Behavioral Economics

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Lecture 5: Time Preferences

Today's Topics

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1. Experiment

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2. Discounting

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3. Traditional model: exponential discounting

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5. Behavioral model: quasi-hyperbolic model

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6. Sophistication and Commitment

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5. Behavioral model: quasi-hyperbolic model
6. Sophistication and Commitment
7. Application

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2. Discounting

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  - Go to the gym or watching Netflix tonight?
- weighting future benefits and costs with present benefits and costs

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- **Problem 1**
  - Receive 100 Euro now
  - Receive 100 Euro in one year

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- **Problem 2**
  - Pay 100 Euro now
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- **We discount the future**

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- In practice:
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  - The interest rate for borrowing is not the same as for lending money.
- And also: **why is there a positive interest rate to be earned in the market in the first place?**

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- Psychological motive: we are **impatient**.
- In this lecture, we will focus on this reason.
  - (so we assume future is certain)

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  - For a consumption profile $x_0, x_1, ..., x_T$:

$$DU(x_0, ..., x_T) = D(0) \cdot u(x_0) + D(1) \cdot u(x_1) + ... + D(T) \cdot u(x_T)$$

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    - Also called inter-temporal utility function

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- **Constant discounting:** in each period the same factor δ.
- Also called **constant discounting**.

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- The ratio of intertemporal utility between consecutive dates is the same (namely δ) reflecting constant discounting.
- $\delta < 1$ implies: the sooner, the better!

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$$DU = u(x_0) + \delta u(x_1) + \delta^2 u(x_2) + \delta^3 u(x_3) + ... + \delta^T u(x_T)$$

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- What happens if $\delta \in (0.87, 0.91)$?

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- In Example 2, Hanneke with $\delta > 0.75$ prefers to study today and have free tomorrow
  - She would make the same choice if the decision was shifted one week (study in one week and have free the evening in a week and one day).

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$$DU = -\delta^7 + \delta^8 \frac{4}{3} > 0 \Rightarrow \delta > 0.75$$

- In fact, the decision can be shifted to any future period $t = \tau$ and if $\delta > 0.75$, she would prefer to study in $t = \tau$ to have a free evening on $t = \tau + 1$.

Constant Discounting

- **More generally:**
  - If, in period $t = \tau$, one prefers waiting s more weeks to get y in period $t = \tau + s$ instead of x in period $t = \tau$ (such that $y > x$),
  - then one should also prefer waiting s more weeks now $(t = 0)$ to get y in period $t = s$ instead of x now.

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- **Constant discounting implies time consistent behavior**
  - if a person prefers $x = (x_\tau, \ldots, x_T)$ to $y = (y_\tau, \ldots y_T)$ **from the perspective of period** $t = 0$, then she will also prefer x to y from **the perspective of period** $t = \tau$.

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  - The person will not alter the decision in period τ ("consistent" decision)

Problem 3

- Receive 100 Euro now
- Receive 110 Euro in one week.

Problem 4

- Receive 100 Euro in 4 weeks
- Receive 110 Euro in 5 weeks.

4. Time inconsistency

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  - This pattern of choice violates constant discounting.

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- In **Problem 4** people typically prefer "110 in 5 weeks" over "100 Euro in a 4 weeks"
  - Under exponential discounting implies $\delta^5 u(110) > \delta^4 u(100) \Rightarrow \delta u(110) > u(100)$
- A contradiction!

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    - **"Decreasing impatience"**

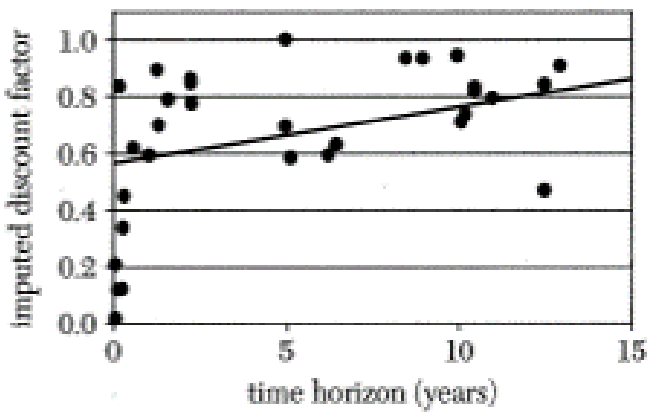

Figure 1a. Discount Factor as a Function of Time Horizon (all studies)

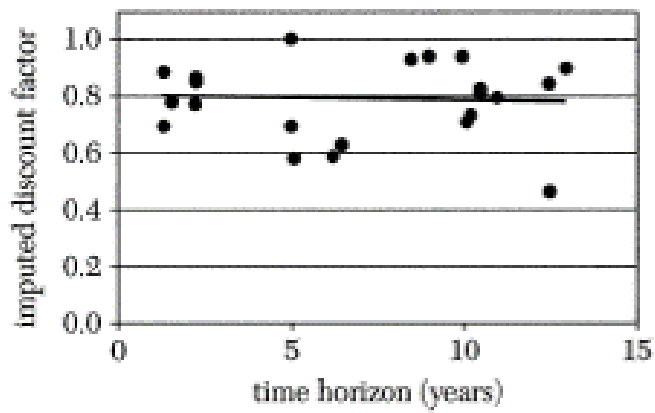

Figure 1b. Discount Factor as a Function of Time Horizon (studies with avg. horizons > 1 year)

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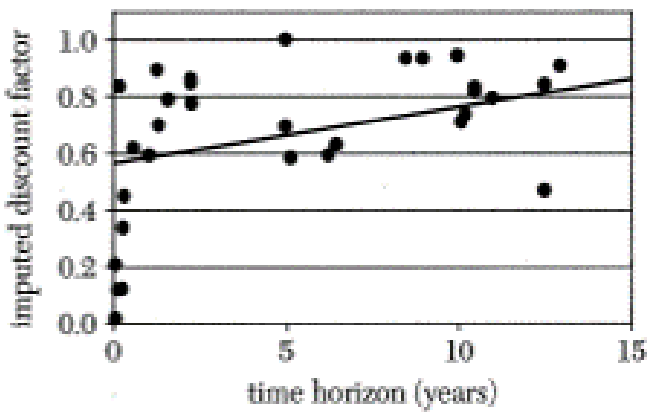

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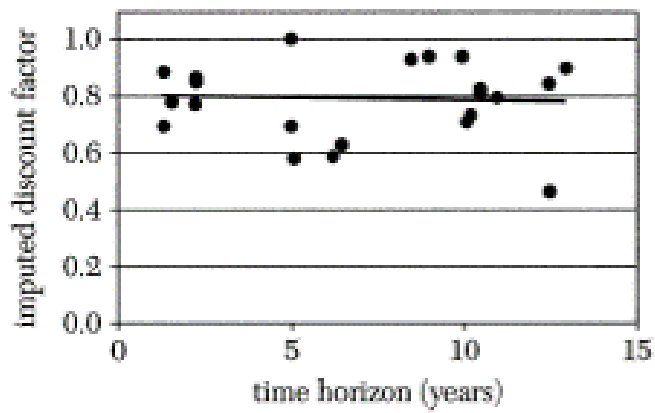

Figure 1b. Discount Factor as a Function of Time Horizon (studies with avg. horizons > 1 year)

  - short-term impatience.

Empirical Findings

- Measurement and findings
  - Empirical studies: find δ.
  - Anomalies...
    - In the short run people are more impatient as in the long run.
    - **"Decreasing impatience"**

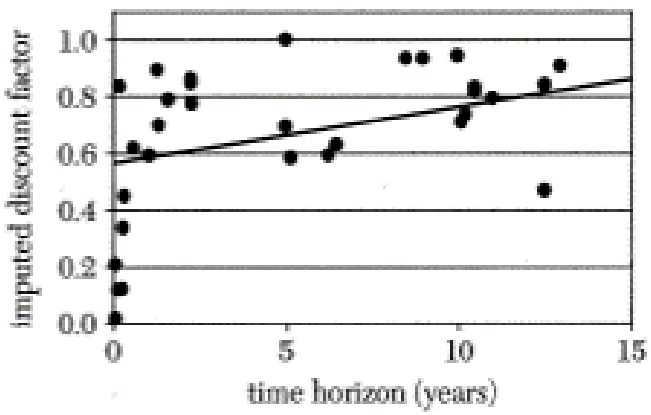

Figure 1a. Discount Factor as a Function of Time Horizon (all studies)

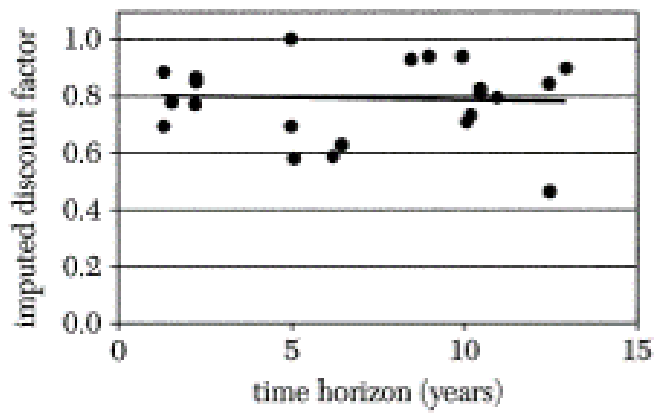

Figure 1b. Discount Factor as a Function of Time Horizon (studies with avg. horizons > 1 year)

  - short-term impatience.
  - violates constant discounting

Read and van Leeuwen (1998)

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- If you were deciding today, would you choose fruit or chocolate for next week?

vs.


Read and van Leeuwen (1998)

- If you were deciding today, would you choose fruit or chocolate for next week?

vs.


- Today, 74% of subjects choose fruit for next week

Read and van Leeuwen (1998)

- If you were deciding today, would you choose fruit or chocolate for today?

vs.


Read and van Leeuwen (1998)

- If you were deciding today, would you choose fruit or chocolate for today?

vs.


- Today, 70% of subjects choose chocolate

Read and van Leeuwen (1998)

- If you were deciding today, would you choose fruit or chocolate for today?

vs.


- Today, 70% of subjects choose chocolate
- Today I want the chocolate bar, but next week I will start to eat healthier...

Read and van Leeuwen (1998)

- If you were deciding today, would you choose fruit or chocolate for today?

- Today, 70% of subjects choose chocolate
- Today I want the chocolate bar, but next week I will start to eat healthier...
- **time inconsistent preferences**

Read et al. (1999)

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  - Some are "low brow"
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- Choose among 24 movies
  - Some are "low brow"
    - e.g. Speed; Four weddings and a Funeral
  - Some are "high brow"
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Figure: Canonical highbrow movie

(A man seeks answers about life, death, and the existence of God as he plays chess against the Grim Reaper during the Black Death.)

Read et al. (1999) (cont'd)

- Picking for tonight: 66% choose low brow.

Read et al. (1999) (cont'd)

- Picking for tonight: 66% choose low brow.
- Picking for 7 days from now: 37% choose low brow.

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Read et al. (1999) (cont'd)

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- Picking for 7 days from now: 37% choose low brow.
- Picking for 14 days from now: 29% choose low brow.
- time inconsistent preferences
- Intuition: Tonight I want to have fun, but next week I want things that are good for me...

5. Behavioral Model: Quasi-hyperbolic discounting.

Quasi-hyperbolic discounting

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- Sometimes also called β-δ preferences.

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- if $\beta = 1$: **constant discounting (as before)**
- $\beta < 1$: **present-biased preferences**
  - All future utilities are multiplied by $\beta < 1$.
  - β captures the present bias.

Quasi-hyperbolic discounting

- A consumption profile $(x_0, x_1, ..., x_T)$ is evaluated at $t = 0$ as

$$DU = u(x_0) + \beta\delta u(x_1) + \beta\delta^2 u(x_2) + \beta\delta^3 u(x_3) + ... + \beta\delta^T u(x_T),$$

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- Individuals discount constantly, but not between today and tomorrow

Example 3: Quasi-hyperbolic discounting and immediate costs

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- **When do you write the assignment?**

Really?

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- Value of going to Feyenoord

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- Value of going to Feyenoord

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- Value of doing the assignment is the same no matter when you write it and you get the reward only after the four weeks.
- **Cost of doing the assignment is not going to Feyenoord**.

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- Assume first $\beta = 1$ and $\delta = 1$.

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- When will the time consistent person write the assignment?

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- Reasoning:
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  - Do the assignment in the week with the minimal cost.
- Do it this week.

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  - Perspective in two weeks: do it in three weeks.
- Do it in three weeks: **procrastination!**.

6. Sophistication and Commitment

Naivete vs Sophistication

Naivete vs Sophistication

- A decision-maker with quasi-hyperbolic preferences may be aware that she is impatient.

Naivete vs Sophistication

- A decision-maker with quasi-hyperbolic preferences may be aware that she is impatient.
- Additional parameter $\hat{\beta}$ are the individual's beliefs about β

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- **Sophistication:** $\hat{\beta} = \beta$.

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  - No surprises about future present bias

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- Assume $\beta = 1/2$, $\delta = 1$, and **sophisticated**,
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- But has correct beliefs about the future
- She solves the problem using **backward induction!**

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- Do it next week

Conclusion of Example 3

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- Sophistication can mitigate self-control problems.

Commitment and Sophistication

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- Suppose that you are sophisticated and can commit at $t = 0$ to make the assignment at any date.

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  - in three weeks, the discounted cost is $1/2 \cdot 13 = 6.5$

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  - next week, the discounted cost $1/2 \cdot 5 = 2.5$
  - in two weeks, the discounted cost is $1/2 \cdot 8 = 4$.
  - in three weeks, the discounted cost is $1/2 \cdot 13 = 6.5$
- Hence, at $t = 0$ you commit to doing the assignment at $t = 1$.

Commitment and Sophistication

- Consider Example 3 again.
- Suppose that you are sophisticated and can commit at $t = 0$ to make the assignment at any date.
- If commitment obliges you to do the assignment...
  - this week, the discounted cost is 3.
  - next week, the discounted cost $1/2 \cdot 5 = 2.5$
  - in two weeks, the discounted cost is $1/2 \cdot 8 = 4$.
  - in three weeks, the discounted cost is $1/2 \cdot 13 = 6.5$
- Hence, at $t = 0$ you commit to doing the assignment at $t = 1$.
- Sophisticates take advantage of commitment.

Commitment and Sophistication

- Suppose that you are naive and can commit at $t = 0$ to make the assignment at any date.

Commitment and Sophistication

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Commitment and Sophistication

- Suppose that you are naive and can commit at $t = 0$ to make the assignment at any date.
- If commitment obliges you to do the assignment...
  - This week, the discounted cost is 3.
  - Next week, the perceived discounted cost is 5.

Commitment and Sophistication

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Commitment and Sophistication

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- Hence, you believe that the plan of doing the assignment at $t = 0$ will happen.

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  - Next week, the perceived discounted cost is 5.
  - In two weeks, the perceived discounted cost is 8.
  - In three weeks, the perceived discounted cost is 13
- Hence, you believe that the plan of doing the assignment at $t = 0$ will happen.
- Naives do not take advantage of commitment.

Commitment and Sophistication

- People who are (partly) sophisticated like to pre-commit themselves:

Commitment and Sophistication

- People who are (partly) sophisticated like to pre-commit themselves:
- Getting up on time

Commitment and Sophistication

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  - Decision in the evening: setting an early wake up time at the alarm clock.

Commitment and Sophistication

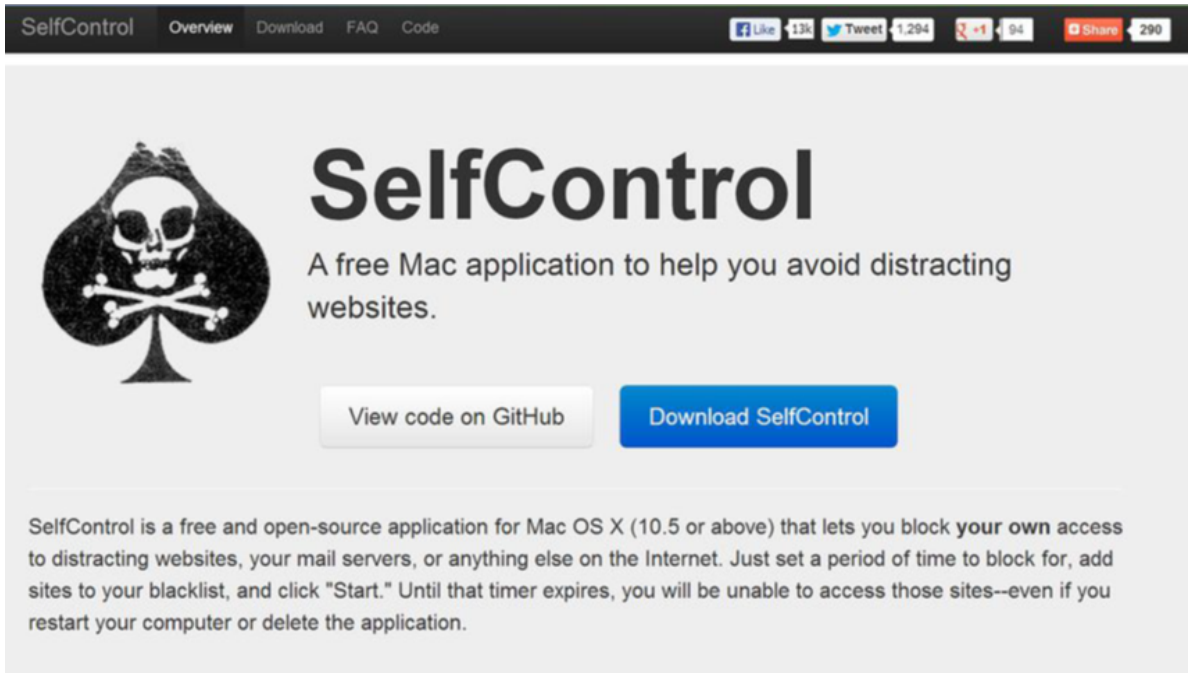
- People who are (partly) sophisticated like to pre-commit themselves:
- Getting up on time
  - Decision in the evening: setting an early wake up time at the alarm clock.
  - In the morning: snooze button

Clocky

Stickk

Figure: "The smartest way to set and achieve your goals"

Self-control



7. Application

Application of commitment (Ariely and Wertenbroch, 2002)

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- **Experiment 1**

Application of commitment (Ariely and Wertenbroch, 2002)

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  - Group A: evenly-spaced deadlines

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- The penalty for delay was 1% per day for late submission

Application of commitment (Ariely and Wertenbroch, 2002)

- **Experiment 1**
- MBA students had to submit three papers during a course.
- Two groups
  - Group A: evenly-spaced deadlines
  - Group B: set own deadlines
- The penalty for delay was 1% per day for late submission
- Demand for commitment (68%) $\Rightarrow$ Implies sophistication

Application of commitment (Ariely and Wertenbroch, 2002)

- No late submissions!

Application of commitment (Ariely and Wertenbroch, 2002)

- No late submissions!
- Grades in Group A (88.7) higher than grades in Group B (85.67)

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Application of commitment (Ariely and Wertenbroch, 2002)

- No late submissions!
- Grades in Group A (88.7) higher than grades in Group B (85.67)
  - Consistent with self-control problems
- Problem of this study: no randomization.

Application of commitment (Ariely and Wertenbroch, 2002)

- **Experiment 2**

Application of commitment (Ariely and Wertenbroch, 2002)

- **Experiment 2**
- 21-day proofreading job: find mistakes in papers and get paid per error.
  - Group A: evenly-spaced deadlines

Application of commitment (Ariely and Wertenbroch, 2002)

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- Naives:
  - $A > B = C$

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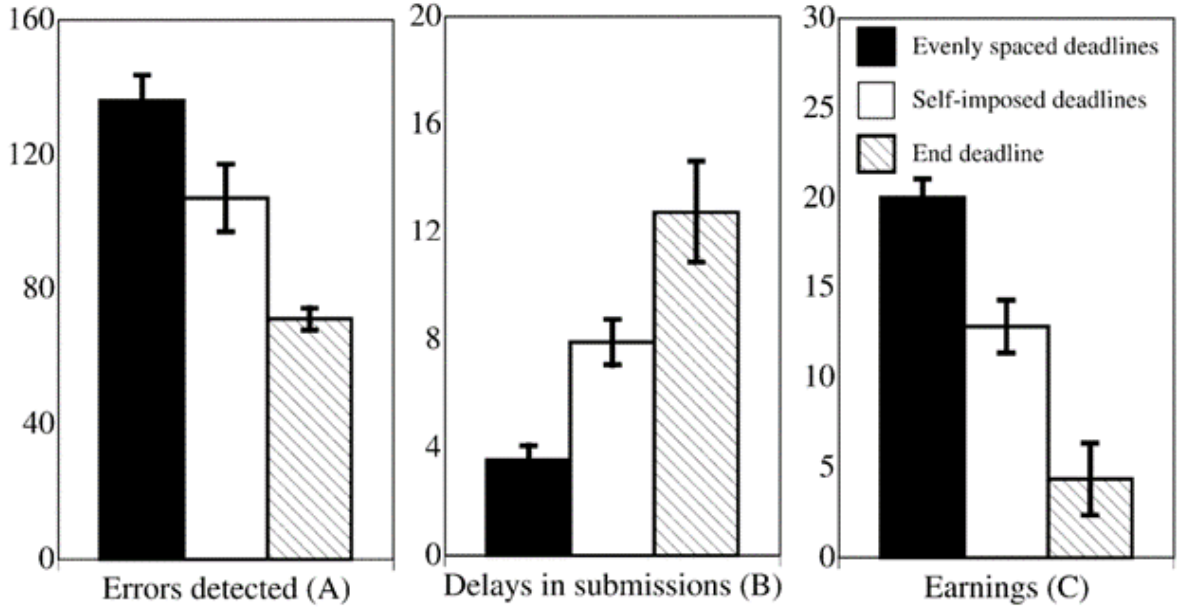
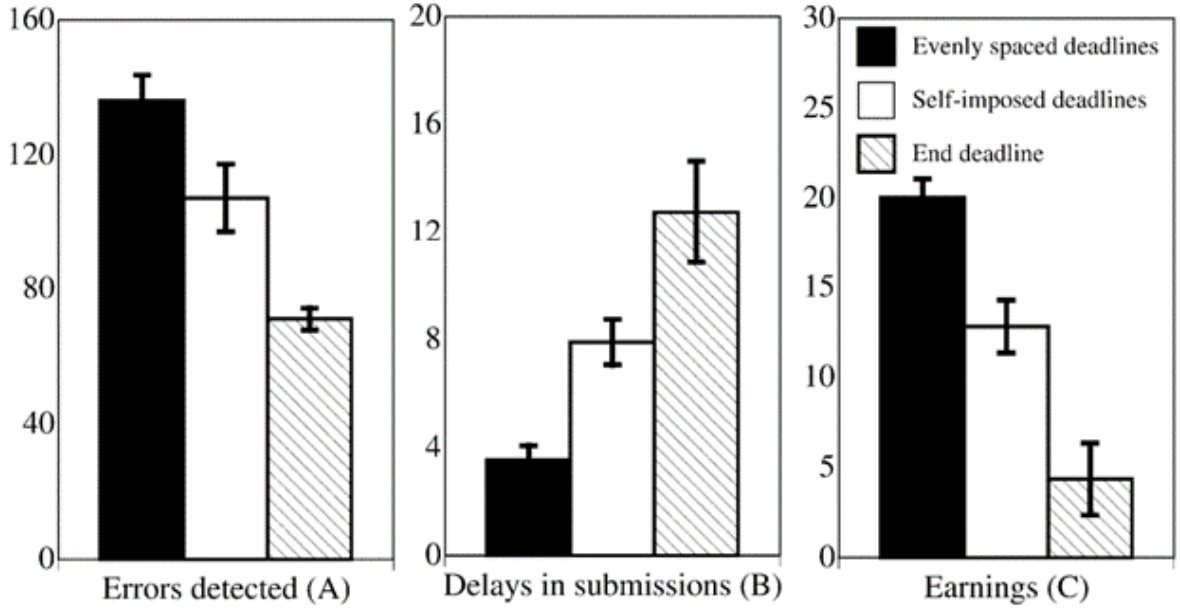


Figure: Results Ariely and Wertenbroch (2002)

Application of commitment (Ariely and Wertenbroch, 2002)



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- Results ($A > C > B$) support the (β, δ) model with some but not full sophistication.

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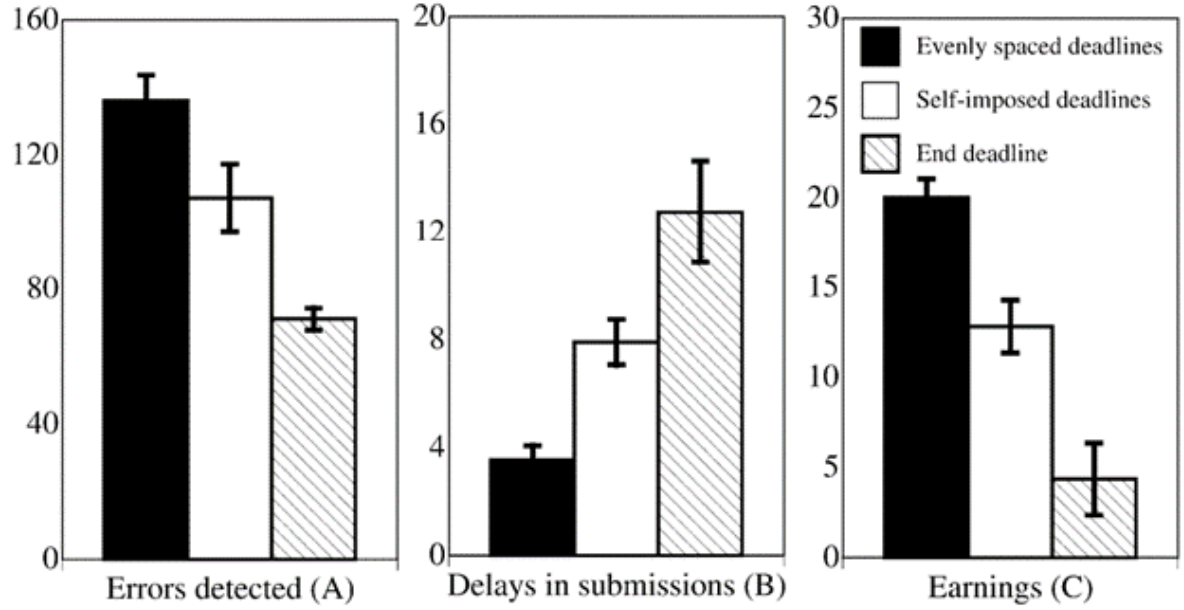

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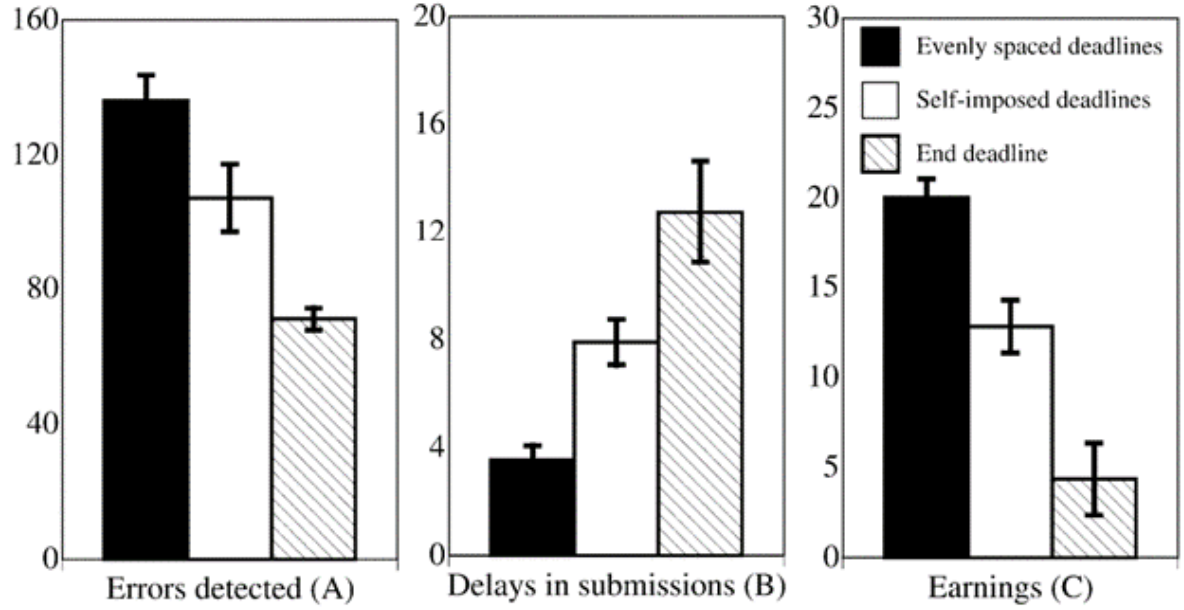

Figure: Results Ariely and Wertenbroch (2002)

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  - People were willing to self-impose deadlines to overcome procrastination
  - Self-imposed deadlines were effective in improving task performance but were not set optimally.

Another nice application

- Duflo, Esther, Michael Kremer, and Jonathan Robinson. "Nudging farmers to use fertilizer: Theory and experimental evidence from Kenya." American economic review 101.6 (2011): 2350-2390.
- will be discussed in Lecture 9.

Exam-like question

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- Values of going to the matches are as in Example 3, and the cost of going to each of the matches is now zero.
- **When do you go to Feyenoord?**

The End!

Today's recommendation

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- Slipknot's "We are not your kind" (2019).
- **Interesting economics fact:** Slipknot received a $500,000, seven-album deal, from Roadrunner Records; the band signed the deal publicly on July 8, 1998. (Talking about present bias)