

# The Quest To Quantify Benefits Of U.S. Water Resource Policies

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# President Reagan's 1981 Executive Order 12291

- Mandated a Cost-Benefit Analysis for every major regulation that the government issued
- Shifted considerable power to OMB through:
  - Review of those Cost-Benefit Analyses (RIA)
  - Approval of data collection instruments
- Did not emerge out of thin air: formal examination of the cost and benefits had a long history on water issues.
  - Briefly describe some of this because it helps set the stage
- Primary focus will be on my work with Robert Mitchell on our valuing benefits of the landmark U.S. Clean Water Act
  - Used in President Clinton's Clean Water Initiative: Analysis of Benefits & Costs (Washington: U.S. EPA Office of Water, 1996) submitted to Congress.

# Early Rumblings

- Dupuit: defines consumer surplus
  - Uses example of where to build a single new bridge over a river. Can be cast in terms of maximum “toll” revenue that could be collected
- Designers of water projects start to consider benefits & cost
  - British faced these questions in building large dams projects in Egypt/India
  - U.S. 1902 Rivers and Harbors
    - 1920 extension introduces distinction between national vs. local benefits
  - 1936 U.S. Flood Control Act allowed Army Corps Engineers to involve itself in flood control projects that provided that, "benefits to whosoever they may accrue are in excess of the estimated costs".



# Guidance Documents

- Start of official government guidance documents
  - Inter-Agency Green Book 1950
  - Water Resources Council (1960; 1979; 1983)
- Much of debate started by these guidance documents involved “intangibles”
  - An intangible was any aspect of a project not cast in monetary terms
  - Originally, almost everything other value of electricity was an intangible
    - Strong early focus on interest rates and initial efforts to deal with uncertainty
  - A key aspect of flood control projects was the (uncertain) loss of life
    - Recognized that quantities needed to be valued in a standardized way: now VSL
  - The big issue become:
    - the change in land values behind reservoirs being built behind dams
    - outdoor recreation which was wildly popular with the public and politicians

# Initial Efforts

- Academics & officials in various water agencies started thinking seriously measuring these intangibles
- There were two major conceptual leaps:
  - Ciracy-Wantrup laid out the case for doing contingent valuation surveys and saw water projects as providing a bundle services
  - Samuelson correctly foresaw that respondents to such a survey eliciting their max willingness to pay for a project would be behave strategically by providing a downwardly biased amount
- Development began on what are now the four standard techniques:
  - As a production process input: the obvious candidate was irrigation water
  - Jack Knetsch used what would now be termed hedonic pricing to look at land values around new TVA reservoirs
  - Clawson and Knetsch do initial codification of recreation travel cost models
  - Davis and later with Knetsch did outdoor recreation CV studies; first comparison of CV & TC water-based recreation estimates reasonably close.



# Valuing Water at Resources for the Future

- In the fall of 1979, I answered a BLIND classified job ad in the Washington Post for a research assistant with an odd set of skills, economics, survey research and statistical programming. Had picked up all of these in non-standard ways.
- Job was at Resources for the Future. I did interviews with Allen Kneese, Robert Mitchell and Cliff Russell.
  - Ended up getting the job to work on EPA sponsored project and my career has been tied to water ever since.
- Environmental epidemiology part of project went nowhere because I discovered major problems in how our THM data had been collected.
  - Led to a long term interest in measurement error and missing data.
- With Cliff Russell I got my first publication in Farm Pond Harvest on trout fishing in farm ponds and worked on the first national travel cost model.

# Robert Mitchell

- Most of my work was with Robert Mitchell where we undertook a series of studies looking at the national benefits of the U.S. Clean Water Act.
  - Robert was not an economist but rather a sociologist who was one of the leading researchers on the new topic of environmental public opinion.
  - This brought a very different perspective to view the air quality benefits work had driven EPA's interest. Randall et al. (JEEM, 1974) piece—existence value.
- One of the first things we saw through extensive in-depth interviews and focus groups was that the bidding game and direct open-ended questions being used in studies just simply did not work.
  - People kept saying if the government has worked out the plan details, just tell us the cost and let us say yes or no. Logically led to binary discrete choice involving single good.
  - The notion that the starting point using in a bidding game was seen as related to cost. The working assumption that the starting point was seen as random was nonsensical.
  - We came up the payment card which converted open-ended question to a multinomial cost and induced a large plausible cost range.
    - Worked with multiple (levels) goods and now shown to produce conservative estimates.



# A Wholistic View

- Our other major insight was that the public's perspective of water was nothing like economists envisioned. Rather than being built up "use by use", people saw water in the form of rivers, streams and lakes as connecting everything, a reflection of K-12 geography classes. They saw water as supporting not only recreation but also a whole raft of what are now called ecosystem services. Again, drawn from their biology classes.
  - A water quality ladder proved to be a key visual aid, but respondents was this as reflective of much more than its recreation-oriented labels.
  - Their general motive for being willing to pay for higher quality water would best be called an obligation to be good stewards. Part of this was driven by the perceptions that they were responsible for a lot of the water pollution due to sewage, and agricultural & urban runoff.
  - There were lots of ways to split their values such direct use, indirect use, & non use and spatially but these all required strong, albeit, often, reasonable assumptions. There was a lot of heterogeneity in what seemed to be natural ways of split their WTP.



# Fundamental Conceptual Issues

- At the time of the study, no one knew what water quality levels were across the U.S.
  - What the public knew was that rivers had caught on fire. Informally, our research suggested most people thought their local water was better than elsewhere but not great.
  - Meetings with EPA water office officials revealed that everything was thought of in terms of monitor readings and how regulations might influence them, but no one could say how these were related to the stated goals of the Clean Water Act
  - An under appreciated impact of our study was that EPA regions slowly started coloring in their major water bodies as boatable, fishable, and swimmable.
  - The way we dealt with the baseline level of water quality in the absence of the Clean Water Act illustrates fundamental difficulty of any retrospective assessment when so much else is going on.

# Marginal Effects

- Much of the success in use of our results was their summary in the form of a straightforward easy to use equation.
  - Produced a way to translate changes in water quality levels into WTP
  - Could be modify for differences in income, environmental attitude, use
- Some auxiliary questions in the survey suggested sharply decreasing marginal WTP of further improvements once a sizeable fraction of the water got to be swimmable.
- It was clear at the time we did the study that the benefits we had predicted from improving water quality would not come to pass by just reducing sewage and industrial pollution, if little was done to effectively control agriculture and urban runoff.



## Other Impacts

- Directly influenced a lot of other water valuation studies in the U.S. and across the world.
- Heavily influenced my later work on consequentiality and the properties of elicitation formats.
- Influenced work with Nick Flores & Michael Hanemann on the fundamentally different structure of Hicksian demand systems with quantity constrained goods.