Slide Series 1: BASICS OF RATIONAL CHOICE THEORY

Preferences and Choices: Some Preliminaries

• Legislative Behavior is more than "how a bill becomes a law"

• "There are two things you dont want to see being made–sausage and legislation." (attributed to Otto von Bismark)

• Q: Why is it complicated?

• A: It involves the aggregation of individual preferences (manifested through votes)

• …and aggregation of preferences can be a messy affair indeed.

Storytellers and Theorists

• Sometimes they are the same thing!

• . . . but storytelling doesn't teach us well, about legislative behavior (though stories help!)

• We want to work within a theoretical framework

• Our framework: "rational choice theory"

• In some quarters, controversial and misunderstood

• Our working view on rationality is this (given by Oskar Morgenstern—a "founding father" of game theory): "In analyzing games, the theory does not assume rational behavior; rather, it attempts to determine what "rational" can mean when an individual is confronted with the problem of optimal behavior in games and equivalent situations." (1968)

• In order to get this off the ground, we need to know a few things.

Moving Parts

• Preferences: what do you want? what outcome is "best"? which alternative is most desired?

Define preferences in terms of alternatives: x, y, z

Example: Preference for Supreme Court nominee

Right-wing Republican:
Pro-life, "Constructionist" *preferred to* Pro-choice, "Interpretivist"

Left-wing Democrat:
Pro-choice "Interpretivist" *preferred to* Pro-life, "Constructionist"

Symbolism:
$x \equiv$ Pro-life, "Constuctionist"
$y \equiv$ Pro-choice, "Interpretivist"

Summary:
Legislator$_i$: $x \ \ P_i \ \ y$
Legislator$_j$: $y \ \ P_j \ \ x$

"P" is the "preference relation."

Another Example: The "Apathetic" Voter:

"There's not a dime's worth of difference between a Republican and a Democrat."

Alternatives in an election: Democrat (d) vs. Republican (r)

Voter$_k$: $d \ \ I_k \ \ r$

"I" is the "indifference relation."

Some Assumptions

- Comparability of alternatives (or completeness)

It's our summary of the preference relation that exists of the ith individual.

$x \ P \ y$ OR $y \ P \ x$ OR $x \ I \ y$

Why this assumptions: imposes restriction that alternatives are meaningfully comparable (e.g. Coke vs. Pepsi, Conflict vs. Negotiation, Wildcats vs. Sundevils); Non-comparable alternatives? (Pepsi vs. Conflict).

- Transitivity of Preferences

$\exists$ 3 alternatives: x, y, z

It's our summary of order (order matters!):

If $x \ P \ y$ and $y \ P \ z$ then $x \ P \ z$; hence $x \ P \ y \ P \ z$.

This is logically consistent. Of course there are several preference profiles that could exist (specifically 3! [read: 3 factorial]):

$x \ P \ y \ P \ z$
$x \ P \ z \ P \ y$
$y \ P \ x \ P \ z$
$y \ P \ z \ P \ x$
$z \ P \ x \ P \ y$
$z \ P \ y \ P \ x$

The problem for legislators? Aggregation!

What about *intransitivity*: $x \ P \ y \ P \ z \ P \ x$

Huh? How can this happen?

Utility Maximization and Uncertainty

• Q: Which alternative do you choose?

• A: The one you desire the most! . . . but wait

• Real world uncertainty exists.

• Constraints exist: the odds of a desired outcome occurring may be *extremely low!*

• THEREFORE, your choice of actions is important: I really want an "A" . . . OK, how're you going to get an "A"?

• Beliefs and Desire come into play: things can get "subjective."

The Runner's Dilemma

Outcomes:
Fast Marathon (x); Fast Half-Marathon (y); Fast 5k (z)

Actions:
80 MPW (A); 50 MPW w/long intervals (B); 40 MPW w/speed work (C)

Desire:
My "utility" for each outcome: $u(x) = .5$; $u(y) = .1$; $u(z) = 1$. (Utility is ordinal [and arbitrarily scaled])

Beliefs:
If A: $\Pr(x) = .6$; $\Pr(y) = .3$; $\Pr(z) = .1$
If B: $\Pr(x) = .3$; $\Pr(y) = .5$; $\Pr(z) = .2$
If C: $\Pr(x) = .1$; $\Pr(y) = .3$; $\Pr(z) = .6$

What we have here is a "lottery" about actions A, B, C—it is probabilistic ("if I do A, the *probability* of x is .6 ...").

Expected Utility

$$EU(Action) = \Pr(x) \times u(x) + \Pr(y) \times u(y) + \Pr(z) \times u(z)$$

In words: the utility of taking some action is equal to the sum of the utilities for each outcome *weighted* by the probability of that outcome actually occurring (i.e. the utilities are weighted by the probabilities). Solving, we get:

$$\begin{aligned} EU(A) &= .43 \\ EU(B) &= .40 \\ EU(C) &= .68 \end{aligned}$$

Given our preference relation of $z \quad P \quad x \quad P \quad y$ and our subjective beliefs about the probabilities of x, y, z, the *rational choice* is to select the action that maximizes our utility. Here, it is choice C.

- Is this a realistic way to think about decision-making?

The Politician's Dilemma

Outcome:

Bill Passes Unamended (x); Bill Passes Friendly Amended (y); Bill Passes Hostilely Amended (z)

Actions:
Seek Closed Rule (A); Seek "Modified" Rule (B); Do Nothing (C)

Desire:
L's "utility" for each outcome: $u(x) = 1$; $u(y) = .5$; $u(z) = 0$.

Beliefs:
If A: $\Pr(x) = 1$; $\Pr(y) = 0$; $\Pr(z) = 0$
If B: $\Pr(x) = .33$; $\Pr(y) = .33$; $\Pr(z) = .33$
If C: $\Pr(x) = .1$; $\Pr(y) = .44$; $\Pr(z) = .55$

Expected Utility:

$$\begin{aligned} EU(A) &= 1.0 \\ EU(B) &= .50 \\ EU(C) &= .32 \end{aligned}$$

The "rational choice" is action "A."

- Does this make sense?

- Sure! …but wait

- Hidden Implications? (You bet!)

Group Choice: Aggregating Preferences

• The Issue: How does one arrive at a coherent group choice from (possibly) many distinct preference arrangements?

• Under some very general conditions, it may be the case that you CANNOT obtain a coherent group choice.

• This is the essence of **Arrow's Theorem**

• Fortunately, with some mild restrictions, we can avoid this problem

• This will get us to **Black's Median Voter Theorem**

• The MVT—and its close relatives—is critical for understanding legislative politics!

Oil and Soil: Resource Acquisition and Environmentalism

• Three Choosers, Three Choices

Choice Set: Drill Now (x), More Research (y), Off-Limits (z)

Preference Arrangement for 3 Committee Members:
L: $z \ P \ y \ P \ x$
C: $y \ P \ x \ P \ z$
R: $x \ P \ y \ P \ z$

• The decision? Hmmm ...
• Let's take a vote! Hmmm ...
• No majority winner for top-preference.
• Let's do a "round-robin" tournament.

Round 1: x vs. y: y "wins" 2–1 (L and C vote for y)
Round 2: x vs. z: x "wins" 2–1 (C and R vote for x)
Round 3: y vs. z: y "wins" 2–1 (C and R vote for y)

Round-Robin Winner: y—More Research (y wins two of the three possible matches; Though note that the majorities are shifting!)

For this committee, we can say the preference arrangement is: $y \ P \ x \ P \ z$.

Oil and Soil Redux

• Suppose L and R negotiate?
• R agrees to support z over x (why might R do this?)

New Preference Arrangement for 3 Committee Members:
L: $z \ P \ y \ P \ x$
C: $y \ P \ x \ P \ z$
R: $x \ P \ z \ P \ y$

• Still, no clear majority winner for top preference.

• Round-robin results:
Round 1: x vs. y: y "wins" 2–1 (L and C vote for y)
Round 2: x vs. z: x "wins" 2–1 (C and R vote for x)
Round 3: y vs. z: z "wins" 2–1 (L and R vote for z)

• We now have a problem! There is no clear round-robin winner.

• Here is the preference relationship: $y \ P \ x \ P \ z \ P \ y$

• The committee's preferences are INTRANSITIVE. They are not logically consistent with our understanding of rational behavior.

• Important Result: Even though each legislator's preference arrangement is complete and transitive, the *group's* preference relation is intransitive.

• The MAJORITIES in each round are CYCLING.

• This is the essence of **CONDORCET'S PARADOX**.

Divide the Dollars

- Distributive Goods are Important!
- Some Call it Pork-Barrel
- Who Doesn't Like Pork-Barrel?
- Al D'Amato: Senator Pothole
- Distributive Goods Means Dividing the Dollars
- How are you going to do it?

Illustration

- Budget: \$1,000
- Three Committee Members: A, B, and C
- Three Districts: x, y, and z
- Three Shares: $s(x)$, $s(y)$, $s(z)$
- The obvious constraint:

$$\sum_{1=1}^{n} s(d) = \$1,000$$

where $s(d)$ is the "share" each district gets.

- Status Quo is the "Fair Distribution":
  $[\$333.33, \$333.33, \$333.33]$

- But wait! Suppose B proposes as amendment:
  $[\$500.00, \$500.00, \$0]$

- If we voted, which alternative would win? The status quo or B's amendment? (The amendment would win 2–1: A and B prefer the amended version over the status quo.[why?]) B's amended version is now the new status quo.

- But wait! Suppose A proposes an amendment to the new status quo:
  $[\$700.00, \$0, \$300.00]$

- If we voted, which alternative would win? The status quo or A's amendment? (The amendment would win 2–1: A and C prefer the amended version over the status quo. [why?]) A's amended version is now the new status quo.

- But wait! Suppose C proposes an amendment to the new status quo:
  $[\$333.33, \$333.33, \$333.33]$

- If we voted, which alternative would win? The status quo or C's amendment? (The amendment would win 2–1: B and C prefer the amended version over the status quo. [why?]) C's amended version is now the new status quo.

- Uh oh. We've just CYCLED BACK TO THE ORIGINAL STATUS QUO.

STOP THE MADNESS

- How do you stop the cycling?

- Let's Go Back to Oil and Soil

- Suppose we endow one of the legislators with agenda control?

- That is, who controls the order in which alternative are voted on?

Three Possible Agendas:

Agenda 1: x, y, z
Agenda 2: y, z, x
Agenda 3: z, x, y

Assume the Following Preference Arrangement for the 3 Committee Members:
L: $z \;\; P \;\; y \;\; P \;\; x$
C: $y \;\; P \;\; x \;\; P \;\; z$
R: $x \;\; P \;\; z \;\; P \;\; y$
The question: if L were in charge, which agenda would L choose? (i.e. 1, 2, or 3?)

If L chose 1: R1: $y > x$; R2: $z > y$ z WINS
If L chose 2: R1: $z > y$; R2: $x > z$ x WINS
If L chose 3: R1: $x > z$; R2: $y > x$ y WINS

- So, YOU are L, which agenda do you choose and why?

- What about C and R?

- Back to divide the dollars.

- How would you stop the cycling?