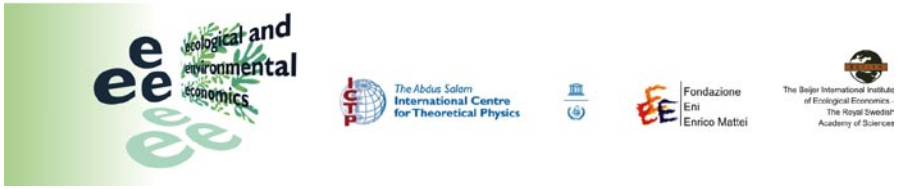

1st Teaching Workshop on Environmental Economics

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Non-market Valuation

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Market failure & public goods

- Markets cannot efficiently allocate public goods or resources with pervasive externalities, for which property rights are not clearly defined - - *the presence of gains and losses that extend beyond the private individuals making the decisions.*

- If markets fail to provide goods for which there is demand (e.g., clean air), they may be provided by other mechanisms. In the case of environmental assets, government generally assumes the role of provider because it possesses the *power and infrastructure needed to ensure that users pay for their consumption of public goods* (through the general tax system, or "green taxes" on polluters). In so doing, *g*overnments translate into action society's preferences regarding the provision of environmental goods.
- The decision-support technique economists recommend for this task is *benefit-cost analysis.*

Allocative efficiency and Measurement

- Measurement is an essential part of efficient resource allocation because it allows the idea of efficiency to be applied to an array of resources (including resource services).
- It serves as the basis for decisions that can improve resource allocation

Why measure?

- To meet the demands for measurement, economists have devised a variety of empirical tools for estimating the benefits and costs of public actions: ***Valuation Methods or Approaches***.
- Measurement plays an important role in lawsuits to compensate the public for private actions that injure public resources.
- Measurement plays a role in debates about resource allocation even when there is no formal requirement to measure benefits and costs.

The need for a *money* metric

- There is a need to measure, i.e., attribute a monetary value to the benefits (or *avoided* damages) from improving, protecting or preserving environmental resources.
- Money metrics can and should be employed as a yardsticks in valuing environmental assets.
- To this end, economists have developed measurement techniques, based on either observed market behavior or on stated preferences.

Indeed, we are willing to pay…

- People pay for environmental assets, either directly or indirectly.
- They pay *directly*
  - when they spend money and time to travel to unique natural sites;
  - by contributing to organizations that promote nature conservation and environmental causes.
- They pay *indirectly*
  - when they pay higher prices or rents for a house in a less polluted or quieter neighborhood,
  - when they purchase bottled spring water on the supposition that it is safer to drink than tap water.

WTP and Well-being

- Economists consider the *maximum sum individuals are willing to pay* for an increase in the provision of some environmental amenity (given income level and other relevant attributes) to be a reasonable expression of its value to the consumers, representing the *price* the good or asset would have fetched *had markets existed*.
- → In perfectly competitive markets, equilibrium prices are supposed to reflect the change (at the margin) in utility, i.e., the (marginal) improvement in "*well-being*".

Valuation involves an important implicit assumption: *The individual possess all the relevant information regarding the effect of environmental amenities on their (or other people's) welfare* (e.g., pollution on health, scenery on level of enjoyment). However, it is doubtful whether *individuals are fully informed* of the consequences of polluted air on their health, and hence, on their well-being.

- ***Should*** money be employed as a yardstick in valuing environmental improvement or degradation?
- *Counter argument*: “There exist intrinsic qualities associated with environmental assets which go beyond any attempt to capture them in a single economic index; there are services of the environment that defy quantitative measurement.” (But, cf., the purchase of a religious object or a work of art? Both carry an economic price tag, which captures the value placed upon it by the pious or art-loving buyer…!)

- "But… what about attempts to associate a "price" with the threat to the *very survival of life on this planet?"* …"Are there any finite monetary values consistent with long-run sustainability of life on planet earth?"
- "Valuation suffers from being a strictly *anthropocentric* approach: it measures changes in *human* welfare, where the individuals involved in the valuation often ignore *intrinsic* values associate with the very existence the living creatures and non-living constituents of nature."

Counter arguments

- Most valuations deal with relatively small, non-catastrophic changes in the state of environmental assets;
  - Money measures provide an explicit and clear expression of the degree of public concern with an environmental issue, via the willingness of members of society to pay for the environmental good; in a sense, it measures the *intensity of the public's preferences and concerns.*
  - In many policy-contexts monetary *implicit* valuations are made anyway by decision-makers.

Two essential steps

The typical steps in measurement:

- Infer a preference fn. (ex., utility fn.) or a behavioral relation (ex., a demand fn.);
- Calculate a benefit measure (ex., WTP).

The two basic valuation approaches

- ***Indirect, or behavioral:*** The researcher observes individual behavior in response to changes in public goods, and infers the value of those changes.
- ***Direct, or stated preferences:*** Contingent valuation (CVM), contingent ranking, contingent choice, conjoint analysis. The researcher poses hypothetical questions to respondents, including responses that trade off improvements in public goods and services for money, and infers preferences for the value of those changes.

What economists prefer?

Economists tend to have more “faith” in market-determined valuations, namely prices, which result from the interaction of the decentralized forces of *supply* and *demand*.

In the absence of government intervention, such market-determined prices are considered 'objective' and 'real', in the sense that they *reflect the true underlying preferences* of individuals, and are not elicited under a hypothetical and artificial market conditions.

The 3 steps of any valuation

- data collection
- model specification
- econometric estimation

The need for econometric estimation

- The need for statistical inference and econometrics arises because individual actions (behavior or responses to a questionnaire) almost never reveal precisely the economic value that we wish to measure.
- Uncertainty about the nature of preference fn., and/or errors in estimation introduce randomness

Indirect approaches

- The indirect approach postulates an explicit relationship between the demand for a market good and the quantity (or level) of environmental goods, known as *weak complementarity.*
- It posits that the consumption of the market good is affected by level of the environmental good or asset associated with it. This demand interdependence allows the investigator to infer how the *demand for the market good* shifts in response to changes in the availability (or the quality) of *the environmental good*. From shifts in the *observable* demand function for the market good, a money-metric utility for the *non-market* good is derived.

I. TCM

- The earliest valuation method employed by environmental economists to study the demand for, and value of, natural resources (national parks, nature reserves, open space), which serve as input services in 'producing' outdoor recreation activities and related amenities: hiking, camping, fishing, boating, swimming, wildlife watching, and the like.
- These services are consumed *in situ*: individuals must travel to the site in order to experience and enjoy them. This involves money (and time) for travel and on-site expenditures.

- TCM exploits this observed relationship, whereby consumers reveal their implicit valuation of the natural resource services through observable travel behavior: The benefits that individuals derive from the recreation area are directly related to the distance that they are prepared to travel in order to visit it and, hence, to their (money and time) cost of travel and other related expenditures.
- It can be considered to be the *value of the site*, or the implicit 'price' the public would have been willing to pay to secure this form of *land use* at that natural site.

II. Hedonic price models

- HPM has been employed to value environmental amenities (e.g., pollution and noise), through the impact on property values.
- To the extent that *property values partly or fully capitalize pollution-induced damages*, HPM may be used to unravel the value of clean air or of quietness embodied in housing prices.

- The basic notion underlying hedonic prices is that every market good is composed of a “bundle of attributes”. The price of, say, a house, *p,* is a function of the “prices” of the individual attributes:
  - *structural attributes*, such as size, age, and number of rooms, denoted by the vector *S.*
  - *Neighborhood attributes*, such as the quality of the school system, open spaces, and access to shopping areas, denoted by the vector *N.*
  - *Environmental amenity*, e.g., air quality, noise level, or proximity to a waste disposal site, denoted by *E*.

- The composite price function would then be denoted by:
  - $p = f(S, N, E)$
- Under the assumption that the housing market is in equilibrium, and that the supply of housing is fixed (at least in the short run), it can be shown the following first-order condition holds:
  - $\boldsymbol{MRSEx \equiv (\delta u / \delta E) / (\delta u / \delta x) = dp / dE}$

- The expression says that the marginal rate of substitution between the market good and the environmental good (= the *willingness to pay for an additional unit of E),* is equal to the *observable* schedule of the marginal *implicit price function* for the environmental attribute *E, dp /dE.*
  - → The locus of all the individual marginal WTP in any given location
  - → a demand schedule for the environmental attribute.

III. Valuing environmental risks to human life: wage differentials in the labor market

When environmental pollution is associated with increased death risks, policy may focus directly on the benefits from programs designed to reduce these risks. The pertinent issue is the *value of a human life saved (*the value of life in a statistical sense of reducing mortality risks, that is the value of a 'statistical life' and not that of any one recognizable individual).

IV. Valuing health damages from market behavior: *Cost of Illness Method*

COI employed to estimate economic gains from improved health.

COI estimates the changes in *private and public expenditures* on health-care and the *value of lost production*, on the basis of the relationship between excess morbidity or mortality and ambient pollution levels ('dose-response functions'). However, these expenditures do not necessarily measure everything that households spend, or are willing to pay to avoid poor health (or death!).

Direct approaches:
Stated Preferences Approaches

Any direct valuation method which aims to elicit explicit or implicit valuations of an environmental asset, through an appropriately constructed set of queries.

There are no actual behavioral changes involved; respondents merely *state* that they would behave in a certain fashion.

- **CVM**: Individuals are prompted to state their WTP for the changes in the (quantity or quality) of the environmental good in question, either through an open question format or a dichotomous choice procedure.

- **Conjoint Analysis (CA)** encompasses a variety of multi-attribute preference elicitation techniques, employed by market researchers to evaluate potential new products and new markets for existing products. It allows for a direct valuation of the *attribute components* of the environmental good (e.g., attributes associated with components of a stream, such as BOD and dissolved oxygen, instead of a single, general term, 'water quality').

From numbers to policy: *what is the value of monetary values?*

If the “product” is so useful, why isn't it fully utilized? Politicians understand and grasp best dollars and cents.

- There is a strong resistance to attaching money values to intangible environmental benefits, arising from aesthetics, preservation of wildlife or human health:
  - (1) these are *priceless*, and cannot be valued,
  - (2) no such tag *should* ever be attached to them on *moral* grounds.

In ancient times they might kill the messenger that brought undesired news; today they shelve the study…