Economic Valuation of Stormwater Management

Application, Challenges and Preliminary Trends

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Motivation

- Exxon Valdez oil spill in Alaska, March 24 1989.
  - Spilling approx. 11 million gallons of crude oil
- Exxon accepted liability for the damage
  - Clean-up cost: US$ 2.1 billion
  - Compensation for local fisheries: US$ 303 million
  - Compensation for damages to local ecology: US$ 900 million
- How are the US$ 900 million calculated?

Why Value the Environment?

- Environment has a value that is independent of human interests.
- 'Humans have no moral basis to determine the (monetary) value of other species.
- Rejecting valuation may assign a default value of zero to the environment.
- $\Rightarrow$ justify further environmental degradation.
- Many public projects require a cost/benefit analysis (CBA)
- Many CBAs fail to incorporate important nonmarket values.

Environmental Values

Willingness-To-Pay (WTP) = Use Value + Option Value + Nonuse Value

- Use Values:
  - Direct use of the environmental resource (e.g. fish, timber)
- Option Values:
  - Willingness to preserve an option to use the environmental good in the future (e.g. more distant natural site)
- Nonuse Values:
  - Willingness to preserve a natural resource that will never be used. Existence value. (e.g. *Antarctic baby seals*)

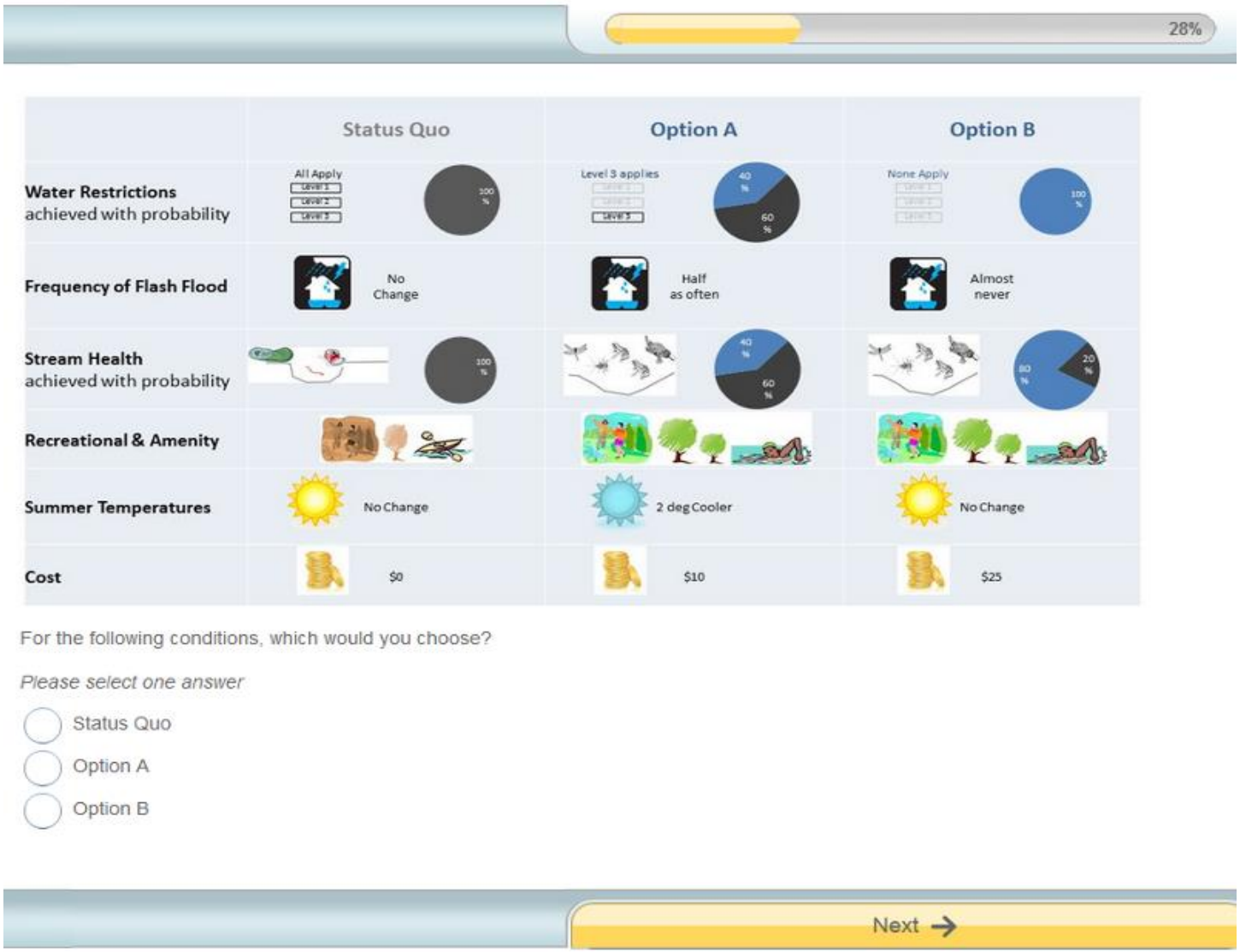
Classification of Valuation Methods

Methods	**Observed Behaviour**	**Hypothetical Behaviour**
Direct	Market Price	Contingent Valuation
Indirect	Travel Cost Hedonic pricing Avoidance expenditures LSA	Choice Modeling

Willingness to pay for Stormwater Management

- Choice Experiment is used to elicit values for most important attributes associated with stormwater management.
  - Survey method.
- Choice Task 1: Present each respondent with numerous hypothetical projects (choice sets) that vary in their attributes:
  - Water restrictions
  - **Stream health**
  - Frequency of flash floods
  - Recreational and Amenity
  - Summer Temperatures
  - Price/Cost

Willingness to pay for Stormwater Management



Survey & Sample

- Two-wave survey in 4 urban communities in VIC and NSW (Fairfield, Manningham, Moonee Valley, Warringah)
- Selection criteria:
  1. CRC Partner council (access to data)
  2. Comparable demographic characteristics (HH income, % home owners)
  3. Comparable precipitation mean (based on BOM rainfall data from the past 100 years)
  4. Differences in precipitation variance (based on BOM rainfall data from the past 100 years)

Survey & Sample

- Wave 1:
  - 980 Personal interviews collected between February 27th and October 6th 2013
  - 2 Pilot studies
    - Researcher personally briefed interview teams.
    - Pilot 1: Manningham council employees - including cognitive supervision
    - Pilot 2: Field - Warringah
- Wave 2: Interviews with approx. 50% of the same households (in approx. 4 months)

Survey & Sample

- Payment instrument: Increase in water bill.
- $\rightarrow$ only owner-occupied homes interviewed.
- $\rightarrow$ only people who are involved in payment of the water bill were interviewed.
- Sample demographics (nutshell):
  - Mean age: 54 (Median 55)
  - Sex: Female/Male - 46/54
  - Median HHincome category: AUD 80-100,000
  - Alternative income measure: perceived income group (high, middle, low)

Challenges

Like all other survey studies, our study is not free of biases!

Why are biases problematic?

- Monetary values should be used to inform policy-makers (Śevidence based policiesŠ).
- Monetary value(s) of environmental goods is one number (or a range of numbers)
- One number is easy to communicate
- One number is easy to criticize. In most cases:
  - For some people the number is too high.
  - For some people the number is too low.

Why are biases problematic?

- Most empirical methods in social/economic sciences (survey methods in particular) suffer from some sort of bias.
- Not acknowledging these biases, is misinformation:
  - Researcher $\Rightarrow$ Policy Maker $\Rightarrow$ General Public
- It is also not enough just to acknowledge this fact ('Our results need to be interpreted accordingly.')

Applying state of the art methods (and go beyond)
$\Rightarrow$ to minimize the size of these biases

Dealing with biases in our application:

- **Hypothetical bias:** Stated willingness-to-pay from the survey is larger than actual willingness-to-pay.
- Reasons:
  - The provision of the actual project could be considered as hypothetical.
  - The payment for the project could be considered as hypothetical.
- The effect of hypothetical bias on WTP is likely to be higher for stormwater management because technology is rather novel.
- The question is 'How big is the potential bias?'

How to address the hypothetical bias?

- How to implement an 'If push comes to shove' situation?
- In an 'ideal' world we would set up a field experiment, where all respondents
  1. are asked about their willingness-to-pay (WTP) AND
  2. a (random) sub-group actually has to pay their stated WTP

How to address the hypothetical bias?

- Our 'second-best' approach is a variation of the field experiment:
  1. Give a random sub-group (Group A) a small amount of initial money (endowment/earnings) (<AUD 50).
  2. Inform group A respondents that one of their choices will be selected (randomly) and the costs of this choice will be subtracted from their endowment/earnings.
  3. Group B does not receive endowment/earnings.
  4. Analyze whether WTP between group A and B are systematically (significantly) different.

Step 1: Choosing the status quo

- Opt-in/opt out
- Dependent variable: Status quo 0/1
- Logit estimates (probit estimates are very similar)
  - Individuals that received endowment or earned money during an intial exercise are 7% more likley to opt for status quo
  - Initial endowment: 6% vs. Earned money: 8%
  - Other control variables: Incomegroup, age, sex, council FE, education

Step 2: WTP for improved stream health

- Dependent variable: Choice between Status quo, Options A & B
- Multinomial logit
  - Individuals that did NOT receive endowment or earned money: AUD 30-40
  - Individuals that did receive endowment or earned money: AUD 10

Step 2: WTP for improved stream health

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