Projection Bias

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Motivation

future Utility

"At any moment our preferences are the result of a unique constellation of needs and desires that may never be repeated. Consequently, when we make choices that will come into effect until later, we have to predict our future preferences (Kahneman & Snell, 1990; Kahneman, Wakker, & Sarin, 1997; March, 1978). The easiest way to do this is to take our current desires as a baseline and then to adjust them according to anticipated changes in circumstances. To the degree that our tastes are stable, this procedure will work faultlessly, but what happens when they are not?" -Read and Van Leeuwen(1998)

Motivation

projection bias

"Loewenstein, Prelec, and Shatto (1998) argue that this occurs because it is difficult for us to imagine what it is like to be in a different visceral state than the one we are currently in. . . .They refer to the inability that we have when in one state of arousal to "get in the shoes" of ourselves in a future state as an intrapersonal empathy gap."

Projection Bias in Predicting Future Utility

- Introduced the concept of "Projection Bias":

  "People understand qualitatively the directions in which their tastes change, but they systematically under-appreciate the magnitudes of these changes."

Step1: A Model of Changing Tastes

To describe changes in tastes, we use "**state-dependent utility**":

- The instantaneous utility in period t is $u(c_t, s_t)$, where c_t is period-t consumption and s_t is the period-t "state".
- s_t is such as hunger, fear, fatigue, etc.
- Example:
  - $u(pie, hungry) > u(pie, full)$
  - $u(coat, cold) > u(coat, warm)$

Step 2: Predictions of Future Tastes

- Suppose you are predicting tastes given future state s, but this prediction is potentially contaminated by your current state s'.
- True taste vs. Current taste vs. Prediction:
  - **True taste** will be $u(c, s)$.
  - **Current taste** will be $u(c, s')$.
  - **Prediction** is denoted by $\tilde{u}(c, s|s')$.
- Example: Suppose you're predicting what your utility from a slice of pie will be when you're full, but this prediction is potentially contaminated by the fact that you' re currently hungry.

$\tilde{u}(c, s \mid s') \Rightarrow$ projected future taste

true current taste

$u(\text{pie}, \text{hungry}) = u(c, s')$

$u(\text{pie}, \text{full}) = u(c, s)$ = true future taste

$u(\text{Ccat}, \text{warm})$

$u(\text{Ccat}, \text{super cold})$

$\tilde{u}(\text{Ccat}, \text{super cold} \mid \underline{\text{warm}})$

Step 2: Predictions of Future Tastes

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- True taste vs. Current taste vs. Prediction:
  - **True taste** will be $u(pie, full)$.
  - **Current taste** will be $u(pie, hungry)$.
  - **Prediction** is denoted by $\tilde{u}(pie, full|hungry)$.

Standard model "rational"

The standard economic assumption is that people's predictions are accurate.

- True taste = Prediction
- $\tilde{u}(c, s|s') = u(c, s)$
- $\tilde{u}(pie, full|hungry) = u(pie, full)$
- $\tilde{u}(cold, warm|cold) = u(coat, warm)$

Projection bias

- "Projection bias" means:

  $\tilde{u}(c, s|s')$ is in between $u(c, s)$ and $u(c, s')$.

  get the direction of change in utility correctly but cannot get the magnitude of change correctly

  current

  future true taste

- $u(pie, hungry) > \tilde{u}(pie, full|hungry) > u(pie, full)$
- $u(coat, cold) > \tilde{u}(cold, warm|cold) > u(coat, warm)$

Step 3: A simple formulation

A person has "simple projection bias":

$$\tilde{u}(c, s|s') = (1-\alpha)u(c, s) + \alpha u(c, s'), \alpha \in (0, 1)$$

future true taste

current true taste

Note: $\alpha = 0$, there is no projection bias.

Examples:

- $\tilde{u}(pie, full|hungry) = \alpha u(pie, hungry) + (1-\alpha)u(pie, full)$
- $\tilde{u}(cold, warm|cold) = \alpha u(coat, cold) + (1-\alpha)u(coat, warm)$

Projection Bias in Economic Applications

- In order to apply projection bias in an economic environment, the starting point MUST be a standard, dynamic economic model with changing tastes (i.e., with state-dependent utility).
- Projection bias does NOT create changes in tastes, rather it creates bias in how people react to underlying changes in tastes.
- Person is not aware of the bias (otherwise could just correct for it).
- Except for these mispredictions, intertemporal preferences are as in the DU Model.

Projection Bias in Economic Applications

Instead of maximizing:

$$U^t = u_t + \delta u_{t+1} + \delta^2 u_{t+2} + ...$$

Person maximizes: exponentially discounted predicted/projected state-dependent utility

$$\tilde{U}^t = u_t + \delta \tilde{u}_{t+1} + \delta^2 \tilde{u}_{t+2} + ...$$

Underappreciation of adaptation

Evidence on underappreciation of adaptation:

- There exists a lot of evidence that people adapt to major changes in life circumstances (winning the lottery, acquiring serious medical conditions, imprisonment etc.).
- There also exists evidence that people underappreciate the extent of such adaptation, and thus overestimate the impact of major changes.

Underappreciation of adaptation

today : healthy → sick
"state" : accustomed to being healthy → accustomed to being sick
"current state" s', s_0 "future state" s, s_1

- Let s_0 be the state of being accustomed to being healthy
- Let s_1 be the state of being accustomed to being sick
- Adaptation means:

$$u(sick, s_1) > u(sick, s_0)$$

- Underappreciation of adaptation means:

$$u(sick, s_1) > \tilde{u}(sick, s_1 | s_0) > u(sick, s_0)$$

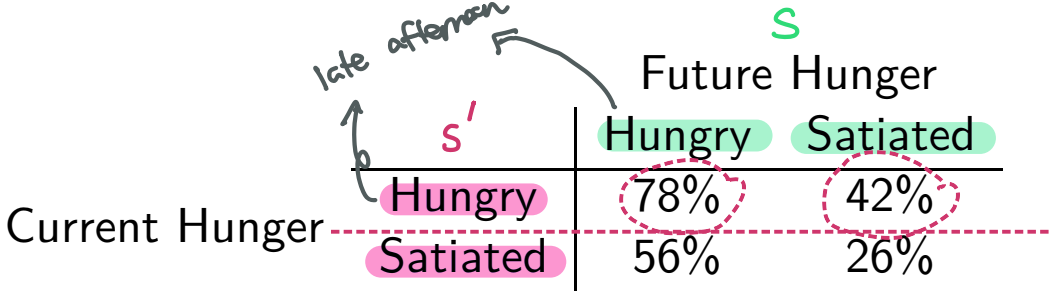
$\tilde{u}(sick, s_1 | s_0) = \alpha\, u(sick, s_0) + (1-\alpha)\, u(sick, s_1)$

Predicting Hunger: The Effects of Appetite and Delay on Choice(Read & van Leeuwen, OBHDP 1998)

- Subjects were 200 employees at several firms in Amsterdam.
- Procedure:
  - Each subject asked to choose between a healthy vs. unhealthy snack to be received in one week.
  - They varied subjects' expected future hunger and their current hunger.
  - The hunger state of the participants was manipulated by varying the time of day when they made their choices: choices were either made when most participants would be hungry (late afternoon) or when they would be satisfied (immediately after lunch).
  - 13 snacks: including 5 pieces of fruit(e.g. apples, banana), 5 chocolate bars(e.g. Mars, Snickers), and 3 salty snacks.

Predicting Hunger

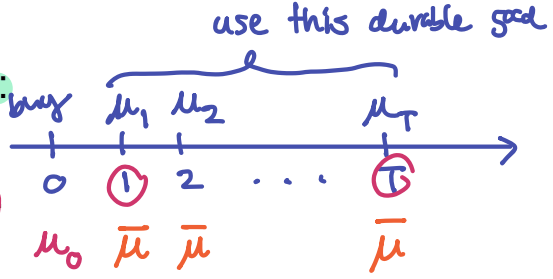
Results: % of Subjects Choosing Unhealthy Snack



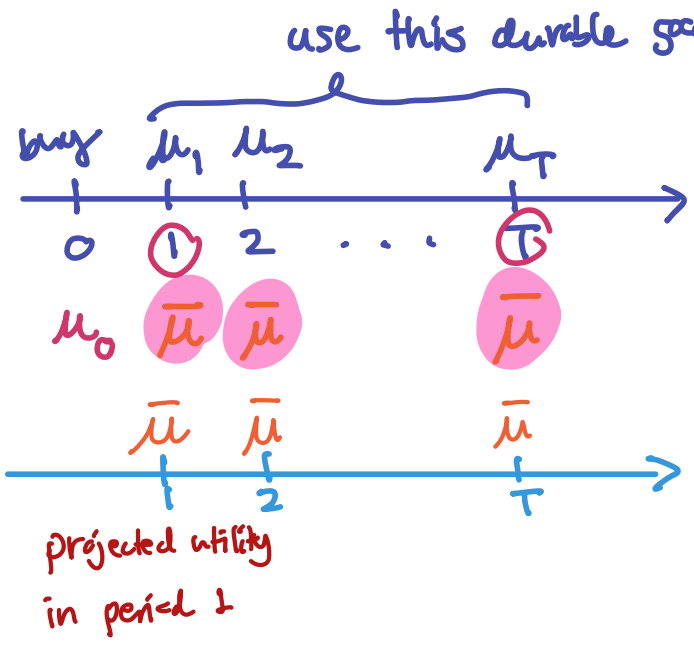
Durable goods

- A durable good yields a utility stream:

$$\mu_1, \mu_2, ..., \mu_T$$



- Suppose $\mu_t \sim iid, E(\mu_t) = \bar{\mu}$.
- Suppose in period 0 a person decides whether to purchase a durable good that will yield utility in periods 1 to T.
- Assume $\delta = 1$.



$= \alpha\mu_0 + (1-\alpha)\bar{\mu}$

$\alpha\mu_0 + (1-\alpha)\bar{\mu}$

$\cdots$

$\alpha\mu_0 + (1-\alpha)\bar{\mu}$

Durable goods

- Optimal WTP from standard model is:

$$WTP = T\bar{\mu}.$$

- With projection bias,

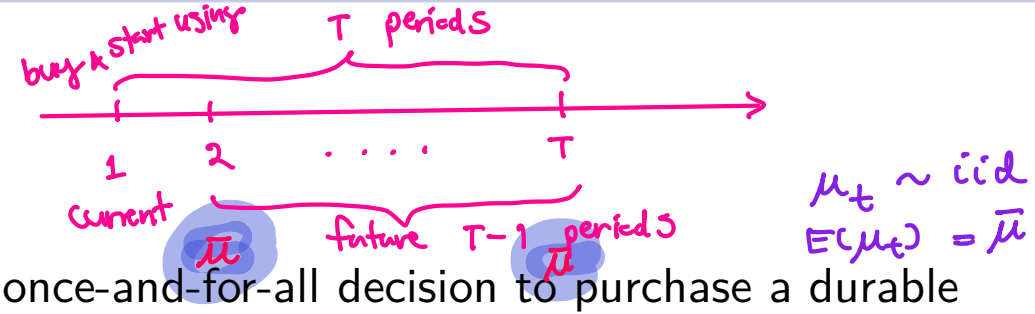
$$WTP = T[\alpha\mu_0 + (1-\alpha)\bar{\mu}]$$

$$WTP = T\bar{\mu} + \alpha T[\mu_0 - \bar{\mu}]$$

If $\mu_0 > \bar{\mu}$, then overprone to buy. If $\mu_0 < \bar{\mu}$, then underprone to buy.

- Hence, for once-and-for-all decisions whether to buy a durable good, projection bias can lead to over-buying or under-buying, depending on whether one's current valuation is high or low.

Setting & Optimal Behavior



- Consider a once-and-for-all decision to purchase a durable good, but now suppose that you can use the good immediately.
- Optimal behavior: rational

$$WTP_{optimal} = \mu_1 + (T-1)\bar{\mu}.$$

$\mu_1 + (T-1)\,E(\mu_t)$

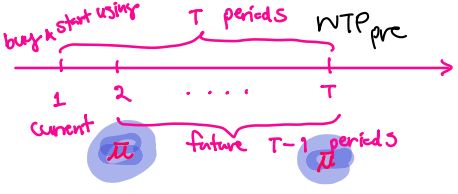
Projection bias vs. Present bias

- Projection bias:

$$WTP_{pro} = \mu_1 + (T-1)[\alpha\mu_1 + (1-\alpha)\bar{\mu}]$$

$$WTP_{pro} = \mu_1 + (T-1)\bar{\mu} + \alpha(T-1)(\mu_1 - \bar{\mu})$$

- Present bias: (assume no projection bias)



$$\mu_1 + \beta(T-1)\bar{\mu} - \beta\bar{p} \geq 0$$

$$WTP_{pre} = \frac{1}{\beta}\mu_1 + (T-1)\bar{\mu}$$

$$WTP_{pre} = \mu_1 + (T-1)\bar{\mu} + \frac{1-\beta}{\beta}\mu_1$$

Comparison

Optimal behavior:

$$WTP_{opt} = \mu_1 + (T-1)\bar{\mu}$$

Projection bias:

$$WTP_{pro} = \mu_1 + (T-1)\bar{\mu} + \alpha(T-1)(\mu_1 - \bar{\mu})$$

Present bias:

$$WTP_{pre} = \mu_1 + (T-1)\bar{\mu} + \frac{1-\beta}{\beta}\mu_1$$

if $\beta = 70\%$ $\Rightarrow$ $\frac{1-\beta}{\beta} = \frac{30\%}{70\%} = 0.42$

$\Rightarrow$ the bias $\frac{1-\beta}{\beta}\mu_1 = 0.42\mu_1$

Distortion

- Present bias can create a small distortion, but cannot be very large unless very large self-control problem.
- Projection bias can create a large distortion, because a high μ_1 can lead you to overestimate value in ALL future periods, hence even if α is small, the distortion can be large.
- You are deciding whether to commit to a long-term consumption stream- exactly the type of environment in which projection bias can be a big problem while present bias typically is not.

References

- Loewenstein, G., T. O'Donoghue, and M. Rabin (2003). "Projection Bias in Predicting Future Utility," Quarterly Journal of Economics, 118, 1209-1248.
- O'Donoghue, Ted. 2019. "Projection Bias- Mispredicting Future Tastes " Lecture Note for ECON 7580, Cornell University
- Read, D., van Leeuwen, Barbara (1998). "redicting Hunger: The Effects of Appetite and Delay on Choice,"Organizational Behavior and Human Decision Processes, Volume 76, Issue 2,