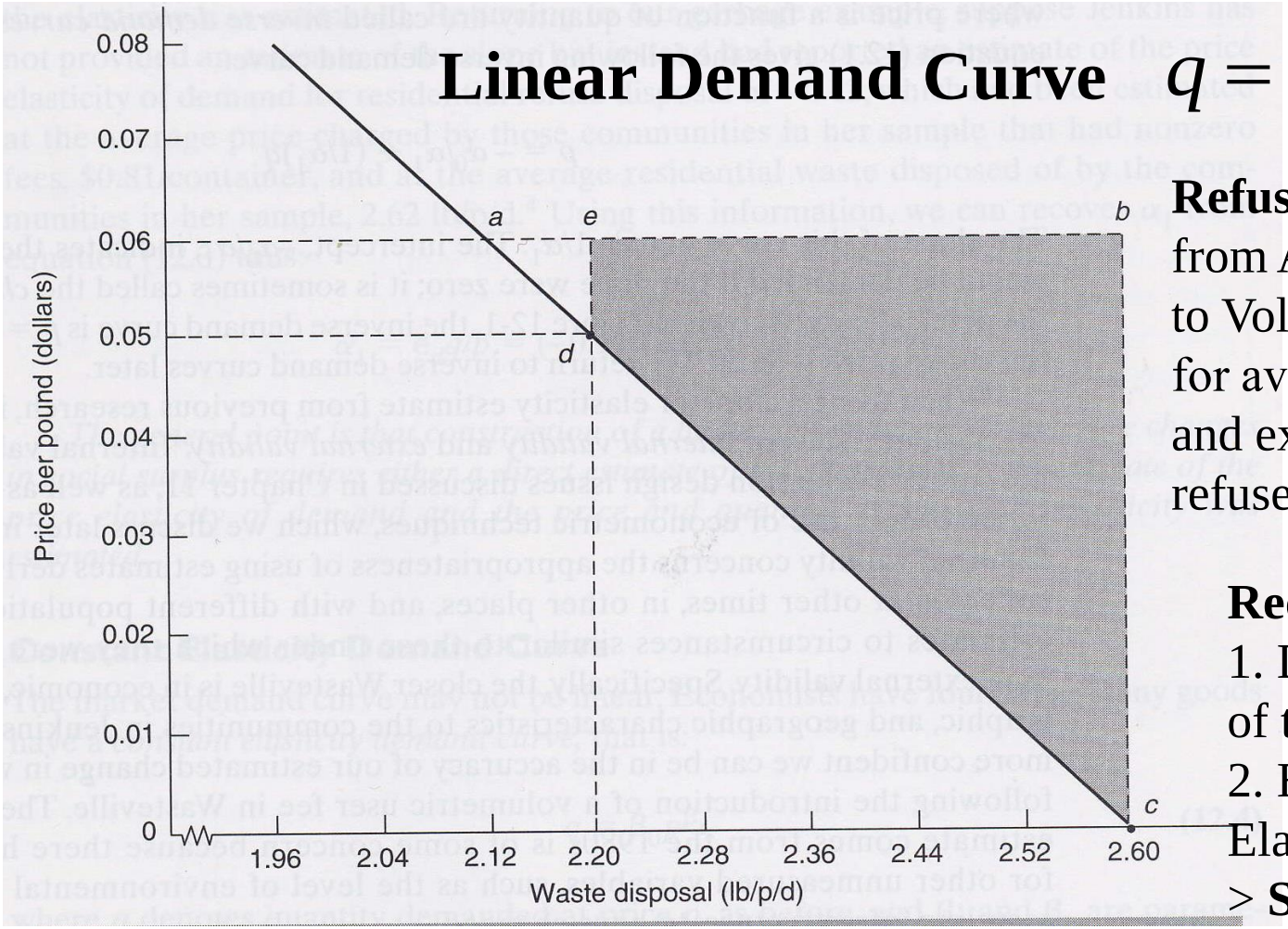
Chapter 13 Valuing Impacts from Observed Behavior: Direct Estimation of Demand Curves



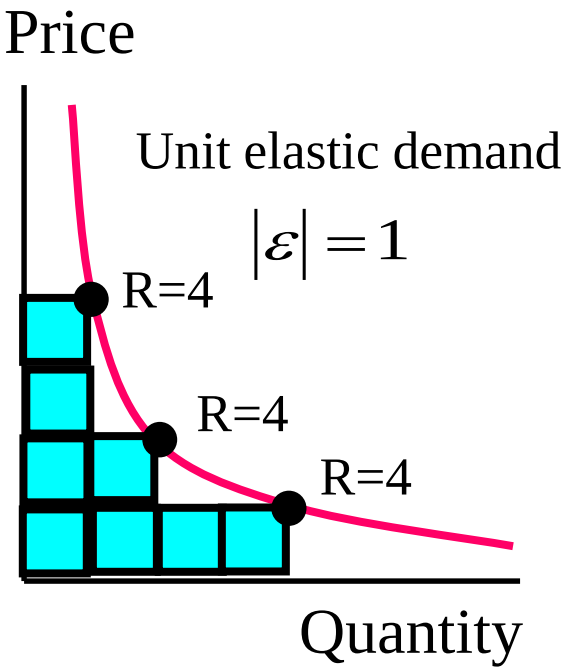
Linear Demand Curve $q = \alpha_0 + \alpha_1 p$

Refuse Disposal Policy
from Annual Fees
to Volume Charge
for avoiding "free riding"
and excessive amount of
refuse disposal.

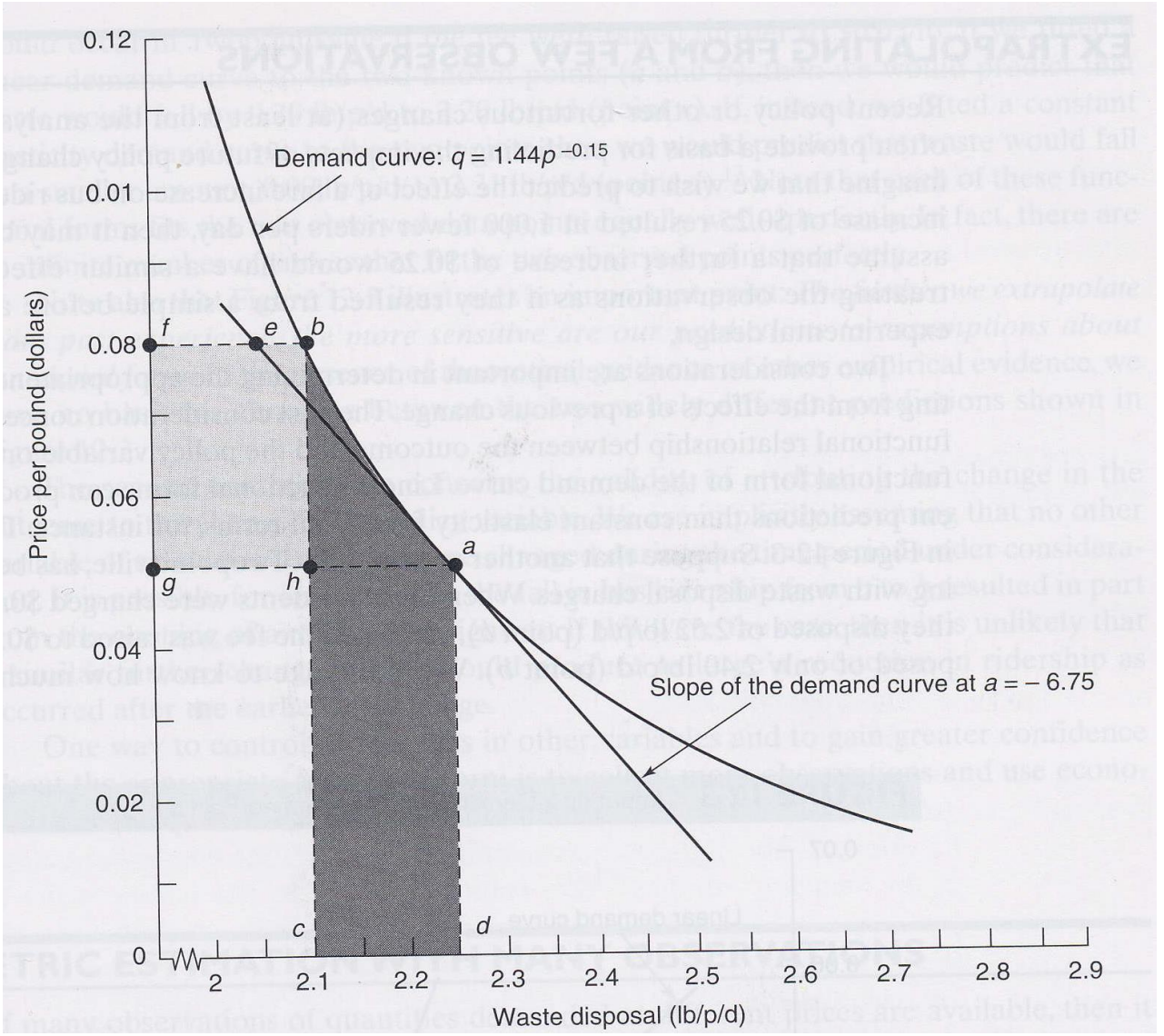
Required data
1. Direct measurement of the slope
2. Estimate of the price Elasticity of demand

> **Shadow Price**

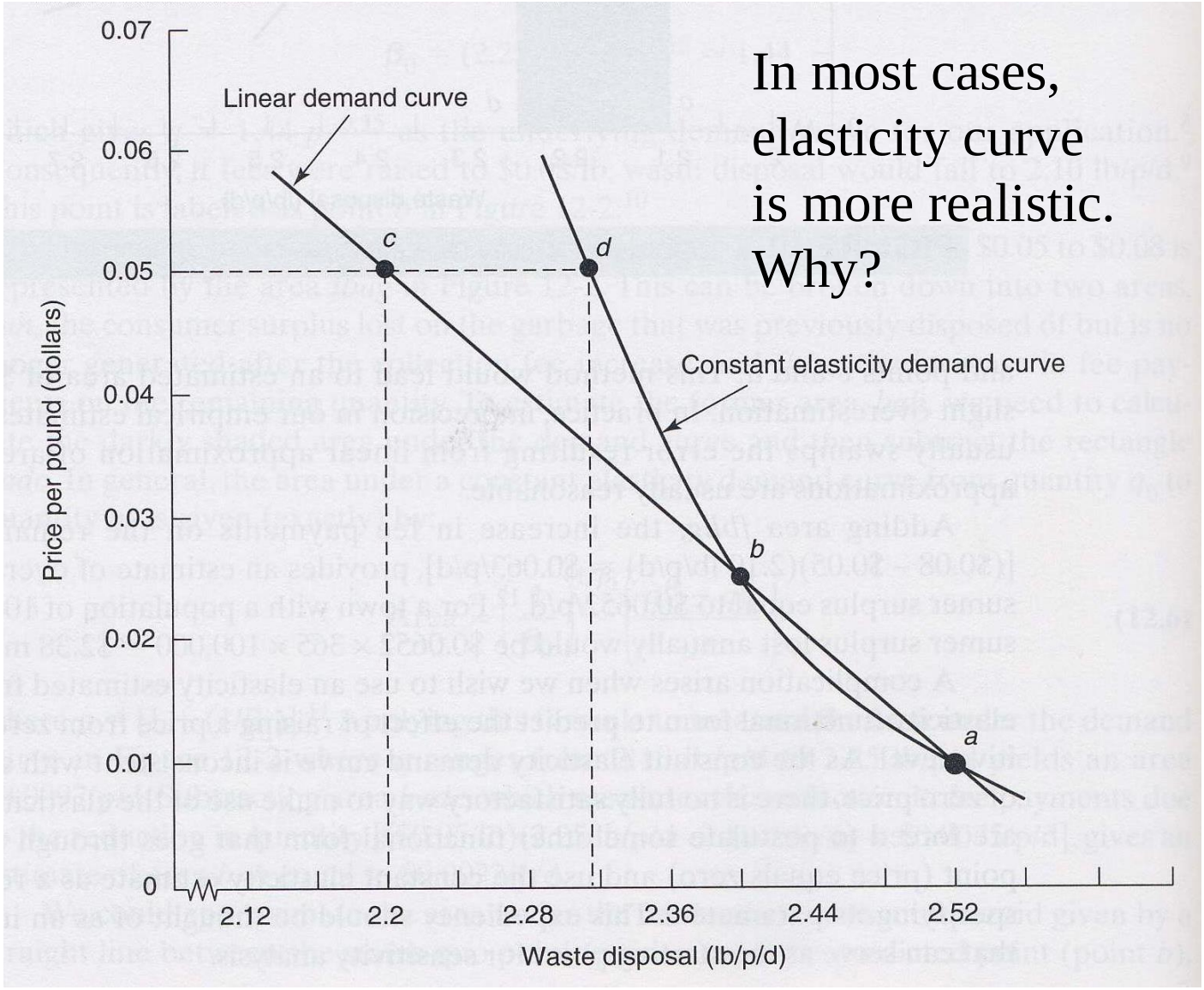
Constant Elasticity Demand Curve



$$q = \beta_0 p^{\beta 1}$$



Extrapolating from Observations



In most cases, elasticity curve is more realistic. Why?

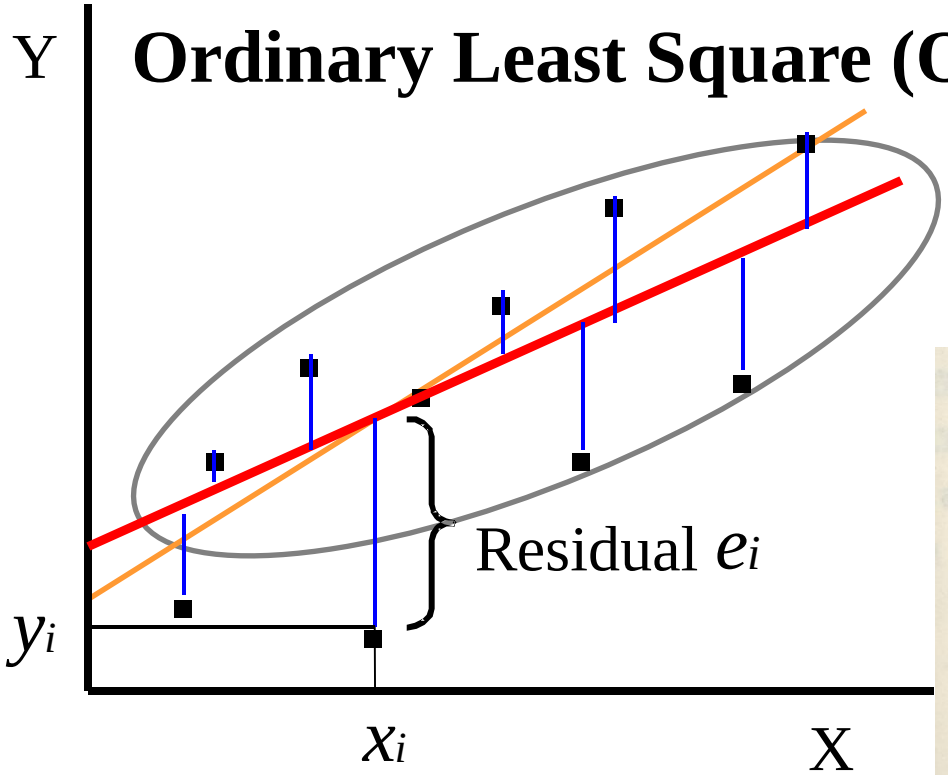
Econometric Estimation

$$q = \alpha_0 + \alpha_1 p + \alpha_2 I + \alpha_3 T + \epsilon$$

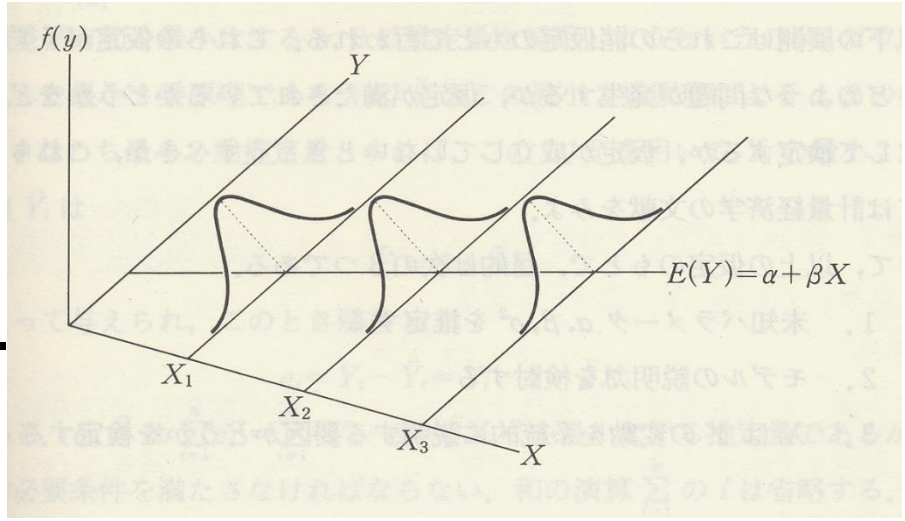
q : explained (dependent) variables

p, I, T: explanatory (independent) variables

Ordinary Least Square (OLS) method



$$\hat{y}_i = \alpha + \beta x_i$$



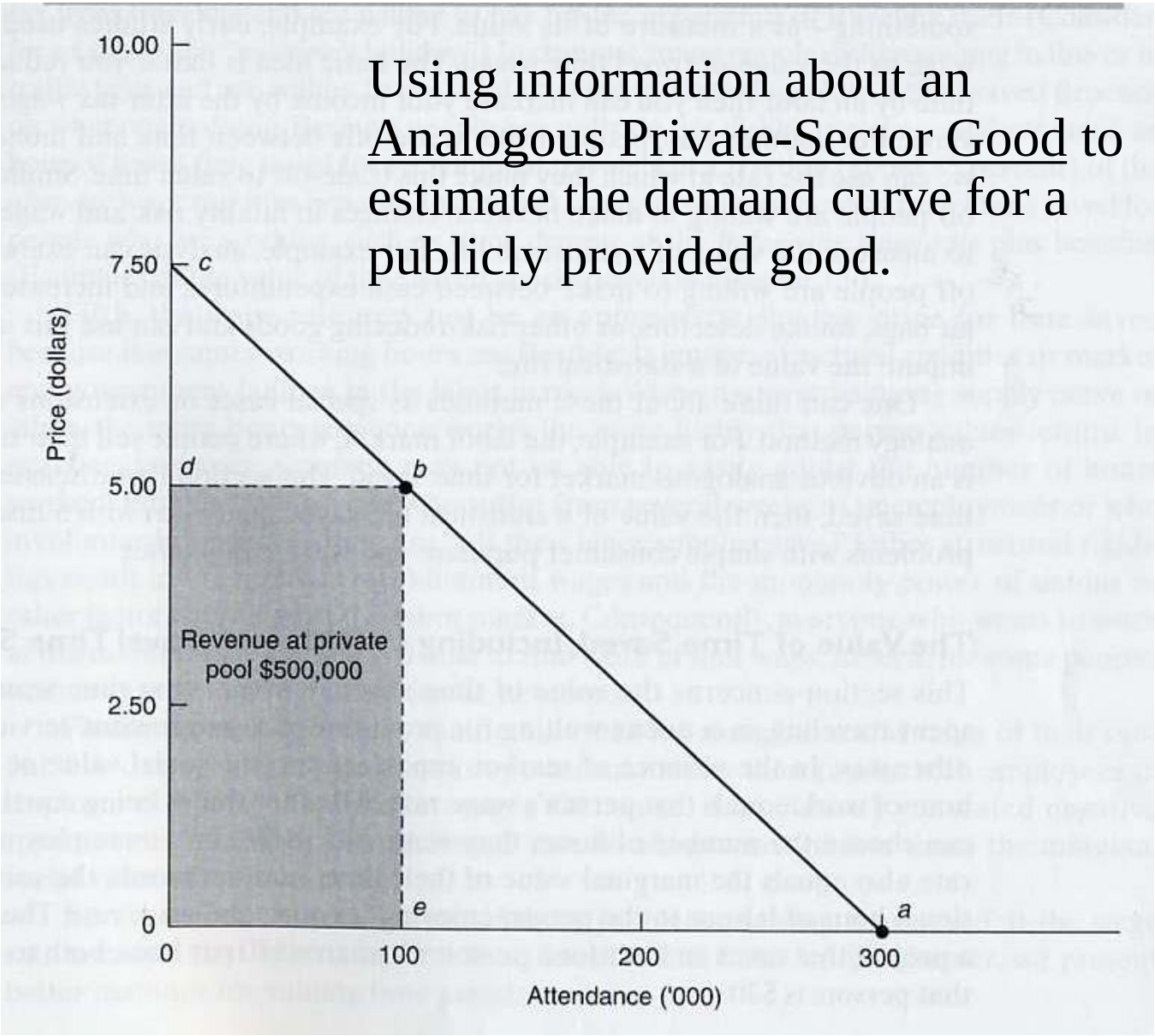
$$e_i = y_i - \hat{y}_i \quad Minimize \sum e_i^2$$

Chapter 14 Valuing Impacts from Observed Behavior: Indirect Market Methods

Observed Behavior = Revealed Preference ⟷ Stated Preference

1. Market Analogy Method
2. Trade-off Method (Value of Time Saved, Value of Statistical Life)
3. Intermediate Good Method
4. Hedonic Pricing Method
5. Travel Cost Method

Analogous Good

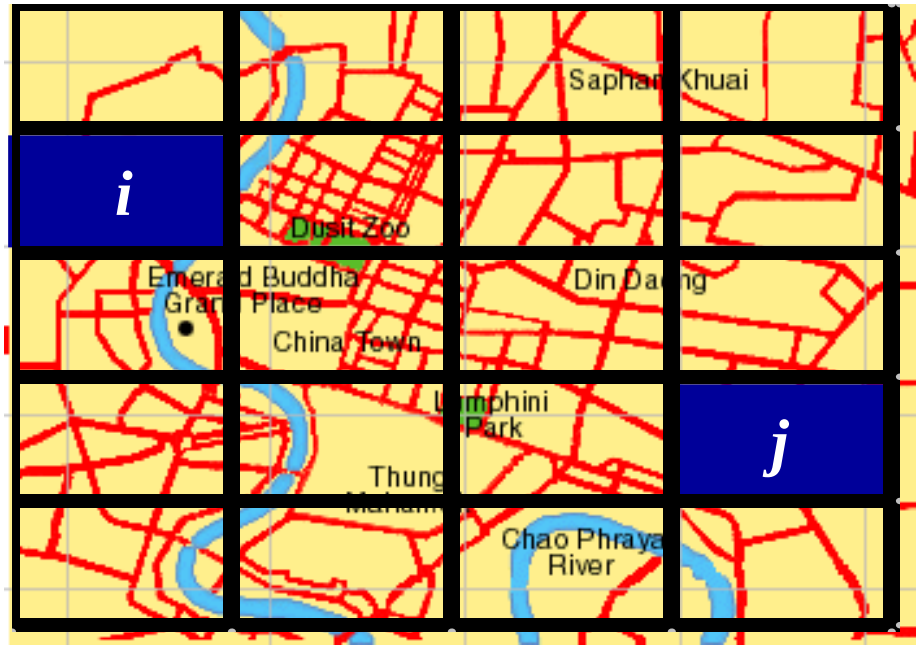


Using information about an <u>Analogous Private-Sector Good</u> to estimate the demand curve for a publicly provided good.

How to estimate Value of Time (VOT)? Case of Transport Project

Generalized Cost

is an amount of money representing the overall disutility (or inconvenience) of traveling between origin *i* and destination *j* by a particular mode.



Zoning

Origin *i*

Destination *j*

Components of Generalized Cost

Public Transport

Fare, Giving up time, …..

Car

Giving up time,

Toll Charge,

VOC (Vehicle Operating Costs):

Fuel, Oil, Tire & Tube, Maintenance and Depreciation

Other components?

Market in Transport Service

Price = Generalized Cost

WTP is the maximum amount of money that a user would be willing to pay to make a trip. (can be interpreted as a maximum generalized cost that they are prepared to accept a trip)

Generalized Cost Function

$$GC = \alpha T + \beta L$$

GC: generalized cost by transport mode [yen/ vehicle]
α : value of time [yen/ vehicle*minute]
β : vehicle operation cost or fare by transport mode [yen/ vehicle*km]
T : average travel time by transport mode [minute]
L : travel distance by transport mode [km]

How to improve society by transport projects

> Reduce Generalized Cost e.g. time saving, accidents reductions

Measurement of "Value of Time"

1) **Resource value**,

based on Opportunity Cost (**Trade-Off Method**)

The value of what one gives up to get something

a) Average (expected) gross wage rate (per hour)

b) National annual income data (instead of gross wage rate)

ex. VOT = GDP / number of employment / working time

2) **Behavioral value**, based on Generalized Cost Function

$$Utility = GC = -0.147TW - 0.0411TT - 2.24C$$

[U/min] [U/$]

(estimated by mode choice model)

VOT = 0.0411 *60mins/ 2.24

= 1.10 US$/ hr / person

Note: Utility for Commuting

Mode choice for commuting:

travel time, waiting time, fares, comfort….

$U(x_1, x_2, ...x_n) = \beta_1 x_1 + \beta_2 x_2 + ... + \beta_n x_n$ β_1, β_2 : parameters

The economic characteristics of transport

Derived nature of the demand

- benefit to travel as short as possible
- "joy riders", "tourists" to be in the minority

Mode choice model bus or car

$U = -0.147TW - 0.0411TT - 2.24C$

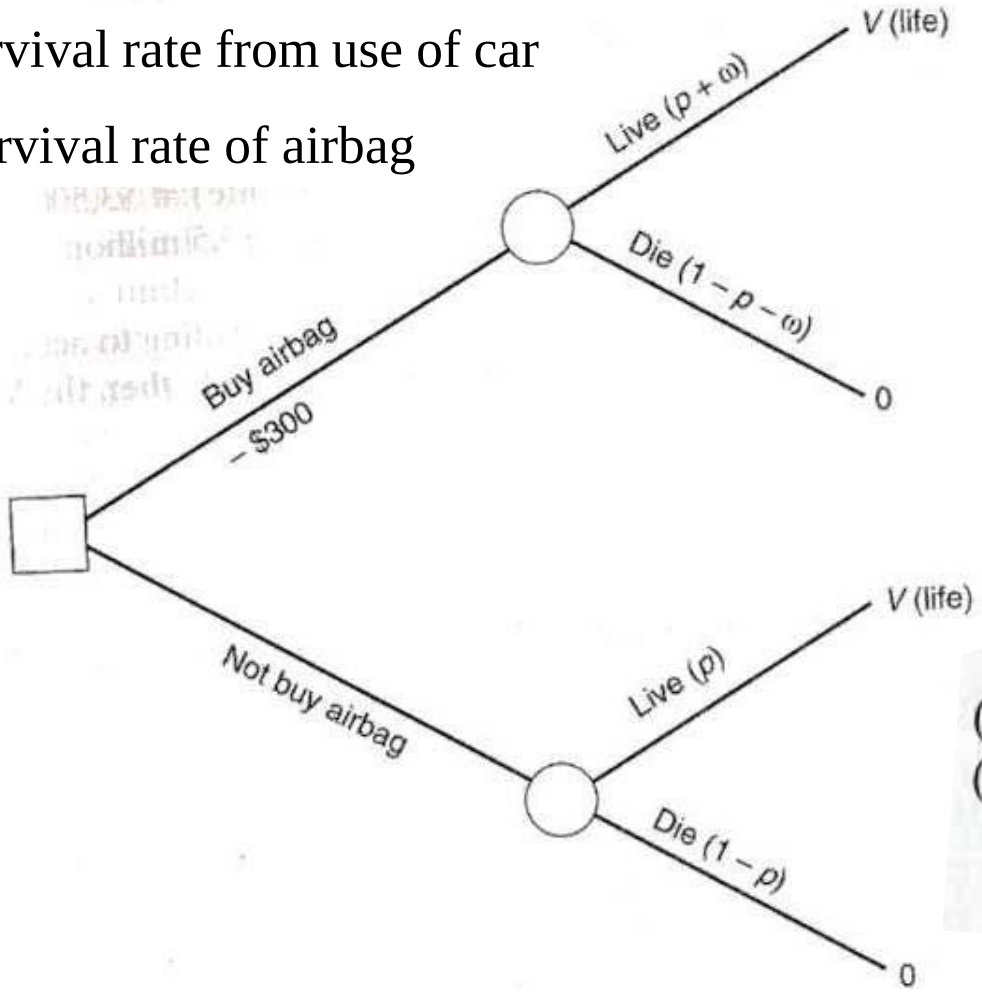
TW: access time (total walking time to and from bus or car)
TT: total time of trip
C: total cost of trip

* Daniel McFadden (1975) Urban Travel Demand, North-Holland
He was awarded the Nobel Prize in Economics in 2000.

The Value of a Statistical Life
- Simple Consumer Purchase Studies -

p: survival rate from use of car

w: survival rate of airbag



indifference

$$(p + \omega)V(\text{life}) - \$300 = pV(\text{life})$$
$$(p + \omega)V(\text{life}) - pV(\text{life}) = \$300$$
$$\omega V(\text{life}) = \$300$$
$$V(\text{life}) = \$300/\omega$$

The Value of a Statistical Life

- **Forgone Earnings Method**

  The value of a life saved = Persons discount future earnings

  Used by the courts. However, many problems exist.

  e.g. It ignores individual's WTP to reduce the risk of their deaths

- **Simple Labor Market Studies**

  Two indifferent supposition for job fatality risk

  (1/1,000) V(life) = $3,500. Then, V(life) = $ 3.5 million

  Greater chance of fatal injury — Riskier job offers

  * People overestimate the occurrence of low-probability *bad* event: e.g. radiation contamination, Ebola hemorrhagic fever.
  * Risk seeking e.g. Mercenary

Intermediate Good Method

To value “education and training programs” as *human capital*.

Annual Benefit = Income (with project) – Income (without project)

Asset Valuation Method

Project affect the prices of assets (e.g. land, housing, stocks, etc). The impacts are said to be *capitalized* into the market value of the assets. Observed increase (or decrease) in asset values can be used to estimate the benefits (costs or disbenefits) of projects.

Hedonic Pricing Method

Problems with Simple Valuation Methods

1. Omitted Variable Problem
2. Self-Selection Bias

> Hedonic Pricing Method overcome these two problems.

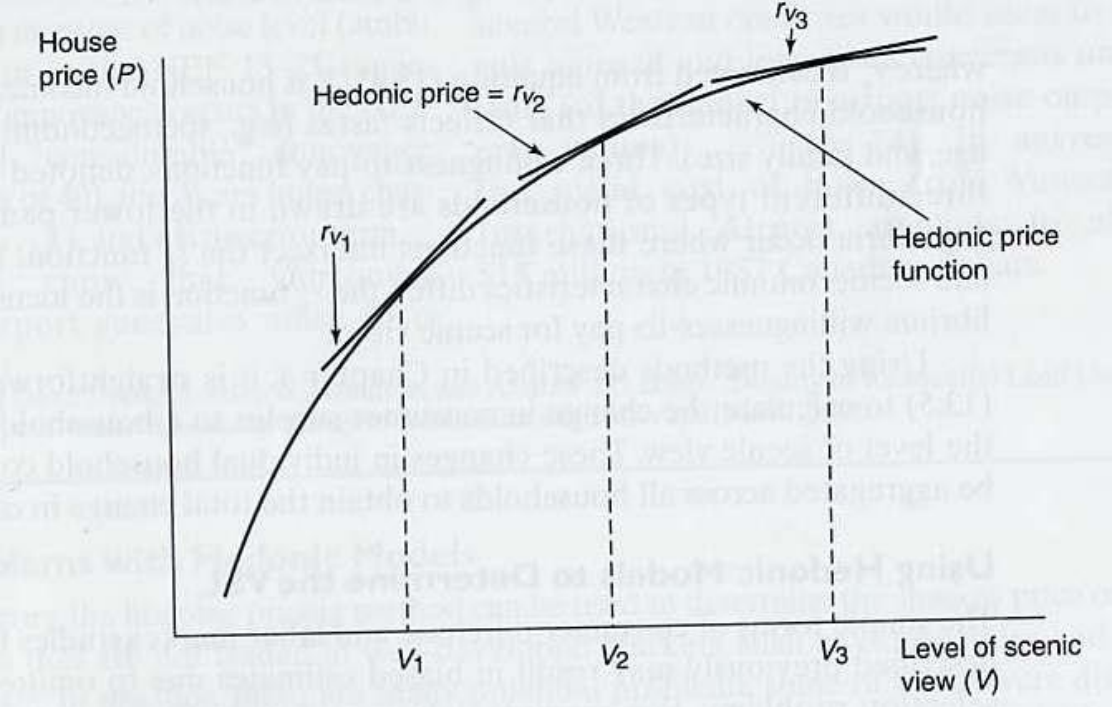
Hedonic Pricing Method = Hedonic Regression Method

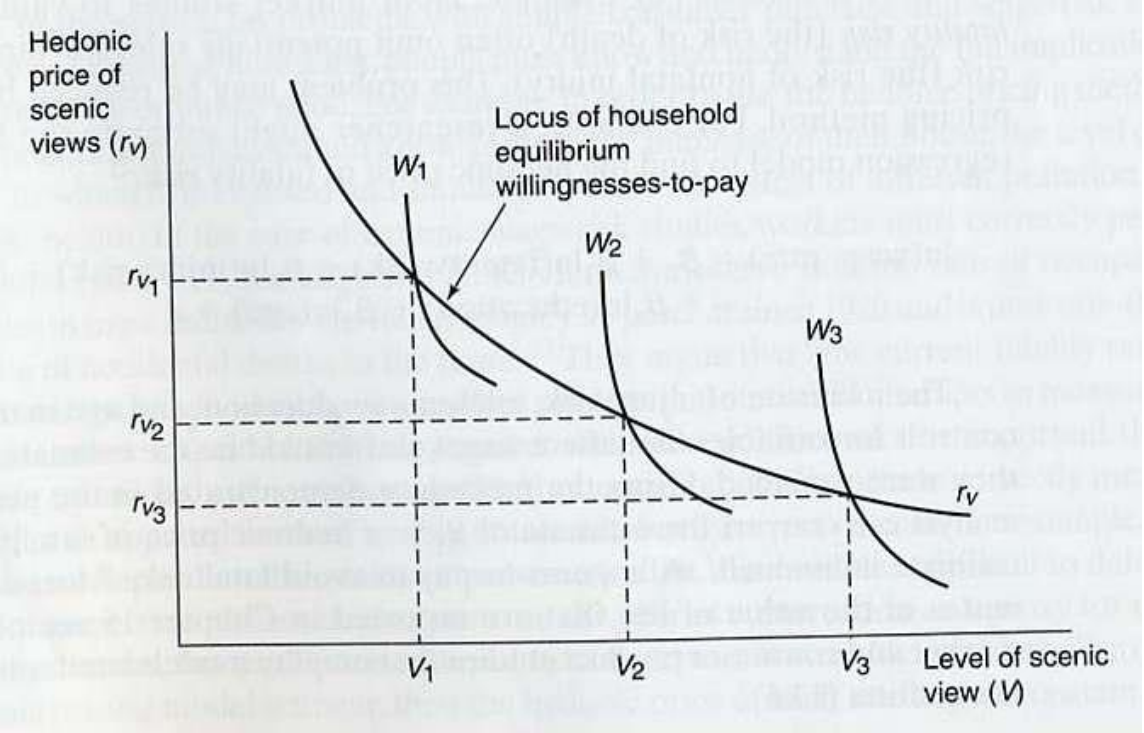
Hedonic Price Function $P = f(CBD, SIZE, VIEW, NBHD)$

(marginal) hedonic price, implicit price,
rent differential of the attribute

$$P = \beta_0 CBD^{\beta 1} SIZE^{\beta 2} VIEW^{\beta 3} NBHD^{\beta 4} e^{\varepsilon}$$

$$\Rightarrow \ln(P) = \ln \beta_0 + \beta_1 \ln(CBD) + \beta_2 \ln(SIZE) + \beta_3 \ln(VIEW) + \beta_4 \ln(NBHD) + \varepsilon$$





Hedonic price of scenic views: Slope

$$r_v = \beta_3 \frac{P}{VIEW}$$

Decreases as the level of the scenic view increases

$$r_v = W(VIEW, Y, Z)$$

Y: household income

Z: household characteristics

Value of Statistical Life

Nonlinear Regression Model

$$\ln(wagerate) = \beta_0 + \beta_1 \ln(\ fatality\ \ risk) + \beta_2 \ln(injury\ risk) + \beta_3 \ln(\ job\ tenure) + \beta_4 \ln(education) + \beta_5 \ln(age) + \varepsilon$$

Travel Cost Method

To value "Recreational Sites"

Zone Travel Cost Methods

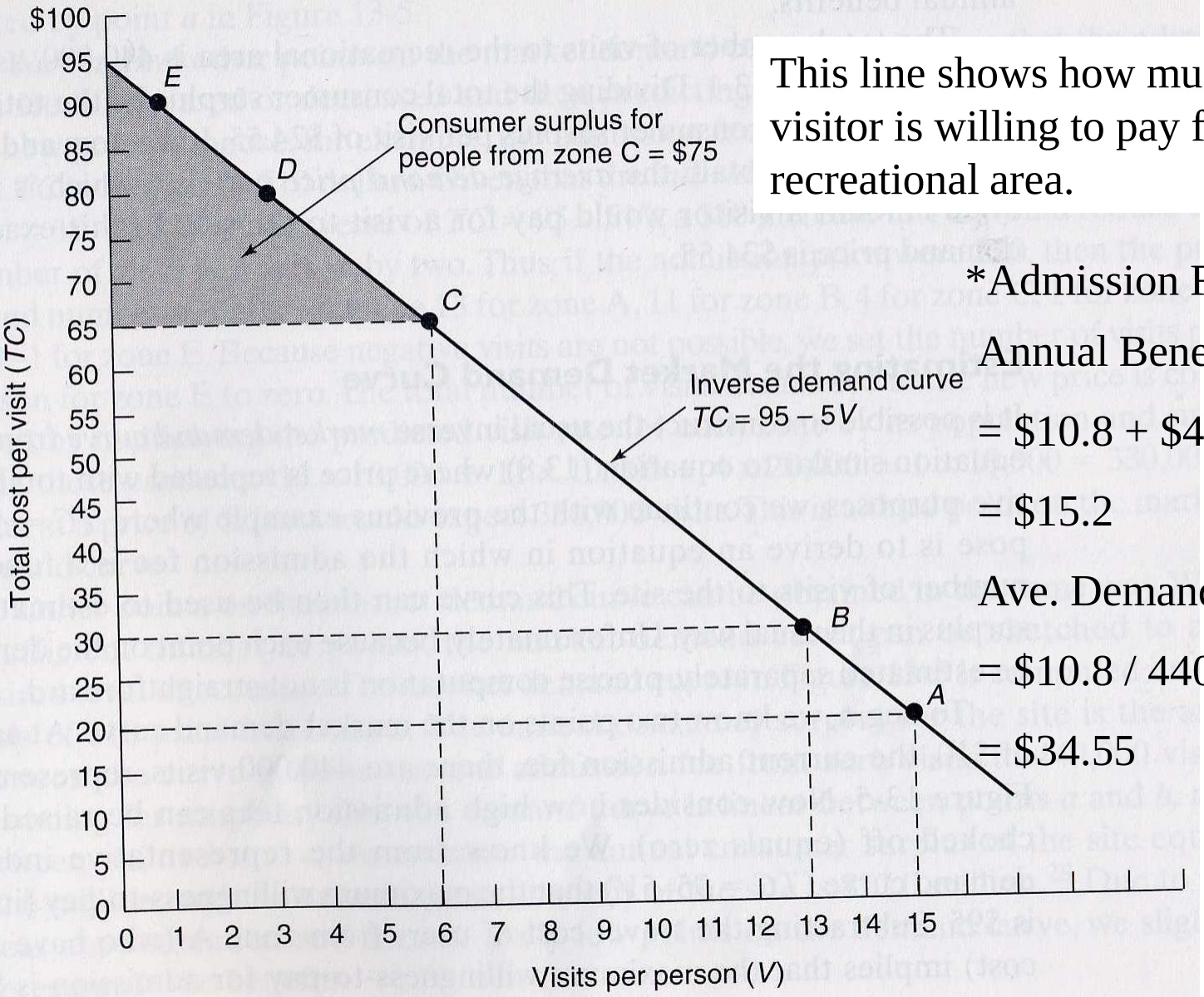
$$\ln\left(\frac{V}{POP}\right) = \beta_0 + \beta_1 \ln \bar{p} + \beta_2 \ln \bar{p}_s + \beta_3 \ln \bar{Y} + \beta_4 \ln \bar{Z} + \varepsilon$$

Zone	Travel Time (hours)	Travel Distance (km)	Average Total Cost per Person ($)	Average Number of Visits per Person	Consumer Surplus per Person	Consumer Surplus per Zone ($ thousands)	Trips per Zone (thousands)
A	0.5	2	20	15	525	5,250	150
B	1.0	30	30	13	390	3,900	130
C	2.0	90	65	6	75	1,500	120
D	3.0	140	80	3	15	150	30
E	3.5	150	90	1	0	0	10
Total						10,800	440

Different value of time for estimating average total cost:

A for $9.40/hr, B for $5.50/hr, C for $10.35/hr, D and E for $8/hr (as wage rate)

Total cost is generally composed of driving, parking, walking and loading and unloading vehicles. Zone E needs customs and immigration crossing the border.



This line shows how much a typical visitor is willing to pay for a visit to the recreational area.

*Admission Fee $10

Annual Benefit [mil.]

= $10.8 + $4.4 (= 0.44 trips*10)

= $15.2

Ave. Demand Price per visit

= $10.8 / 440000 + $10

= $34.55

Presentation & Report

1. Select one method of Valuing Market/ Non-Market Goods from Chapter 9, 13, 14, 15, 16 and 17.
2. Find one paper from **any international scientific peer-reviewed journals** published after the year 2000 (should not be a conference paper and/or report) from any research fields in using the selected method.
3. Present your selected paper in 8 minutes by powerpoint or pdf.

Report Submission

Deadline: **November 30 (Wed), 1 pm**

Summarize 4 pages report and submit by email to my secretary, Ms. Hattori. (hattori.n.ad@m.titech.ac.jp):

1) Reasons to select this paper.
2) Advantages and disadvantages of your selected method in the context of your selected topic. Discuss whether other methods are possible to apply for the selected topic.
3) Respond some questions by me if you need.
4) Impression (comments, requests, etc) of this course.

Following is the note of presentation.

1. You can use PowerPoint or PDF for your presentation in my computer. You cannot use your computer for time saving.

2. Submit your presentation file by 20:00 of the day before your presentation date to me. hanaoka@ide.titech.ac.jp

3. You cannot exchange your presentation file after submission. If change, your evaluation score can be decreased.

4. You need to submit the your selected paper to me as a printed (hard) copy just before your session.

5. You need to attend whole your session. You may also attend other sessions, but up to you.