Introduction to Bounded Rationality

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Introduction

Focus
Discussion of imperfect information, which we will be our
Some stylized facts we may want to explain

Overview
Today we will come our first behavioral topic: bounded
So far covered the rational model in (excruciating) detail

Introduction
Plan for Today

- Standard model: \( C(A) = \max_{x \in A} u(x) \)

If this is wrong, two ways to go:
1. Modify objective
2. Modify constraints

Most of behavioral economics concerned with approach 1

Bounded rationality concerned with approach 2

Optimal behavior within some additional constraints

What is bounded rationality?

- Costs to acquiring or processing information
  - E.g. Simon [1955], Stigler [1961], Sims [2003]

- Limits on reasoning
  - E.g. Camerer [2004], Crawford [2005]

- Thinking averse
  - E.g. Camerer [2004], Camerer [2005]

- Thinking automaton
  - E.g. Wilson [2002]

- Semi-rational models
  - E.g. Gabaix et al. [2008], Gabaix [2013], Esponda [2008], Rabin and Vayanos [2010]

- Heuristics
  - E.g. Piccione and Rubinstein [1993], Artoleva [2013]

- Automatons
  - E.g. Gabaix et al. [2008], Gabaix et al. [2010]
Advantages and Disadvantages of Bounded Rationality

Advantages:
- Can microfound behavioral models - explain how behavioral phenomena can change with the environment
- Too much choice
- Status quo bias
- Compromise effect
- Salience/Framing Effects
- Failure to choose the best option
- Statistical biases
- Too much choice

Disadvantages:
- May be wrong!
- What is correct constraint?
- Regression bias

What might we want to explain with bounded rationality?
What Might We Want to Explain With Bounded Rationality

- Random Choice
- Status Quo Bias
- Failure to Choose the Best Option
- Salience/Framing Effects
- Too Much Choice

Random Choice (Mosteller and Nogee 1951)

Each bet offered 16 times
Gamble is \( \frac{1}{4} \) probability win amount and \( \frac{1}{16} \) loss of 5¢

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What Might We Want to Explain With Bounded Rationality?

- Random Choice
- Status Quo Bias
- Failure to Choose the Best Option
- Salience/Framing Effects
- Too Much Choice
- Statistical Biases
- Compromise Effect
- Too Much Chance
- Sunk Costs/Thinking Errors
- Failure to Consider the Best Option
- Status Quo Bias
- Random Chance

Status Quo Bias/Inertia (Madrian and Shea 2001)

Also in effect on those not automatically enrolled
- Effect reduces with tenure
  - Opt In: 86%
  - Opt Out: 77%

Average takes up after 15 months of tenure
- Opt In: 37%
- Opt Out: 86%

Two types of plans
- Opt In
- Opt Out

Describe behavior of workers in firms that offer 401(k) savings plans.
What Might We Want to Explain With Bounded Rationality

• Random Choice
• Status Quo Bias
• Failure to Choose the Best Option
• Salience/Framing Effects
• Too Much Choice
• Statistical Bias
• Compromise Effect
• Suboptimal Choice
• Failure to Choose the Best Option
• Status Quo Bias
• Random Choice

Failure to Choose the Best Option (Caplin, Dean, Martin 2011)
Failure to Choose the Best Option (Caplin, Dean, Martin, 2011)

Choice Objects

- 6 treatments
- 3 x choice set size (10, 20, and 60 options)
- 2 x complexity (3 and 7 operations)
- 2 x choice set (2 and 0 operations)
- No time limits

Choice Objects Table

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
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<tr>
<td>2</td>
<td>18</td>
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<td>3</td>
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<td>5</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

Failure to Choose the Best Option (Caplin, Dean, Martin, 2011)
### Results

**Failure rates (%) (22 subjects, 657 choices)**

<table>
<thead>
<tr>
<th>Set size</th>
<th>Complexity 3</th>
<th>Complexity 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>7% 24%</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>22% 56%</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>29% 65%</td>
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</tbody>
</table>

**Average Loss ($)**

<table>
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<tr>
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<tbody>
<tr>
<td>37</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>0.41 1.69</td>
</tr>
<tr>
<td>20</td>
<td>1.10 4.00</td>
</tr>
<tr>
<td>40</td>
<td>2.30 7.12</td>
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**Failure rate (%) (22 subjects, 657 choices)**
What Might We Want to Explain With Bounded Rationality

• Random Choice
• Status Quo Bias
• Failure to Choose the Best Option
• Salience/Framing Effects
• Experiment in supermarket
  • Posted prices usually exclude sales tax
  • Reduced demand for these goods by about 8%
  • Archival data shows that, for alcohol, elasticity with respect to sales tax (in addition) was similar to price elasticity
  • Exercise that allows people to choose the best option

Salience (Chetty, Looney and Kroft, 2009)
What Might We Want to Explain With Bounded Rationality

- Random Choice
- Status Quo Bias
- Too Much Choice
- Salience/Framing Effects
- Failure to Choose the Best Option
- Statistical Biases
- Random Choice

Salience (Chetty, Looney, and Krort, 2009)
Too Much Choice (Iyengar and Lepper 2000)

- Set up a display of jams in a local supermarket.

- Two treatments:
  - Limited choice — 6 jams
  - Extensive choice — 24 jams

- Record what proportion of people stop to look at the display in the two treatments.

- Slightly more people stop to look at the display in the extensive choice treatment:
  - 60% extensive choice treatment
  - 40% limited choice treatment

- Far more people chose to buy jam conditional on stopping in the limited choice treatment:
  - 3% extensive choice treatment
  - 31% limited choice treatment
Too Much Choice and Simplicity Seeking (Iyengar and Kamenica 2010)
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- Random Choice
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- Statistical Biases
- Compromise Effect
- Gambler’s Fallacy (Croson and Sundali 2005)
- Proportion of Gambler’s Fallacy bets in casino gambling
Hot Hands Fallacy (Offerman and Sonnemans 2000)

- Two types of coins
  - Fair: Independent
  - Unfair: Repeat last outcome with probability 70%
- Prior distribution: 50/50
- Subjects observe 20 coin flips, then report probability of unfair coin

Gambler’s Fallacy (Croson and Sundali 2005)

- For each subject, proportion that overestimate probability of unfair coin
What Might We Want to Explain With Bounded Rationality

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- Compromise Effect (Simonsen 1989)
Imperfect Perception and Information Acquisition

We are going to focus on models of bounded rationality in which the DM does not necessarily internalize all available information. Instead, they may have a ‘perceptual state’ which is different from the information available to the researcher. This is different from most standard models where the DM has perfect perception (e.g., knows what is in their choice set) or we know exactly what the DM knows. In general, there may be a gap between what we know as the researcher and what the DM knows. We can expect perception to be imperfect, and this can lead to misperceptions.

In some cases, the DM may not look at all available options. For example, a shopper may not look at all available options and may be unaware of what we know as the researcher. Buyer may not perfectly perceive the quality of a car, which is different from the actual state of the world. This is different from most standard models where the DM has perfect perception of the world.

Imperfect perception and information acquisition can lead to misperceptions, which in turn can affect decision-making. We need to be aware of these limitations when designing models of bounded rationality.
Imperfect Perception and Information Acquisition

This can lead to choice ‘mistakes’ from the point of view of an external observer.

Choose an inferior option.

Make wrong choice given state.

These mistakes may be ‘optimal’ given information costs and constraints.

We will consider two types of unawareness.

1. ‘All or nothing’

Alternatives are either completely understood or nothing.

Examples:

- Caplin, Dean and Martin [2011],
- Masatlioglu, Nakajima and Ozbay [2012],
- Manzini and Mariotti [2014].

Additional references for this approach to understanding are:

- …

This can lead to choice ‘mistakes’ from the point of view of an external observer.
Imperfect Perception and Information Acquisition

We will consider two types of unawareness:

1. Models of partial learning

2. States of the world $\Omega$ with prior $\mu$

3. Choice over actions $a: \Omega \rightarrow \mathbb{R}$

4. Choose an information structure $\gamma$

5. Choices can be conditioned only on the information structure $\pi$(\gamma$|\omega$)

Examples:

- Sims [2003] (Rational Inattention)
- Matejka and McKay [2015]
- Caplin and Dean [2015]

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