Lecture 4f: Choice over Time
Anticipatory Utility and Beliefs

EC 404: Behavioral Economics
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March 22, 2024

Motivating Experiment

Based on Loewenstein (*EJ* 1987)

Motivating experiment: Ask subjects

- ▶ (1) their *WTP* for a kiss from a movie star of their choice at date x.

- ▶ (2) their *WTP* to avoid a 110-volt shock at date x.

He uses a within-subjects design, and uses $x =$ now, 3 hrs, 24 hrs, 3 days, 1 yr, and 10 yrs.

Motivating Experiment

Let's denote the *WTP* for c at date x by $WTP(c, x)$.

Under the "standard" discounted-utility interpretation,

$$WTP(c, x) = D(x) * v(c)$$

▶ $v(c)$ is the instantaneous utility from c.

▶ $D(x)$ is discounting associated with delay x.

Normalizing $D(0) = 1$, this implies:

$$\frac{WTP(c, x)}{WTP(c, 0)} = \frac{D(x)v(c)}{D(0)v(c)} = D(x)$$

Interpretation: Anticipatory Utility

Loewenstein interprets as evidence of "anticipatory utility":

▶ Leading up to the kiss, you get positive utility from anticipating it; hence, you may prefer to delay the kiss so that you can properly anticipate it.

▶ Leading up to the shock, you get negative utility from anticipating it; hence, you may prefer to accelerate the shock so that you do NOT need to anticipate it.

A Model with Utility from Anticipation

Instantaneous utility in period t given by

$$u(c_t, c_{t+1}) = v(c_t) + w^A(c_{t+1}).$$

- $v(c_t)$ is utility from current consumption.
- $w^A(c_{t+1})$ is utility from anticipating future consumption.

In period 1, the person chooses $(c_1, c_2, ...)$ to maximize

$$U^1 \equiv \sum_{\tau=1}^{\infty} \delta^{\tau-1} u(c_\tau, c_{\tau+1}).$$

What is $w^A(c_{t+1})$? Let's assume

$$w^A(c_{t+1}) = \phi * v(c_{t+1})$$

- Anticipatory utility is proportional to consumption utility, where $\phi < 1$ reflects the "vividness".

Example: The "Kiss"

Recall:
$$u(c_t, c_{t+1}) = v(c_t) + \phi * v(c_{t+1})$$

^^

Period-1 intertemporal utility of "kiss":

▶ Kiss in period 1: $v(\text{kiss})$

▶ Kiss in period 2: $\phi * v(\text{kiss}) + \delta * v(\text{kiss})$

▶ Kiss in period 3: $0 + \delta * \phi * v(\text{kiss}) + \delta^2 * v(\text{kiss})$

If $\phi + \delta < 1$, optimal to have kiss now (in period 1).

If $\phi + \delta > 1$, optimal to have kiss in near future (in period 2).

More Examples of Anticipatory Utility

Suppose you're thinking about going on vacation:

▶ For a long time, you thought probably no time for a 3-day vacation.
▶ Then one day find out that probably will have time off (80%).
    . . . and then confirmed as 100% likely when it happens.
▶ Belief evolution:
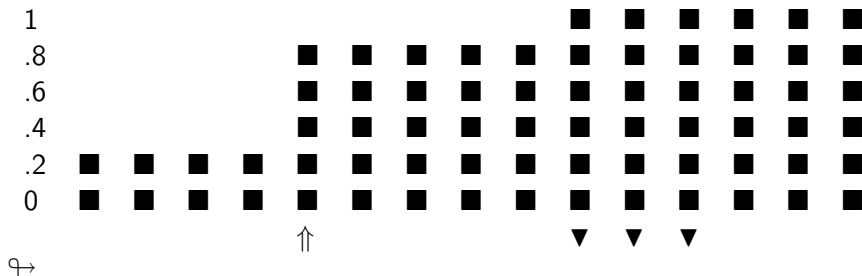
More Examples of Anticipatory Utility

As with other parts of this course, we'll discuss utility in time.

▶ That is, we will talk about real-time "happiness" without choice.

This isn't radical, even though it might seem even farther from mainstream. Stay calm.
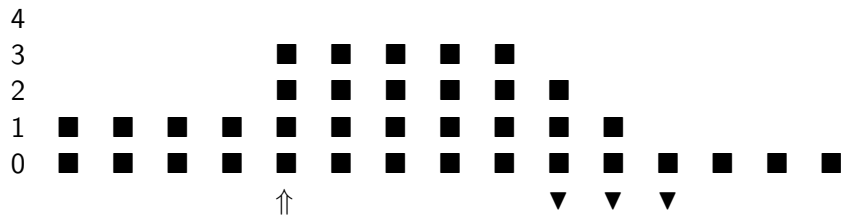
▶ As before, this will have implications for choice.

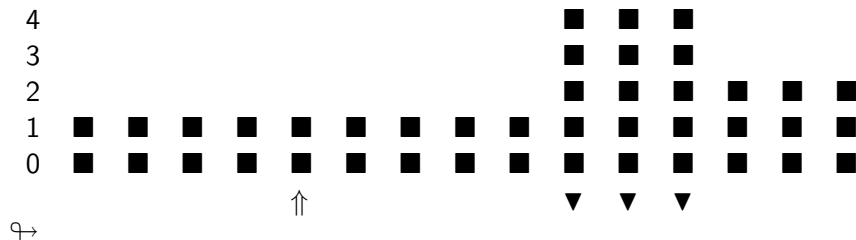So let's consider the utility of a person who has the beliefs from previous slide. Could be:
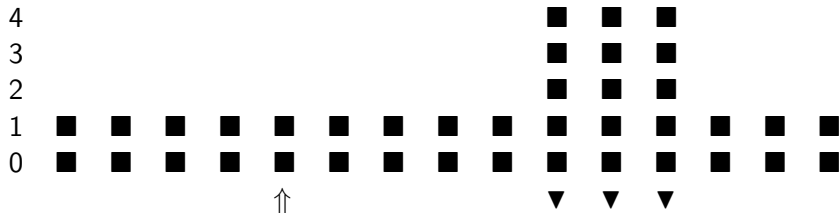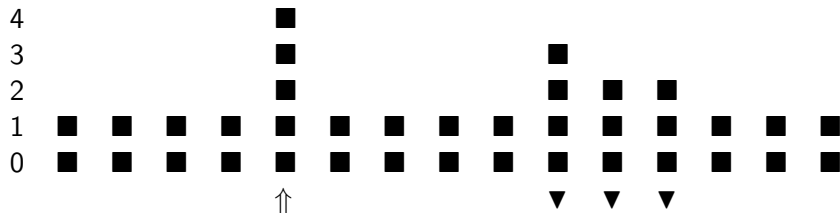
Belief-Based Utility

Or could be:

Or could be:

Belief-Based Utility

Or could be (my personal vote):

Belief-Based Utility

So what?

▶ Why care about the timing or reason for enjoying a vacation?

▶ Often: We don't. All captured by u(vacation).

    ▶ Reduced form probably best for "remembered utility".

But can matter for various reasons. Three are:

▶ Use direct happiness data if and only if our theories specify timing of utility.

    ▶ (Not a topic of this course, but interesting to think about).

▶ Beliefs/information matter even when behavior is unaffected.

▶ Affects choice: including time inconsistency, commitment, etc.

Belief-Based Utility

Suppose planning vacation:

- ▶ Have anticipatory preferences *for holiday-making only*.
- ▶ Club Cococabana holiday package, *total* anticipatory utility plus consumption and remembered utility well worth $10,000.
- ▶ But without anticipatory utility, *not* nearly worth it.
- ▶ Can/must buy months in advance.

Situation A: All but $50 is fully refundable if 24 hours in advance.

- ▶ What would a fully rational (sophisticated) person do?
- ▶ She **would/would not** (cross out one) buy the package, and then she **would/would not** (cross out one) go on the vacation.
  - ▶ She **would/would not** (cross out one) buy the package, and then she **would not** go on the vacation.
- ⇒ She **would not** buy the package, then **would not** go on the vacation.

Belief-Based Utility

If fully rational and have the specified preferences

- ▶ You won't sign up under Situation A,
    - ▶ because you'll cancel, *and know you'll cancel*.
- ▶ Won't get anticipatory utility after all.

"Fully rational" defined (or, sophisticated):

- ▶ Dynamically optimal, anticipating correctly own conduct.
- ▶ But **not** the beliefs that make you happiest.
- ▶ With belief-based preferences, the two are *different*.

Situation B: Contract allows no refunds.

- ▶ What would a person do?
- ▶ Buy package? Go on vacation?
    - ▶ She **would** buy the package, and then she **would** go on the vacation.

Belief-Based Utility

Predictions in A&B **do/do not** (cross out one) violate classical assumptions about preferences?

- ▶ This **does** violate classical axioms/assumptions about preferences.
    - ▶ Chose plan "No Buy" from {No Buy, Go, Cancel} in Situation A.
    - ▶ "Go" from {No Buy, Go} in Situation B.
    - ▶ (And worse off in Situation A)

This **should/should not** (cross out one) freak you out?

- ▶ This **should not** freak you out.

Violating such an axiom **should/should not** (cross out one) thrill you?

- ▶ It **should not** thrill you.

Instead be interested in realism, insight, and importance of assumptions.

(Not sure of realism, importance this example)

Consumption & Savings with Anticipatory Preferences

Setting and Preferences

Yugi will live for 3 periods, has $\$Y$ to spend over that time (no interest), seeks to maximize his (undiscounted) lifetime utility $U^1 = u_1 + u_2 + u_3$.

▶ In period t, "consumption utility" m_t that depends on c_t.

▶ Also gets utility from anticipating his future consumption utility.

▶ Why from anticipating solely his future consumption utility?
  ▶ Why not also from future anticipatory utility?
  ▶ We'll ignore.

Belief-Based Utility

Attempt to model this:

$$u_1 = m(c_1) + \phi[m(c_2) + m(c_3)]$$
$$u_2 = m(c_2) + \phi[m(c_3)]$$
$$u_3 = m(c_3)$$

▶ where $\phi \geq 0$ is relative concern for anticipatory utility.

Question: what is *incoherent* about such preferences?

▶ u_1 cannot depend on c_2 or c_3. Only **beliefs** about c_2, c_3.

Belief-Based Utility

2nd attempt to model:

- $u_1 = m(c_1) + \phi E_1\{m(c_2) + m(c_3)\}$
- $u_2 = m(c_2) + \phi E_2\{m(c_3)\}$
- $u_3 = m(c_3)$

where $E_t\{m(c_\tau)\}$ is period-t expectations of period-τ consumption.

- Would want more complete version of this if there is uncertainty.

When beliefs deterministic, shorthand:

- $u_1 = m(c_1) + \phi[m(\widetilde{c}_2^1) + m(\widetilde{c}_3^1)]$
- $u_2 = m(c_2) + \phi[m(\widetilde{c}_3^2)]$
- $u_3 = m(c_3)$

where $\widetilde{c}_\tau^t$ are Yugi's period-t beliefs about period-τ consumption.

- **What will Yugi do?**

Belief-Based Utility

Candidate solution: Yugi solves

Max $_{c_1,c_2} = m(c_1) + (1 + \phi)m(c_2) + (1 + 2\phi)m(Y - c_1 - c_2)$.

- E.g., if $m(x) = \ln(x)$, then:
  - $c_1^{**} = \frac{1}{3+3\phi}Y, \qquad c_2^{**} = \frac{1+\phi}{3+3\phi}Y, \qquad c_3^{**} = \frac{1+2\phi}{3+3\phi}Y$
- How do these depend on ϕ?
  - Respectively decreasing, independent of, and increasing in ϕ.
  - Intuition?

- If $\phi = 1$, then:
  - $c_1^{**} = \frac{3}{18}Y, , \qquad c_2^{**} = \frac{6}{18}Y, \qquad c_3^{**} = \frac{9}{18}Y$

Is this what Yugi will do?

Claim: We have under-specified features of the environment.

- We need to say when Yugi is making (committed) choices.
- Situation 1:
    - Yugi fully rational and can commit, then yes.
- Situation 2:
    - Yugi fully rational and *cannot* commit, then only c_1^* is right.

E.g., if $\phi = 1$, then ...

Belief-Based Utility

	Can Commit	Cannot Commit
c_1^*	$\frac{3}{18}Y$	$\frac{3}{18}Y$
c_2^*	$\frac{6}{18}Y$	$\frac{5}{18}Y$
c_3^*	$\frac{9}{18}Y$	$\frac{10}{18}Y$

What is interesting?

- ▶ Consumes more period 2 with commitment than without!
- ▶ Why does commitment increase period-2 consumption?
  - ▶ Because assumed anticipation is over future consumption utility alone (and not future anticipatory utility), happier looking forward to smoothed consumption than back-weighted consumption.
  - ▶ But in period 2, this is no longer a consideration.

Belief-Based Utility

Reasons increased consumption profiles besides anticipatory utility?

▶ Precautionary savings.

▶ Backward-looking habit formation.

Reasons we may rarely see increasing consumption?

▶ Present bias: consumption smoothing may be self-control problem.

▶ Because: anticipatory model isn't quite right.

▶ Reminder: models should own *all* their implications

    ▶ Anticipatory utility makes some strange ones.

Belief-Based Utility

Stepping (well) outside the rational framework:

▶ What if Yugi can fool himself into believing lifetime income Y is something else?

▶ What might he tell himself?
  ▶ Choose to be optimistic to consume anticipation.
  ▶ But trades off against induced under-saving.
  ▶ See, e.g., Brunnermeier and Parker (2005).

▶ But ... what if Yugi can tell himself other stories?
  ▶ Like that he earns lots of interest on his savings?
  ▶ Or wonderful afterlife if maximize true lifetime utility.

▶ Fundamental Theorem of Optimal Distortion of Anticipatory Prefs:
  ▶ If no restrictions, then choose beliefs to maximize **both** anticipatory preferences and "direct-consumption" utility.

Belief-Based Utility

More generally, models (that many of us have tried) for "motivated" *willful* distortion of beliefs, if not Bayesian (as about to see!) run into problems...

- ▶ Psychological realism?
- ⇒ Need a model of what are the limits to distortions.