WILLINGNESS-TO-PAY FOR ECOSYSTEM SERVICES: DO PAYMENT ELICITATION MECHANISMS MATTER?

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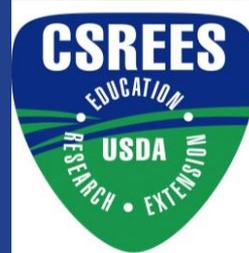
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Challenges in public goods provision

- Public goods and ecosystem services
  - Public goods are non-rival and non-excludable. (Davis and Holt 1993)
    - Non-rival: multiple consumers can consume the same unit of the good at the same time
    - Non-excludable: no one can be excluded from consuming the good, even those who do not pay
    - Examples of public goods include clean air, lighthouses, and national defense.
  - Ecosystem services are the benefits people obtain from ecosystems, and they are often public goods. (Millennium Ecosystem Assessment 2005)

Challenges in public goods provision

- Free-ridership problem
  - Public goods are an example of market failure, because consumers can enjoy the benefits without paying. (Davis and Holt 1993)
  - Almost everyone agrees that ecosystem services are valuable, but there are few tools for private action that account for the public's values. (Swallow et al. 2008)
- Policy options to enhance ecosystem services
  - Options like regulations and payment for ecosystem services programs can improve ecosystem services, but do not account for society's values.
  - Market approach
    - Reduce free-ridership by using payment elicitation mechanisms designed for public goods.

Research Goal

- To compare the field performance of payment elicitation mechanisms* for public goods
  - Measure willingness-to-pay for forest ecosystem services in Rhode Island
  - Examine the influences of socioeconomic characteristics on preferences

  * A payment elicitation mechanism is simply a method of eliciting payment from a consumer for a good.

Setting: Forest ownership and ecosystem services in Rhode Island

- Amphibian habitat, recreation uses, and scenic views

- Timber harvesting in Rhode Island

- Important tradeoffs for forest managers and policymakers

Conceptual Framework

- Four payment elicitation mechanisms were examined in this study:
    - Voluntary Contribution Mechanism (VCM)
    - Proportional Rebate Mechanism (PR)
    - Uniform Price Cap Auction (UPC)
    - Pivotal Mechanism (PM)

Voluntary Contribution Mechanism (VCM)

- Same as donations
- Simple: offers = contributions
- No features to reduce free-riding

Proportional Rebate Mechanism (PR)

- A threshold amount must be met or exceeded for the good to be provided.

- If offers meet or exceed the threshold, excess contributions are rebated to contributors in proportion to their offer.

- If offers do not meet the threshold, no one pays.

- In laboratory experiments and in theory, PR reduces but does not eliminate free-ridership.

Uniform Price Cap Auction (UPC)

- A threshold amount must be met or exceeded for the good to be provided.
- A capped price is determined that will meet the threshold such that all who offered at least the capped price will pay that price, and those who offered less pay their entire offer.
- The uniform price may seem fair.
- There could be an incentive to reduce your offer to pay a lower price.

Pivotal Mechanism (PM)

- A threshold amount must be met or exceeded for the good to be provided.
- The only consumers who pay are those whose contributions make a difference in reaching the threshold; all others pay nothing.
- Free-ridership incentives are eliminated, and the dominant strategy is to reveal your true value.
- However, PM is complex to understand and impractical as a fundraising method.

Hypothesis

Willingness-to-pay:
PM>UPC>PR>VCM

	Mechanism	Expected to:
PM	Pivotal Mechanism	Eliminate free riding
UPC	Uniform Price Cap Auction	Reduce free riding
PR	Proportional Rebate Mechanism	Reduce free riding
VCM	Voluntary Contribution Mechanism	Allow free riding

Data Collection

- Choice experiment survey
  - Design
  - Sections:
    - Payment mechanism description
    - Choice questions
    - Forest community opinions
    - Conservation program opinions
    - Socioeconomic questions
  - Implemented by mail in northwest Rhode Island: sample size of 800, response rate of 27.13%

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Attributes and levels of forest management contracts

Attribute	Levels
Increase in survival chance of local amphibian populations	Increase from 30%-45%
	Increase from 30%-60%
	Increase from 60%-75%
	Increase from 60%-90%
Number of acres protected	100 acres
	200 acres
	300 acres
	400 acres
Use of wooded land surrounding vernal pools	No access or views provided
	Roadside view
	Walking access and roadside view
	Walking and biking access and roadside view
Maximum cost per year	$10/year
	$35/year
	$60/year
	$90/year
	$120/year
	$150/year
	$175/year
	$200/year

Sample Choice Question

Question #2 Assume that these two contracts are the only options available to you today.			
	Contract A	**Contract B**	**Not Buy**
Increase in survival chance of local amphibian populations	Local survival chance increases from 60% to 75%	Local survival chance increases from 60% to 90%	No increase in the local populations' survival chance
Number of acres protected	100 acres	200 acres	No harvest restrictions
Use of wooded land surrounding vernal pools	Walking and biking access and roadside view	Roadside view	No access or views provided
Maximum Cost per Year	$35/year	$150/year	$0
Please check one of the boxes to indicate for which contract, if any, you would be willing to pay at most the stated amount.	☐ Contract A ($35/year)	☐ Contract B ($150/year)	☐ Neither Contract ($0)

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Framework for empirical models

Random utility framework (Hanemann 1984)

- Indirect utility: $U_{im} = V_{im} + e_{im}$

- An individual is assumed to choose alternative i if $U_{im} > U_{jm}$ for all $j \neq i$. Therefore, choices can be modeled as the probability of choosing alternative i as follows:

$$Pr[i\ chosen] = Pr[V_{im} + e_{im} > V_{jm} + e_{jm}],$$
$$\text{for all } j \in C, j \neq i,$$

where C is the set of all alternatives.

Empirical Models

☐ Tradeoffs between ecosystem services
  ☐ Nested logit model
☐ Role of payment mechanisms and heterogeneity in preferences
  ☐ Mixed logit model

Results:
Tradeoffs between ecosystem services

- Increases in amphibian survival rates from the base level of 30%-45% are preferred
- Amount of acres protected
  - Higher number of acres preferred
- Recreation options
  - Active recreation options (walking and biking) result in higher utility than no access
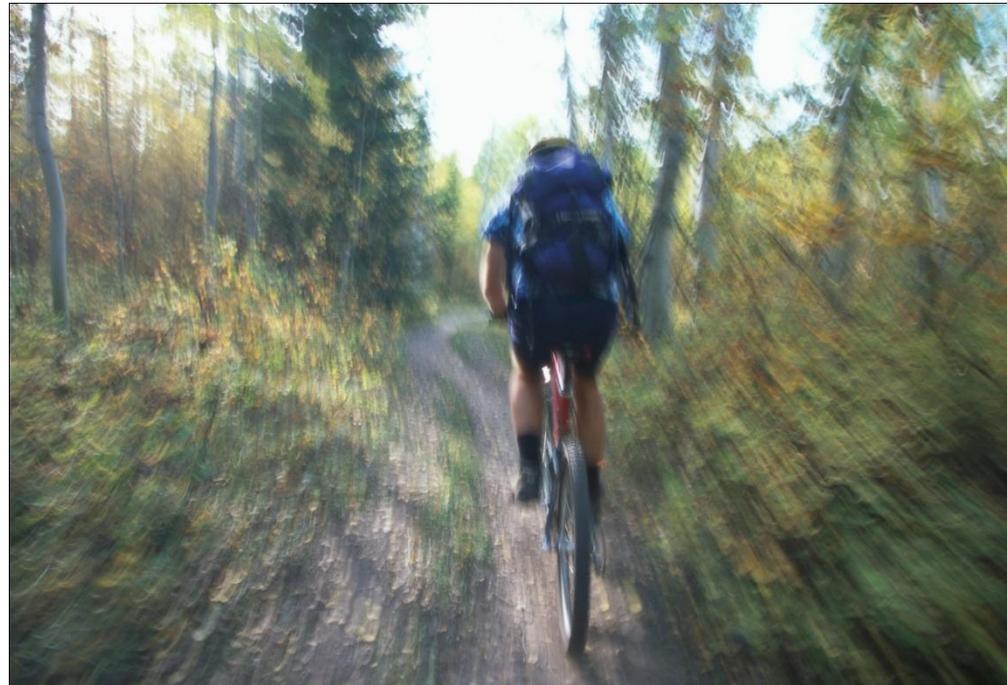
Results: Role of payment mechanisms

- Willingness-to-pay estimates:
  - VCM>PM>UPC>PR
    - *Hypothesis was: PM>UPC>PR>VCM*
  - Simple, familiar mechanism is preferred
  - Fairness also appears to be important

	Mechanism	Expected to:
PM	Pivotal mechanism	Eliminate free riding
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VCM	Voluntary Contribution Mechanism	Allow free riding

Results: Willingness-to-pay for ecosystem services

Table 13. Marginal Willingness-to-Pay Estimates for each Attribute Computed from Mixed Logit Models ($)

Variable	Pooled (1)	VCM (2)	PR (3)	UPC (4)	PM (5)
Survival chance increases 60%-90%	23.02*** (15.02)	30.31*** (21.70)	16.59*** (3.69)	20.32*** (4.49)	26.68*** (6.00)
Survival chance increases 60%-75%	11.28*** (4.07)	18.11*** (6.44)	9.91*** (3.19)	12.14*** (4.49)	15.94*** (5.31)
Survival chance increases 30%-60%	-3.04 (4.12)	-9.03 (5.74)	-4.94* (2.91)	-6.05* (3.55)	-7.94 (4.87)
Acres	0.15*** (0.02)	0.22*** (0.05)	0.12*** (0.02)	0.15*** (0.03)	0.19*** (0.04)
Walking and biking access and roadside view	20.66*** (4.99)	27.43*** (7.03)	15.01*** (4.62)	18.39*** (5.77)	24.15*** (6.69)
Walking access and roadside view	15.78*** (4.61)	25.83*** (7.19)	14.13*** (3.38)	17.31*** (4.59)	22.74*** (5.82)
Roadside view	-17.59*** (4.68)	-26.41*** (7.66)	-14.45*** (3.51)	-17.70*** (4.78)	-23.24*** (6.24)

*Significant at 10% level; ** significant at 5% level, *** significant at 1% level.
Standard errors were computed by the delta method and are in parentheses.

Results: Heterogeneity in preferences

- High utility for forest contracts: bikers, homeowners, those who favor public contributions, non-hikers

- Low marginal utility of income: opinions towards forest community amenities and public contribution to conservation programs

- High marginal utility of income: bikers, homeowners, those with children under 18

Implications

- For researchers:
  - Mechanism descriptions need further study to address complexity and practicality issues
  - Practice with the mechanisms could improve their performance

- For managers:
  - Socioeconomic characteristics of the population are an important consideration
  - Higher quality habitat is preferred

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Acknowledgements

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