

Lecture 13

Contingent valuation method

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AEM 4510

Roadmap

- How do stated preference methods differ from revealed preference methods?
- How do we do contingent valuation?

Stated vs revealed preference

Revealed preference methods

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Travel cost: visits to sites of different attributes and costs

We then used our economic theory to show how we could use the market prices/costs to reveal people's valuation for non-market goods

Stated preference methods

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This particular approach is called **contingent valuation**: a survey-based method for eliciting total economic values, usually WTP, that people place on goods, services, and amenities

Contingent valuation method (CVM)

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- Draws on psychology as well as economics
- Only valuation methods that can be used to estimate non-use value (although studies elicit total value; if non-users, we have non-use value)
- Very time-consuming and expensive if well done

Contingent valuation method (CVM)

CVM has had a lot of impact on policy:

- Executive and legislative: regulatory impact analysis (RIAs)
- Judicial: private litigation, government litigation

CVM history

1963: Robert Davis values changes in Maine recreational areas in Harvard PhD dissertation

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CVM history

1989: Exxon Valdez oil spill – non-use value losses estimated by CV method to exceed \$2.2 billion; Exxon launches research & campaign to discredit CV



CVM history

1992: NOAA Panel rules that results from CV studies were valid and sufficiently reliable for use in litigation (as “starting point”); also offers guidelines for future use

The screenshot shows a tweet from Beatrice Cherrier (@Undercoverhist). Her profile picture is a cartoon illustration of a person with a brain-like texture. The tweet text is: "1/ Loooong tweetstorm on use of contingent valuation method in Exxon Valdez case & what it says on how economics science & expertise work". Below the tweet is a small image of a TIME magazine cover featuring a man's face and the text "Special Report: The Times Square Bomber". At the bottom right, there is a link to "Contingent Valuation: Is Some Number Better than No Number?" and the journal citation "Journal of Economic Perspectives — Volume 8, Number 4 — Fall 1994 — Pages 45–64".

CVM applications

Damages from Exxon Valdez oil spill

CVM applications

Damages from Exxon Valdez oil spill

Damages from Deepwater Horizon oil spill

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Benefits from visibility improvements at the Grand Canyon

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Damages from Deepwater Horizon oil spill

Benefits from visibility improvements at the Grand Canyon

Benefits from improving water quality

How do we conduct a CVM study?

- Clearly identify the good/service and the (policy-induced) change in the good/service to be valued – oil spill on beach (what's valued? A day at the beach; a view of the beach, a degraded beach, water pollution?)

How do we conduct a CVM study?

- Clearly identify the good/service and the (policy-induced) change in the good/service to be valued – oil spill on beach (what's valued? A day at the beach; a view of the beach, a degraded beach, water pollution?)
- Identify whose values are to be estimated: geographical scope of “market” through focus group and pretest

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- Identify whose values are to be estimated: geographical scope of “market” through focus group and pretest
- Design information component of the survey instrument. Describe item to be valued, payment vehicle (tax, user fee, product prices)

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- Select a data collection mode: in person, mail, phone; and choose statistical sampling design
- Administer survey to a random sample of the market
- Conduct statistical analyses, do validity test, use elicited WTP for policy analysis

CVM components

Collect information on consumer's past, present, and expected future use of good, demographics, etc

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How do we elicit WTP?

CVM elicitation

There's a lot of options, some are better than others

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Ask for WTP (open-ended) – unfamiliar, few real markets in which we're asked to generate our reservation price

- "What is your max you would pay to create four self-sustaining wolf packs in four remote areas of Colorado?" This type of question is called "open-ended" CVM

CVM elicitation

Bidding Game – start with a WTP number, ask for yes-no response, then increase/decrease until indifference (Problem: starting-point bias)

- I ask, "Would you pay 1 dollar to create four self-sustaining wolf packs in four remote areas of Colorado?" If you say "yes", I can ask about 2 dollars. If you say yes to 2 dollars, then I ask a larger amount, etc. Questions stop when you say no. Can also play this game starting with a large amount and work down.

CVM elicitation

Payment Card – present a card with a set of possible payments, respondent circles largest value they would pay

- On the following payment card (a card with a bunch of different \$ amounts) circle the largest amount you would be willing to pay to create four self-sustaining wolf packs in four remote areas of Colorado. This is a payment-card question

CVM elicitation

Referendum (Discrete Choice) – start with different baseline WTP number for each respondent, get yes or no; stop. Minimizes bias, recommended by NOAA. Problem: requires more data, and so more costly

- "Creating four self-sustaining wolf packs in four remote areas of Colorado will increase your state taxes by 10 dollars a year for five years. Would you vote for such a proposal?" This is a "referendum CVM" question, dollar amounts vary across respondents)

CVM elicitation media

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Online Surveys: most common recently due to cost

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Online Surveys: most common recently due to cost

In-person survey: expensive, but reliable; recommended by NOAA Panel; problems: interviewer bias? socially-correct responses?

Potential CVM problems

Hypothetical Markets: We are asking people to value something in a market that isn't real, answers might not reflect real preferences

- "warm glow"
- Protest zeros
- Hypothetical bias: a tendency to overstate values (especially in terms of WTA instead of WTP) when no money is actually at stake

We try to address this with **entreaties**: scripts read before a stated preference survey to try to induce the respondent to not give a biased response

- Reminds respondents to consider budget constraint

Cheap talk (Cummings and Taylor, 1999)

... in a recent study, several different groups of people voted on a referendum just like the one you are about to vote on. Payment was hypothetical for these groups, as it will be for you. No one had to pay money if the referendum passed. The results of these studies were that on average, across the groups, 38 percent of them voted "yes". With another set of groups with similar people voting on the same referendum as you will vote on here, but where payment was real and people really did have to pay money if the referendum passed, the results on average across the groups were that 25 percent voted yes. That's quite a difference, isn't it?

Cheap talk (Cummings and Taylor, 1999)

This difference between hypothetical outcomes and real stakes outcomes is called **hypothetical bias**

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How can we get people to think about their vote in a hypothetical referendum like they think in a real referendum, where if enough people vote "yes," they'll really have to pay money? How do we get them to think about what it means to really dig into their pocket and pay money, if in fact they really aren't going to have to do it?

Cheap talk (Cummings and Taylor, 1999)

Let me tell you why I think that we continually see this hypothetical bias, why people behave differently in a hypothetical referendum than they do when the referendum is real. I think that when we hear about a referendum that involves doing something that is basically good – helping people in need, improving environmental quality, or anything else – our basic reaction in a hypothetical situation is to think: sure, I would do this. I really would vote "yes" to spend the money....

Cheap talk (Cummings and Taylor, 1999)

But when the referendum is real, and we would actually have to spend our money if it passes, we think a different way. We basically still would like to see good things happen, but when we are faced with the possibility of having to spend money, we think about our options: if I spend money on this, that's money I don't have to spend on other things... we vote in a way that takes into account the limited amount of money we have.... This is just my opinion, of course, but it's what I think may be going on in hypothetical referenda.

Cheap talk (Cummings and Taylor, 1999)

So if I were in your shoes... I would ask myself: if this were a real referendum, and I had to pay \$10.00 if the referendum passed: do I really want to spend my money this way? If I really did, I would vote yes; if I didn't, I would vote no....

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So if I were in your shoes... I would ask myself: if this were a real referendum, and I had to pay \$10.00 if the referendum passed: do I really want to spend my money this way? If I really did, I would vote yes; if I didn't, I would vote no....

In any case, I ask you to vote just exactly as you would vote if you were really going to face the consequences of your vote: which is to pay money if the proposition passes. Please keep this in mind in our referendum.

"Cheap talk" referendum question

The Nature Conservancy Proposition:

“Everyone here in the room will contribute \$10.00 to the Georgia Chapter of the Nature Conservancy. The contribution is to be used for the purpose of purchasing additional lands in the state of Georgia to be protected and held in stewardship by the Nature Conservancy.”

"Cheap talk" referendum question

Ask this question to three groups:

- real referendum
- hypothetical referendum
- hypothetical referendum with cheap talk

Potential CVM problems

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We need to make the respondent believe their answer matters for passage (i.e., it's "pivotal") and that they will have to pay what they say (no free riding)

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Value Cues: Does the way that the question is asked suggest a correct answer to the respondent (e.g., starting-point bias, yea-saying bias)

CVM example: Improvements in the Adirondacks

Major air quality initiatives have cited reduced acid precipitation as a benefit of further reductions in sulfur dioxide (SO₂) and nitrogen dioxides (NO_x)

- 1990 Clean Air Act Amendments
 - 2005 Clean Air Interstate Rule
 - 2004 Clear Skies Proposal

CVM example: Improvements in the Adirondacks

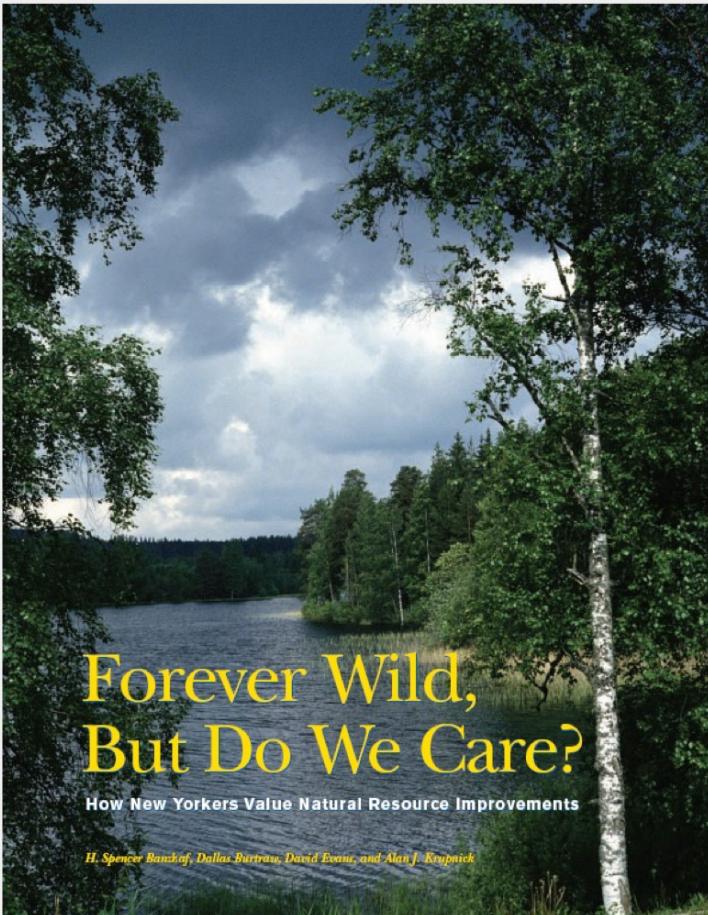
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Programs are costly: clear skies cost 4.3 bil. (2010) rising to 6.3 bil. (2020)

- Aggregated benefits estimated to be 336 million to 1.1 billion (accounting for statistical uncertainties these estimates could halve or double)

CVM example: Improvements in the Adirondacks



The survey introduces an intervention where New York State would run a tax-financed program to drop lime from airplanes onto lakes and affected forests to neutralize the acidity

This was a necessary ruse that was accepted by respondents

Summary of the science

Adirondack Park covers 20% of NY State: **three times the area of Yellowstone National Park**

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Adirondack Park has:

- 6 major river basins, 3000 lakes
- Largest set of old growth forests in the east
- 33 tree species, lots of native plants
- 9 million visitors

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In 1984: 19% of lakes chronically acidic

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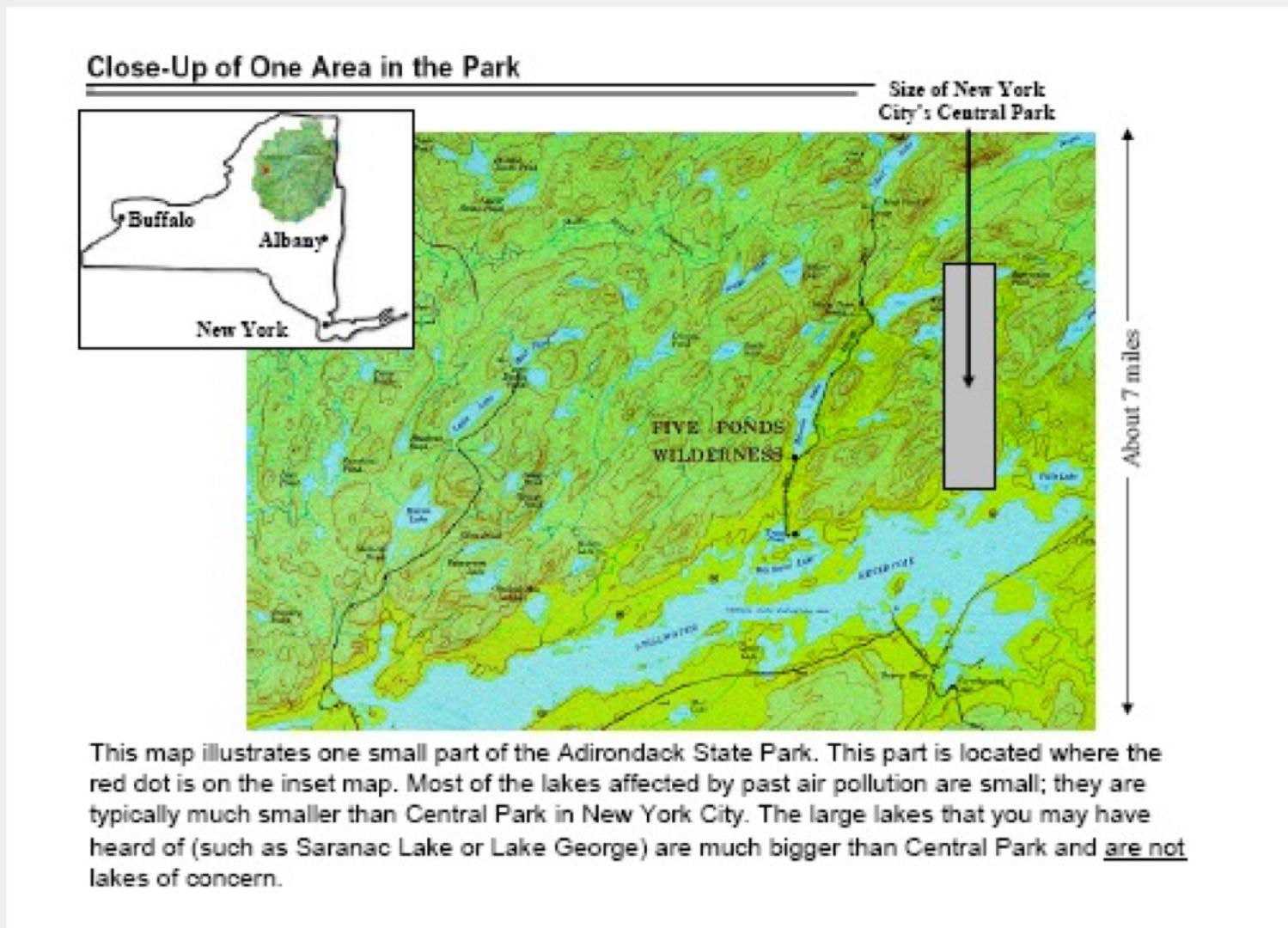
Depending on chemical thresholds under the 1990 CAAA, this could fall to 11% by 2040 or rise to 43 percent

Summary of the science

Table 1. Summary of the Science of Acid Precipitation at Adirondacks Park

Science	Instrument
Approximately 3,000 lakes, mostly small; half degraded or devoid of fish.	In description.
Fish decline attributable to acidification through aluminum mobilization; some from natural causes.	In description.
Effect on forests, but less well understood. Possible effect on birds.	Base case: Effect on one tree and two bird species. Scope case: Effect on three tree and four bird species.
1990 CAAA reductions leave stable ecological baseline or improving slightly; potential of nitrogen saturation.	Base case: Baseline not worsening, not improving. Scope case: Baseline worsening.
Uncertainty in time period for recovery; uncertain time period to nitrogen saturation.	Uncertainty excluded.
No health effects.	Explicitly addressed and excluded in instrument.
Expected changes from lower acidification include improvements in between 20% and 40% of lakes; small improvements in forests and bird populations.	Base case: 20% increase in lakes that support fish in ten years. Slight improvements to forests and birds. Scope case: 40% improvement in lakes that support fish in ten years; larger improvements in more types of forest and bird populations.

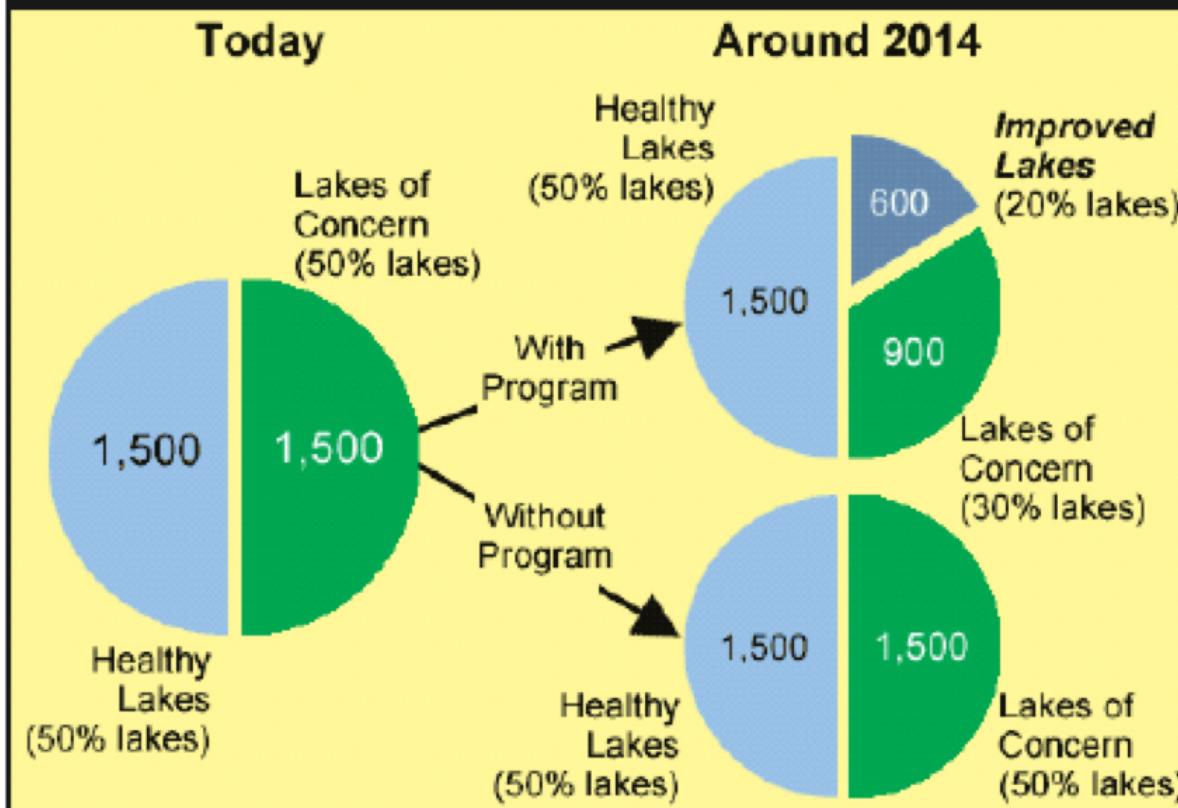
ADK map



Eliciting WTP

Here is a picture of how the program will affect the lakes:

About 600 lakes of concern have the right soils and chemistry to benefit from liming. The other 900 lakes of concern would not be helped by the improvement program.



Eliciting WTP

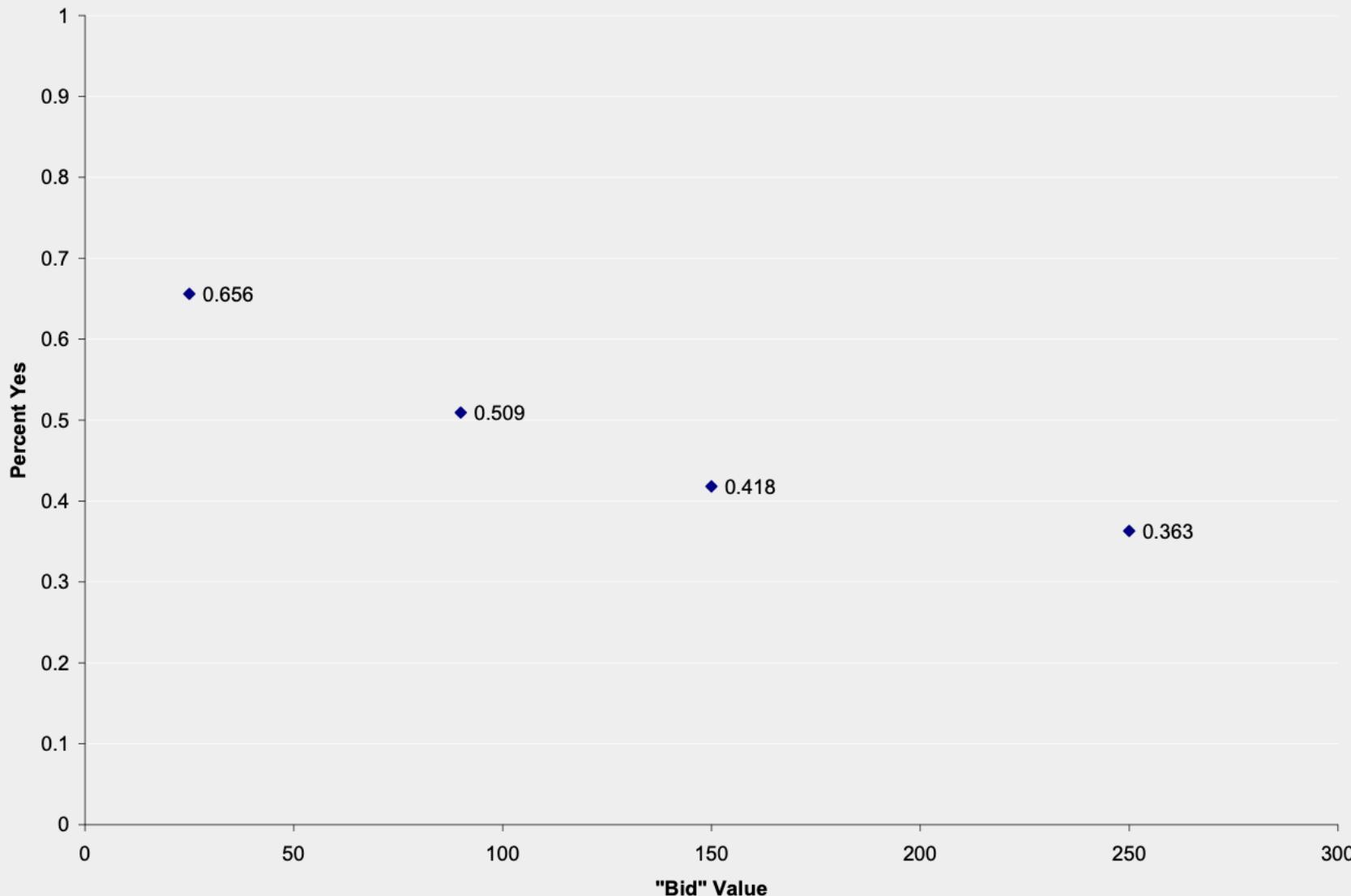
If the majority of voters support this program, your household's share of its cost would be \$250 [\$900, \$1500, \$2500] in total, or \$25 [\$90, \$150, \$250] per year, paid as an additional tax over the next ten years

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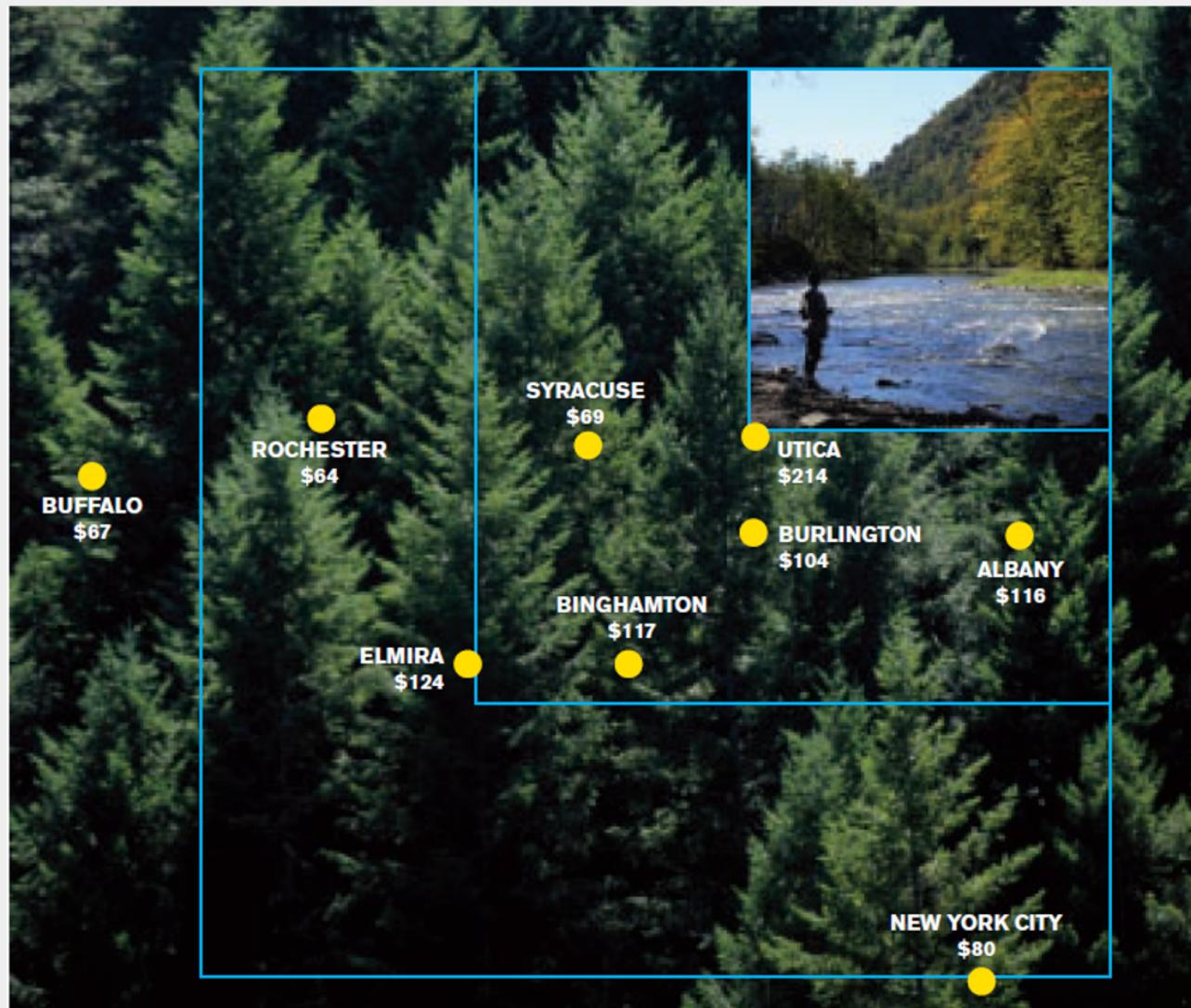
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If a vote were held today, would you vote For the program or Against it? [Yes / no] (Circle one answer)

WTP for base scenario



Average WTP by region



WTP estimates

Depending on improvement scenario and estimation method, estimated median WTP ranged from 48 to 159 dollars per household per year

WTP estimates

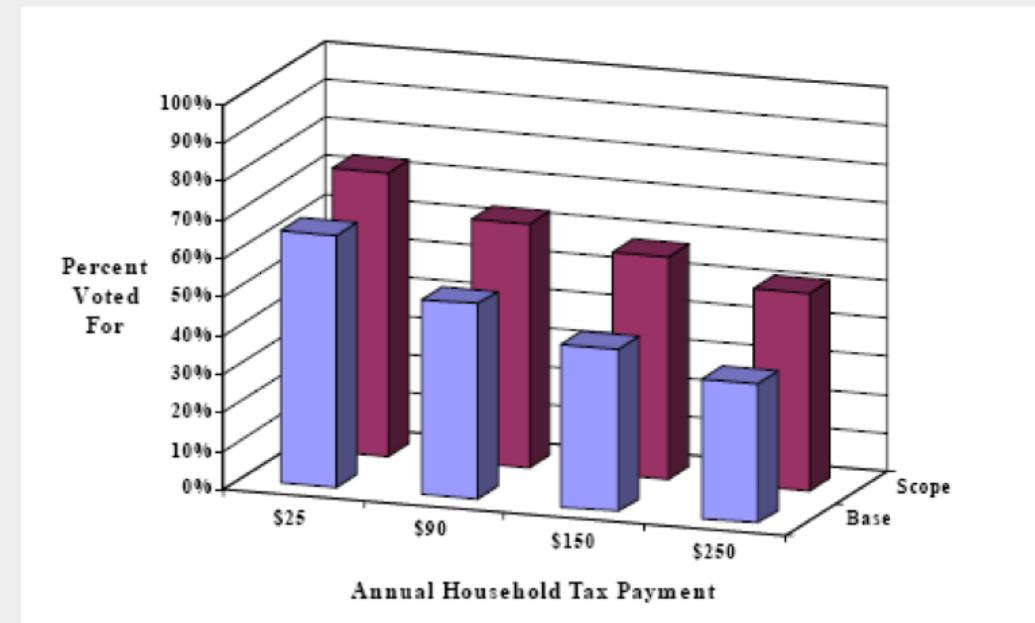
Depending on improvement scenario and estimation method, estimated median WTP ranged from 48 to 159 dollars per household per year

Aggregated across 7 million residents in NY state and using a range of discount rates, estimate aggregate annualized benefits of 336 million to 1.1 billion dollars

Test for validity

WTP increased with:

- Income
- Personal stake (e.g. frequency of visits)
- Proximity
- Self-stated environmentalist, liberal, etc



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Second largest spill after 2010 Deepwater Horizon

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The punitive damages were reduced to \$507.5 million after multiple appeals including the last one to the Supreme court

CVM and Exxon Valdez

“Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez” by Richard T. Carson, Robert C. Mitchell, W. Michael Hanemann, Raymond J. Kopp, Stanley Presser, and Paul A. Ruud

We will look at their survey instrument to see how "best practices" are followed



CVM and Exxon Valdez: background

A-10A. SHOW MAP 2²⁶

This map shows Prince William Sound. (PAUSE) It is an enlargement of the area shown in blue on Map 1 (SHOW). The Sound is a body of salt water, a little over one hundred miles wide. As you can see, it has many islands and inlets, so its coastline is several hundred miles long (TRACE OUT PORTION OF COAST).

From Valdez (POINT) this is the route the tankers use to the Gulf of Alaska (TRACE ROUTE), a journey of 75 miles.

They leave Prince William Sound for the open sea here. (POINT AT PLACE WHERE THE TANKERS ENTER THE GULF OF ALASKA)

CVM and Exxon Valdez: background



CVM and Exxon Valdez: background

BOX A

SHOW PHOTO A

This photograph shows Valdez from the air. This is the town (POINT) and across from the town is the terminal where the oil is piped onto tankers (POINT). These are some tankers (POINT).

The tankers go through the narrows here (POINT) into Prince William Sound. The Exxon Valdez tanker went aground on an underwater reef about here (POINT).

This whole area (POINT) is Prince William Sound.

SHOW PHOTO B

The next photo shows a view of part of the Sound.

As you can see, it is ringed with high mountains. In many areas there are glaciers that break up and produce small icebergs. This photo shows the Columbia Glacier which is more than 100 feet high (POINT TO GLACIER WALL). Icebergs from this glacier sometimes float into the shipping lanes.

SHOW PHOTO C

As you can see in the next photo, the area is largely undeveloped.

Most of the land has been set aside as national forest and state parks. People use the area for fishing, boating, camping and other recreation. In the whole area there are only a few small towns. (PAUSE)

CVM and Exxon Valdez: background



CVM and Exxon Valdez: wildlife

This part of Alaska is also home to a great deal of wildlife.

A number of different types of birds, including sea ducks, bald eagles, grebes, and murres live in the area.

SHOW PHOTO D

The next photo shows sea gulls (POINT) and cormorants (POINT) at a nesting site on a cliff.
(PAUSE)

SHOW PHOTO E

The next photo shows a group of murres. (PAUSE)

In addition to the birds, animals such as sea otters and seals live around the Sound.

SHOW PHOTO F

Here is a sea otter floating on the water. (PAUSE)

CVM and Exxon Valdez: wildlife



CVM and Exxon Valdez: spill

SHOW PHOTO G

The next photo shows a tanker sailing through the Sound. (PAUSE)

About two tankers a day or over 700 tankers a year make this journey. Many are supertankers which are as long as three football fields.

The supertanker Exxon Valdez was carrying slightly more than 53 million gallons of Alaskan crude oil when it ran aground on an underwater reef.

The 11 million gallons that spilled made it the largest oil tanker spill to occur in United States waters. Winds and tides spread the oil over a large part of Prince William Sound and part of the Alaskan coastline outside the Sound.

CVM and Exxon Valdez: spill

Because of the wind and currents, some shore was heavily oiled, some lightly oiled, and much was not affected at all. The oiling was heaviest in Prince William Sound.

Most of the affected shore outside Prince William Sound was only very lightly oiled. (POINT)

SHOW MAP 4

This map shows how the oil spread in Prince William Sound. (PAUSE) The red color shows where the shore was more heavily affected (POINT) and the purple where the effects were lighter. You can also see that many areas of shore were not affected by the spill (POINT).

SHOW PHOTO H

The next photo shows a heavily oiled shore soon after the spill. As you can see, the oil covered the rocks near the water (POINT).

SHOW PHOTO I

The next photo is a close-up view of a very heavily oiled shore in Prince William Sound before the cleanup. (PAUSE)

CVM and Exxon Valdez: spill

As you may know, Exxon made a large effort to clean up the oil on the beaches.

SHOW PHOTO J

The next photo shows some of the cleanup activity that took place in the summer after the spill. One of the cleanup techniques was to wash as much of the oil as possible off the shore into the water where it was scooped up by special equipment and taken away. It was not possible to remove all the oil from the rocky beaches in this way because some had already soaked into the ground and couldn't be washed out. Scientists believe that natural processes will remove almost all the remaining oil from the beaches within a few years after the spill. (PAUSE)

CVM and Exxon Valdez: clean up



CVM and Exxon Valdez: wildlife consequences

BOX B

During the period of the spill there were about one and a half million seabirds and sea ducks of various species in the spill area inside and outside Prince William Sound. (POINT)

As you can see from this card, 22,600 dead birds were found. (POINT)

The *actual* number of birds killed by the oil was larger because not all the bodies were recovered. Scientists estimate that the total number of birds killed by the spill was between 75,000 and 150,000.

About *three-fourths* of the dead birds found were *murrels*, the black and white bird I showed you earlier. This is shown on the first line of the card. (POINT)

Because an estimated 350,000 murres live in the spill area, this death toll, though high, does *not* threaten the species.

One hundred of the area's approximately 5,000 bald eagles were also found dead from the oil.

The spill did *not* threaten any of the Alaskan bird species, including the eagles, with extinction. (PAUSE)

Bird populations occasionally suffer large losses from disease or other natural causes. Based on *this* experience, scientists expect the populations of all these Alaskan birds to recover within 3 to 5 years after the spill. (PAUSE)

CVM and Exxon Valdez: wildlife consequences

SHOW CARD 5²⁸

The only mammals killed by the spill were sea otters and harbor seals. This card shows information about what happened in Prince William Sound. According to scientific studies, about 580 otters and 100 seals in the Sound were killed by the spill. Scientists expect the population size of these two species will return to normal within a couple of years after the spill.

Many species of fish live in these waters. Because most of the oil floated on the surface of the water, the spill harmed few fish. Scientific studies indicate there will be no long-term harm to any of the fish populations.

CVM and Exxon Valdez: hypothetical market

A-13B. In the little over ten years that the Alaska pipeline has operated, the Exxon Valdez spill has been the only oil spill in Prince William Sound that has harmed the environment.

Some precautions have already been taken to avoid another spill like this. These include checking tanker crews and officers to see if they have been drinking, keeping a supply of containment equipment in Valdez, putting trained cleanup crews on 24 hour alert, and improving the Coast Guard radar.

Congress has also recently required all new tankers to have two hulls instead of one. The Exxon Valdez, like most other tankers, had only a single hull. Double hulls provide more protection against oil leaking after an accident.

However, it will take ten years before all the single hulled tankers can be replaced. Scientists warn that during this ten year period another large spill can be expected to occur in Prince William Sound with the same effect on the beaches and the wildlife as the first spill.

CVM and Exxon Valdez: hypothetical market

In order to prevent damage to the area's natural environment from another spill, a special safety program has been proposed.

We are conducting this survey to find out whether this special program is worth anything to your household.

Here's how the program would work.

Two large Coast Guard ships specially designed for Alaskan waters will escort each tanker from Valdez all the way through Prince William Sound until they get to the open sea. These escort ships will do two things.

First, they will help prevent an accident in the Sound by making it very unlikely that a tanker will stray into dangerous waters. (PAUSE)

Second, if an accident does occur, the escort ships will carry the trained crew and special equipment necessary to keep even a very large spill from spreading beyond the tanker. (PAUSE)

CVM and Exxon Valdez: hypothetical market

This drawing shows how this would be done. (PAUSE)

SHOW CARD 6²⁹

Escort ship crew would immediately place a boom that stands four feet above the water and five feet below the water, called a Norwegian sea fence, around the entire area of the spill. (POINT IF NECESSARY) Because oil floats on the water, in the first days of a spill, the sea fence will keep it from floating away. The oil trapped by the sea fence would be scooped up by skimmers, and pumped into storage tanks on the escort ships. Within hours, an emergency rescue tanker would come to the scene to aid in the oil recovery and transport the oil back to Valdez.

This system has been used successfully in the North Sea by the Norwegians.

CVM and Exxon Valdez: hypothetical market



CVM and Exxon Valdez: hypothetical market

SHOW CARD 7³⁰

This card summarizes what the program would prevent in the next ten years. Without the program (POINT) scientists expect that despite any other precautions there will be another large oil spill that will cause the same amount of damage to this part of Alaska as the last one. (PAUSE)

With the program they are virtually certain there will be no large oil spill that will cause damage to this area.

CVM and Exxon Valdez: hypothetical market

A-14B. Because two tankers usually sail from Valdez each day, the Coast Guard would have to maintain a fleet of escort ships, skimmers, and an emergency tanker, along with several hundred Coast Guard crew to run them.

Although the cost would be high, the escort ship program makes it virtually certain there would be no damage to Prince William Sound's environment from another large oil spill during the ten years it will take all the old tankers to be replaced by double-hulled tankers.

It is important to note that this program would not prevent damage from a spill anywhere else in the United States because the escort ships could only be used in Prince William Sound.

CVM and Exxon Valdez: valuation

If the program was approved, here is how it would be paid for.

All the oil companies that take oil out of Alaska would pay a special one time tax which will reduce their profits. Households like yours would also pay a special one time charge that would be added to their federal taxes in the first year and only the first year of the program.

This money will go into a Prince William Sound Protection Fund. The one time tax will provide the Fund with enough money to pay for the equipment and ships and all the yearly costs of running the program for the next ten years until the double hulled tanker plan takes full effect. By law, no additional tax payment could be required.

CVM and Exxon Valdez: valuation

If the program is approved, the oil companies that bring oil through the Alaska pipeline (including Exxon) will have to pay part of the cost by a special tax on their corporate profits.

A-14E. Because everyone would bear part of the cost, we are using this survey to ask people how they would vote if they had the chance to vote on the program.

We have found some people would vote for the program and others would vote against it. Both have good reasons for why they would vote that way.

Those who vote for say it is worth money to them to prevent the damage from another large spill in Prince William Sound.

Those who vote against mention concerns like the following.

CVM and Exxon Valdez: valuation

A-15. Of course whether people would vote for or against the escort ship program depends on how much it will cost their household.

At present, government officials estimate the program will cost your household a total of \$[specified amount here]. You would pay this in a special one time charge in addition to your regular federal taxes. This money would only be used for the program to prevent damage from another large oil spill in Prince William Sound. (PAUSE)

If the program cost your household a total of \$(amount) would you vote for the program or against it?

CVM and Exxon Valdez: valuation

A-16. What if the final cost estimates showed that the program would cost your household a total of \$(amount)? Would you vote for or against the program?

A-17. What if the final cost estimates showed that the program would cost your household a total of \$(amount)? Would you vote for or against the program?

CVM and Exxon Valdez: valuation

Table 1. Program Cost by Version and Question

Version	A-15	A-16	A-17
A	\$10	\$30	\$5
B	\$30	\$60	\$10
C	\$60	\$120	\$30
D	\$120	\$250	\$60

CVM and Exxon Valdez: valuation

Version A	0 - 5	5 - 10	10 - 30	30 - ∞
Version B	0 - 10	10 - 30	30 - 60	60 - ∞
Version C	0 - 30	30 - 60	60 - 120	120 - ∞
Version D	0 - 60	60 - 120	120 - 250	250 - ∞ .