

Preference for Commitment

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- In order to discuss preference for commitment we need to be able to discuss **preferences over menus**
- Interpretation: choosing a set of alternatives from which you will make a choice at a later date.
- What would be the standard way of assessing a menu of options $A = \{a_1, a_2, a_3, \dots\}$?
- Assume that you will choose the best option from the menu at the later date
- Then a menu A is preferred to menu B if the best option in A is better than the best option in B
- i.e.

$$A \succeq B \text{ if and only if } \max_{a \in A} u(a) \geq \max_{b \in B} u(b)$$

- For a 'standard' decision maker, more options to choose from is always (weakly) better
- Add alternative a to a choice set A
 - Either a is preferred to all the options already in A
 - a will be chosen from the expanded choice set
 - $\{a\} \cup A$ is better than A
 - Or there is some b in A which is preferred to a
 - a will not be chosen from the expanded choice set
 - $\{a\} \cup A$ is no better, and no worse than A
- DM will always prefer to have a bigger menu to choose from

$$\begin{aligned} B &\subset A \\ \Rightarrow A &\succeq B \end{aligned}$$

- This may not be the case if the DM suffers from problems of temptation:
- Classic example: A dieter might prefer to a restaurant with the menu

fish
salad

rather than one with the menu

fish
burger
salad

- Why?
- (At least) two possible reasons
 - ① Would prefer to not eat the burger, but worries they will succumb to temptation if the burger is available
 - ② Thinks they will be able to overcome the temptation to eat the burger, but it will be costly to do so

- We are going to discuss a model of menu preferences and choice that captures both these forces
- Based on the classic work of Gul and Pesendorfer [2001]
- Updated (and better explained) by Lipman and Pesendorfer [2013]

- Let C be a compact metric space
- $\Delta(C)$ set of all measures on the Borel σ -algebra of C (i.e. all lotteries)
 - Use lotteries because it means set of choice objects is convex
- Endow $\Delta(C)$ with topology of weak convergence
- Z all non empty compact subsets of $\Delta(C)$ (Hausdorff topology)
- Let \succeq be a preference relation on Z
 - Interpretation: preference over menus from which you will later get to choose
- Let \trianglerighteq be a preference relation on $\Delta(C)$
 - Interpretation: preferences when asked to choose from a menu

- For $x, y \in Z$ and $\alpha \in (0, 1)$ define

$$\begin{aligned} & \alpha x + (1 - \alpha)y \\ = & \{p = \alpha q + (1 - \alpha)r \mid q \in x, r \in y, \} \end{aligned}$$

- E.g. if $x = \{\delta_a\}$, $y = \{\delta_b, \delta_c\}$ the

$$\begin{aligned} & \alpha x + (1 - \alpha)y \\ = & \left\{ \begin{array}{l} \alpha a + (1 - \alpha)b \\ \alpha a + (1 - \alpha)c \end{array} \right\} \end{aligned}$$

- Mixture of all elements in menu x with all elements in menu y

Modelling Preference over Menus

- Using this set up we will place axioms on \succeq and \triangleright
- First, we will consider conditions which are necessary and sufficient for the standard model
 - Single utility function
 - Represents \triangleright (choice from menus)
 - \succeq (choice between menus) represented using largest utility in the set
- Next, consider how to alter these axioms in order to generate the 'Gul Pesendorfer' model
 - Allows for both 'temptation' and 'self control' to be expressed in menu preferences

Axiom 1 (Preference Relations) \succeq, \supseteq are complete preference relations

Axiom 2 (Independence) $x \succeq y$ implies

$$\alpha x + (1 - \alpha)z \succeq \alpha y + (1 - \alpha)z \quad \forall x, y, z \in Z, \\ \alpha \in (0, 1)$$

- Notice that this is not the same as 'standard' independence
- Mixing operation is different
- Need to think a bit about how to interpret it

- Interpretation of independence: Standard Independence + Indifference to Timing of Uncertainty
 - Imagine we extended \succeq to preferences over lotteries over menus
 - Independence would now say that, if we prefer choosing from x to choosing from y then we prefer choosing from x $\alpha\%$ of the time (and z $(1 - \alpha)\%$ of the time) to choosing from y $\alpha\%$ of the time (and z $(1 - \alpha)\%$ of the time)
 - Randomization occurs before choosing at second stage
- Claim: choosing contingent plans in this set up gives rise to the same probability distribution over outcomes as come about from 'Gul Pesendorfer' mixing

- Example

$$\frac{1}{2}x + \frac{1}{2}z$$

$$x = \{x_1, x_2\}, z = \{z_1, z_2\}$$

- Gul-Pesendorfer mixing: a menu of

$$\left\{ \begin{array}{l} \frac{1}{2}x_1 + \frac{1}{2}z_1 \\ \frac{1}{2}x_2 + \frac{1}{2}z_1 \\ \frac{1}{2}x_1 + \frac{1}{2}z_2 \\ \frac{1}{2}x_2 + \frac{1}{2}z_2 \end{array} \right\}$$

- 'Standard' Mixing: 50% chance of menu x , 50% chance of menu y
 - Contingent plan: choose either x_1 or x_2 from x and either y_1 or y_2 from y
 - Uncertainty decided before second stage choice
 - Set of contingent plans gives rise to same menu of lotteries over outcomes as does GP mixing

- If timing of resolution of uncertainty is not important there is an equivalence between
 - Choosing a contingent plan for a lottery over menus
 - Choosing from a menu of lotteries generated by 'Gul Pesendorfer' mixing
- Thus, 'standard' independence and indifference to timing of uncertainty give rise to GP independence

Axiom 3 (Sophistication) $x \cup \{p\} \succ x \Leftrightarrow p \triangleright q \ \forall \ q \in x$

- This is the axiom that links together first and second stage choice.
- Whether or not people are sophisticated is going to be an important empirical question
 - Do they understand the choices they will make from a given menu?
 - If not, may underestimate their degree of self control
 - e.g. sign up for gym memberships they do not use
 - or make costly commitments which they subsequently do not stick to.

Axiom 4 (Continuity) Three continuity conditions:

- ① (Upper Semi Continuity): The sets $\{z \in Z | z \succeq x\}$ and $\{p \in \Delta(C) | p \succeq q\}$ are closed for all x and q
- ② (Lower vNM Continuity): $x \succ y \succ z$ implies $\alpha x + (1 - \alpha)z \succ y$ for some $\alpha \in (0, 1)$
- ③ (Lower Singleton Continuity): The sets $\{p : \{q\} \succeq \{p\}\}$ are closed for every q

- The Standard Model of preference over menus

$$U(z) = \max_{p \in z} u(p)$$

for some linear, continuous utility $u : \Delta(C) \rightarrow \mathbb{R}$ such that

- U represents \succsim
- u represents \triangleright

- Equivalent to axioms 1-4 and

$$x \succeq y \Rightarrow x \cup y \sim x$$

- $x \succeq y$ implies that the best alternative in x is weakly better than the best alternative in y
- The best alternative in $x \cup y$ is the same as the best alternative in x
- Thus $x \cup y \sim x$
- Note that this implies

$$x \supset y \Rightarrow x \succeq y$$

- Say $y \succ x$
 - either $x/y \succeq y$ in which case

$$x = x/y \cup y \sim x/y \succeq y \succ x$$

- or $y \succeq x/y$

$$x = x/y \cup y \sim y \succ x$$

- Preference over menus given by

$$U(x) = \max_{p \in x} [u(p) + v(p)] - \max_{q \in x} v(q)$$

- u : 'long run' utility
- v : 'temptation' utility
- Interpretation:
 - Choose p to maximize $u(p) + v(p)$
 - Suffer temptation cost $v(p) - v(q)$
- Unlike the standard model, the Gul Pesendorfer model can lead to strict preference for smaller choice sets

$$x \supset y \text{ but } x \prec y$$

Why Preference for Smaller Choice Sets?

Case 1: Commitment

Object	u	v
Salad	4	0
Fish	2	1
Burger	1	4

- Which menu would the DM prefer? $\{s\}$ or $\{s, b\}$?

$$\begin{aligned}U(\{s\}) &= \max_{x \in \{s\}} (u(x) + v(x)) - \max_{y \in \{s\}} v(y) \\&= 4 + 0 - 0 \\&= 4\end{aligned}$$

$$\begin{aligned}U(\{s, b\}) &= \max_{x \in \{s, b\}} (u(x) + v(x)) - \max_{y \in \{s, b\}} v(y) \\&= 1 + 4 - 4 \\&= 1\end{aligned}$$

Why Preference for Smaller Choice Sets?

Case 1: Commitment

Object	u	v
Salad	4	0
Fish	2	1
Burger	1	4

- Menu $\{s\}$ preferred to $\{s, b\}$
- Interpretation: b would be chosen from the latter menu
 - $u(b) + v(b) > u(s) + v(s)$
- But s has higher long run utility
 - $u(s) > u(b)$
- The DM would rather not have b in their menu, because if it is available they will choose it.

Why Preference for Smaller Choice Sets?

Case 1: Commitment

- More generally, consider p, q , such that

$$\begin{aligned}u(p) &> u(q) \\ u(q) + v(q) &> u(p) + v(p)\end{aligned}$$

- Then

$$\begin{aligned}U(\{p\}) &= u(p) \\ U(\{p, q\}) &= u(q) + v(q) - v(q) = u(q) \\ U(\{q\}) &= u(q)\end{aligned}$$

- Interpretation: give in to temptation and choose q
- 'Weak set betweenness'

$$\{p\} \succ \{p, q\} \sim \{q\}$$

Why Preference for Smaller Choice Sets?

Case 2: Avoid 'Willpower Costs'

Object	u	v
Salad	4	0
Fish	2	1
Burger	1	4

- Which menu would the DM prefer? $\{s\}$ or $\{s, f\}$?

$$\begin{aligned}U(\{s\}) &= \max_{x \in \{s\}} (u(x) + v(x)) - \max_{y \in \{s\}} v(y) \\&= 4 + 0 - 0 \\&= 4\end{aligned}$$

$$\begin{aligned}U(\{s, f\}) &= \max_{x \in \{s, f\}} (u(x) + v(x)) - \max_{y \in \{s, f\}} v(y) \\&= 4 + 0 - 1 \\&= 3\end{aligned}$$

Why Preference for Smaller Choice Sets?

Case 2: Avoid 'Willpower Costs'

Object	u	v
Salad	4	0
Fish	2	1
Burger	1	4

- Menu $\{s\}$ is preferred to menu $\{s, f\}$
- However, this time, s would be chosen from both menus, as

$$u(s) + v(s) > u(f) + v(f)$$

- The DM still prefers to have f removed from the menu because it is more tempting: $v(f) > v(s)$
- The DM is able to exert self control if both options are on the menu, but it is costly to do so

Why Preference for Smaller Choice Sets?

Case 2: Avoid 'Willpower Costs'

- More generally, consider p, q , such that

$$u(p) > u(q)$$

$$v(q) > v(p)$$

$$u(p) + v(p) > u(q) + v(q)$$

- Then

$$U(\{p\}) = u(p)$$

$$U(\{p, q\}) = u(p) + v(p) - v(q)$$

$$U(\{q\}) = u(q)$$

- Interpretation: fight temptation, but this is costly
- 'Strict set betweenness'

$$\{p\} \succ \{p, q\} \succ \{q\}$$

Temptation and Self Control

- We say that q tempts p if $\{p\} \succ \{p, q\}$
- We say that a decision maker exhibits self control at y if there exists x, z such that $x \cup z = y$ and

$$\{x\} \succ \{y\} \succ \{z\}$$

- $\{x\} \succ \{y\}$ implies there exists something in z which is tempting relative to items in x
- $\{y\} \succ \{z\}$ implies tempting item not chosen
- if it were then

$$\begin{aligned} \max_{p \in y} u(p) + v(p) &= \max_{p \in z} u(p) + v(p) \Rightarrow \\ U(y) &= \max_{p \in y} (u(p) + v(p)) - \max_{q \in y} v(q) \\ &\leq \max_{p \in z} (u(p) + v(p)) - \max_{q \in z} v(q) \\ &= U(z) \end{aligned}$$

Why 'Long Run' and 'Temptation' Utilities?

- So far we have described u as 'long run' utility and v as 'temptation' utility
- Why is this a behaviorally appropriate description?
- u describes choices over singleton menus:

$$U(\{p\}) = u(p) + v(p) - v(p) = u(p)$$

and so describes preferences when the DM is not tempted

Why 'Long Run' and 'Temptation' Utilities?

- v leads to temptation: q tempts p only if $v(q) > v(p)$
 - Case 1: $u(p) + v(p) \geq u(q) + v(q)$

$$\begin{aligned}U(\{p\}) &> u(\{p, q\}) \\ \Rightarrow u(p) &> u(p) + v(p) - \max_{r \in \{p, q\}} v(r) \\ \Rightarrow \max_{r \in \{p, q\}} v(r) &> v(p) \\ \Rightarrow v(q) = \max_{r \in \{p, q\}} v(r) &> v(p)\end{aligned}$$

Why 'Long Run' and 'Temptation' Utilities?

- v leads to temptation: q tempts p only if $v(q) > v(p)$
 - Case 2: $u(q) + v(q) > u(p) + v(p)$

$$\begin{aligned}U(\{p\}) &> u(\{p, q\}) \\ \Rightarrow u(p) &> u(q) + v(q) - \max_{r \in \{p, q\}} v(r) \\ \Rightarrow u(p) + \max_{r \in \{p, q\}} v(r) &> u(q) + v(q) \\ \Rightarrow \max_{r \in \{p, q\}} v(r) &= v(q) > v(p)\end{aligned}$$

- Last line follows from assumption $u(q) + v(q) > u(p) + v(p)$

- Imagine that differences in v are large relative to differences in u
- In the limit, model reduces to

$$U(x) = \max_{p \in x} u(p) \text{ s.t. } v(p) \geq v(q) \quad \forall q \in x$$

- This is the 'Stolz' model
- Implies no strict set betweenness, and not self control
- $\beta - \delta$ model is of this class

Axiomatic Characterization of GP Model

- Set Betweenness: for any x, y s.t $x \succeq y$

$$x \succeq x \cup y \succeq y$$

- Notice the difference to the 'standard' model

$$x \succeq y \Rightarrow x \cup y \sim x$$

- Smaller sets can be strictly preferred

Axiomatic Characterization of GP Model

- Set Betweenness: for any x, y s.t $x \succeq y$

$$x \succeq x \cup y \succeq y$$

- Necessity:

- $x \succeq y$ implies that

$$u(p^x) + v(p^x) - v(q^x) \geq u(p^y) + v(p^y) - v(q^y)$$

where

$$p^i = \arg \max_{p \in i} u(p) + v(p)$$

and

$$q^i = \arg \max_{q \in i} v(q)$$

- NTS $x \succeq x \cup y$

Axiomatic Characterization of GP Model

- Two cases:
- Case 1: $u(p^x) + v(p^x) \geq u(p^y) + v(p^y)$

$$\begin{aligned}u(p^x) + v(p^x) &\geq u(p^y) + v(p^y) \Rightarrow \\u(p^x) + v(p^x) &= u(p^{x \cup y}) + v(p^{x \cup y}) \Rightarrow \\u(p^x) + v(p^x) - v(q^x) &\geq u(p^{x \cup y}) + v(p^{x \cup y}) - v(q^{x \cup y})\end{aligned}$$

- Case 2: $u(p^x) + v(p^x) < u(p^y) + v(p^y)$
 - implies $v(q^x) \leq v(q^y)$ as x is preferred to y

$$\begin{aligned}u(p^y) + v(p^y) &= u(p^{x \cup y}) + v(p^{x \cup y}) \\v(q^{x \cup y}) &= v(q^y) \Rightarrow \\u(p^{x \cup y}) + v(p^{x \cup y}) - v(q^{x \cup y}) &= u(p^y) + v(p^y) - v(q^y) \\&\leq u(p^x) + v(p^x) - v(q^x)\end{aligned}$$

Axiomatic Characterization of GP Model

Theorem

\succeq satisfies Axioms 1, 2, 4 and set betweenness if and only if it has a Stolz representation or a G-P representation

Theorem

The proper relation \succeq and \triangleright satisfy Axioms 1-4 and set betweenness if and only if

- \succeq has a Stolz representation and $p \triangleright q$ if and only if $v(p) > v(q)$ or $v(p) = v(q)$ and $u(p) \geq u(q)$
- or \succeq has a G-P representation and $u(p) + v(p)$ represents \triangleright

Sketch of Proof that Axioms Imply Representation

- **Lemma 1:** Axioms 1, 2, 4 imply a linear $U : Z \rightarrow \mathbb{R}$ that represents \succeq and is continuous on singleton sets
 - This is standard, and makes use of the mixture space axioms

Sketch of Proof that Axioms Imply Representation

- **Lemma 2:** Show that

$$\begin{aligned}U(x) &= \max_{p \in x} \min_{q \in x} U(\{p, q\}) \\&= \min_{q \in x} \max_{p \in x} U(\{p, q\})\end{aligned}$$

- Utility depends only on 'chosen element', and 'most tempting element'
- **Proof: Let** $\bar{u} = \max_{p \in x} \min_{q \in x} U(\{p, q\}) = U(\{p^*, q^*\})$
- Note that $U(\{p^*, q\}) \geq U(\{p^*, q^*\}) = \bar{u} \ \forall \ q \in A$
- Set betweenness implies $\bar{u} \leq U(\cup_{q \in x} \{p^*, q\}) = U(x)$
- Also, for every $p \in A$, $\exists \ q_p \in A$ such that $U(\{p, q_p\}) \leq \bar{u}$
- By set betweenness $\bar{u} \geq U(\cup_{p \in A} \{p, q_p\}) = U(x)$

Sketch of Proof that Axioms Imply Representation

- **Lemma 3:** Show that

$$\begin{aligned}U(\{x\}) &> U(\{x, y\}) > U(\{y\}) \\U(\{a\}) &> U(\{a, b\}) > U(\{b\})\end{aligned}$$

implies

$$\begin{aligned}&U(\alpha \{x, y\} + (1 - \alpha) \{a, b\}) \\&= U(\{\alpha x + (1 - \alpha)a, \alpha y + (1 - \alpha)b\})\end{aligned}$$

- This comes straight from super independence and the fact that $\alpha x + (1 - \alpha)a$ is the best and $\alpha y + (1 - \alpha)b$ the most tempting element

Sketch of Proof that Axioms Imply Representation

- Define

$$\begin{aligned}u(p) &= U(\{p\}) \\v(s; p, q, \delta) &= \frac{U(\{p, q\}) - U(\{p, (1 - \delta)q + \delta s\})}{\delta}\end{aligned}$$

- u is the long run utility
- v is a measure of how tempting s is relative to p and q (under the assumption p is chosen)

Sketch of Proof that Axioms Imply Representation

- **Lemma 4:** Show that, if

$$U(\{p\}) > U(\{p, (1 - \delta)r + \delta s\}) > U(\{(1 - \delta)r + \delta s\})$$

for all $s \in \Delta(C)$, then

- ① $U(\{p\}) > U(\{p, s\}) > U(s) \Rightarrow v(s; p, q, \delta) = U(\{p, q\}) - U(\{p, s\})$
- ② $v(p; p, q, \delta) = U(\{p, q\}) - U(\{p\})$

- Follows from Lemma 3

Sketch of Proof that Axioms Imply Representation

- **Lemma 5:** Show that, if

$$U(\{p\}) \geq U(\{p, q\}) \geq U(\{q\})$$

and for some r and δ

$$U(\{p\}) > U(\{p, (1 - \delta)r + \delta s\}) > U(\{(1 - \delta)r + \delta s\})$$

for all $s \in \Delta(C)$, then

$$\begin{aligned} & U(\{p, q\}) \\ = & \max_{w \in \{p, q\}} [u(w) + v(w; p, r, \delta)] - \max_{z \in \{p, q\}} [v(z; p, r, \delta)] \end{aligned}$$

Sketch of Proof that Axioms Imply Representation

- **Proof** (assuming)

$$U(\{p\}) > U(\{p, q\}) > U(\{q\})$$

- By previous lemma

$$\begin{aligned}v(q; p, r, \delta) &= U(\{p, r\}) - U(\{p, q\}) \\&\geq U(\{p, r\}) - U(\{p\}) \\&= v(p; p, r, \delta)\end{aligned}$$

and so

$$\max_{z \in \{p, q\}} [v(z; p, r, \delta)] = v(q; p, r, \delta)$$

- Also

$$\begin{aligned}u(p) + v(p; p, r, \delta) &= U(\{p\}) + U(\{p, r\}) - U(\{p\}) = U(\{p, r\}) \\u(q) + v(q; p, r, \delta) &= U(\{q\}) + U(\{p, r\}) - U(\{p, q\})\end{aligned}$$

and so

$$\max_{w \in \{p, q\}} [u(w) + v(w; p, r, \delta)] = u(p) + v(p; p, r, \delta)$$

Sketch of Proof that Axioms Imply Representation

- This then implies

$$\begin{aligned} & \max_{w \in \{p, q\}} [u(w) + v(w; p, r, \delta)] - \max_{z \in \{p, q\}} [v(z; p, r, \delta)] \\ &= u(p) + v(p; p, r, \delta) - v(q; p, r, \delta) \quad (1) \\ &= U(\{p\}) + U(\{p, r\}) - U(\{p\}) - U(\{p, r\}) + U(\{p, q\}) \\ &= U(\{p, q\}) \quad (2) \end{aligned}$$

Sketch of Proof that Axioms Imply Representation

- Finally, pick p, q such that

$$U(\{p\}) > U(\{p, q\}) > U(\{q\})$$

(if such exists) and pick δ such that

$$U(\{p\}) > U(\{p, (1 - \delta)q + \delta s\}) > U(\{(1 - \delta)q + \delta s\})$$

for all s (which we can do by continuity)

- Define $v(s)$ as $v(s; p, q, \delta)$, and show that $v(s; p, q, \delta)$ doesn't depend on the specifics of the last three parameters.
- Lemma 5 therefore gives

$$U(\{p, q\}) = \max_{w \in \{p, q\}} [u(w) + v(w)] - \max_{z \in \{p, q\}} [v(z)]$$

- Lemma 2 then extends this result to an arbitrary set A

- Imagine

$$\{p\} \succ \{p, q\} \succ \{q\} \succ \{q, r\} \succ \{r\}$$

- DM can resist q for p and resist r for q .
 - Can they resist r for p ?
- Under the GP model, the above implies

$$\begin{aligned}u(p) &> u(q) > u(r) \\v(r) &> v(q) > v(p) \\u(p) + v(p) &> u(q) + v(q) > u(r) + v(r)\end{aligned}$$

- Which in turn implies

$$\{p\} \succ \{p, r\} \succ \{r\}$$

- 'Self Control is Linear'

Discussion: What is Willpower?

- It seems that the following statement is meaningful:
 - Person A has the same long run preferences as person B
 - Person A has the same temptation as person B
 - Person A has more willpower than person B
- Yet this is not possible in the GP model
- Alternative: Masatlioglu, Nakajima and Ozdenoren [2013]

$$\begin{aligned} U(z) &= \max_{p \in z} u(p) \\ \text{subject to } \max_{q \in z} v(q) - v(p) &\leq w \end{aligned}$$

Discussion: Strict Set Betweenness and Random Strolz

- Does $\{p\} \succ \{p, q\} \succ \{q\}$ imply self control?
- Imagine that you are a Strolz guy with $u(p) > u(q)$, but are not sure that you will be tempted
- Half the time

$$v(p) = v(q)$$

half the time

$$v(p) < v(q)$$

- Implies

$$\begin{aligned}U(\{p\}) &= u(p) \\U(\{p, q\}) &= \frac{u(p) + u(q)}{2} \\U(\{q\}) &= u(q)\end{aligned}$$

- Strict set betweenness without self control

- Say with probability ε won't be tempted so

$$\hat{U}(z) = (1 - \varepsilon)U(z) + \varepsilon \max_{p \in z} u(p)$$

- Can lead to violations of set betweenness.
- Let $g = \text{gym}$, $j = \text{jog}$, $t = \text{tv}$

$$u(g) > u(j) > u(t)$$

$$v(g) < v(j) < v(t)$$

$$u(j) + v(j) > u(t) + v(t) > u(g) + v(g)$$

- For ε small

$$\{t, j\} \succ \{t, g\}$$

as

$$\begin{aligned}U(\{t, j\}) &= u(j) + v(j) - v(t) \\U(\{t, g\}) &= u(t)\end{aligned}$$

- but

$$\{t, j, g\} \succ \{t, j\}$$

as with probability ε no temptation and will go to the gym

Discussion: Preference for Flexibility

- Consider choice between menus of drinks cocoa or lemonade
- Must choose between menus now, but your choice from those menus will occur on March 1st
- Which would you prefer?

$\{c\}$, $\{l\}$ or $\{c, l\}$?

- Choice of $\{c, l\}$ over both $\{c\}$ and $\{l\}$ is a violation of set betweenness

Discussion: Preference for Flexibility

- X : set of alternatives
- S : set of states
- $\mu \in \Delta(S)$: probability distribution over states
- $u : X \times S \rightarrow \mathbb{R}$: utility function
 - $u(x, s)$ utility of alternative x in state s
- Preference uncertainty driven by uncertainty about s

Discussion: Preference for Flexibility

- Let A be a menu of alternatives
- Choice from A will take place **after** the state is known
- Value of A **before** the state is known given by

$$U(A) = \sum_{s \in S} \mu(s) \max_{x \in A} u(x, s)$$

- U represents **choice between menus**

Discussion: Preference for Flexibility

- The 'preference uncertainty' model implies a (potentially strict) preference for larger choice sets

$$A \succeq B \Rightarrow A \cup B \succeq A$$

- Compare to 'standard' model

$$A \succeq B \Rightarrow A \cup B \sim A$$

- And Set Betweenness

$$A \succeq B \Rightarrow A \cup B \preceq A$$

- Preference uncertainty can provide a powerful force that works against a preference for commitment
 - See Amador, Werning and Angeletos [2006]

- So far, we have assumed that a DM is sophisticated
 - They understand their second stage choice
 - Implemented by the axiom $x \cup \{p\} \succ x \Leftrightarrow p \triangleright q \ \forall \ q \in x$
- What about a DM who is not sophisticated?

- Example 1: A DM who ignores temptation

Object	u	v
Salad	4	0
Fish	2	1
Burger	1	4

- Assume these preferences represent choices that the DM will make from the menu
- But they believe that their choices will be governed by u
- Such a DM will prefer $\{s, b\}$ to $\{s\}$, but when faced with the choice from $\{s, b\}$ will choose b
- Such a DM will violate sophistication
 - Never exhibit a preference for commitment

- Example 2: A DM who underestimates temptation

Object	u	v	v'
Salad	5	0	0
Fish	2	1	1
Burger	1	9	5

- Assume that a DM has temptation driven by v , but believes that they have temptation driven by v'
- They are offered the chance to buy a 'commitment contract' where they have to pay \$2 if they eat the burger
- Assume that $u(2) = 2$, $v(2) = 2$ the u of money is additive with u of consumption and the v of money is additive with the v of consumption
- Let $b + c$ be the burger with the commitment contract

- Example 2: A DM who underestimates temptation

Object	u	v	v'
Salad	5	0	0
Fish	2	1	1
Burger	1	9	5
B+C	-1	7	3

- The DM will have preferences

$$\{b + c, s\} \succ \{b, s\}$$

as

$$\begin{aligned} U(\{b + c, s\}) &= u(s) + v'(s) - v'(b + c) = 2 \\ &> 1 = u(b) = U(\{b, s\}) \end{aligned}$$

- But the DM will actually choose $b + c$ over s at the second stage as

$$u(b + c) + v(b + c) = 6 > 5 = u(s) + v(s)$$

- Example 2: A DM who underestimates temptation

Object	u	v	v'
Salad	5	0	0
Fish	2	1	1
Burger	1	9	5
B+C	-1	7	3

- End up with lower 'long run' utility
- Also a violation of sophistication as

$$\{b + c, s\} \succ \{b + c\}$$

but $b + c$ will be chosen from the former menu

- Menu preferences allow us to formalize a model of preference for commitment
- We argued that this is a sign that people have problems with temptation

- Temptation: Preference for Commitment

$$A \succeq B \Rightarrow A \cup B \preceq A$$

- Preference uncertainty: Preference for Flexibility

$$A \succeq B \Rightarrow A \cup B \succeq A$$

- Compare to 'standard' model

$$A \succeq B \Rightarrow A \cup B \sim A$$

- Gul and Pesendorfer provide a model which allows for both temptation and self control

$$U(x) = \max_{p \in x} [u(p) + v(p)] - \max_{q \in x} v(q)$$

- Characterized by set betweenness: $x \succeq y \Rightarrow x \succeq x \cup y \succeq y$