WTP for Reducing Hazardous Air Pollutants

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The Problem

- EPA needs estimates of the benefits of HAPS regulations
  - Over 100 NESHAPs (e.g., for iron and steel foundries, petroleum refineries)
  - Cost of each is often < $100 million
  - Typical regulation reduces emissions of multiple pollutants
- Also desirable to estimate benefits of Title III of 1990 CAAA – of regulations in the aggregate

The Problem

- Large number of HAPS (187) makes the damage function approach tedious to apply
  - Dose-response information on cancer and other effects is sparse; often based on animal studies
  - But 133 HAPS have been included in NATA database, which maps exposure and estimates life time cancer risk and RfCs for respiratory effects
  - Cancer risks are unevenly distributed but small
- Could use NATA database to value risk reductions

Key Issues

- What benefits to value?
  - Health endpoints (risk of cancer, neurological defects)
  - Reduction in emissions or exposure
- Include altruistic values?
- Value subjective v. objective risks?
- How to value reduced anxiety/ambiguity?
- Can valuation results be applied to different policies? Is benefits transfer possible?

Specific Options

- Damage function approach (w & w/o altruism)
- Property value studies
- Valuation up the DF chain
  - Value emissions changes
  - Value ambient changes
  - Value exposure changes
- Alternative metrics
  - Number of people brought below the reference dose
  - Probability a person is brought below the reference dose
- Value reduced anxiety/ambiguity
- Value reductions in risk disparities

Damage Function Approach

- Δemissions → Δpopulation-weighted ambient concentrations → Δ health effects (e.g., cancer cases)
- Could estimate cancer cases avoided for cancer-causing HAPS
  - NATA database provides estimates of cancer risks from many HAPS – so risk assessment is possible
- Multiply by value of reducing risk of fatal (and non-fatal) cancers
  - Estimates of value of reducing cancer risk exist that incorporate both dread and latency
- Advantages:
  - Can be used to assess benefits of specific regulations or all
  - People are asked to value something they understand

Damage Function Approach with Altruism

- Benefits using DF approach are likely to be small since average risks are small
- But some people are more highly exposed
  - Will people pay to reduce risks to highly exposed persons?
- Altruistic values should be added to WTP for a private risk reduction if
  - Altruism is paternalistic
  - They should not be added if altruism is "pure"

Paternalistic v. "Pure" Altruism

- Problem: How stringently to regulate HAPs?
  - More stringent regulation will raise the cost of goods and services but reduce everyone's cancer risks
- "Pure" altruism: A cares about B's cancer risk and about the cost to B of a more stringent HAP
  - B's rate of substitution between cancer risk and $ (B's WTP to reduce cancer risk) already captures this tradeoff
  - Correct B-C rule is to compare sum of private WTPs to cost of regulation
- Altruistic values should be added to WTP for a private risk reduction if A cares ***only*** about B's health
  - That is, if altruism is paternalistic

Can We Measure "Paternalistic" Altruism?

- Could ask what people would pay for a private good that would reduce other people's risk
  - Contribute to a fund that would put filters in the homes of people who are highly exposed to HAPs
  - This elicits my WTP to reduce the cancer risk to others
  - Could also ask my WTP to reduce my own cancer risk through such a device
  - Sum private and altruistic WTPs

Property Value Approach - I

- Impact of air toxics may be capitalized into property values, reflecting consumer WTP
- But must separate value of emissions from disamenity of living near an industrial facility
- Need data on property values, housing and neighborhood characteristics (including HAPS)
  - For houses with different exposures to HAPS
  - Before and after a change in HAP emissions

Property Value Approach - II

- Approach is data-intensive and difficult to generalize
  - If find impact for certain HAPS can't necessarily use to value other HAPS
- If HAPs emissions are capitalized into property values what does this measure?
  - Does it measure value of health benefits?
  - Does it measure subjective or objective risks?
- Impacts of changes in TRI emissions have been difficult to find
  - Bui and Meyer (2003) find no effects

Valuation up the DF chain

- Valuing exposure, ambient, or emissions changes
- Definition of commodity gets progressively fuzzier up the chain and WTP less credible
- Stated preference may be preferred to revealed preference methods
- How useful for individual rules if many substances are affected?

Relevant literature

- WTP up the chain
  - Roe et al, 2001 (WTP for Green Power)
  - Poe and Bishop (undated) (WTP for reduced nitrates in groundwater
- Information treatments
  - Bergstrom and Dorfman (1994) WTP to reduce Aldicarb and nitrates in groundwater
  - Poe and Bishop (undated)

An Approach

- Information treatments to obtain these values can be tested
  - Step 1: give general information for the entire chain, only being specific about emissions; ask for WTP to reduce emissions
  - Step 2: Then, in same survey (or better, with enough money, different surveys) be more specific on ambient change and ask for WTP for these changes
  - Step 3: Same for exposure
  - Step 4: same for cancer cases
  - Could be with or without altruism
- Use Houston benzene study results to develop case study information treatments – conduct in Houston

Alternative metrics

- With C-R functions unavailable, but with RfCs, use alternative metrics involving thresholds
  - Number of people brought below threshold (altruism)
  - Probability (certainty) a person brought below threshold (private) (see Hoffmann, Krupnick and Adamowicz, in process, for blood lead)
- Could be incorporated into DF chain as substitute for cancer/non-cancer health effects and tested as in previous slide
- Arbitrariness in use of thresholds
- Still need to describe health effects with RfCs

Valuing anxiety

- Sources of anxiety:
  - Dread attached to outcome (cancer v. heart attack)
  - Perceived high probability of adverse outcome
  - Uncertainty about probability of adverse outcome
  - An independent effect, i.e., an outcome in itself (Adler, 2004)
- Anxiety not a separate commodity to be valued:
  - Dread attached to cancer is reflected in WTP to reduce cancer v. other mortality risks
  - High subjective risk perceptions often conflict with low objective risks; not clear subject risks should be valued
  - Ambiguity about risks will often increase WTP
- For HAPS: Is it all embedded? Sensitive to scenario?

Literature on Anxiety and Dread

- Literature review finds no independent measures of WTP for reduced anxiety, but call for such studies:
  - (Adler, 2004). Pricing of fear; rejection of tailoring approach
- There is a literature on embedded dread, however
  - Seven studies reviewed in Robinson et al. (2009)
  - WTP for dreaded vs. "not dreaded" fatalities or disease range from 1/1 to 2.5/1.

Table 3: Effects of Risk Perception and Dread **THIS SLIDE NOT IN PRESENTATION**

Study	Key Findings	Ratio
Magat, Viscusi, and Huber (1996)	No difference between auto fatalities and fatal lymphoma.	1/1
Hammitt and Liu (2004)	Cancers valued one-third more than noncancers. Air pollution risks valued at twice the risks from drinking water.	1.3/1 2/1
Jones-Lee and Loomes (1995)	No differences attributable to scale of accident. Rail-related risk reductions valued 50 percent higher than road-related risks.	1/1 1.5/1
Subramanian and Cropper (2000)	For six pairs of public health and environmental health programs, a 100 percent change in program attributes (blame, ease of avoidance, seriousness, personal impact, program effectiveness, appropriateness of intervention, fairness of funding, and the time lag) leads to a 5 to 150 percent change in the risk trade-off.	1.05/1 to 2.5/1
Chilton et al. (2002)	The value of preventing deaths from rail accidents and fires was at most 20 percent higher than the value of preventing road accidents.	<1.2/1
Adamowicz et al. (forthcoming),	Microbial risks valued one-third more than cancers (generally insignificant).	1.3/1
Itaoka et al (2006)	Deaths from nuclear power disaster vs. routine deaths from fossil fuel air emissions	2.5/1

Valuing Ambiguity Aversion

- All risks are subjective; some risks are ambiguous (Frish and Baron, 1988)
- Ambiguous risks: subjective experience of missing (unreliable) information relevant to prediction (Frish and Baron, 1988)
- Revealing ambiguity can bias WTP downwards
- But, people WTP more to reduce an ambiguous than a certain risk.
- Could allow/test for risk ambiguity in HAPS context

Literature on Effect of Ambiguity

- Viscusi, Magat and Huber (1991): nerve disease and lymphoma in 2 locations: perceived risks higher for ambiguous risks
- Shogren (2005) CV for reducing foodborne illness in 2 restaurants. Mean (but not median) WTP greater (1.3-2.0) when the information conflicts.
- Riddel and Shaw: CV for WTA risks of nuclear waste transport. WTA rises with ambiguity in risks (wider risk ranges)
- Fox and Tversky and Trautmann, Vieider and Wakker (2008): Ambiguity aversion is a social phenomenon

Valuing reductions in risk disparities

- In addition to risk reductions in general, people may be willing to pay something for reducing risk disparities: inequality aversion
- Could be regional, race, income groups.
    - Could use NATA maps
- Ideally would want respondents to value a change in the *distribution* of risks
  - Absolute risk levels matter as well as equality of risks
  - How to reconcile with pure v. paternalistic altruism?

Conclusions

- Ideally, want to separate risk assessment from valuation
  - Argues for having people value health endpoints (e.g., cancer risks)
  - Allows results to be transferred from one context to another
  - Could incorporate altruism and/or ambiguity about risk in valuation
- If want to value emissions or ambient concentrations
  - Should test impact of information given on valuation
  - Need to incorporate characteristics of pollutant into scenario description to ensure transferability

Two Possible Ways Forward

- For an 812 study, value reductions in cancer risks, including altruism
  - Apply to reduction in cancer risks from all HAPS
  - Would require new stated preference study
- Investigate impact of valuing outcomes farther up the DF chain
  - Compare responses to valuing reductions in emissions v. reductions in health endpoints
  - Use different information treatments