Doing It Now or Later

Ted O’Donoghue and Matthew Rabin


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Introduction

- Economists almost always capture impatience by exponential discounting of future payoffs.
- Casual observation, introspection, and psychological research all suggest that the assumption of time consistency is importantly wrong.
- It ignores the human tendency to grab immediate rewards and to avoid immediate costs in a way that our long-run selves do not appreciate.
- Such tendencies are called *present-biased preferences*. 
Introduction

- Two sets of distinctions are emphasized.
- The temporal distribution of costs and rewards.
  - Immediate costs: the costs of an action are immediate but any rewards are delayed – procrastination.
  - Immediate rewards: the benefits of an action are immediate but any costs are delayed – overeating.
- The sophistication level of the decision maker.
  - Sophisticated: people correctly foresee that they will have self-control problems.
  - Naive: people do not foresee these self-control problems.
Let $u_t$ be a person’s instantaneous utility in period $t$.

$U^t(u_t, u_{t+1}, ..., u_T)$ represents the person’s intertemporal preferences from the perspective of period $t$.

While exponential discounting is typically assumed to capture impatience, it is more than an innocuous simplification of a more general class of preferences, since it implies that preferences are time-consistent.

People tend to exhibit a specific type of time-inconsistent preferences that we call present-biased preferences.
Present-biased preferences

- **Definition:** $(\beta, \delta)$-preferences are preferences that can be represented by: for all $t$,
  
  $U^t(u_t, u_{t+1}, ..., u_T) := \delta^t u_t + \beta \sum_{\tau=t+1}^{T} \delta^\tau u_\tau$, where $0 < \beta$, $\delta \leq 1$.

- $\delta$ represents long-run, time-consistent discounting.

- $\beta$ represents a bias for the present.
  
  - If $\beta = 1$, the preferences are simply exponential discounting.
  - If $\beta < 1$, they imply present-biased preferences.
Present-biased preferences

- Researchers have converged on a simple strategy for modeling time-inconsistent preferences: the person at each point in time is modeled as a separate agent who is choosing her behavior to maximize her current preferences.

- The question that necessarily arises is what a person should believe about her future selves’ preferences.
  - A person could be sophisticated and know exactly what her future selves’ preferences will be.
  - A person could be naive and believe that her future selves’ preferences will be identical to her current self’s.

- It is probably safe to say that there are elements of both sophistication and naivete in the way people anticipate their own future preferences.
There is an activity that a person must perform exactly once.

There are $T < \infty$ periods in which she can do it.

Let $\mathbf{v} := (v_1, v_2, ..., v_T)$ be the reward schedule, and let $\mathbf{c} := (c_1, c_2, ..., c_T)$ be the cost schedule, where $v_t \geq 0$ and $c_t \geq 0$ for each $t$.

If she does the activity in period $t$, she receives reward $v_t$ but incurs cost $c_t$, and makes no further choices.

If she waits, she will face the same choice in period $t + 1$; if she waits until the end, she must do it then.
Doing It Once

- There is an important distinction between immediate costs and immediate rewards.
- These two cases are analyzed, using the $(\beta, \delta)$-preferences.
- For simplicity (as usual), $\delta = 1$: no “long-term” discounting.
- Let $U^t(\tau)$ denote the intertemporal utility from the perspective of period $t$ of completing the activity in period $\tau \geq t$. 
Doing It Once

- Immediate costs: if a person completes the activity in period $\tau$, then her intertemporal utility is

$$U^t(\tau) = \begin{cases} 
\beta v_\tau - c_\tau & \text{if } \tau = t, \\
\beta v_\tau - \beta c_\tau & \text{if } \tau > t.
\end{cases}$$

- Immediate rewards: if a person completes the activity in period $\tau$, then her intertemporal utility is

$$U^t(\tau) = \begin{cases} 
v_\tau - \beta c_\tau & \text{if } \tau = t, \\
\beta v_\tau - \beta c_\tau & \text{if } \tau > t.
\end{cases}$$
Doing It Once

- Consider three types of agent:
  - TC: people with standard exponential, time-consistent preferences.
  - Sophisticates: people with time-inconsistent preferences but sophisticated perceptions.
  - Naifs: people with time-inconsistent preferences and naive perceptions.

- A person’s behavior is fully described by a strategy $s := (s_1, s_2, ..., s_T)$, where $s_t \in \{Y, N\}$.
- Without loss of generality, $s_T = Y$. 
Definition: A perception-perfect strategy is a strategy that in all periods (even those after the activity is performed), a person chooses the optimal action given her current preferences and her perceptions of future behavior.

- For TCs, it is a strategy $s_{tc}^t$ that satisfies for all $t < T$, $s_{tc}^t = Y$ if and only if $U^t(t) \geq U^t(\tau)$ for all $\tau > t$.
- For naifs, it is a strategy $s_n^t$ that satisfies for all $t < T$, $s_n^t = Y$ if and only if $U^t(t) \geq U^t(\tau)$ for all $\tau > t$.
- For sophisticates, it is a strategy $s^s_t$ that satisfies for all $t < T$, $s^s_t = Y$ if and only if $U^t(t) \geq U^t(\tau')$ where $\tau' := \min_{\tau > t} \{ \tau \mid s^s_\tau = Y \}$.

- Let $\tau_a := \min \{ t \mid s^a_t = Y \}, a \in \{ tc, s, n \}$. 
Example 1: Suppose that costs are immediate (writing a report or watching a movie), $T = 4$, and $\beta = 1/2$ for naifs and sophisticates. Let $\mathbf{v} = (\bar{v}, \bar{v}, \bar{v}, \bar{v})$ and $\mathbf{c} = (3, 5, 8, 13)$.

- $s^{tc} = (Y, Y, Y, Y)$, so TCs do the report in period $\tau_{tc} = 1$.
- $s^n = (N, N, N, Y)$, so naifs do the report in period $\tau_n = 4$.
- $s^s = (N, Y, N, Y)$, so sophisticates do the report in period $\tau_s = 2$. 


The problem is straightforward for TCs.

- In period 3, $U^3(3) = \bar{v} - 8$ and $U^3(4) = \bar{v} - 13$. Since $U^3(3) > U^3(4)$, $s^{tc}_3 = Y$.
- In period 2, $U^2(2) = \bar{v} - 5$, $U^2(3) = \bar{v} - 8$ and $U^2(4) = \bar{v} - 13$. Since $U^2(2) > U^2(3) > U^2(4)$, $s^{tc}_2 = Y$.
- In period 1, $U^1(1) = \bar{v} - 3$, $U^1(2) = \bar{v} - 5$, $U^1(3) = \bar{v} - 8$ and $U^1(4) = \bar{v} - 13$. Since $U^1(1) > U^1(2) > U^1(3) > U^1(4)$, $s^{tc}_1 = Y$. 
Naifs do not foresee that they will give in to their self-control problem.

- In period 3, \( U^3(3) = 0.5\bar{v} - 8 \) and \( U^3(4) = 0.5(\bar{v} - 13) \). Since \( U^3(3) < U^3(4) \), \( s_3^{tc} = N \).
- In period 2, \( U^2(2) = 0.5\bar{v} - 5 \), \( U^2(3) = 0.5(\bar{v} - 8) \) and \( U^2(4) = 0.5(\bar{v} - 13) \). Since \( U^2(3) > U^2(2) \), \( s_2^{tc} = N \).
- In period 1, \( U^1(1) = 0.5\bar{v} - 3 \), \( U^1(2) = 0.5(\bar{v} - 5) \), \( U^1(3) = 0.5(\bar{v} - 8) \) and \( U^1(4) = 0.5(\bar{v} - 13) \). Since \( U^1(2) > U^1(1) \), \( s_1^{tc} = N \).
In contrast, sophisticates know that they will be hampered by the self-control problem.

- In period 3, $U^3(3) = 0.5\bar{v} - 8$ and $U^3(4) = 0.5(\bar{v} - 13)$. Since $U^3(3) < U^3(4)$, $s_{3tc} = N$.

- In period 2, $U^2(2) = 0.5\bar{v} - 5$, $U^2(3) = 0.5(\bar{v} - 8)$ and $U^2(4) = 0.5(\bar{v} - 13)$. Since $\tau' = 4$ and $U^2(2) > U^2(4)$, $s_{2tc} = Y$.

- In period 1, $U^1(1) = 0.5\bar{v} - 3$, $U^1(2) = 0.5(\bar{v} - 5)$, $U^1(3) = 0.5(\bar{v} - 8)$ and $U^1(4) = 0.5(\bar{v} - 13)$. Since $\tau' = 2$ and $U^1(2) > U^1(1)$, $s_{1tc} = N$. 

Example 2: Suppose that rewards are immediate (watching a movie), \( T = 4 \), and \( \beta = 1/2 \) for naifs and sophisticates. Let \( \mathbf{v} = (3, 5, 8, 13) \) and \( \mathbf{c} = (0, 0, 0, 0) \).

- \( s^{tc} = (N, N, N, Y) \), so TCs do the report in period \( \tau_{tc} = 1 \).
- \( s^{n} = (N, N, Y, Y) \), so naifs do the report in period \( \tau_{n} = 3 \).
- \( s^{s} = (Y, Y, Y, Y) \), so sophisticates do the report in period \( \tau_{s} = 1 \).
Proposition

(1) If costs are immediate, then \( \tau_n \geq \tau_{tc} \). (2) If rewards are immediate, then \( \tau_n \leq \tau_{tc} \).

- The present-bias effect: when costs are immediate, people with present-biased preferences tend to procrastinate; when rewards are immediate, they tend to preproperate.
- The result is a direct reflection of this effect.
Behavior

Proposition

For all cases, $\tau_s \leq \tau_n$.

- On top of the present-bias effect, there is also the sophistication effect: because sophisticates are (correctly) pessimistic that they will behave themselves in the future, they are more inclined than naifs to do it now, regardless of whether it is costs or rewards that are immediate.
- Because of this, sophisticates act before naifs.
- No clear relationship can be established between $\tau_{tc}$ and $\tau_s$. 
Example 3: Suppose that costs are immediate, $T = 3$, and $\beta = 1/2$ for naifs and sophisticates. Let $v = (12, 18, 18)$ and $c = (3, 8, 13)$. Then, $\tau_s = 1$ and $\tau_{tc} = 2$.

- For TCs, $U^2(2) = 18 - 8 = 10$ and $U^2(3) = 18 - 13 = 5$, so $U^2(2) > U^2(3)$. However, $U^1(1) = 12 - 3 = 9$ and $U^1(2) = 18 - 8 = 10$, so $U^1(1) < U^1(2)$.
- For sophisticates, $U^2(2) = 0.5 \cdot 18 - 8 = 1$ and $U^2(3) = 0.5(18 - 13) = 2.5$, so $U^2(2) < U^2(3)$. However, $U^1(1) = 0.5 \cdot 12 - 3 = 3$ and $U^1(3) = 2.5$, so $U^1(1) > U^1(3)$. 
The behavior of naifs intuitively and directly reflects their bias for the present.

- Naifs undersave in essentially any saving model.

Sophisticates can behave in ways that seemingly contradict having present-biased preferences.

- Sophisticates may complete an unpleasant task before TCs.
- Sophisticates hence may save more than TCs.
- The sophistication effect that often operate in contradiction to the present-bias effect can be quite significant.