Lezione 3.8
Valori di non-uso

Taxpayers: Science as a Global Public Good

- Johansson and Kriström (2015, 24–25):

"A resource or a service might be valued even if it is not consumed. Such values are referred to as non-use values, but sometimes they are labelled passive-use or intrinsic values. … If the project being evaluated affects non-use values, this should be reflected in the cost-benefit analysis… among these are existence values."

- Any citizen contributes to the funding of scientific knowledge creation every day, through a small share of any collected tax on sales, income, or property
- People are often willing to pay to protect whales, pandas, tropical forests, bald eagles, and many other goods they are not directly using
- If properly asked through well-designed special surveys (contingent value experiments), citizens may reveal their willingness to pay (WTP) to protect the existence of environmental goods
- similar preference: preservation of cultural heritage goods, such as archeological sites, monuments, libraries, and opera houses
- There are similar social preferences for **scientific research and their discovery potential → research infrastructure (RI) activity**

Contingent Valuation (CV) - Experiment

- Since earlier ‘90s the willingness-to-pay (WTP) has been used to value public goods
- Contingent Valuation (CV) is a statistical technique used to elicit the WTP by directly asking people how much they would pay for a specific public good
- Thousands of studies worldwide have used CV for eliciting the WTP for:
  - environmental goods (e.g. ecosystems, forests, and endangered species)
  - cultural goods (museums, theatres, monuments, and cultural heritage sites)
- Report of the NOAA Panel on CV by Arrow et al (1993)
- Contemporary Guidance for Stated Preferences Studies by Johnston et al (2017)

Public good value, tax-payers: Survey to France tax-payers (1)

Ethics

- Respect of the privacy (Code ICC/ESOMAR)
- Anonymity (France Law – n 78-17 Jan 1978)
- Treatment of data
  - ✓ scientific purposes
  - ✓ destruction after 5 years
- Voluntary participation
- No conflict of interests

Informed consent to be signed before starting the survey approved by the Ethic Committee of the University of Milan

ENQUÊTE SUR LA SOUTIEN DE LA POPULATION À LA RECHERCHE SCIENTIFIQUE AU CERN

- Expository clarity
- Understandable for the public
- Informative and realistic
- Shortness
- Data controls
- Two modalities of data collection based on web users in France*
  - ✓CAWI – 88% (877)
  - ✓CAPI – 12% (123)

Make respondents aware about CERN

- **Two- page description of what CERN is and what it does**
- **2 minute video showing what particle physics research at CERN consists of**

*Eurostat ICT Household survey 2017

- To a sample of 1,005 French citizens (from 18 years old) representative of the French adult population
- In February 2018, after a long design and testing phase
- The questionnaire (in 4 sections) was the result of several rounds of consultations involving University of Milan, CERN, CSIL, CV experts

SECTION A:
'*YOUR INTERESTS*'
general interests and opinions about the importance of scientific research

SECTION B:
'*YOUR KNOWLEDGE OF CERN*'
focus on CERN and its research activity

SECTION C:
'*YOUR SUPPORT AT CERN*'
questions aiming at eliciting respondents' WTP for future investments in particle physics research

SECTION D:
'*YOUR PROFILE*'
respondents' demographic and socioeconomic characteristics

Public good value, tax-payers: Survey to France tax-payers (2)

PREAMBLE

Particle accelerator research, including the Large Hadron Collider (LHC) at CERN, has established a theoretical representation of the Universe. However, the research highlights phenomena that can not be explained by this theory.
CERN Member States, including France, are financing this research. Here are two possible scenarios for the future of this research

Scenario A

CERN Member States decide to invest in a new particle accelerator in the next decade. It will make discoveries on phenomena that cannot be explained today. This new accelerator will be operated for at least twenty-five years

Scenario B

CERN Member States decide not to invest in a new particle accelerator. The research activity with the existing accelerator, the LHC, will gradually decrease over the next twenty years. The possibility of finding answers on unexplained phenomena will remain limited

WTP QUESTION

REFERENDUM-LIKE QUESTION (NOAA Guidelines)

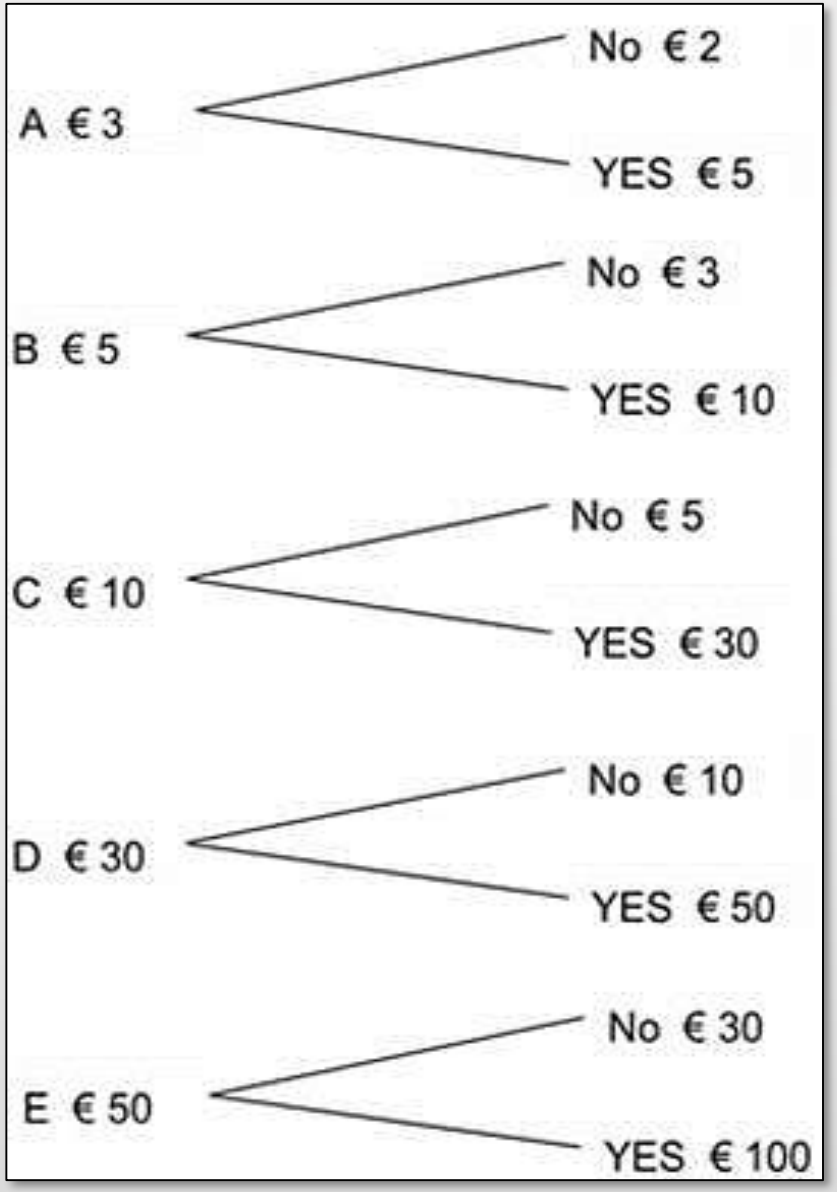
Would you agree to pay the amount of EUR X per year as a taxpayer for the construction of a new particle accelerator at CERN as described in scenario A?

Text extracted from the questionnaire (English translation)

How we quantified the WTP – Bidding Scheme

- 5 versions (A,B,C,D,E) of the questionnaire, one for each bid, randomly distributed
- 5 sub-samples, 201 respondents per sub-sample each representative of the French population of voters
- WTP questions with follow-up
- Question on maximum WTP

E.g. (C) Would you agree to pay the amount of EUR 10 per year as a taxpayer for the construction of a new particle accelerator at CERN as described in scenario A?



The bounded conditional average WTP

The Double-Bounded Dichotomous Choice Model:

Mean WTP = **f** (income, male, age, education, occupational status, family size, region of residence, awareness of CERN, scientific interest, cultural values)

$$\ln L(\theta) = \sum_{i=1}^{N} \{ I_i^{YY} \ln[1 - G(t_i^u;\, \theta)] + I_i^{YN} \ln[G(t_i^u;\, \theta) - G(t_i^0;\, \theta)] + I_i^{NY} \ln[G(t_i^0;\, \theta) - G(t_i^l;\, \theta)] + I_i^{NN} \ln G(t_i^l;\, \theta) \}$$

I_i^{YY} = **I** (*i*th respondent' path is "yes-yes")
I_i^{YN} = **I** (*i*th respondent' path is "yes-no")
I_i^{NY} = **I** (*i*th respondent' path is "no-yes")
I_i^{NN} = **I** (*i*th respondent' path is "no-no")

I (.) takes on the value of one if its argument is true and zero otherwise.

and

t_i^0 is the initial bid
t_i^u is the upper bid
t_i^l is the lower bid
$G(t_i;\, \theta) \equiv \Phi\,(t_i;\, \theta)$
$\theta = (\beta, \sigma)$

$Mean\ (WTP) = \tilde{x}'\hat{\beta}$

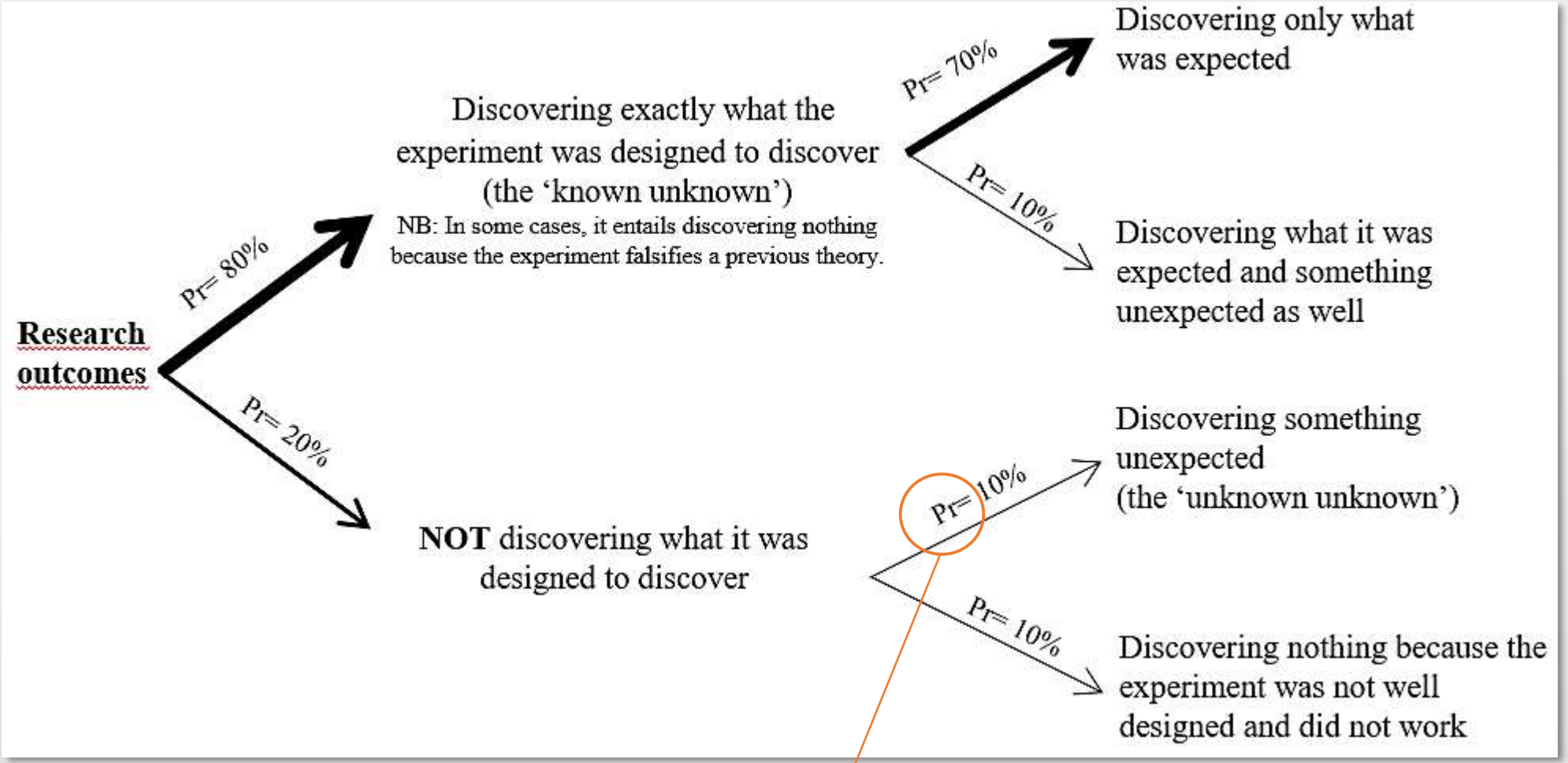
$\tilde{x}$ denotes some values of the covariates (e.g. the average value, the value for each individual or groups of individuals), and $\hat{\beta}$ is the corresponding vector of coefficients to be estimated.

Findings:

Unconditonal average maximum WTP: **13.5 €**	Bounded conditional average WTP: **4€**	Contribution that french citizens actually paid to CERN in the form of taxation in 2017: **2.7 €**

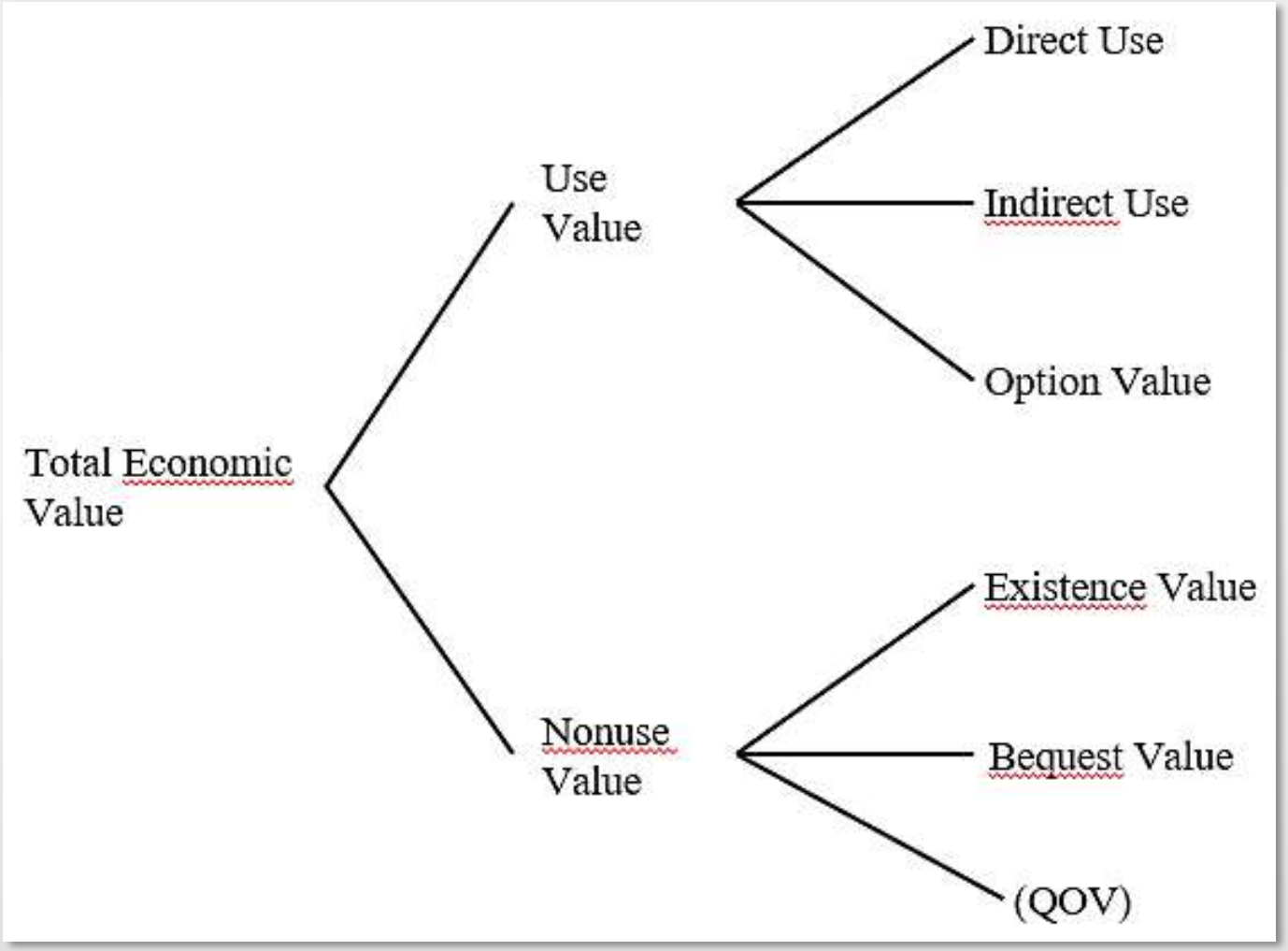
Use and Nonuse Value of Discoveries

Illustrative example showing probabilities associated with various research outcomes:



Pr = probability

Total economic value



The Value of Discovery as a Public Good

The CBA test when $NPV_u < 0$ is:

$$EXV_0 - |NPV_u| > 0.$$

The RI is deemed to have a positive measurable social impact if the positive EXV is greater than the net costs (i.e., negative NPV_u of measurable use-components)