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Discount rate, time preference, and technology adoption

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What this research is about

- Discount rates
- Time preferences
- How *impatient* people are
- The more impatient people are, the more they prefer money now to money later
- Public policy:
- Paying less (but over a shorter period of time) may
 - Lead to more uptake (matches preferences better)
 - More stuff purchased for less money



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This research is about discount rates and when I say “discount rates” what I really mean is *time preferences*, i.e. how *impatient* people are.

The more impatient people are, the more they prefer money now to money later.

Findings

- Elicit time preference information in a field experiment with 208 U.S. farmers
 - Find an overall discount rate of at least 34%
 - Results are unique in at least two ways:
 1. Unusually large payments: \$400-\$500
 2. Field-payment context (not ^{0%} standard elicitation)
- Farmers were known *ex-ante* to be either early or late adopters of conservation technologies
 - We find significant differences in discounting behavior between early and later adopters in a decision model that assumes farmers optimally smooth experimental payments
- Simulated differences in risk preferences do not dramatically reduce inferred discount rates



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Experimental elicitation

- Goal is to induce individuals to make a decision, from which we can infer their discount rates
- How is this usually done?
- Basic unit of information: e.g., “Would you rather have \$100 now or \$100+\$X in one year?”
- Existing experiment studies elicit time-preference using an MPL format (Pender, 1996; Harrison, et al., 2002; Andersen, et al., 2008)
- Exceptions (Andreoni and Sprenger, 2012; Laury, et al., 2012)



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Field experiment

- This study: Single-choice format
 - Provides single-bounded measure of individual discount rates
 - Reduces potential effects from framing
 - Increases saliency
- Farmers assigned to one of three treatments:

	Now payment	Later payment	Implied APR
Treatment 1	\$405	\$430	8%
Treatment 2	\$405	\$463	18%
Treatment 3	\$405	\$498	28%

- Sample size was 293: (158 BMPC, 135 LS)



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Quantity of information we have about a given individual is less, but the quality may be higher.

Field experiment

- Conducted by AFT using mail/web
- Postcard was sent, alerting farmers that a letter was coming soon
- Letter came approximately one week later
 - “American Farmland Trust (AFT) greatly values the environmental services produced by well-managed farms, and has received a grant that allows us to present you with a **thank you check for all that you are doing to save the land that sustains us**. The check value is around \$400.. . . To receive this check, you do not have to give us any private information or fill out a survey. You simply need to go online before Wednesday, June 15, 2011, and choose how you want to receive your check – a process that will take less than five minutes. If you do not have access to a computer, you can fill out the accompanying form and mail it back in the self-addressed stamped envelope provided.”



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Farmers had the choice of returning their choice in the mail, or making their choice online.

The letter explaining the payment and the payment choice was about a page; I've excerpted it here.

Let me just point you to the key part, highlighted in red.

All farmers in the sample were thought to be applying conservation practices to their land, and AFT had had contact with each of these farmers to discuss these conservation practices.

AFT offered each farmer a *thank you* check for “all that you are doing to save the land that sustains us” – that is, for practicing conservation. This is all consistent with AFT’s mission.

Field experiment

- Choice could be completed by mail or online

Please let us know which payment option you prefer (check only one option):

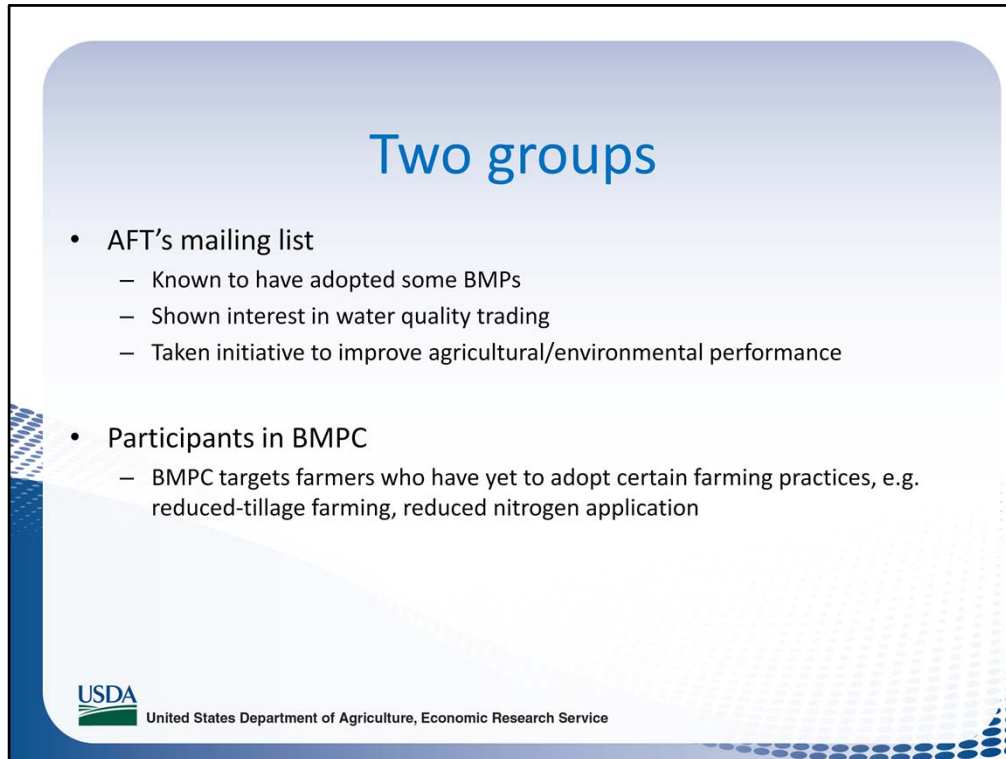
☒ \$405 right away (your check should arrive in the mail in approximately 15 days)

☐ \$463 at the start of the next growing season (your check will be mailed out March 1, 2012)

- Follow-up letter one week after due date



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Going to show you the results in one moment, but it's time now to briefly discuss the two groups.

The first group was pulled from AFT's mailing list. These were farmers who had expressed interest in water quality trading, for example, who had participated in workshops and listening sessions on various topics, and who were broadly known to have taken some initiative to implement conservation practices. For lack of a better term, you might call these "progressive" farmers. I know that's a loaded term. I'm not saying that everybody in this group was necessarily an early adopter of a large suite of conservation practices, but what I am more confident in saying is that these individuals were *different* from the second group.

The second group was made up of individuals who participated in AFT's BMPC. The BMPC was specifically targeted by AFT (using the help of local crop advisors) at individuals who had not yet adopted a particular practice, e.g. reduced-till or agronomic application of fertilizer.

Split is imperfect, but meaningful.

Results and interpretation

- Early adopters are estimated to have a discount rate of approximately 34%
- BMPC farmers are estimated to have a discount rate of approximately 48%
- Isn't this...way too high?
- Similar results were common, yet puzzling until a large innovation took place:
 - Joint estimation of risk and time preference results in smaller inferred time preference (Andersen, et al., 2008)
 - Higher payments needed to induce waiting if a person is risk averse



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Not going to focus too much on this difference.

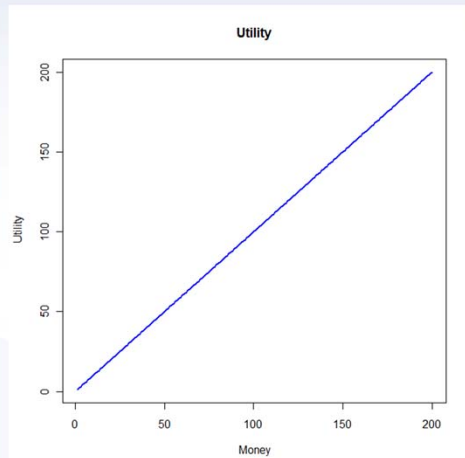
Forget about 48%...34% is still REALLY HIGH.

Even though I say these results are really high, similar results have been common in the experimental literature.

This puzzled experimental economists until Andersen and his coauthors said “ah-ha! You silly gooses, there’s nothing wrong with the data, but you’re interpreting the data wrong.”

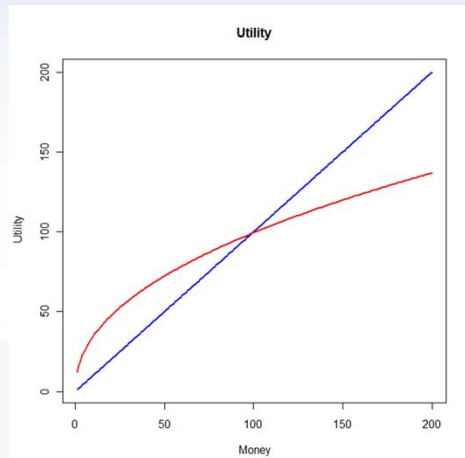
People aren’t as impatient as you thought, and the reason is that you haven’t controlled for diminishing marginal utility.

Interpreting the data



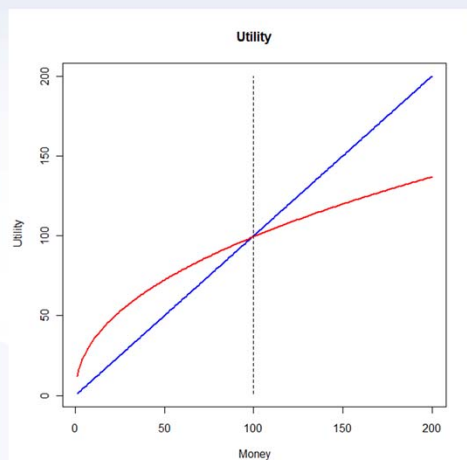
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Interpreting the data



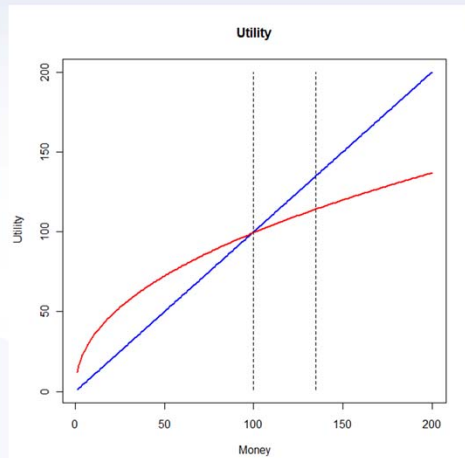
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Interpreting the data



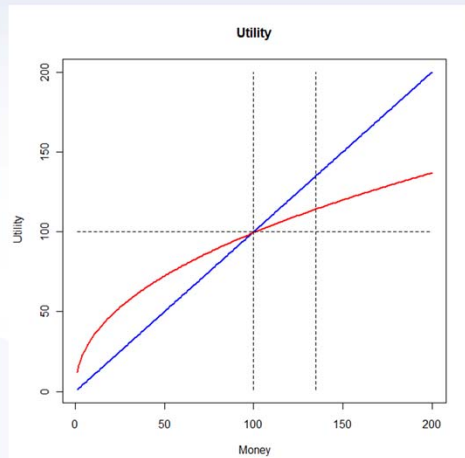
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Interpreting the data



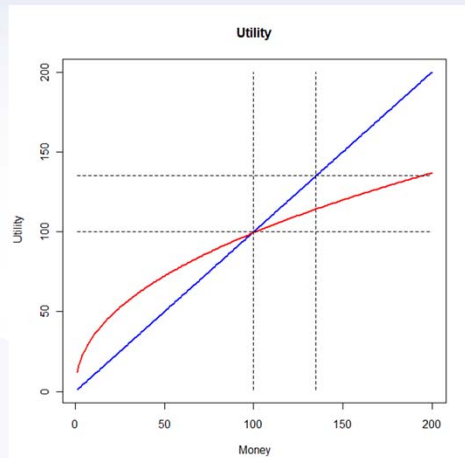
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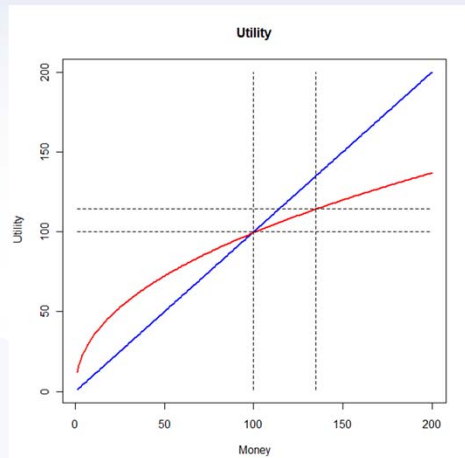
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Interpreting the data



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Interpreting the data



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Interpreting the discount rate

- Diminishing marginal utility: each extra dollar brings less than one unit of extra utility
- In order to deliver a given amount of utility, more money is needed
- A person with more rapidly diminishing marginal utility (more risk averse person) will demand more money in exchange for waiting
- Observing indifference between \$100 now and \$142 in a year could mean:
 1. A discount rate of 35%, or
 2. A discount rate of 15% with a risk aversion coefficient of 0.54



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Estimation Results

- In light of this...
- Aren't our results too high?
- If we had controlled for utility curvature, would we find much lower (more reasonable) rates of time preference?
- Our contention: No.
- Reason: Consumption smoothing
- If people take their time consuming payments, they can preserve the utility of the payments



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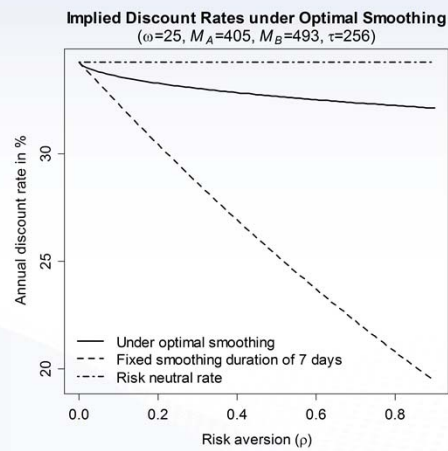
Illustration of Effect

Units	Total Utility
1	3
2	5
3	6



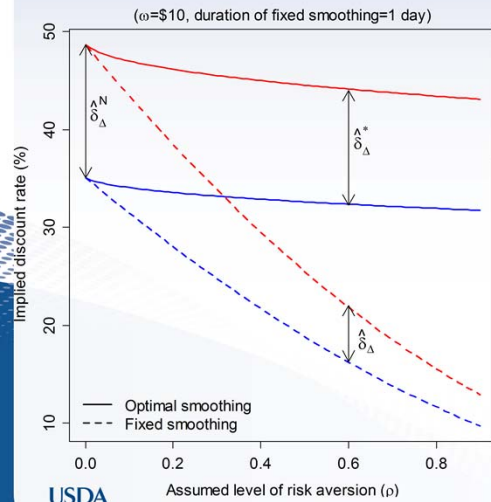
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Illustration of Effect



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Simulations under Optimal Smoothing



- Discount rate levels fall faster for fixed than optimal durations
- Difference between early and late adopters is relatively unaffected by risk aversion levels under optimal smoothing; Not true for a fixed duration of $\lambda=1$



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Review

- Discount rates are large (replicating lab-like levels) despite:
 - Field sample & high payment levels
 - Consideration of diminishing marginal utility (risk)
- The inferred difference between early and late adopters is maintained under a model of optimal smoothing
- Even under alternative scenarios of the differences in and levels of risk aversion and background consumption.



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Time preference & policy

- How can time preference behavior be utilized to enhance the outcomes of policies for a range of long-term USDA goals for conservation and production?
- Paying less (but over a shorter period of time) may
 - Lead to more uptake (matches preferences better)
 - Particularly influence late adopters (composition effect)



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