Voluntary Approaches to Environmental Protection and Resource Conservation: An Economics Perspective

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Standard Typology of VAs

- Unilateral initiatives (self-regulation)
- Negotiated agreements (bilateral, multi-lateral)
- Public voluntary programs
- (Information disclosure programs)

Some examples

Pollution control/energy conservation:

- Danish energy agreements
- US 33/50 Program
- European washing machine agreement
- OPower home energy reports

Conservation:

- US Conservation Reserve Program and EQIP
- Mexico's Payments for Hydrological Environmental Services (deforestation)
- Fishing cooperatives ("sectors")
- Dolphin-safe tuna

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Perceived Advantages of VAs

- Cost savings from increased flexibility
- Improved information flows
- Reduced confrontation
- Reduced implementation delays
- Income support

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Perceived Disadvantages of VAs

- Ineffective
- Not economically efficient
- Can delay imposition of effective policies
- Payments can be costly (social cost of funds, entry)

Evaluating VAs

Three economic criteria:

1. Effectiveness → did VA lead to an improvement?

   Need to compare outcome with a counter factual (hypothetical) outcome/baseline

   - Relative to outcome under no policy/no action (BAU)
   - Relative to outcome under alternative policy

2. Cost-effectiveness → was it achieved at least cost?
   - At individual level (need flexibility)
   - In aggregate (need equal marginal costs across firms)

3. Efficiency → did improvement increase/maximize net benefits (benefits minus costs)?

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Aggregate amount of pollution reduction or conservation depends on:

- Number of participants
- Amount of abatement (conservation) undertaken by each participant
- Impact on the number of polluting (resource degrading) individuals or firms

These, in turn, depend on:

- Design issues
- Individual/firm characteristics
- Market structure

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Design Issue 1: Participation Incentives

Two key features of VAs:

1. Participation is not compulsory and cannot be enforced by law

2. Individuals/firms only participate if they feel it is in their best interest (as they define it)

→ Need to consider participation incentives ("participation constraint")

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Design Issue 1: Participation Incentives (cont.)

Motives for participation:

- Environmental stewardship
  - "green preferences"
  - Social norms
- Market-based incentives
  - Through input markets (e.g., suppliers, capital markets)
  - Through output markets (e.g., "green" demand or consumer protection – public vs. private goods)
- Benefits from cooperation
  - Due to oligopolistic market structure (e.g., product-based VAs)
  - Due to "tragedy of commons" (e.g., fisheries)

Design Issue 1: Participation Incentives (cont.)

Motives for participation (cont.):

- Incentive payments (from governments, NGOs, individuals): "Payments for Ecosystem/Environmental Services" (PES)

- Regulatory threats/exemptions
  - Credibility of threat

Design Issue 1:
Participation Incentives (cont.)

General principle:

Participation incentives depend not only on the benefits of participation but also on the costs of participation (i.e., obligations under VA)

→ there is often a tradeoff, i.e., greater obligations lead to lower participation, and vice versa

→ Need to consider both simultaneously

Design Issue 2:
Stringency of Requirements (Target)

When regulator is involved in designing VA, it must be mutually beneficial → target must lie between:

(1)Maximum amount an individual/firm would be willing to undertake voluntarily , and

(2)Minimum amount regulator would be willing to accept

These depend on expected outcomes/returns for both if VA fails, i.e.,, outcomes under alternatives

→ can influence outcome of VA not only through design of VA but also through alternatives

Design Issue 2:
Stringency of Requirements (cont.)

When VA involves "sale" of environmental services, sale must be mutually beneficial → target must be set so that:

(1)Maximum amount purchaser would be willing to pay exceeds

(2)Minimum amount provider would be willing to accept

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Design Issue 3:
Practice vs. Performance-based VAs

Targets (and compliance) can be based on:

1. Inputs: actions or practices (design stds), or
2. Outputs: environmental performance/outcome (performance stds)

General principles:

1. Performance standards are generally more efficient than design standards
   - More flexible → more cost-effective
   - Less opportunity for shifting/avoidance
   - Promote innovation and technology adoption
2. Standards should be as closely linked to objectives as possible

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Design Issue 3:
Practice vs. Performance based VAs

Challenges in setting performance standards:

- Monitoring performance can be difficult, depending on context (e.g., emissions vs. species conservation)
- Lack of control over other factors affecting performance could dampen incentives
- Uncertainty would generate risk for participants → negative welfare effects if participants are risk averse

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Design Issue 4: Targeting

Heterogeneity regarding benefits and costs → need to target incentives

Possible approaches:

1. Cost targeting
2. Benefit targeting
3. Benefit-cost targeting
   - More efficient
   - Requires more information

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Design Issue 4: Targeting (cont.)

Issues:

- Changes in benefits and costs over time → need to adjust incentives/targeting over time

- Asymmetric information about benefits and/or costs → need to induce revelation of information increases cost to regulator

Design Issue 5: Additionality

Ensure that realized actions or outcomes would not have been realized without VA

- Equity issues ("getting something for nothing")
- Efficiency issues
  - Inefficient use of scarce resources
  - Assessment of benefits and costs and stringency of target

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Design Issue 6: Slippage/Leakage

VA can induce increased degradation outside the program, stemming from:

- Substitution of production from enrolled to non-enrolled entities/activities
- Intensification of damaging activities
- Output price effects from decreases in supply or increases in demand (wealth effects)
- Payment effects that induce entry or deter exit from the market

Design Issue 7: Individual vs. Group VAs

Issues regarding group VAs:

- Free-riding
- Strategic interaction, including collaboration/collusion
- Multiple equilibria and coordination
- Communication/information sharing
- Risk pooling

Design Issue 8:
Monitoring and Enforcement
(if not self-enforcing)

Requires:

- Observability
- Accountability
- Credible sanctions/consequences for non-compliance

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Design Issue 9: Distributional Impacts

Differential impacts can be evaluated based on:

- Size groups (e.g., small vs. large firms)
- Income groups (e.g., poor vs. wealthier farmers)
- Factor markets (e.g., labor vs. capital)
- Price effects (e.g., consumers vs. producers)
- Geographic regions (e.g., rural vs. urban, north vs. south)

Summary of Necessary Conditions for Success

- Sufficiently strong participation incentives for targeted population (based on benefits and costs)
- Clearly identified standards for behavior or performance that ensure additionality and avoid slippage
- Sufficient monitoring to determine voluntary compliance with standards
- Ability to reduce free-riding

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Conclusion so far:

(1) When conditions above are met, VAs can be effective in generating environmental or conservation improvements.

(2) When these conditions do not hold, a VA is not likely to be effective.

Empirical evidence is consistent with this, i.e., it is mixed: Some VAs appear to have been effective, while others have not

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European Washing Machine Agreement

- 1996: major European producers/importers of washing machines collectively agree not to produce/import low efficiency models
- 1997-2002: share of high efficiency models increases from 51% to 83%
- 2002: commitment is renewed for 2002-2008
- 2007: members announce will not be renewed again; call for mandatory efficiency standards instead

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Predictions from Economic Theory

(Ahmed and Segerson, *Resource and Energy Economics,* 2011)

- **Unilateral commitment by a single firm to restrict or eliminate sales on low efficiency products will reduce firm's profits**
- **However, collective modest restrictions can increase profits, depending on:**
  - **Stringency of the required reductions**
  - **Relative performance of "green" product**
  - **Size of industry (extent of competition)**
  - **Number of firms that commit and adhere to the agreement (extent of free-riding)**
- **Firms have an incentive to cheat on the agreement → need some form of enforcement**

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Statistical Evidence of Effectiveness: Key challenge

- Need to determine (unobservable) counter-factual
- Need to compare performance of "treatment" group with performance of "control" group
- Need to control for other possible explanations of observed outcomes:
    - Contemporaneous changes in conditions that affect outcomes (e.g., market conditions, technology, regulations)
    - Differences in characteristics of participants and non-participants, due to self-selection or targeting

(Greenstone and Gayer, 2009; Pattanayak et al., 2010,)

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33/50 Program

(Bi and Khanna, *Land Economics,* 2012)

- Established in 1991
- Goal: Reduce aggregate releases of 17 toxic chemicals by 33% by 1992 and by 50% by 1995, relative to 1988 baseline
- Firms were invited to participate and could choose own reductions
- Results reported by EPA: aggregate releases decreased by 55% by 1995 → "success"
- 2 of 17 chemicals were being phased out under Montreal Protocol

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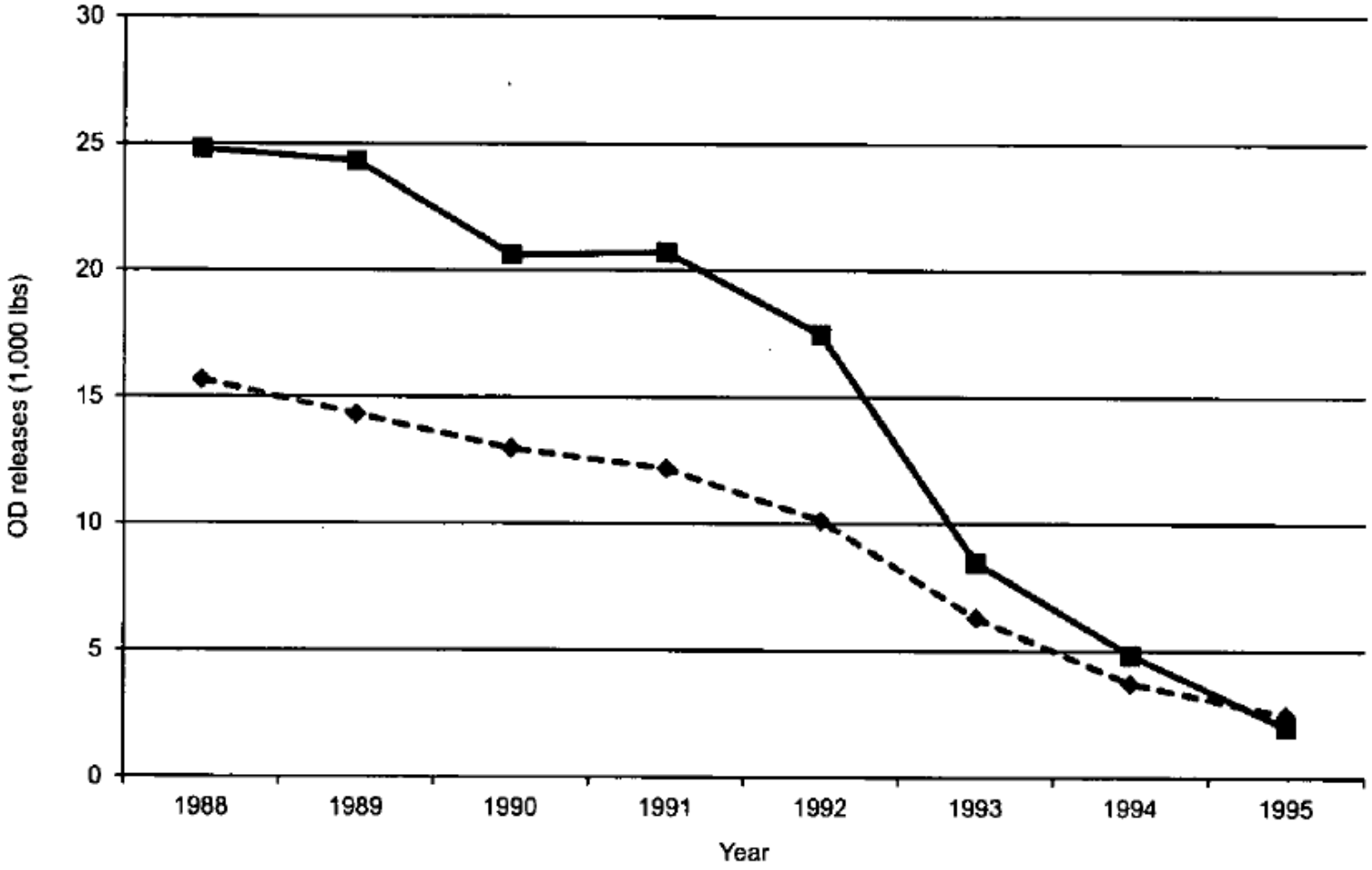

FIGURE 1
Average Ozone Depleting Chemical Releases, 1988–1995

(Bi and Khanna, 2012)

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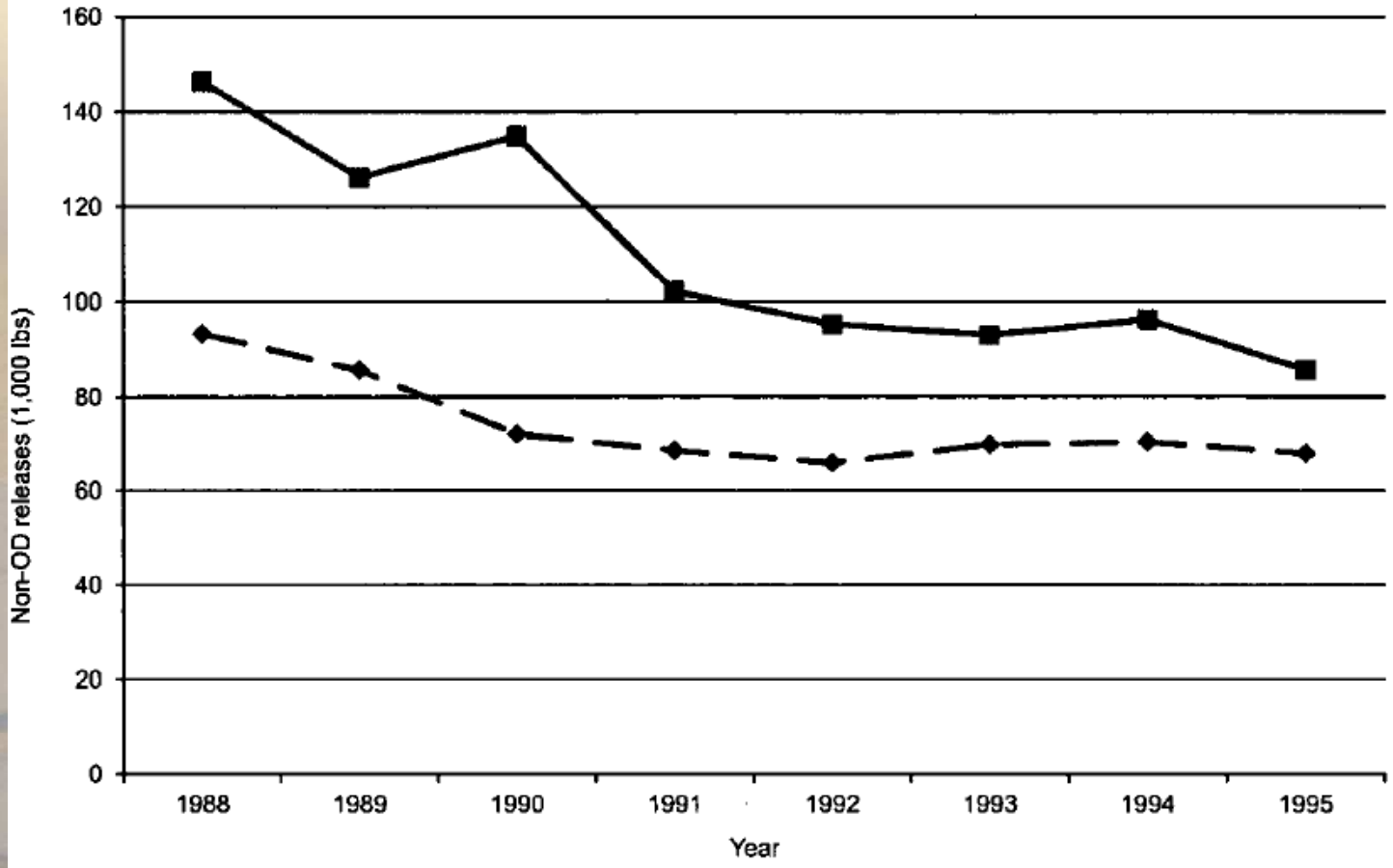

FIGURE 2
Average Releases for Non–Ozone Depleting Chemicals, 1988–1995

33/50 Program: Methodology

(Bi and Khanna, 2012)

- Facility level data on releases and characteristics for participants and non-participants
- 2-stage estimation (to allow for endogenous participation decision at facility level)
- 8,756 facilities and 4,123 parent companies (34,339 total observations)
- Include time trend
- Separate impact analysis for chemicals subject to Montreal Protocol

33/50 Program: Findings

(Bi and Khanna, 2012)

- Rate of reduction across all chemicals was 18.8% to 23.7% higher for participants than non-participants, even after accounting for
  - Reductions prior to program
  - Downward trend in releases even in absence of program
- Rate of reduction for ozone-depleting chemicals was not significantly different across participants and non-participants
- Conducting analysis at facility-level is critical (modeling participation at firm level suggest impacts of only 5.1-6.6%

Mexico's Payments for Hydrological Services (PHAS) Program

(Alix-Garcia, et al., Working Paper, 2011)

- Government program that pays landowners to maintain forest cover on enrolled land.
- Aim: decrease deforestation → promote hydrological services, carbon sequestration, biodiversity, etc.
- 2003-2009: 2.27 million hectares enrolled

Concerns:

- Additionality: Paying landowners who would have maintained forest cover anyway?
- Slippage: Increased deforestation on other (non-enrolled) land, due to:
  - Substitution effects
  - Output price effects

Mexico's PSAH: Methodology

(Alix-Garcia et al, 2011)

- Parcel-level data for 2004 (352 recipients, 462 non-recipients)
- Construct control group based on matches from applicant pool based on region, tenure-type, and other observables such as land characteristics (e.g., slope, elevation)
- Test for substitution (by comparing deforestation rates in non-enrolled portions of enrolled properties to those of matched control properties)
- Test for output price slippage (by comparing deforestation on un-enrolled land in areas with high and low total enrollment

Mexico's PSAH: Findings

(Alix-Garcia et al, 2011)

- Between 2003-2006, program decreased average percentage of land deforested by 1.2 percentage points
- Given base of 2.4% deforestation over period, this constitutes a 50% reduction
- Program had significant relative impact but small absolute impact, because of low baseline rate
- Evidence of heterogeneous substitution slippage based on wealth

SDWA Reporting Requirements

(Bennear and Olmstead, *JEEM,* 2008)

- US Safe Drinking Water Act requires reporting of detected contaminants and violations, beginning in 1998
- Requirements differ by size of water suppliers:
  - 10,000+ must mail reports directly to households
  - Smaller suppliers must post but do need not mail

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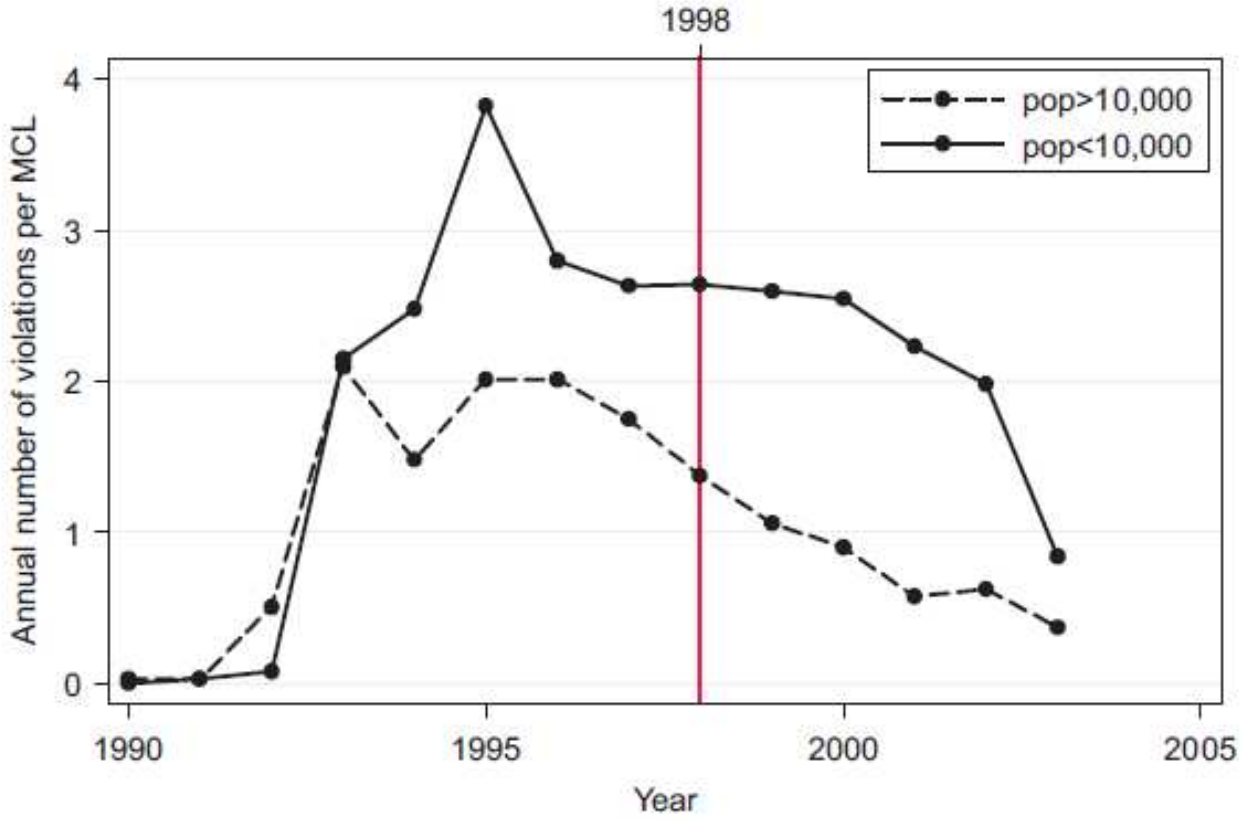

Fig. 1. Total violations per MCL by water suppliers, 1990–2003. *Note*: Each point graphs annual violations per MCL, splitting MA water suppliers by system size at the 10,000-person CCR mailing threshold.

SDWA Requirement: Methodology

(Bennear and Olmstead, 2008)

- Panel data on violations and supplier characteristics for 517 water suppliers in MA from 1990-2003
- Treatment group: Large suppliers (10,000+)
- Control group: Small suppliers
- Primary: Difference-in-difference estimation
- Test for impact of new MCL regulations

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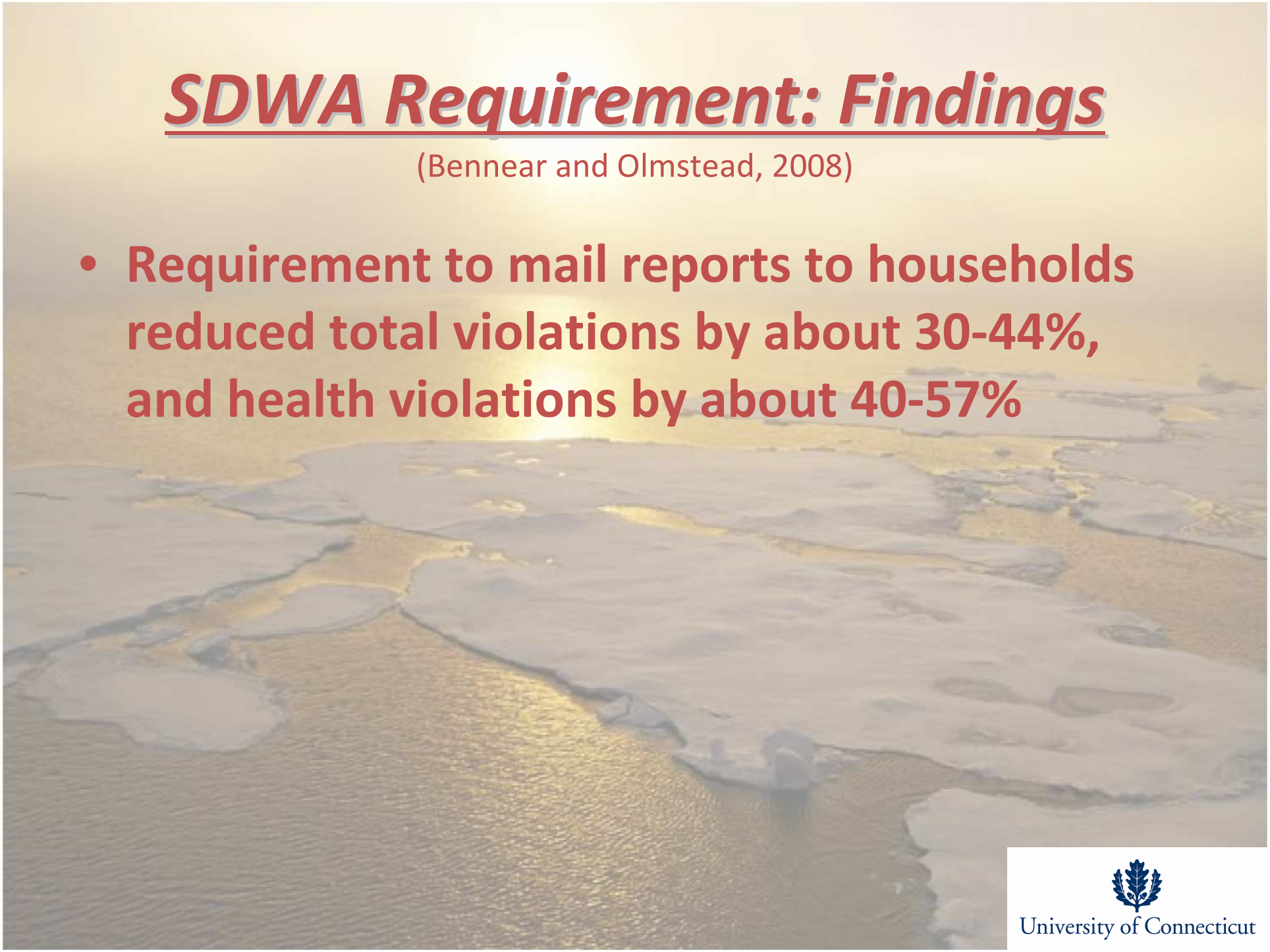
SDWA Requirement: Findings

(Bennear and Olmstead, 2008)

- **Requirement to mail reports to households reduced total violations by about 30-44%, and health violations by about 40-57%**



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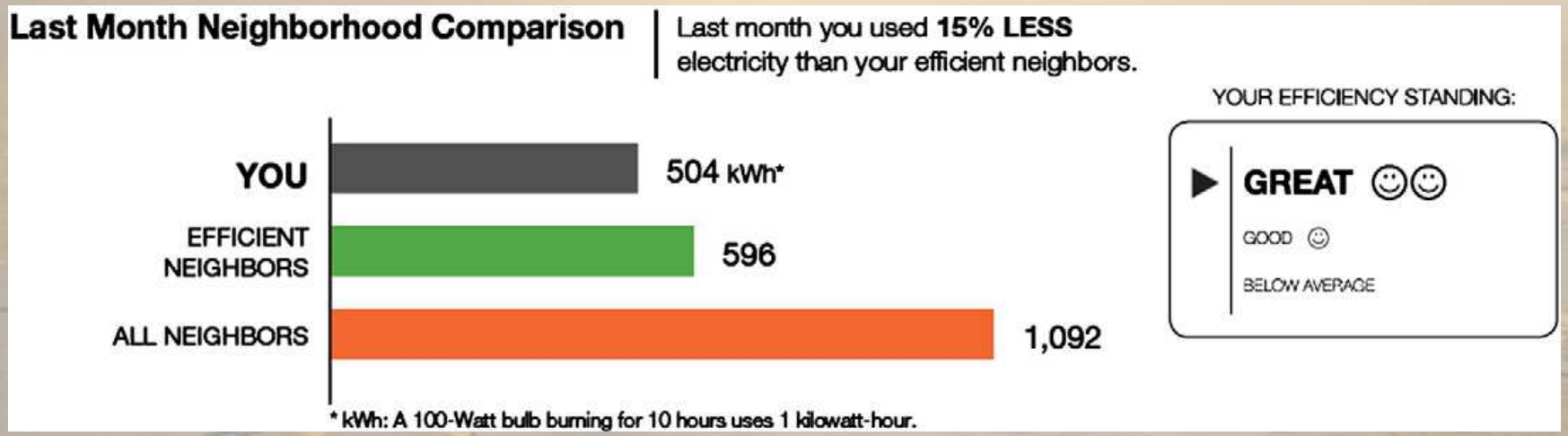
OPOWER Program

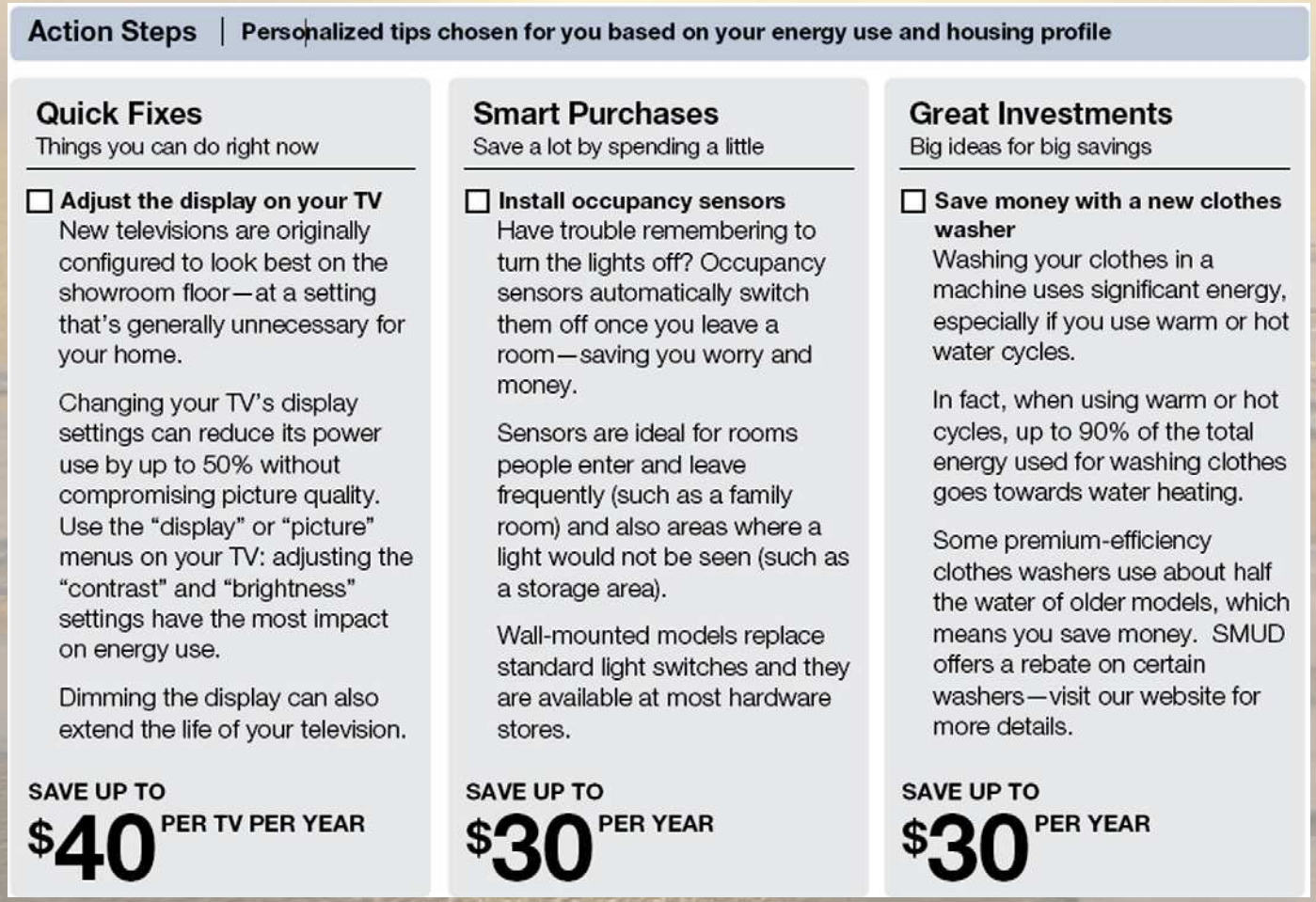
(Allcott, *Journal of Public Economics,* 2011)

- **OPower has contracts with 47 utilities in 21 states**
- **Randomized set of households sent "Home Energy Reports" comparing their usage to usage by similar neighbors, and suggesting ways to reduce energy use**
- **Purpose: foster energy conservation through social norms**

Home energy reports: social comparison module



Home energy reports: actions steps module



Action Steps | Personalized tips chosen for you based on your energy use and housing profile

Quick Fixes
Things you can do right now

☐ **Adjust the display on your TV**
New televisions are originally configured to look best on the showroom floor—at a setting that's generally unnecessary for your home.

Changing your TV's display settings can reduce its power use by up to 50% without compromising picture quality. Use the "display" or "picture" menus on your TV: adjusting the "contrast" and "brightness" settings have the most impact on energy use.

Dimming the display can also extend the life of your television.

SAVE UP TO
$40 PER TV PER YEAR

Smart Purchases
Save a lot by spending a little

☐ **Install occupancy sensors**
Have trouble remembering to turn the lights off? Occupancy sensors automatically switch them off once you leave a room—saving you worry and money.

Sensors are ideal for rooms people enter and leave frequently (such as a family room) and also areas where a light would not be seen (such as a storage area).

Wall-mounted models replace standard light switches and they are available at most hardware stores.

SAVE UP TO
$30 PER YEAR

Great Investments
Big ideas for big savings

☐ **Save money with a new clothes washer**
Washing your clothes in a machine uses significant energy, especially if you use warm or hot water cycles.

In fact, when using warm or hot cycles, up to 90% of the total energy used for washing clothes goes towards water heating.

Some premium-efficiency clothes washers use about half the water of older models, which means you save money. SMUD offers a rebate on certain washers—visit our website for more details.

SAVE UP TO
$30 PER YEAR

OPower Program: Methodology

(Allcott, 2011)

- Used individual household data from 17 experiments across U.S.
- Includes 22 million utility bills for 588,446 households for treatment group (received reports) and control group (no reports)
- Also includes household-level characteristics
- Estimate average treatment effect using difference-in-difference approach

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OPower Program: Findings

(Allcott, 2011)

- Average Treatment Effect: 2% reduction in energy use
- Increased frequency (monthly vs. quarterly reports) increases ATE by 0.5%
- Based on short run price elasticity of -0.1 to -0.18, impact is equivalent to impact of a short run price increase of 11% to 20%
- Effects vary by decile groups
  - 6.3% for highest decile consumption groups
  - 0.3% for lowest decile consumption groups

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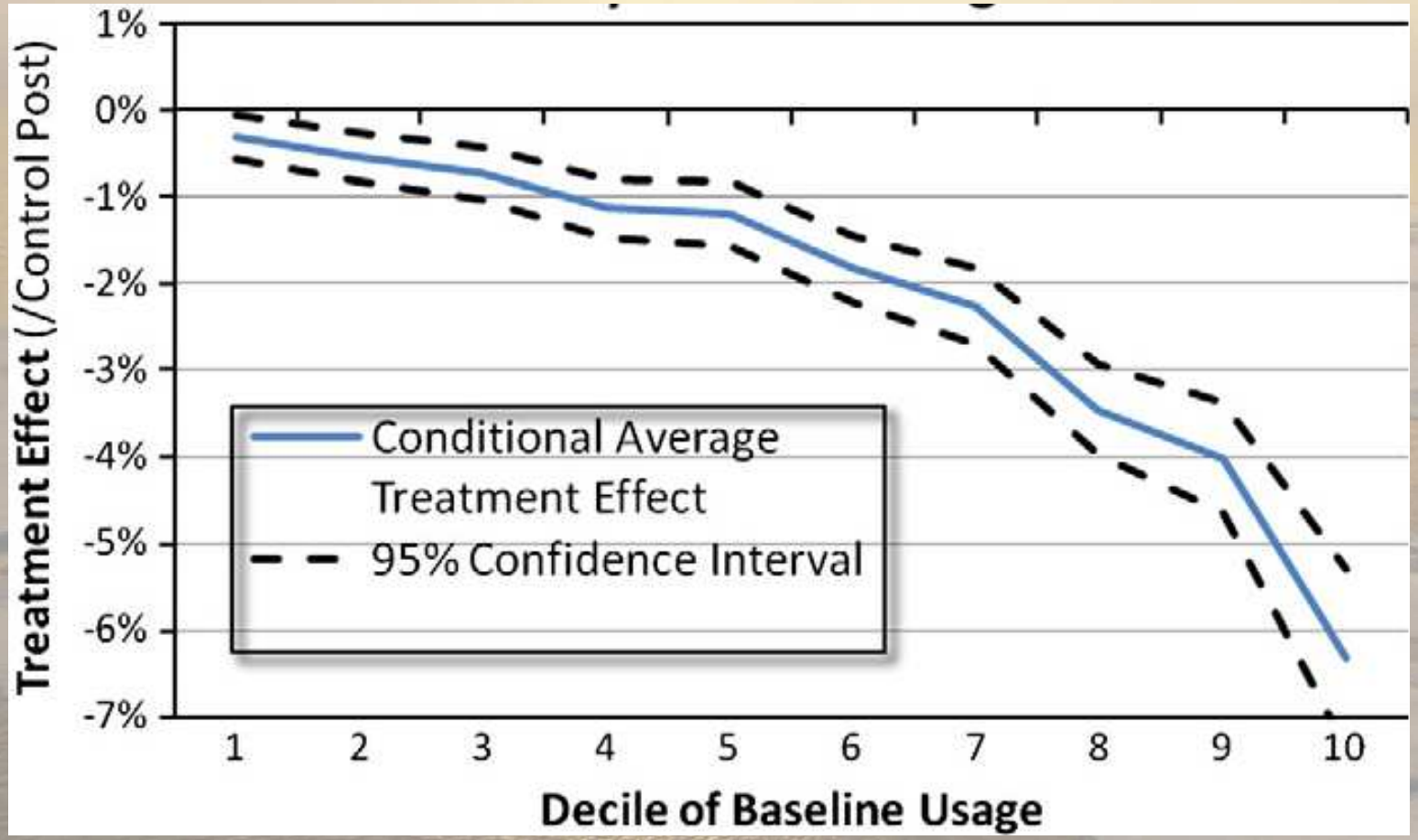
Effects of Baseline Usage Decline

(Alcott, 2011)



Insights from Behavioral Economics?

Theoretical models of VAs are all based on neoclassical model of rational choice.

What is role of:

- Social norms (Allcott, 2012)
- Quasi-hyperbolic discounting (Heutel, 2011)
- Temptation (Tsvetanov and Segerson, 2012)