Values of Environmental Goods

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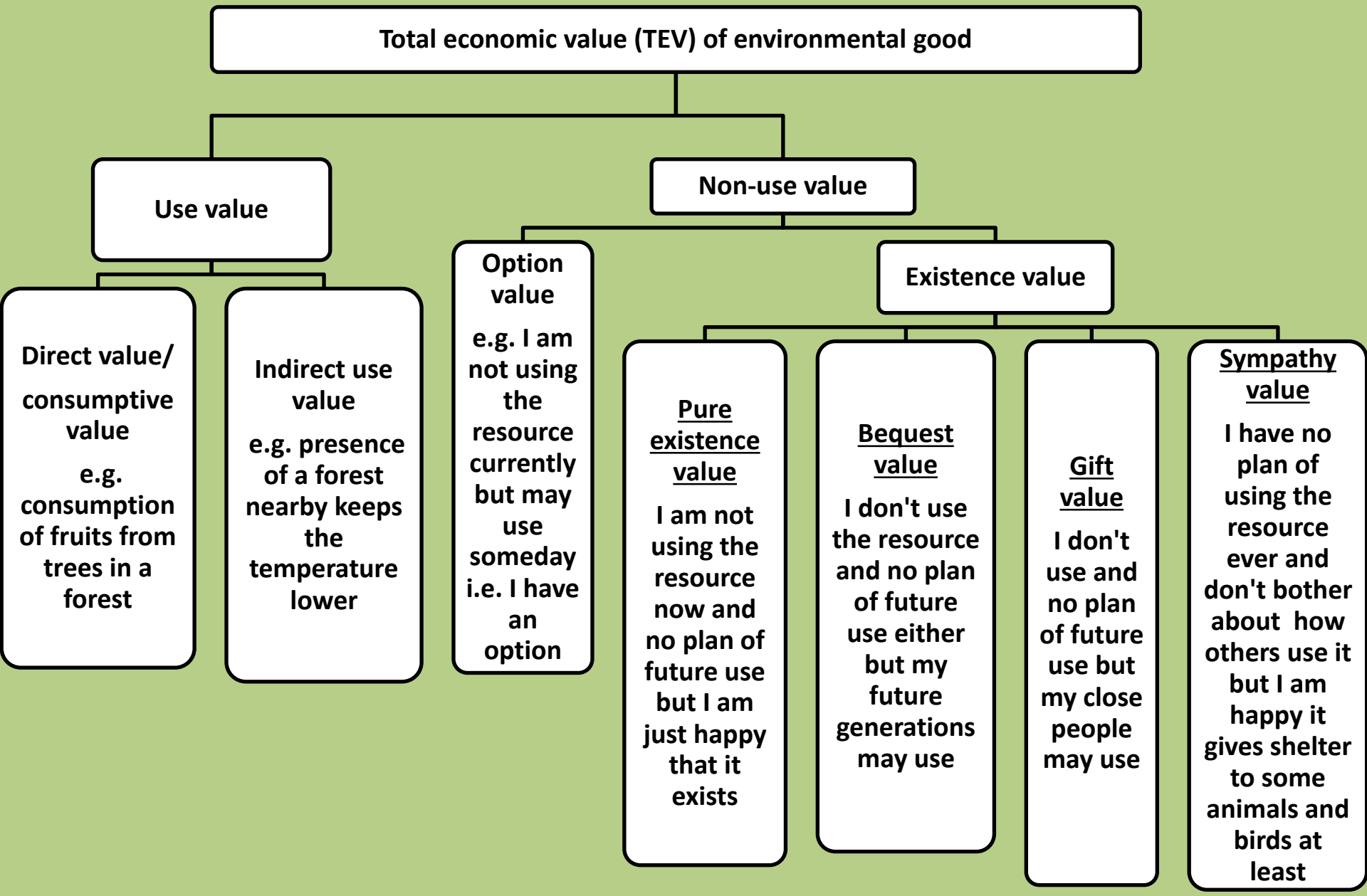
Types of goods can be classified as:

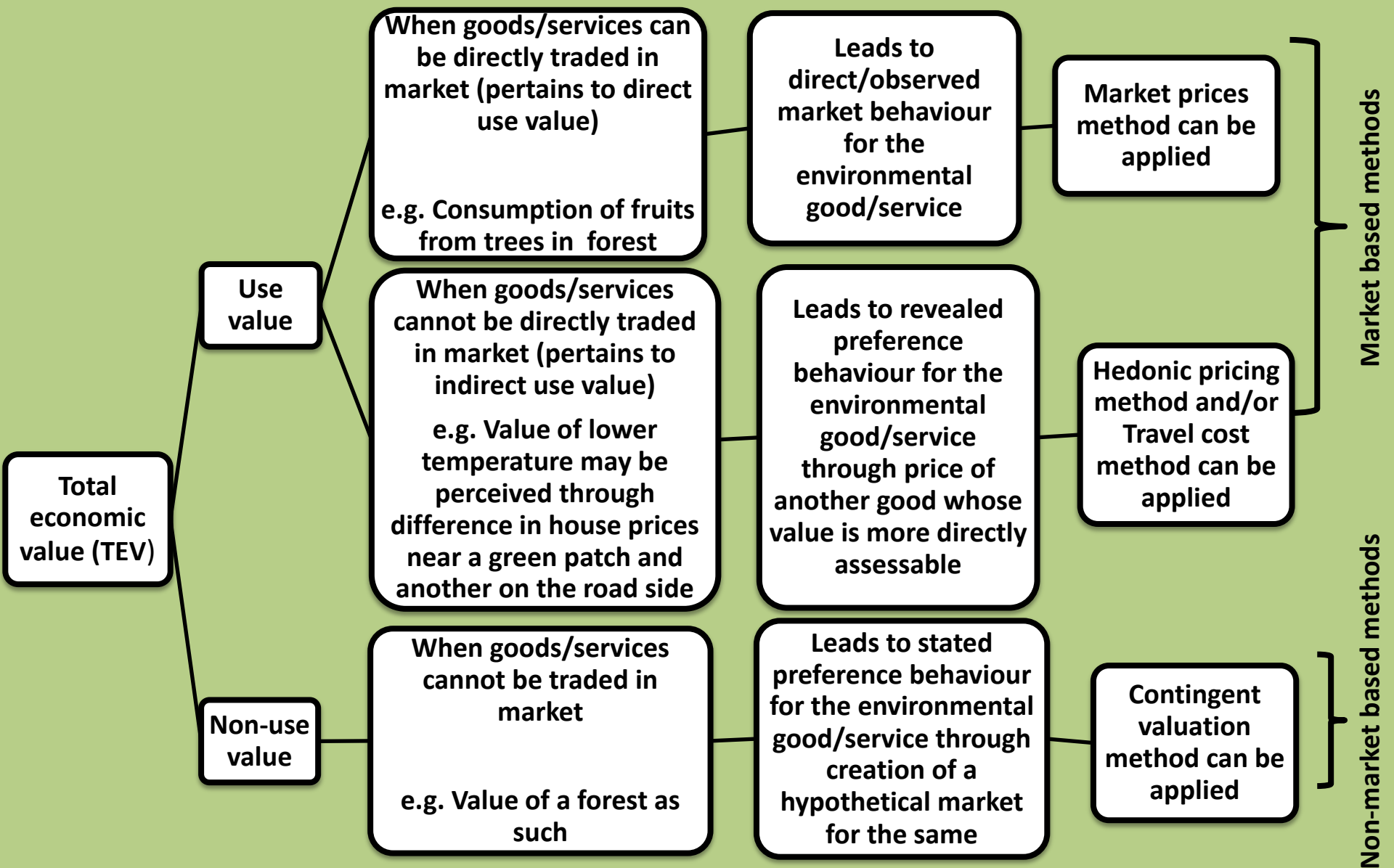
	Rival	Non-rival
Excludable	Private goods	Club goods
Non- excludable	Open access resources/ common property resources/ environmental goods	Public goods

- Environmental goods are typically called as open access resources or common property resources as they belong to everyone and can be used freely by everyone, e.g. forests, rivers, etc.
- They are rival like private goods but non-excludable like public goods
- Since environmental goods are rival but non-excludable, it is difficult to trade them in market and assess their value

Total economic value of environmental goods:



Methods of valuing environmental goods:



Valuation of Environmental Goods: Contingent Valuation Method (CVM)

Introduction

- **Measurement of value of environmental goods/services through interview/survey technique**

- **Via response to a hypothetical market**

- **Asks individuals the maximum amount they are willing to pay (WTP) to use/preserve an environmental good or service**

  Or

  The minimum amount they are willing to accept (WTA) as compensation to forgo the good or service

- **How the method is to work**

  Example: Suppose a power plant is producing electricity and damaging the environment. Customers/public will be asked – they will have to pay a price to save environment. When applied, as a result price of electricity will increase. So consumption will fall causing production to fall and so environmental damage will be reduced

- **Broadly two steps in CVM:**
  1. **Construction of hypothetical market**
  2. **Obtaining data and analysing it**

1. Construction of hypothetical market:

- **Detailed description of environmental good/service being valued should be provided**
- **Situation before and after proposed change must be stated**
- **Detailed description of way of payment should be provided**

2. Obtaining data and analysing it:

- **<u>Identification of</u>**
- **Object to be valued**
- **Unit of measurement of WTP/WTA**
- **Time span of valuation**
- **Respondents**

➢ **Questionnaire designing should include**

- **Accurate information of state of affairs**
- **Questions on socio-economic information**
- **Clarity on the amount and method of payment**

➢ **Survey of sample population**

- **As population is large sample survey is advisable**
- **Deciding sample designing**
- **Deciding survey time and area**
- **Training of investigators**
- **Conducting the survey**

➢ **Database creation and data analysis**

- **Collection and verification of data**
- **Creation of database**
- **Elimination of invalid questions**
- **Data analysis**

➢ **WTP estimation**

- **Respondents may be asked to choose the amount and way of payment out of a range of options**
- **Respondents may be asked to state the amount and way of payment on their own**
- **Conversion of individual WTP into overall WTP using models like logit, probit, game theory or other statistical tools**
- **Estimation of annual WTP**
- **Calculation of annual net benefits/total value of environmental good/service**

Advantages

➢ **Uniquely suited to address non-use values**

➢ **Can be applied to all situations i.e. HPM may not be able to differentiate between effect of different pollutants but only overall air quality but CVM can ask people about specific pollutants**

Limitations

- Large sample required for desired results
- Identification of who would benefit from the good and who would pay
- Face-to-face interviews most reliable but expensive
- Possibility of

- Non-response bias
- Strategic bias – people may free ride
- Information bias – respondents would react as per information available.
- Hypothetical bias – problem of overstating WTP since only a hypothetical market
- Operational bias – if respondents are unfamiliar with the good/service
- Design bias

  (i) Starting point bias – close end questions

  (ii) Vehicle bias – chances of overstating of WTP if payment method is indirect as burden is less perceived through indirect tax

Valuation of Environmental Goods: Hedonic Pricing Method (HPM)

Introduction

- Goods that do not have market prices themselves can often affect prices of marketable goods e.g. air quality in different locations affecting house prices
- Word 'hedonic' relates to pleasure – how much the pleasure from air quality, noise level, etc. adds value to another good i.e. house

Assumptions

- Price of a property is related to the stream of benefits to be derived from it
- Prices paid by individuals for commodities reflect both environmental and non-environmental characteristics
- Implicit cost are sometimes referred to as hedonic prices which are related to the environmental attributes of the property

Taking example of a house,

A hedonic price function can be represented as

$$P_i = f([S_{1i} \dots S_{ki}, N_{1i} \dots . N_{mi}, Z_{1i} \dots Z_{ni}] \quad \text{.....(1)}$$

Where

P_i **= Price of house**

S = Structural characteristics like type of construction of terrace, house area, no. of rooms, presence of garage, etc.

N = Neighbourhood characteristics like accessibility to work, crime rate, availability of schools, etc.

Z= Environmental characteristics like air quality , level of noise pollution, presence of greenery, etc.

Being more specific in terms of functional form and considering only one variable say air quality, Equation(1) can be expressed as a linear equation as given below

$$P_i = \alpha_0 + \beta_1 S_{1i} + \cdots + \beta_k S_{ki} + \gamma_1 N_{1i} + \cdots + \gamma_m N_{mi} + \delta_a Z_a \text{ .....(2)}$$

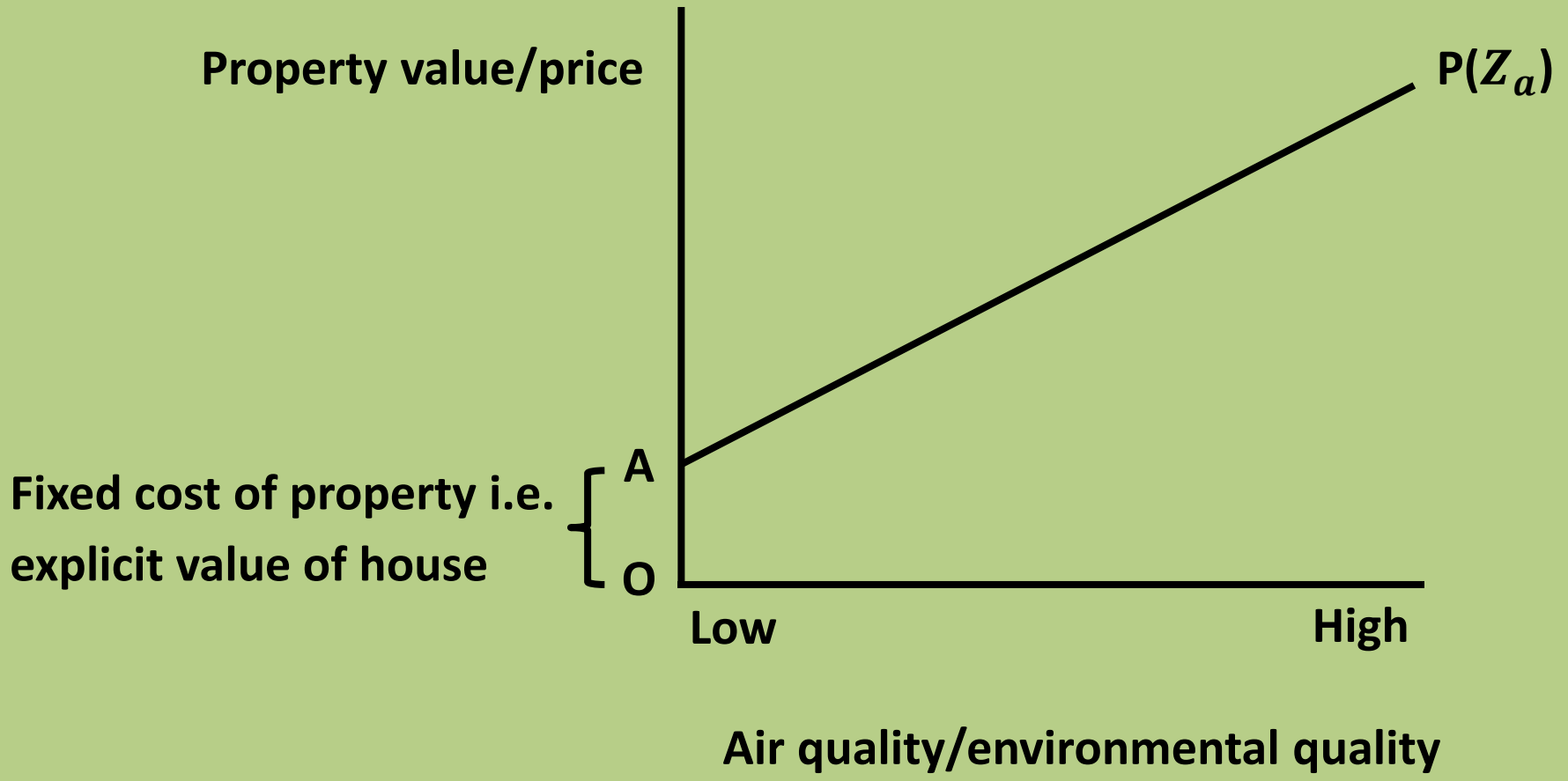
Where $\delta_a > 0$, because we usually see there exists a positive relation between air quality and house price (private house)

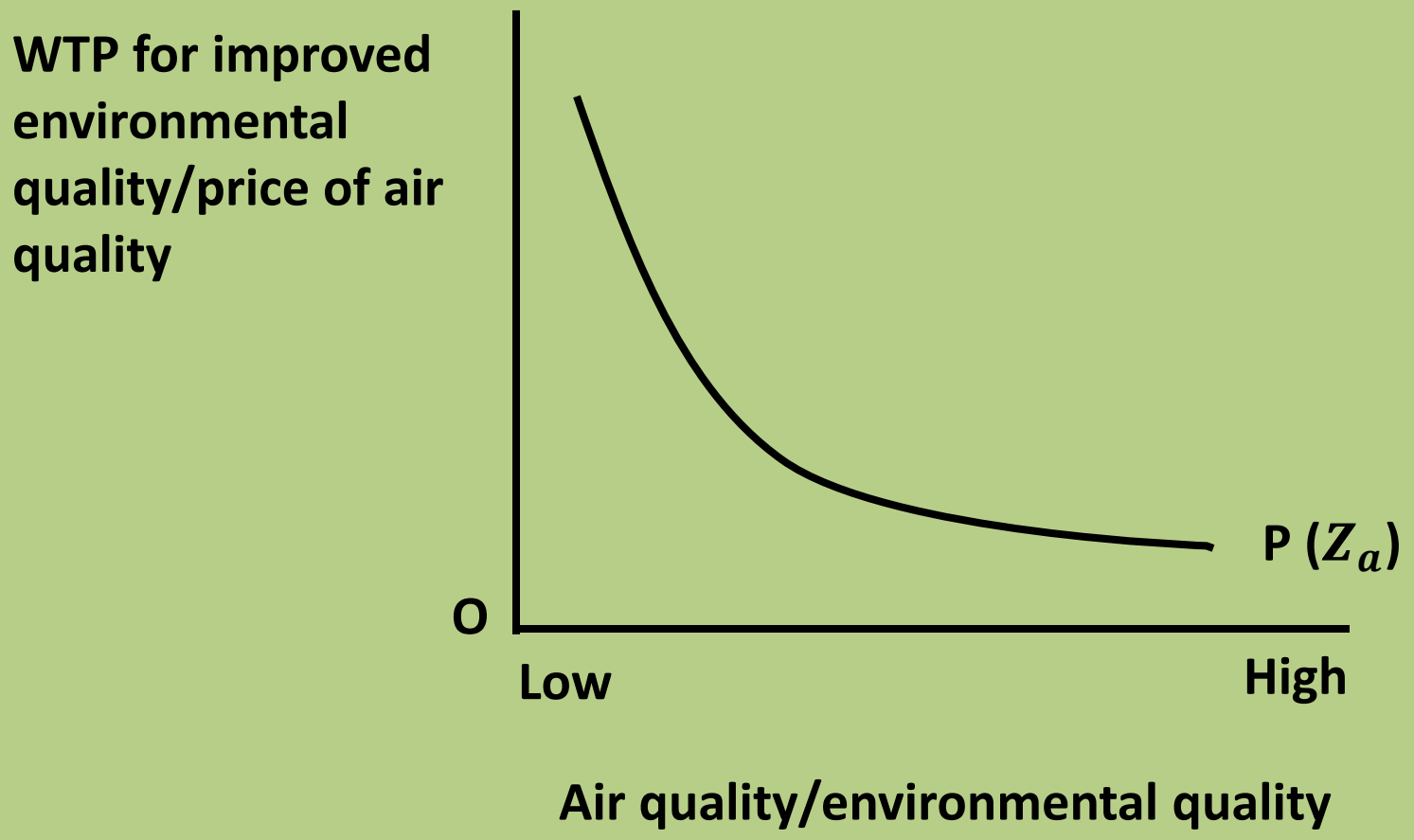
Often a log linear model is used as it allows better separation of the effects of different attributes
Ultimately, like a normal regression model, we want an unbiased estimate with smallest possible standard error

Limitations

- **Chance of specification error due to valuable**
- **Chance of specification error due to wrong mathematical model**
- **Chance of multicollinearity**
- **Problem with respect to data regarding factors on which house price depends as they are not standardized**
- **Can be mainly used to assess localised impacts**

Graphically illustration of aggregate WTP for marginal changes in environmental attributes





When air quality is very low people are willing to pay a higher price for better air quality. But after the air quality has reached a standard, people's WTP for even better air quality decreases.

Valuation of Environmental Goods: Travel Cost Method (TCM)

Introduction

- Surrogate to market method
- The cost approach tries to determine demand for an environmental good that depends on travel cost (opportunity cost of time spent in travelling and on site, fuel expenses, parking fees, etc.)
- Usually used for valuation of public recreation sites with zero or normal admission fee

Based on 3 main assumptions

- Cost of using a recreation site is more than the admission fee
- People living at different distances from the site face different costs for using the site
- In absence of systematic variations with distance, travel costs can be used as a proxy for deriving the demand for the site

Theory

- The theory develops by first assessing the relationship between distance from a recreation site and the number of visits for one individual
- In an example of visit to a site say a beach, prominent monetary costs to be borne are fuel cost (directly proportional to distance from beach), wear and tear of vehicle cost (constant at the current time), parking fee (constant), etc. along with other not-so-visible costs like opportunity cost of time spent in travelling and on site
- The number of visits against travel cost are plotted for one individual, taking the travel cost on Y-axis and the number of visits on the X-axis, which gives the demand curve for the site for that individual
- Taking into account the travel cost at which the number of visits is zero, and the actual travel cost and number of visits at it , the consumer surplus is calculated which gives the value placed by that individual on the site

- **Suppose there are 3 localities A, B and C from which individuals visit the beach**

Value of the site for all individuals visiting it from location A

= value/consumer surplus of one individual A * number of individuals visiting the site from location A

Similarly,

Value of the site for all individuals visiting it from location B

= value/consumer surplus of one individual B * number of individuals visiting the site from location B

And,

Value of the site for all individuals visiting it from location C

= value/consumer surplus of one individual C * number of individuals visiting the site from location C

- **Ignoring the non-use values, total value of the recreational site = value/consumer surplus for all individuals visiting the beach from locality A + value/consumer surplus for all individuals visiting the beach from locality B + value/consumer surplus for all individuals visiting the beach from locality C**
- **Travel cost method is to based on :**

  benefit to the society as a whole= total consumer surplus

Limitations of the method

- **Demand curve has to be linear to apply TCM**
- **Assumes visit to a site depends only on cost of travelling and important factors like choices and preferences of people are totally ignored**
- **Value of TCM for policy purposes will be limited if estimation biases are not addressed**

References

1. **Kolstad, Charles D. (2010) 'Environmental economics'. 2nd Edition. Oxford University Press.**

2. Lesser J. ,Dodds D. & Zebre R. , Jr. (1997) 'Environmental Economics and Policy' 1 st Edition. Addison Wisley.