) preferred flat rates to paying per minute
- Taxonomy of possible reasons from Lambrecht and Skiera (2006):
  1. Insurance effect: risk-averse DM may seek de facto insurance against possible high use
  2. Taxi meter effect: the ticking of a taxi meter makes the ride seem less pleasant
  3. Convenience effect: status quo effect or rational inattention to confusing optimization problem
  4. Overestimation effect: DM may anticipate more demand for a good than they will actually have

Lambrecht and Skiera (2006)

- Three pronged approach to study tariff-choice biases:
  1. Transaction data for 10,882 customers of a European ISP for a 5 month period
     - ‘Overall wrong’: consumer chose a tariff that didn’t minimize billing rate over the period analyzed
     - ‘Always wrong’: consumer didn’t chose a cost minimizing tariff in any single period
  2. Survey of 241 MBA students on tariff choices and the causes of tariff choice biases
  3. Survey of 1,078 customers of the ISP, matched for 941 of them with their transaction data

Lambrecht and Skiera (2006)

		Criterion 1: Overall Wrong			Criterion 2: Always Wrong		
		Best Tariff			Best Tariff		
	Chosen Tariff	Tariff 1 (%)	Tariff 2 (%)	Flat Rate (%)	Tariff 1 (%)	Tariff 2 (%)	Flat Rate (%)
Three months (N = 10,882)	Tariff 1	**93.7**	5.3	1.0	**98.7**	1.2	.1
	Tariff 2	48.1	**43.4**	8.5	37.6	**61.1**	1.3
	Flat rate	19.8	8.4	**71.8**	17.5	7.8	**74.7**
Five months (N = 7559)	Tariff 1	**94.5**	4.7	.8	**99.6**	.4	.0
	Tariff 2	46.4	**47.8**	5.8	29.3	**70.4**	.3
	Flat rate	14.3	12.0	**73.7**	10.5	10.5	**79.0**

Notes: Bolded numbers represent customers who chose a tariff that minimized their billing rate.

- Table describes the type and frequency of 'mistakes' made by the ISP customers
- Survey data also finds flat rate bias
- Convenience effect not that important but evidence of other explanations exists

Multiple rationales

Another approach to dealing with violations of IIA is to see the DM as having a ‘bag’ of strict preference relations such that each choice is maximal for one of them

- Kalai, Rubinstein, and Spiegler (2002) introduce a formal version of ‘rationalization by multiple rationales’
- The philosophical question of whether two choices made at different times or places can really be comparable to each other is taken quite literally here
- Question is: what is the smallest number of rationales that explains a set of choices that the economist has observed?
- Authors emphasize that they agree with Sen (1993) that ‘motives, values or conventions’ matter and should be incorporated before we worry about IIA; e.g. if I worry about looking greedy, the consequences of taking a piece of cake clearly change and so one doesn’t need multiple rationales to understand me

Multiple selves

The idea of multiple selves has a rich history across academic disciplines and in pop culture

- 'Dual process' models in psychology
- The angel and the devil on your shoulders
- Multiple selves is a modeling approach that will be available and relevant in lots of places later in our course, including
  - A game / conflict / negotiation between different versions of yourself
  - Trying to corral your future self
  - The selfish you versus the selfless you
  - Mental states and response to news / evidence

Thinking, fast and slow

Kahneman's (2011) "Thinking, Fast and Slow' summarizes his research career

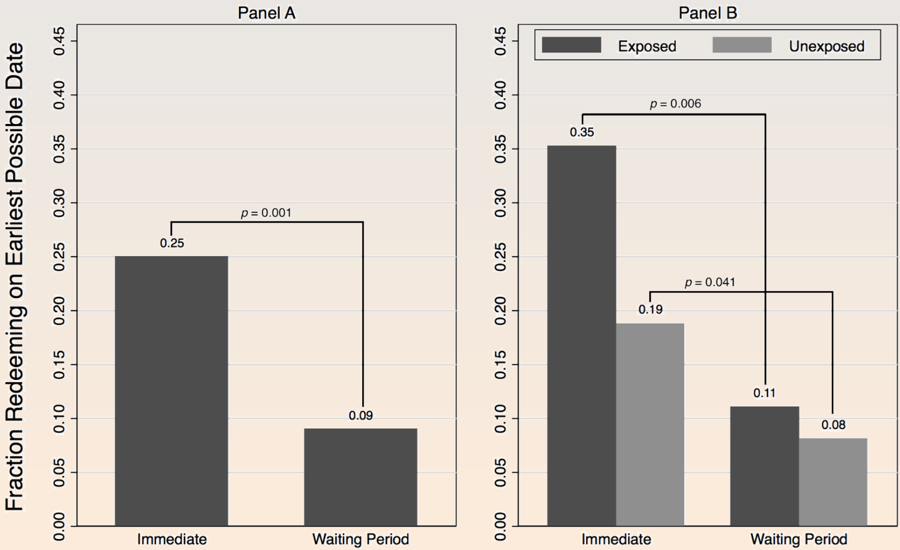
- The title derives from his theory of two modes of thought:
  1. System 1: fast, intuitive, instinctive
  2. System 2: slow, deliberative, analytical
- This model of decision making is one lens through which we can view many things we'll study in the course
- What are some ways that we could incorporate this in an economic model?

Waiting to choose

Imas, Kuhn, & Mironova (2016)

- Field experiment in Bukavu, Democratic Republic of Congo
- Grocery store customers got a voucher: free 1kg bag of flour on a pre-specified date
- For every day after the redemption date that the coupon was saved, get one extra bag of flour, up to five total
  - Treatment 1: redemption date was immediate
  - Treatment 2: redemption date was tomorrow
- Customers who had been exposed to violence were more likely to redeem immediately in treatment 1 but not in treatment 2

Imas, Kuhn, & Mironova (2016)



Imas, Kuhn, & Mironova (2016)

Second experiment using Amazon Mechanical Turk online labor market

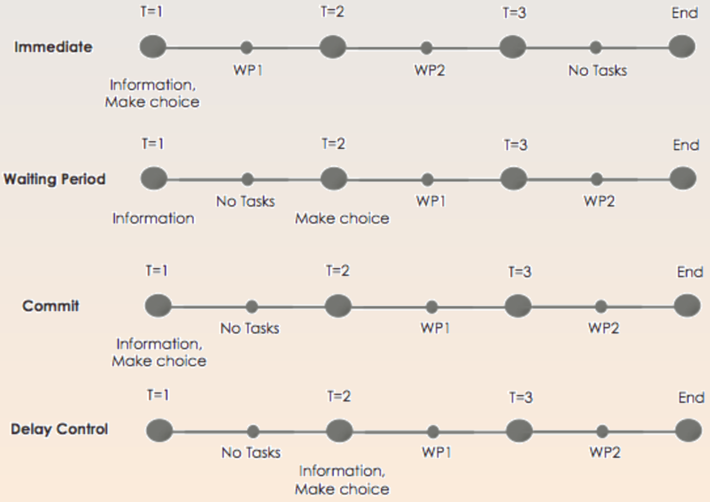
- 122 participants recruited to complete a series of real-effort tasks over about 3 hrs
- To get the $20 payment, had to finish a number of tasks over two 1 hour work periods
- Work periods constrained to be exactly one hour (regardless of how long it actually took) and the excess explicitly labeled as free time
- Variation: putting off the work until the second period means more tasks had to be done

Table 3: Choices in the Online Study

Budget	Max. WP1 Tasks	Max. WP2 Tasks	# of Options	Interest Rate
1	40	60	11	50%
2	40	50	11	25%
3	40	45	6	12.5%
4	40	40	11	0%

WP1 and WP2 refers to Work Period 1 and 2, respectively. Maximum tasks allocated to one work period imply that zero tasks would be allocated to the other work period. The last column lists implied one-hour interest rates.

Imas, Kuhn, & Mironova (2016)



Imas, Kuhn, & Mironova (2016)