

Valuing Impacts from Observed Behavior: Indirect Market Methods

Yoshitsugu Kanemoto

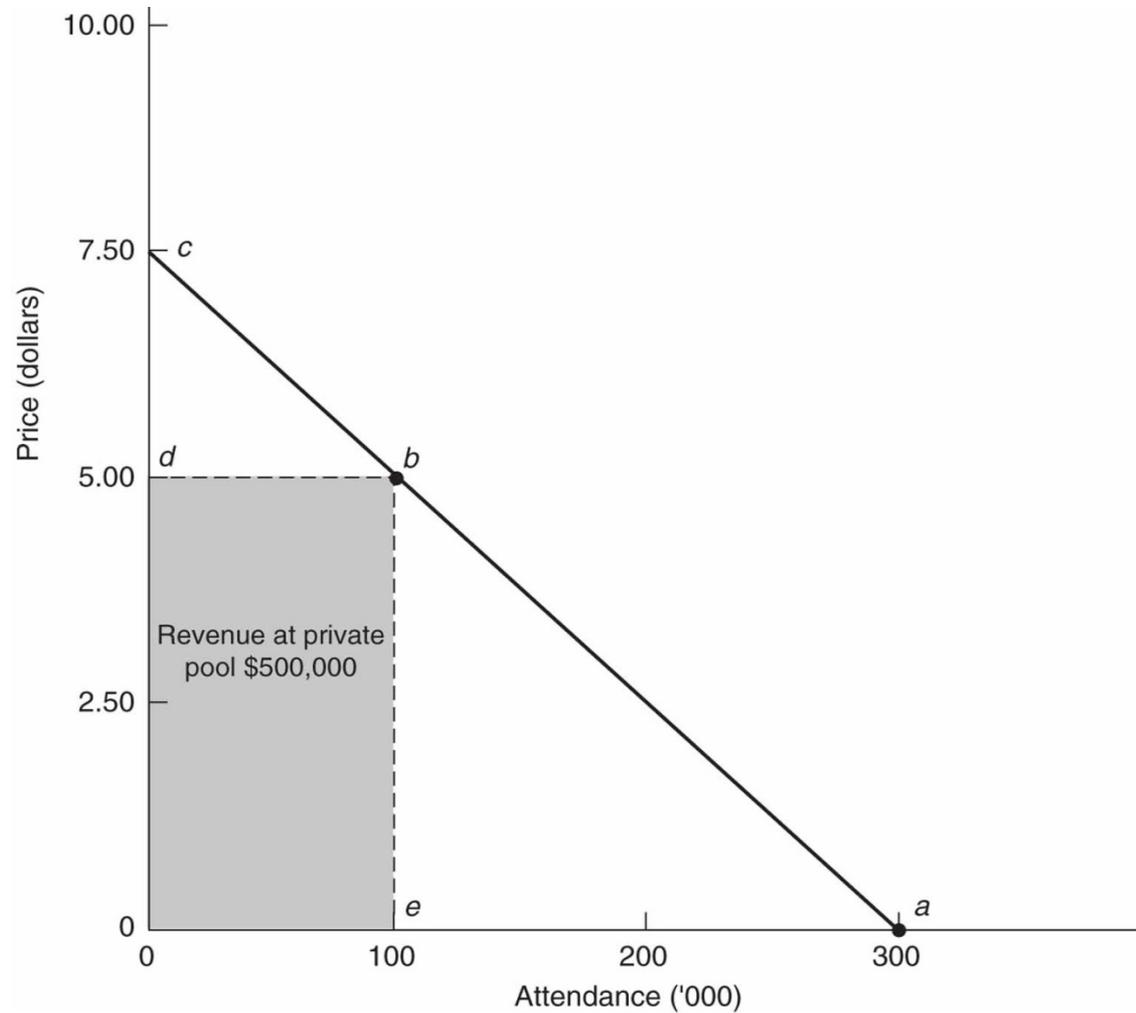
BGVW Chapter 14 "Valuing Impacts from Observed Behavior: Indirect Market Methods"

Indirect Market Methods

- ▶ Estimating shadow prices based on observed behavior when markets for the (primary) good do not exist.
- ▶ Market analogy method
- ▶ Trade-off method
- ▶ Intermediate good method
- ▶ Asset valuation method
- ▶ Hedonic price method
- ▶ Travel cost method
- ▶ Defensive expenditure method

Market analogy method

- ▶ Uses data on similar goods in the private market to estimate the implicit “price” or the demand curve for publicly provided goods
 - ▶ Example: Rents in the private rental housing market to estimate WTP for public housing
 - ▶ Subsidized goods: (Subsidized) $\text{Price} < \text{WTP}$, Price in the private market may be higher than this WTP.
- ▶ Estimate demand curves from the private sector data
 - ▶ Example: Free public pool and a private pool
 - ▶ Quality differences are important

Figure 14-1 Demand Curve for Visits to a Municipal Swimming Pool

Copyright © 2011 Pearson Education, Inc. publishing as Prentice Hall

Trade-off method

- ▶ Trade-off method: Use the opportunity cost as a measure of value
- ▶ VTTs (value of travel time savings):
 - ▶ trade-off between travel time and work hours, use the after-tax wage rate to estimate the value of time
- ▶ VSL (value of statistical life):
 - ▶ Foregone earnings methods, Consumer purchase studies (life-saving devices), Labor market studies (wage premiums for risky jobs)

▶ Using the wage rate to estimate VTTS

- ▶ Problems with using the wage rate to estimate VTTS
 - ▶ Wages ignore benefits. As benefits are a form of compensation for work, they should be added to wages.
 - ▶ Taxes. For people who are not working, use the after-tax wage rate (plus benefits).
 - ▶ People could be working while traveling or waiting and, therefore, time saved would be worth less than the wage rate (plus benefits).
 - ▶ People value different types of time differently. Importantly, many people enjoy traveling.
 - ▶ The wage rate may not be appropriate due to rigidities in the market or market failures. For example, people may not be able to easily adjust the number of hours they work.
 - ▶ Firms may not pay employees their marginal social product.
- ▶ Using the wage rate is only a first approximation

VSL by the trade-off method

- ▶ Forgone earnings
 - ▶ Not appropriate
 - ▶ Higher values for young, high income males
 - ▶ Ignores WTP
 - ▶ VSL: WTP for a small reduction in risk
- ▶ Consumer purchase studies
 - ▶ Air bag: \$300, Reduce the probability of death by 1/10,000
 - ▶ $VSL = \$3,000,000$
- ▶ Labor market studies
 - ▶ Wage rate differences
 - ▶ Increase in the probability of fatal on-the-job accident by 1/1,000/year is accompanied by an increase in wage of \$3,500 per year
 - ▶ $VSL = \$3.5\text{million}$

Problems with consumer purchase and labor market studies

- ▶ These methods assume workers and consumers fully understand the risks, which they may not.
- ▶ They also assume that people in the studies are representative of the population, while they may not be. For example, people who take risky jobs may like to take risks which would lead to a relatively small gap in the salary between risky and less-risky jobs.
- ▶ They assume that researchers have accurate measures of the risks.
- ▶ The WTP to reduce fatality risk (and therefore the estimated VSL) depends on both the level of risk and the change in the risk level due to the policy. People probably have diminishing marginal utility for safety.
- ▶ This method assumes that the relevant markets are efficient and all other variables are constant (no omitted variable problem).

Intermediate Good Method

- ▶ If a project produces an intermediate good that is not sold in a well functioning market, then its value can be imputed by determining the value added to the “downstream activity”.
 - ▶ Annual Benefit = $NI(\text{with project}) - NI(\text{without project})$
 - ▶ NI = net income of downstream business
- ▶ Irrigation program
 - ▶ Water: Intermediate input for agricultural production
 - ▶ Benefit: Increase in agricultural income
- ▶ Education and training program
 - ▶ Average incomes of those in the program to those who are not
 - ▶ Does not include the consumption values of education

Asset Valuation Method

- ▶ **Changes in the price for certain capital goods**
 - ▶ Value of noise: the price of a house in a noisy neighborhood vs. the price of a similar house in a quiet neighborhood
 - ▶ Producer surplus of the new regulations: Changes in the market values of firms following a regulatory change (an event study)
 - ▶ Information is quickly and efficiently capitalized into prices
- ▶ **Irrigation: Rise in agricultural land price**
- ▶ **Environmental value: Housing price**
 - ▶ Noise, Parks
- ▶ **Event studies**
 - ▶ Stock prices after regulatory changes
 - ▶ Impacts on JREIT prices of a change in tax provision

QQ

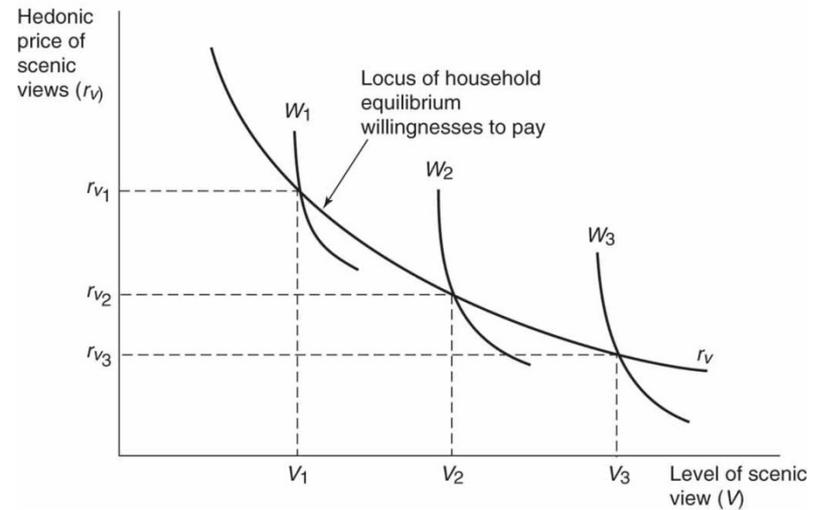
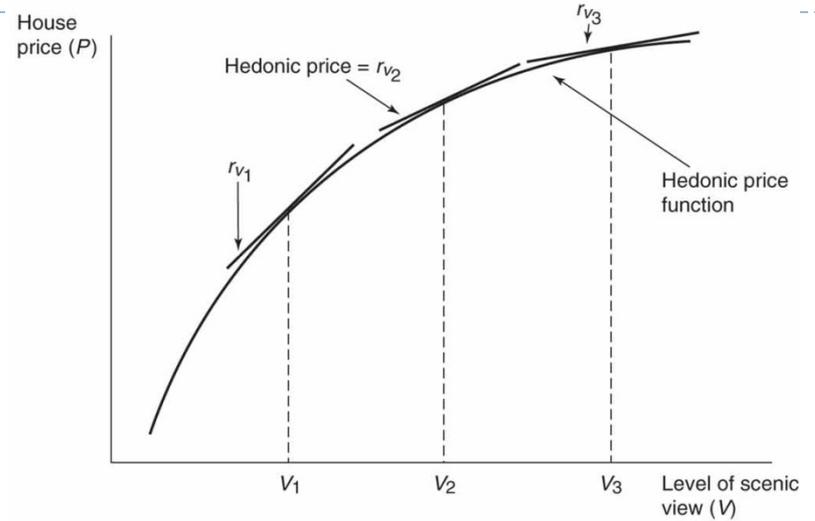
-
- ▶ 1. Give an example of a policy to which market analogy method can be applied.
 - ▶ 2. When evaluating the benefits of the supply of irrigation water by a dam, which of the intermediate input method and the asset valuation method is more reliable? What are reasons of your choice?

The Hedonic Price Method

- ▶ Problems with the market analogy, trade-off, intermediate good, and asset valuation method
 - ▶ Omitted Variable Problem
 - ▶ Correlation between omitted variables and the explanatory variables introduces biases in parameter estimates.
 - ▶ Self-Selection Bias
 - ▶ Risk lovers choose high risk jobs.
 - ▶ People who are noise resistant tend to live in noisy areas.
- ▶ Hedonic regression
 - ▶ Overcome the problems from omitted variables and self-selection by multiple regression.
- ▶ Hedonic price function
 - ▶ $P = f(\text{CBD}, \text{Size}, \text{View}, \text{Nbhd}) = f(\text{Characteristics Vector})$
 - ▶ $P = \beta_0 + \beta_1 \text{CBD} + \dots + \beta_3 \text{VIEW} + \dots + \varepsilon$
- ▶ Hedonic price (= Marginal hedonic price)
 - ▶ $r_v = \beta_3$

Figure 14-3 The Hedonic Price Method

- ▶ Hedonic price function and the hedonic price



Applications of the hedonic price method

▶ Traffic noise

	External cost (+1dB,yen/ m ²)	T-value	Area
Shimizu, Hidano(1988)	-2,000	-2.76	Route 8
Yamazaki (1991)	-20,942	-3.79	Route 7
Yazawa, Kanemoto (1992)	-3,500	-2.7	Kawasaki
Hidano, Hayashiyama, Inoue (1996)	-5,300	-2.08	Setagaya

▶ VSL

$$\ln(\text{wage rate}) = \ln\beta_0 + \beta_1 \ln(\text{fatality risk}) + \dots + \varepsilon$$

Problems with the Hedonic Price Method

- ▶ People must know and understand the implications of the attribute that is being valued.
- ▶ Variables should be measured without error (the errors in variables problem).
- ▶ The functional forms should be correct (specification error problem).
- ▶ The omitted variable problem. The omitted variables may be correlated with explanatory variables.
- ▶ There may be multicollinearity problems, e.g., fatality risk and non-fatality risk might be highly correlated. Dropping one variable would lead to an omitted variable problem.
- ▶ The market should have enough alternatives so that people can locate at their optimum point on the curve.
- ▶ Markets are assumed to adjust immediately to changes in the attributes of interest and to all other factors.
- ▶ The asset prices reflect expectations on future changes. Using current amenity levels may cause biases.

Travel Cost Method

- ▶ **TCM (Travel cost method)**
 - ▶ The total cost varies because of differences in the travel cost component.
 - ▶ Estimate demand curve based on the total cost.
- ▶ **Estimation of demand schedule by TCM**
 - ▶ Select a random sample of households within the market area of the site.
 - ▶ Survey these households to determine their numbers of visits to the site over some period of time, all of their costs involved in visiting the site, their costs of visiting substitute sites, their incomes, and other characteristics that may affect their demand.
 - ▶ Specify a functional form for the demand schedule and estimate it using the survey data

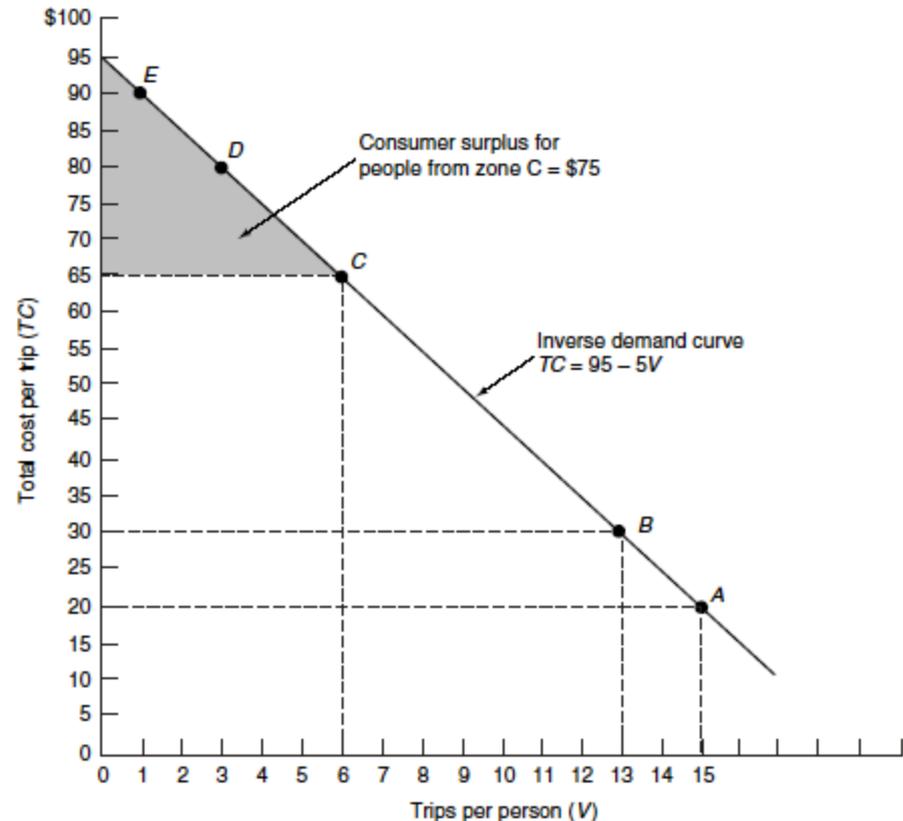
Zonal TCM and Individual TCM

- ▶ **Zonal Travel Cost Method, ZTC**
 - ▶ Survey actual visitors
 - ▶ Visitors are allocated to a particular zone, depending on their “travel costs” (usually distance).
- ▶ **Individual Travel Cost Method, ITC**
 - ▶ Observe each individual’s number of trips

Zonal Travel Cost Method

- ▶ For each zone, the analyst computes the average number of visits per year and the average total travel cost.
- ▶ Using these observations estimate the relationship between cost/trip and the number of trips per person.
- ▶ The consumer surplus for a visitor from a particular zone is given by the area below this curve and above the cost of a visit from that zone, as shown in Figure 14-4.
- ▶ By repeating this calculation for each zone, it is possible to calculate the total consumer surplus, as shown in Table 14-1.

Figure 14-4



Limitations of the TCM

- ▶ Visitors must have different travel costs.
- ▶ Analytical problems in measuring the total cost of a visit. How does one measure opportunity cost of travel time? Does one include the marginal cost of capital goods used at the site? Should multiple purpose trips be included in the data?
- ▶ Travel cost may be endogenous not exogenous. People who plan to travel to the site frequently may choose to live near the site.
- ▶ Other econometric problems, such as truncation (drawing sample from only visitors. There may be omitted variables (if tastes or substitutes vary across zones).
- ▶ The method estimates the WTP for the entire site rather than features of the site.
 - ▶ It's possible to value features if people in zones can choose among alternative sites with different attributes – by using the “hedonic travel cost method”.

Defensive Expenditures Method

- ▶ **Defensive expenditure: an expenditure in response to something undesirable, such as pollution.**
 - ▶ If smog improves (worsens) you may spend less (more) on having your windows cleaned.
 - ▶ The change in expenditures can be used as a measure of the cost of the change in pollution.
- ▶ **Problems**
 - ▶ Reduced spending on a defensive expenditure underestimates the benefits of cleaner air.
 - ▶ It assumes people adjust quickly to the new equilibrium, such as new smog levels.
 - ▶ Defensive expenditure may not remedy entire the damage.
 - ▶ Defensive expenditures may have benefits other than remedying damage, which should be included.
 - ▶ Not all defensive expenditures are purchased in markets, for example, some people clean their own windows; changes in these “expenditures” should also be included.

QQ

- ▶ List two problems in estimating a small park within a port by the travel cost method.
- ▶ In the cost-benefit analysis of a water project, a variation of the defensive expenditures method has been used. In estimating the reduction in the cost of stockpiling, the following calculation was used. What is your opinion on this method?

Stockpiling cost per year = 100 (yen/liter) × 20 (liter/person) × 3 (days) × 447,000 (people) = 2,682,000 (thousand yen)

Note: Stockpiled water is assumed to be in the form of bottled water (60 liter/person (20 liter × 3 days)). The water is replaced once a year.