



# Preferences for Equality in Environmental Outcomes

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# Introduction

- A primary objective of many environmental regulations is to reduce overall health risks of the population.
- The benefits of these risk reductions are generally valued by what people are willing to pay to reduce their own risks.
- People may also care about the distribution of health risks in the population.
- We administer a stated preference survey to understand people's preferences towards how equally health risks are distributed in the population.

# Theory I

- Assume an individual has a utility function that depends on both average income and how equally income is distributed in the population.
- The Equally Distributed Equivalent income (EDE) is the amount of income which, if equally distributed, yields the same utility as the existing distribution of income.
- For the Atkinson SWF:
  - $EDE = (\text{mean income}) * (1 - A)$
  - $A$ , the Atkinson index of income inequality, is the maximum proportion of income a person would give up if the remainder were equally distributed.

## Theory II

- Assume an individual has a utility function that now depends on both average health risks and how equally these risks are distributed in the population.
- The Equally Distributed Equivalent risk (EDE) is the amount of risk which, if equally distributed, yields the same utility as the existing distribution of risk.
- For the Atkinson SWF over bads (Sheriff & Maguire 2013):
  - $EDE = (mean\ risk) * (1 + A')$
  - $A'$ , the modified Atkinson inequality index for bads, is the proportionate increase in risk a person would accept if the remainder were equally distributed.

# Estimation of Health Risk Preferences

- We can estimate  $A'$  if we know (1) the baseline distribution of health risks and (2) the associated EDE:

$$EDE = (\text{mean risk}) * (1 + A')$$

$$A' = \frac{EDE}{(\text{mean risk})} - 1$$

- What is the best way to elicit EDEs from respondents? Difficult to ask directly.

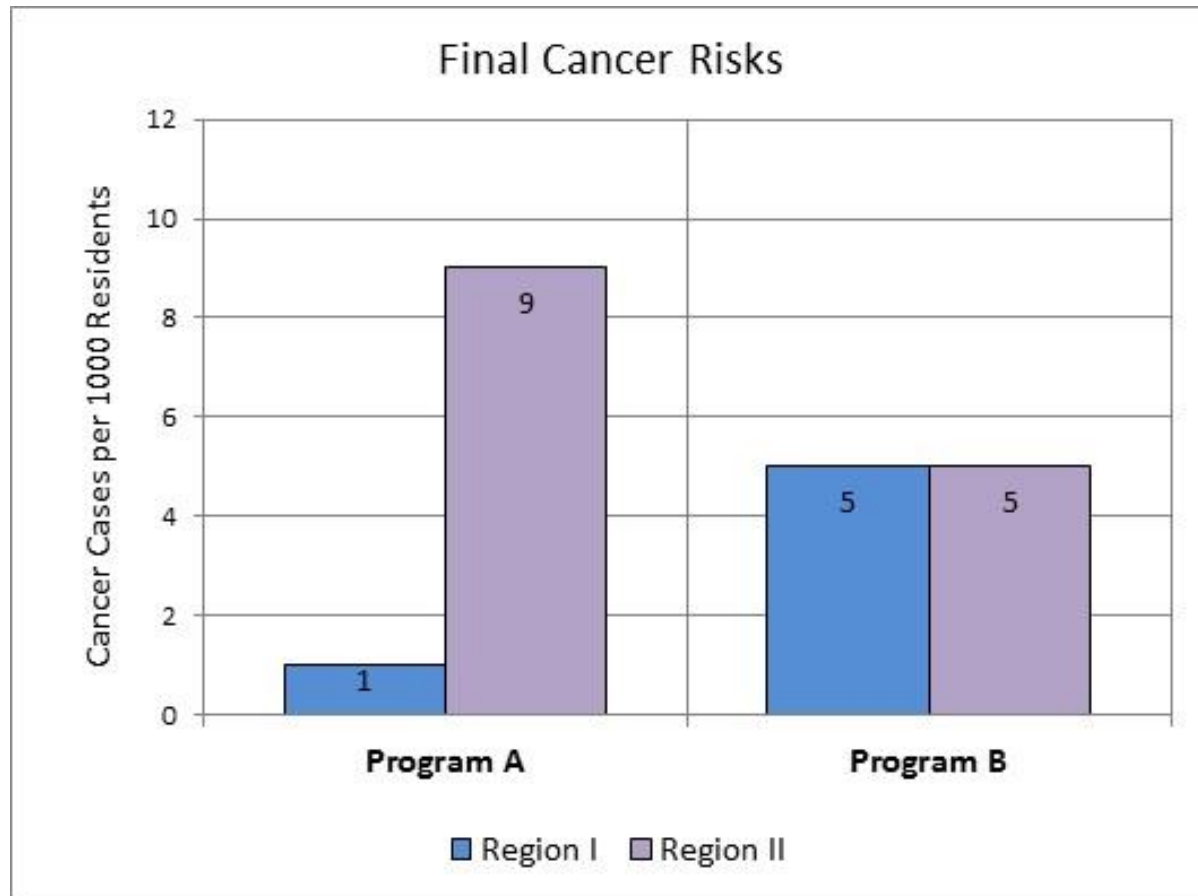
# Estimation of Health Risk Preferences

- Rather than asking for the EDE directly, we use a series of dichotomous choice questions.
- Respondents must pick between two environmental programs that result in different distributions of risks
  - One program results in an equal distribution of risks.
  - One program results in an unequal distribution of risks.
  - We vary the risk level of the equal distribution until respondents are indifferent between the two programs.

# Scenario

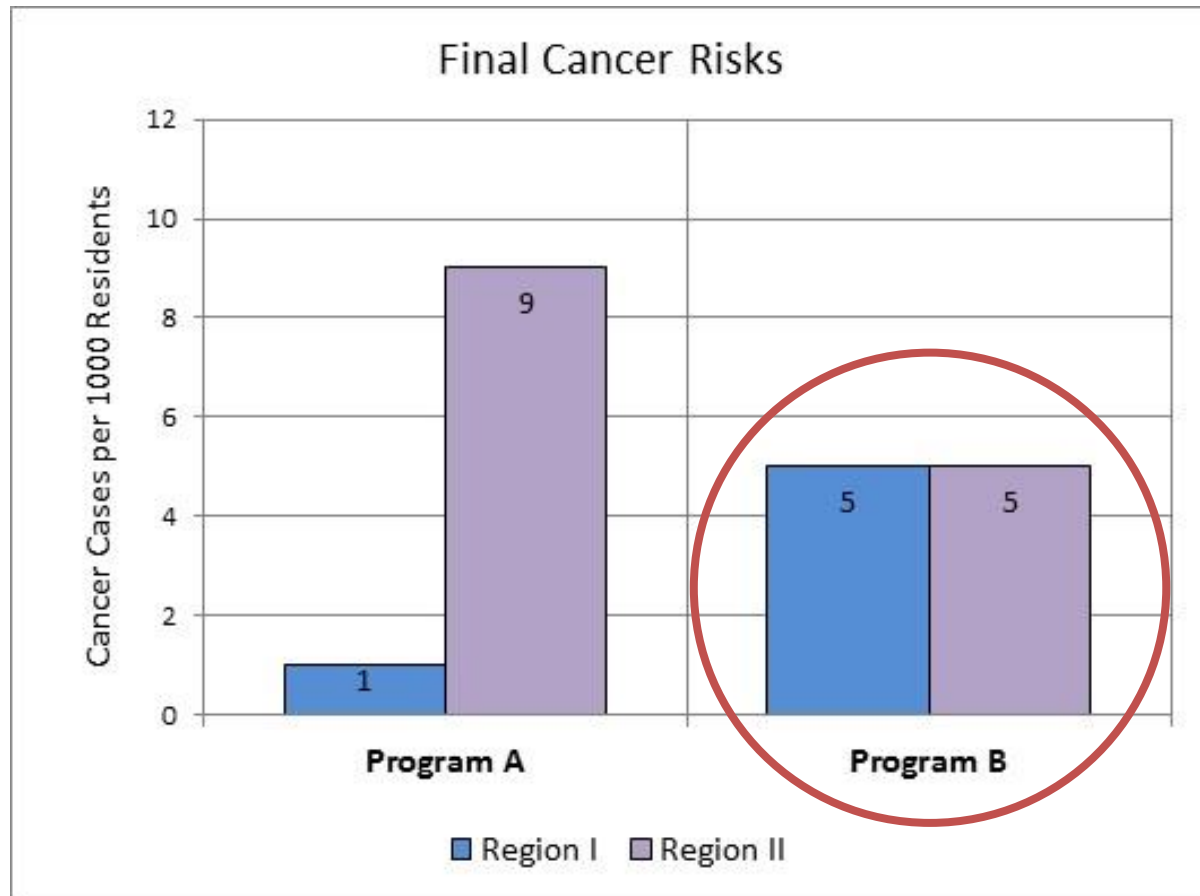
- A state's Department of Environmental Protection is considering two approaches to cleaning up pollution in the state in order to reduce cancer risks:
  - **Program A:** Focus clean-up efforts in a randomly selected half of the state. The other region receives less clean-up, leading to an unequal distribution of risks post-policy.
  - **Program B:** Address pollution sources spread evenly across the state.
  - Both regions have identical demographics and risks pre-policy.
  - The respondent does not live in the state.
  - Residents are unaware of their health risks and are thus unable to change their risks.

# Survey Instrument

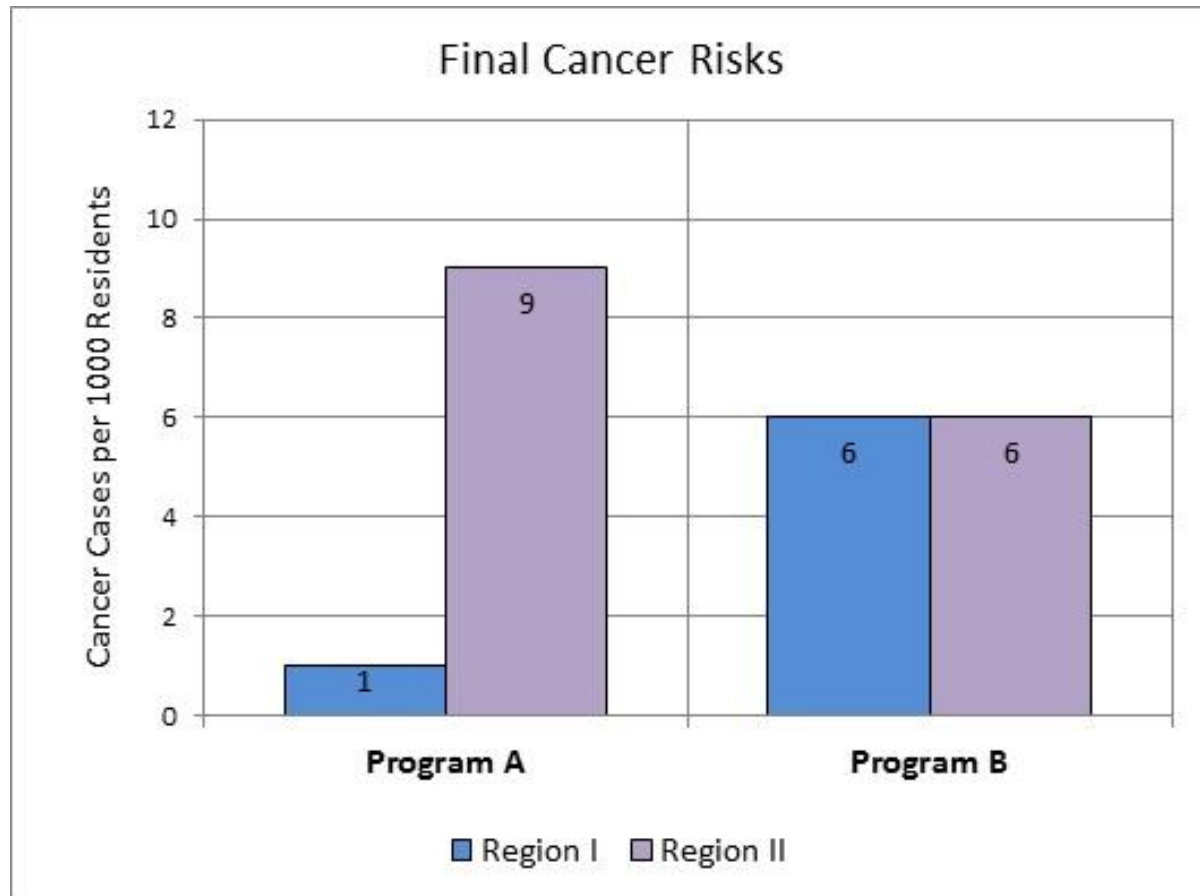




# Survey Instrument



# Survey Instrument



# Estimating Income Inequality Aversion

- We compare our health risk equality preferences with more commonly estimated preferences for income equality.
- We use “leaky bucket experiments” to gauge income inequality aversion
  - Amiel et al. 1999, Beckman et al. 2004, Pirttilä and Uusitalo 2010, Schaufele et al. 2010
- We show respondents the 2013 income distribution in two bars (top and bottom 40% of households).

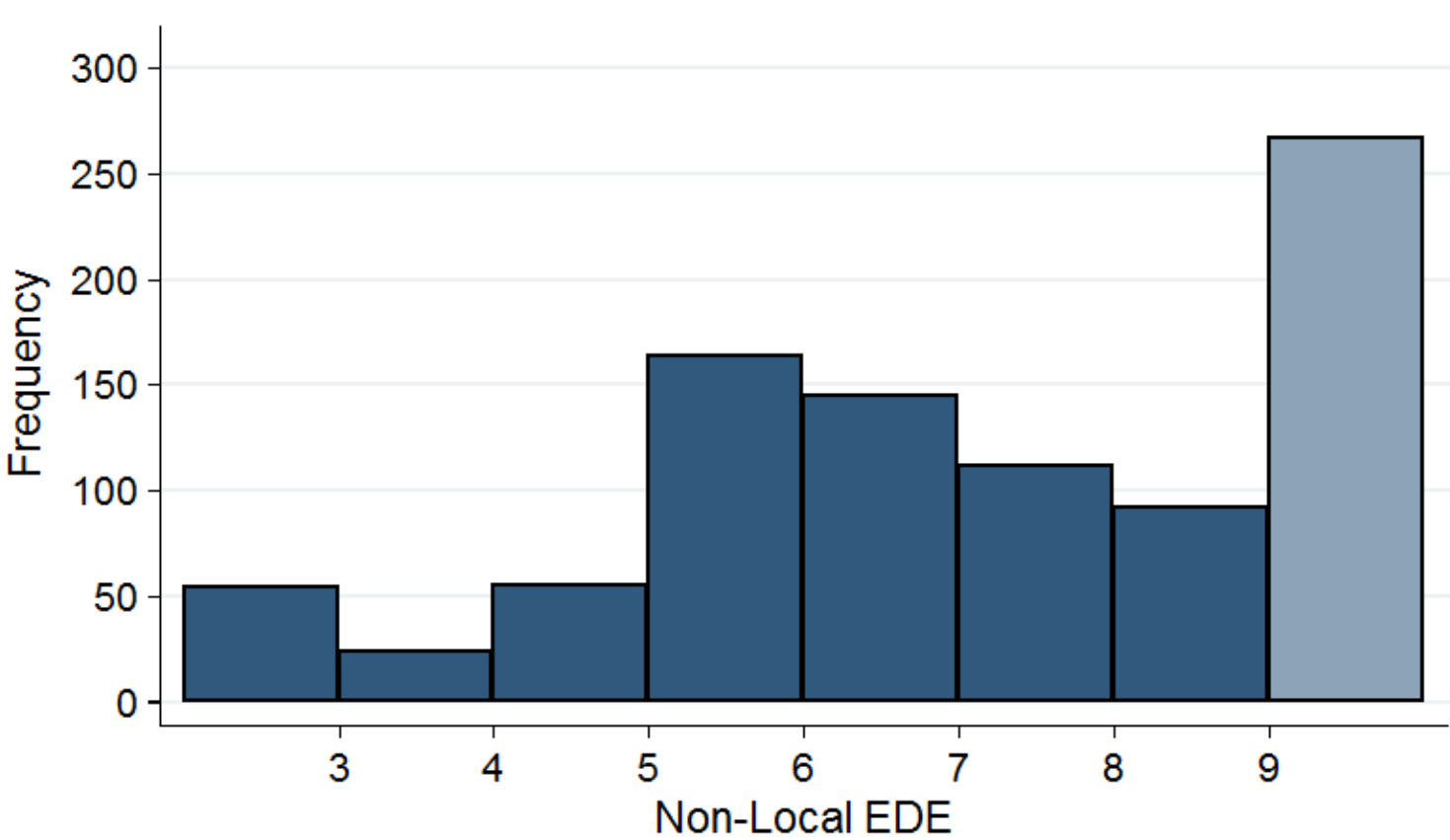
# Estimating Income Inequality Aversion

- Would you be willing to transfer \$1000 from each of the top 40% of households to each of the bottom 40%?
- Would you be willing to take \$1000 from each of the top 40% of households to transfer \$X to each of the bottom 40%?
  - $X < \$1000$ : \$750, 500, 250, 100
  - Continue dichotomous choices until we can identify each individual's "maximum tolerable leakage" (MTL).
  - We use the MTL to compute the Atkinson Index for income inequality.

# Survey

- Administered nationally through SurveyMonkey Audience (N = 913) in August 2015
  - Not representative
- Four sections:
  - Environmental clean-up scenarios (inequality and risk aversion)
  - Leaky bucket experiment (inequality aversion)
  - Coin flip experiment (risk aversion)
  - Demographic and attitudinal questions
- Tested for sensitivity to scale, effect of specified health risk, question ordering.

# Results



# Lexicographic Preferences

- 29% of respondents answer lexicographically
  - Always select the equal distribution, regardless of mean outcomes.
  - 25% of respondents displaying perfect comprehension scores also answer lexicographically.
- Half of lexicographic respondents cite equality or fairness in follow-up questioning:
  - “10 for every 1000 is not a great outlook, but if everyone is even across the board; then it’s a better decision.”
  - “I think everyone should have equal access to a clean environment.”
  - “I will always choose equal risk. Get used to it.”

# Results

- 85% of respondents exhibit inequality aversion
  - Mean EDE (non-lexicographic): 6.1 cases per 1,000
  - Median EDE (non-lexicographic): 6.5 cases per 1,000
  - Median EDE (with lexicographic): 7.5 cases per 1,000
- We calculate the Atkinson Index for Health Risks,  $A'$ :

$$A' = \frac{EDE}{(\text{mean risk})} - 1$$

- Using the mean (median) EDE, we find that respondents are willing to accept an increase in average risks of 22% (50%) if the risks are equally distributed in the population.



# Inequality Aversion Across Contexts

## Health risks

- 85% of respondents are averse to health risk inequality
- Atkinson Index
  - 0.22 (mean)
  - 0.50 (median)
- Inequality aversion not dictated by political ideology

## Income

- 59% of respondents are averse to income inequality
- Atkinson Index
  - 0.05 (mean)
  - 0.02 (median)
- Liberals more averse to income inequality than conservatives

# Robustness

- Results are largely robust to:
  - Question ordering
    - But, presenting income inequality questions first seems to make respondents more averse to inequality in health risks
  - Type of health risk
    - Cancer vs. chronic lung disease
  - Scale of health risks and income
    - Required by Atkinson utility function
  - Whether policies affect respondents' health risks

# Caveats

- Not representative
- Lexicographic responses cannot be incorporated into mean Atkinson Index
- Differences in elicitation technique for income and environmental health risks
  - Health risks: dichotomous choice bounding of EDE
  - Income: leaky bucket experiment
- EDE depends on the alternative (1:9) distribution

# Conclusions

- The magnitude of inequality aversion stresses the importance of evaluating distributional effects of environmental policy
- Individuals appear more inequality averse to health risks than income
  - No equivalent to progressive taxation for redistributing health risks post-policy
- A significant portion of respondents always settle for an equal distribution—even if everyone is worse off
- Future research should focus on:
  - How the alternative distribution affects the EDE
  - How to evaluate lexicographic responses and whether to incorporate their preferences in measures of inequality aversion

# Thank You

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