



# Observability, Nonpoint Source Pollution, and Information Costs

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# Nonpoint Source Pollution

- Nutrients in surface water are a problem and the National Water Quality Inventory indicated that livestock are major contributors to impaired rivers and lakes
- Adoption of effective manure management practices can improve water quality
- NPS – inability to observe emissions at reasonable cost → emphasis on voluntary adoption



- "Barriers to Adoption of Manure Management Practices by AFO's" is a 406 project developed to examine this issue
- An extension of the original project

# Literature Review

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- Literature on NPS pollution control instruments generally assumes that farmers have perfect information on the effect of adoption on profitability and water quality
  - The problem is thus one of information asymmetry; however farmers may not be aware of all the effects of their actions, even on-farm ones (pesticides and cancer)



# Adoption

- Adoption literature indicates that observability – whether one can observe the innovation (terraces) and the results (reduced erosion) increases adoption by providing information to farmers at low cost (Llewellyn et al.)
- “Trialability” (using a new corn variety on part of your land) implicitly assumes that the results are observable

# Environmental Impacts as Credence Goods?

- Search goods – can determine quality before purchase
- Experience goods – can determine quality after purchase (Nelson)
- Credence goods – costs of determining quality are prohibitively high and /or the effects occur with a time lag (Darby and Karni)
- Organic produce is an example (McCluskey)



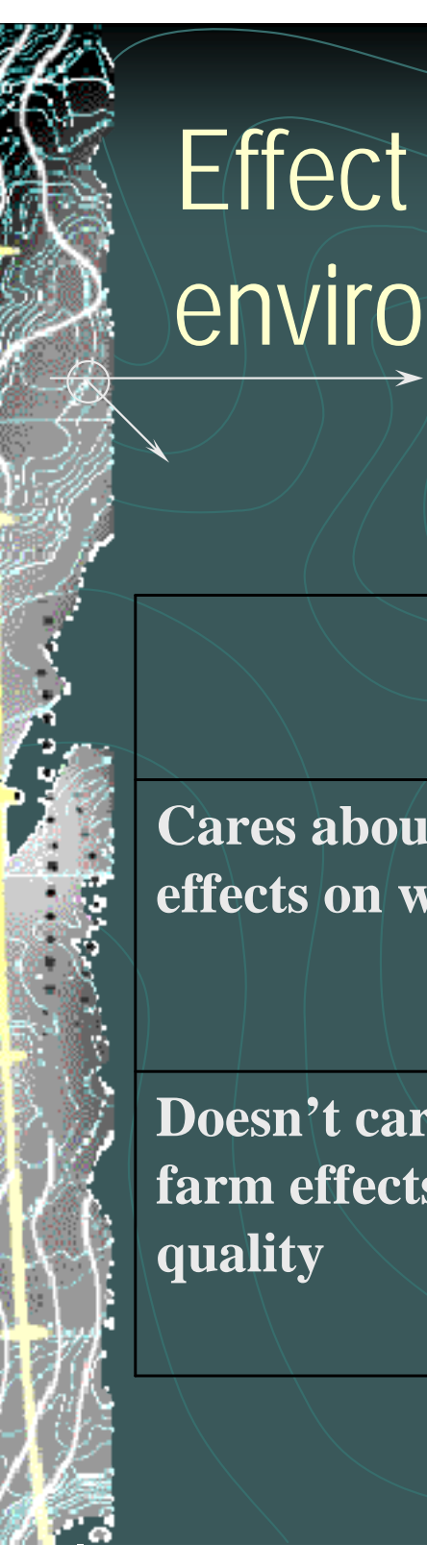
- All of these models of consumer behavior also assume that there is asymmetric information, the seller knows what is being provided but the buyer doesn't
- Barzel's work assumes that both buyers and sellers would incur measurement costs for attributes

# Hypothesis



- For farmers who gain utility from improved water quality, adoption will be higher if, *ceteris paribus*:
  - Laboratory tests or sophisticated modeling are not required
  - The result is readily observable or noticeable
  - The linkage is obvious
  - Non-stochastic process
  - Minimal time lag

# Effect of observability on adoption of environmental practices (same profitability)



	<b>Observable</b>	<b>Non-observable</b>
<b>Cares about off-farm effects on water quality</b>	<b>Adopt the practice</b>	<b>Don't adopt the practice</b>
<b>Doesn't care about off-farm effects on water quality</b>	<b>Don't adopt the practice</b>	<b>Don't adopt the practice</b>

# Examples



- Groundwater vs surface water awareness
- Cho et al. WTP for ↓ hardness vs copper
- “Brown, smelly” remark by Roxanne Johnson
- Quote from Iowa farmer about other farmers adopting what they SAW on his farm



# Data

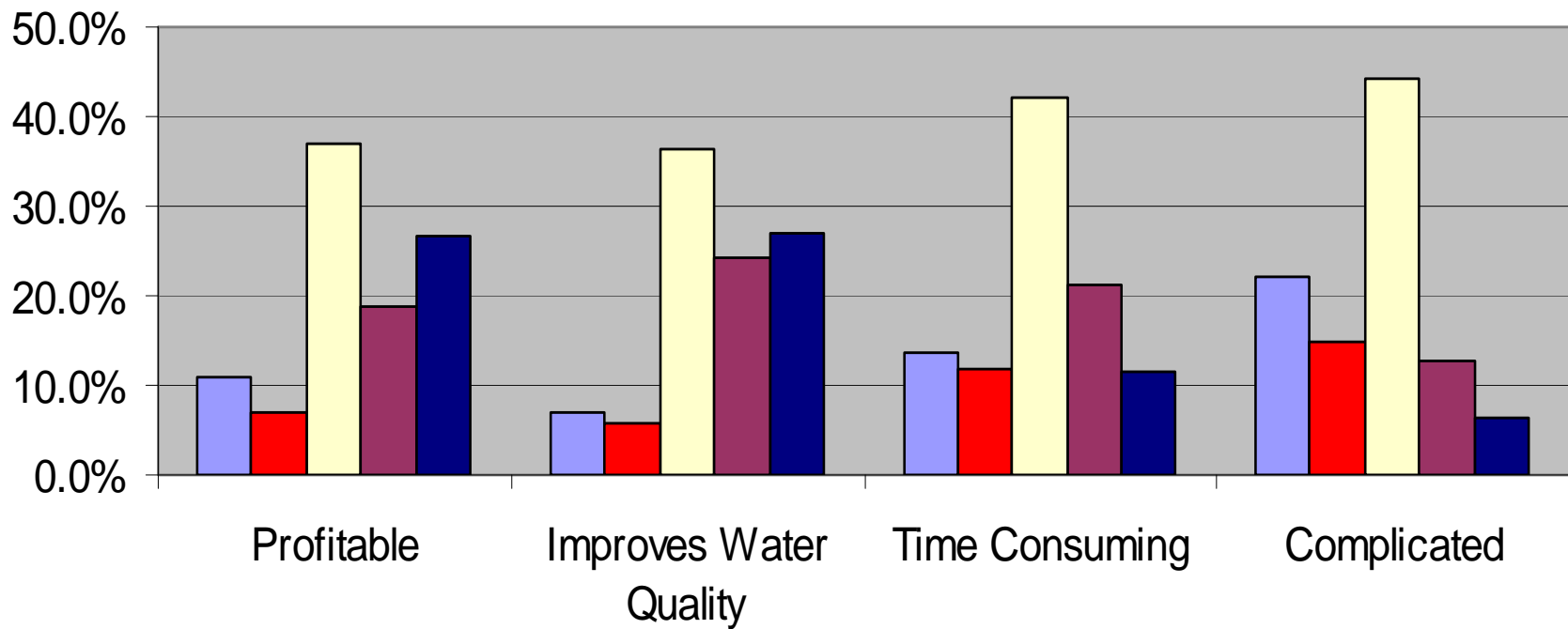
- Survey of MO and IA livestock farmers was conducted in spring 2006
- Effective response rate of 37.4% (Conduct your surveys in January!)
- Stratified by sales and species, under \$10,000 not sampled
- CAFOs excluded from this analysis to focus on voluntary adoption

# Results

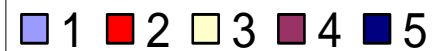


- Manure testing adoption rate of 28% (can reduce excess nutrient applications and thus runoff by combining this info with soil tests, appropriate calibration, etc.)
- Setbacks adoption rate of 62% (do not apply manure within 100 feet of a water body, reduces runoff)
- → manure testing effect less direct

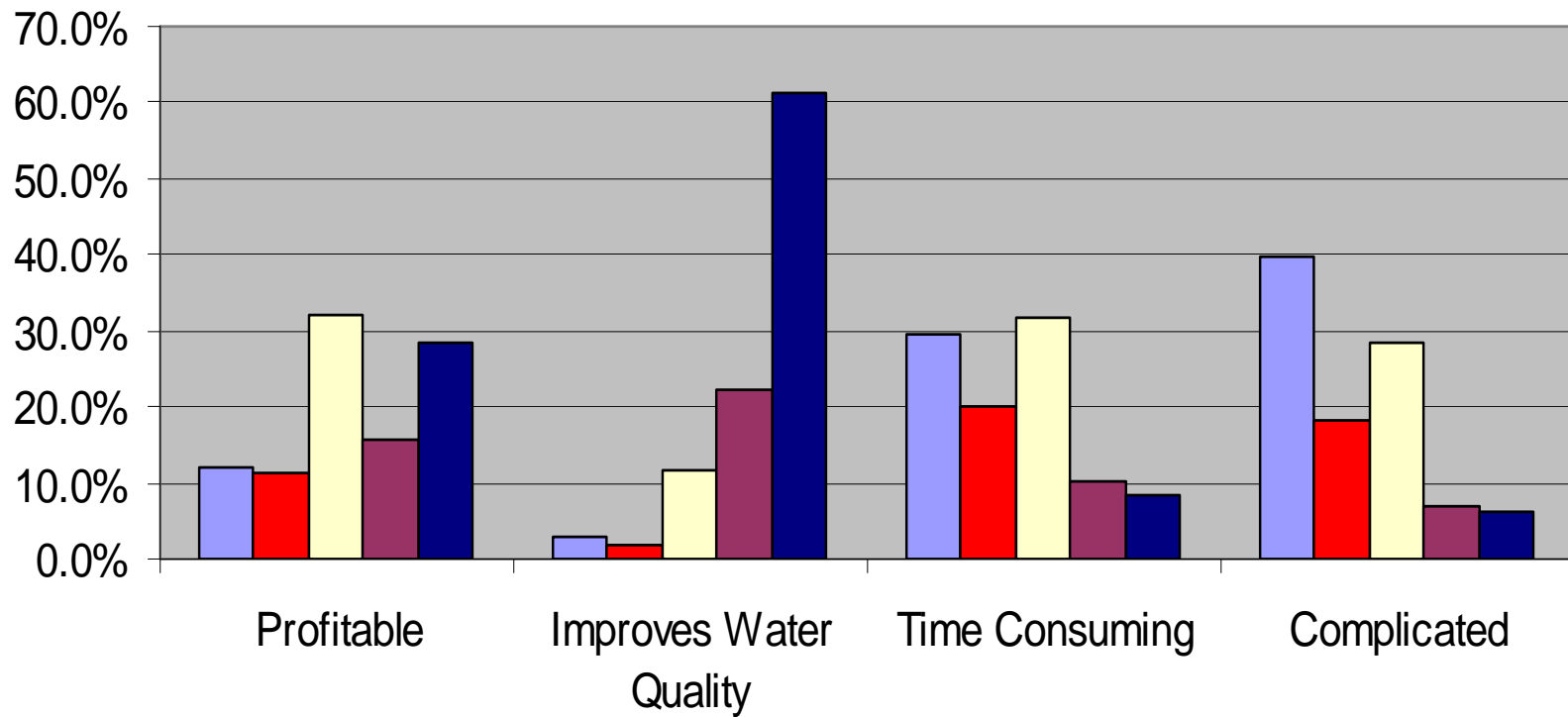
## Perceptions about Manure Test



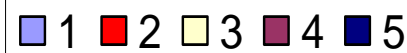
Likert Scale (1-strongly disagree to 5-strongly agree)




## Perceptions about Maintaining Setback



Likert Scale (1-strongly disagree to 5-strongly agree)





# Preliminary Probit model results

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- Perception of profitability increased adoption for both practices ( $p < 0.01$ )
  - Perception of effect on water quality was positive and significant ( $p < 0.05$ ) for setbacks but not for manure testing
  - If manure testing was perceived to be complicated, this reduced adoption ( $p < 0.01$ ) but there was no effect on setbacks
  - No effect of "time consuming" for either practice




- Having a lake or stream on the property made them more likely to adopt setbacks ( $p < 0.01$ ) but had no effect on adoption of manure testing
- Compared to a base off-farm income category of \$10,000 to 24,999, farmers with over \$100,000 were less likely to test manure ( $p < 0.10$ ) and farmers with \$50,000 -99,999 were more likely ( $p < 0.10$ ) to adopt setbacks (opportunity cost of time in both cases?)

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- Similarly, farmers who said that transportation costs affected where they applied manure were more likely to adopt setbacks ( $p < 0.05$ )
  - Farmers who indicated the smell of manure bothered them or their families (a noticeable attribute) were less likely to test manure ( $p < 0.01$ )
  - Concern about water quality had no effect (but the mean response was 4.2 on a scale of 1-5) nor did their agreement with "managing manure improves water quality".

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- Dairy farms were more likely to adopt manure testing ( $p < 0.05$ ) but less likely to adopt setbacks ( $p < 0.05$ ) than swine farms
  - Number of animal units was positively associated with adoption of manure testing ( $p < 0.01$ ) but there was no effect on either practice of farm sales category
  - Other variables that were not significant included age, education, expectations about future regulation, and number of highly erodible acres
  - Alternative model specifications and treatment of Likert scale variables will follow

# Summary and Conclusions

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- The two practices (which had similar perceptions regarding profitability) differed in their perceived effect on water quality and this had a significant effect on adoption. Also, those with water bodies on their land were more likely to adopt setbacks.
  - This provides support for the importance of observability but one would need to have objective information about the relative effect on water quality of these practices as well.



- For practices that are not easily observable, extra educational activities or new technologies may be appropriate
- Mark Risse example from Georgia
- Perhaps the old business adage should be modified to "What can be measured gets managed"
- Presentation of these and other results to NRCS, Extension professional audiences?



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