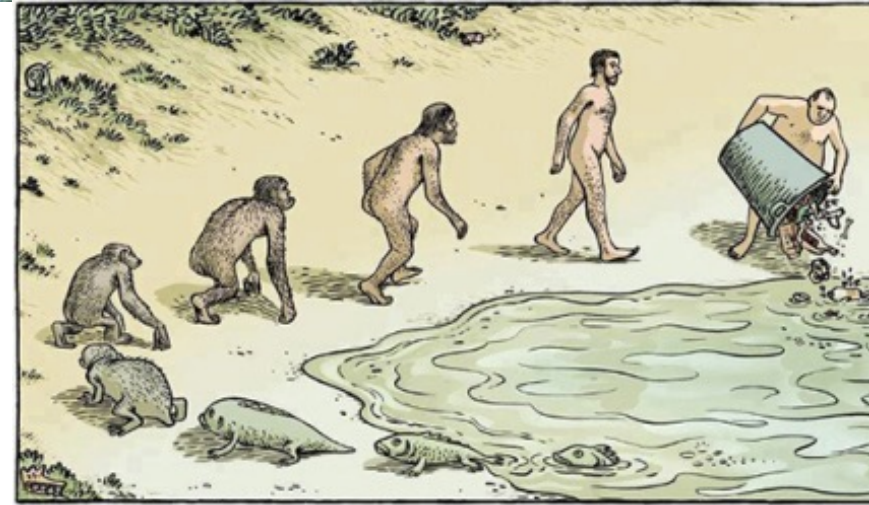




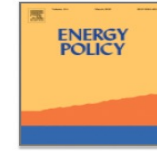
EE476
Environmental Economics
Lecture Non Market Valuation 3
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Benefit transfer

- taking a unit value of a non-market good estimated in an original or primary study (the “study site”) and using this estimate – perhaps after some adjustment – to value benefits or costs that arise when a new policy or investment project (“policy site”) is implemented.





Willingness to pay for green electricity in Tianjin, China: Based on the contingent valuation method

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This study applies a [contingent valuation](#) method to investigate the WTP of residents in Tianjin, China for green electricity. It uses a logit model to test whether the respondents have WTP. In addition to the factors affecting the respondents' viewpoints frequently discussed in previous studies, this paper has also considered the influence of high prevalence of respiratory disease. Furthermore, it employs a [multiple regression](#) model to identify the factors that significantly affected the WTP. **According to a sample of 468 respondents, most residents have positive WTP with an average value of CNY 32.63 per month.** The main driving factors for a positive WTP are knowledge of renewable energy, belief towards the government, behavior, education, history of respiratory disease and others. The factors affecting the value of WTP include income, belief, disease, gender and age, and the first three factors often have positive influences while the last one has negative impact. Furthermore, males tend to have a higher WTP than females.

Unit transfer

- Taking a single value estimate, or a set of value estimates from pre-existing primary studies and transferring them to the policy site.
- The unit values from the primary study could be transferred “as is” or adjusted. (converting currency, adjusting for inflation, adjusting for income or expert opinion).
- A widely used formula for adjusted transfer is:

$$WTP_P = WTP_S (Y_P/Y_S)^e,$$

- where Y is income per capita,
- e is the income elasticity of WTP: this term is an estimate of how the WTP for the (non-market) good in question varies with changes in income).
- According to this expression, if e is assumed to be equal to one, then the ratio of WTP at sites S and P is equivalent to the ratio of per capita incomes at the two sites (i.e. $WTP_P/WTP_S = Y_P/Y_S$)

Unit transfer

- Unit transfer might can involve pooling mean or median estimates from number of prior studies and then taking the mean or median of those as the unit value to transfer. Similarly, the upper and lower boundaries of those unit values can be used to produce a range of estimates at the policy sites

Table 3
Summary of studies on the WTP for green electricity.

Reference	Survey area	Object of study	Method	Year	WTP	Period
Zhang and Wu (2012)	Jiangsu, China	green electricity	CV-PC	2010	\$1.15–1.51	Per month
Guo et al. (2014)	Beijing, China	Renewable electricity	CVM-SBDC	2011–2015	\$2.70–3.30	Per month
Kim et al. (2012)	Korea	green electricity	CVM-DBDC	2010	\$1.35	Per month
Roe et al. (2001)	US	green electricity	CE	1997	\$73.55	Per year
Zorić and Hrovatin (2012)	Slovenia	Green electricity	CE	2008	€ 4.2	Per month
Zografakis et al. (2010)	Crete	Renewable energy	CVM-DBDC	2007	€16.33	Quarterly
Yoo and Kwak (2009)	Korea	Green electricity	CV-SBDC	2006	\$ 1.8–2.2	Per month
Nomura and Akai (2004)	Japan	Green electricity	CV-DBDC	2000	\$17	Per month
Mozumder et al. (2011)	US	renewable energy	CV-OE	2010	10%: \$5.77 20%: \$15.04	Per month
Lee and Heo (2016)	Korea	renewable energy	CV-DBDC	2014	\$3.10	Per month
Kim et al. (2013)	Korea	Renewable electricity	CV-DBDC	2010	\$1.26	Per month

Function transfer

- if it is known that WTP at the study site is a function of a range of physical features of the site and its use as well as the socio-economic (and demographic) characteristics of the population at the site, then this information itself can be used as part of the transfer.
- For example, if $WTP_S = f(A, B, C, Y)$ where A,B,C are additional and significant factors affecting WTP (in addition to Y) at site *S*, then WTP_P can be estimated using the coefficients from this equation, but using the values of A, B, C, Y at site *P*.

$$WTP_S = 3 + 0.5Y_S - 0.3 AGE_S + 2.2 EDUC_S$$

- That is, WTP_S increases with income and educational attainment but decreases with age as described. In this transfer approach, the entire benefit function would be transferred as follows:

$$WTP_P = 3 + 0.5Y_P - 0.3 AGE_P + 2.2 EDUC_P$$

- As an example of the implications of this approach, if the population at the policy site is generally much older than that at the study site, then WTP_P – other things being equal – will be lower than WTP_S .

Discretet choice experiment

- The DCE method is derived from Lancaster's (1966) characteristics of value theory which states that any good may be described by a bundle of characteristics and the levels that these may take.
- By varying the levels the attributes take across the options and by including a monetary attribute it is possible to estimate the total value of a change in a good or service as well as the value of its component attributes.

Framework.

- According to this framework, the utility function for each respondent i (U) can be decomposed into two parts: a deterministic element (V), which is typically specified as a linear index of the attributes (X) of the φ different alternatives in the choice set, and a stochastic element (e), which represents unobservable influences on individual choice.

$$U_{ij} = V_{ij}(X_{ij}) + e_{ij} = bX_{ij} + e_{ij}$$

- Thus, the probability that any particular respondent prefers option g in the choice set to any alternative option η , can be expressed as the probability
- that the utility associated with option g exceeds that associated with all other options

$$P[(U_{ig} > U_{ih}) \forall h \neq g] = P[(V_{ig} - V_{ih}) > (e_{ih} - e_{ig})]$$

- In order to derive an explicit expression for this probability, it is necessary to know the distribution of the error terms (e_{ij}). A typical assumption is that they are independently and identically distributed with an extreme-value (Weibull) distribution:

$$P(e_{ij} \leq t) = F(t) = \exp(-\exp(-t))$$

$$P(U_{ig} > U_{ih}, \forall h \neq g) = \frac{\exp(\mu V_{ig})}{\sum_j \exp(\mu V_{ij})}$$

$$\log L = \sum_{i=1}^N \sum_{j=1}^J y_{ij} \log \left[\frac{\exp(V_{ij})}{\sum_j \exp(V_{ij})} \right]$$







where y_{ij} is an indicator variable which takes a value of one if respondent φ chose option i and zero otherwise.

Measuring preferences for nuclear energy scenarios in Italy



Attributes	Levels
Distance from the nuclear plant	20, 50, 100, 200 km from city of residence
Nuclear waste reduction	30%, 20%, 10%, no reduction
Atmospheric emission reduction	20%, 10%, no reduction
Electricity bill reduction	30%, 20%, 10%, no reduction
Public investments	Construction of hospitals, land recovery measures, no investments

- Given the five attributes and their levels, with two options per choice task, the total number of possible choice scenarios is 576 (4 distance levels * 4 waste reduction levels * 3 emission reduction levels * 4 bill reduction levels * 3 public investment levels).
- (There is procedures to choose only some scenarios)

	PROJECT A	PROJECT B
Distance from the nuclear plant 	20 Km	100 Km
Waste reduction 	20%	20%
Emissions reduction 	20%	10%
Electricity bill reduction 	10%	30%
Building of new hospitals 	NO	YES
Land recovery measures 	YES	NO

	Project A	Project B	None
I prefer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Measuring preferences for nuclear energy scenarios in Italy

- The analysis assumes that the deterministic component of the utility function V_{ij} (of the i^{th} respondent for the φ different alternatives in the choice set) depends linearly on the attributes of the choices presented as follows:

$$V_{ij} = \beta_1 \text{ASC} + \beta_2 \text{Distance}_{200} + \beta_3 \text{Distance}_{100} + \beta_4 \text{Distance}_{50} + \beta_5 \text{Waste}_{30} + \beta_6 \text{Waste}_{20} + \beta_7 \text{Waste}_{10} + \beta_8 \text{Emissions} + \beta_9 \text{Hospitals} + \beta_{10} \text{Land} + \beta_{11} \text{Bill}$$

- The **ASC** is an **alternative specific constant** capturing the variation in choices that is not explained by the attributes. Here it represents the “none” option in each choice set. A positive coefficient b_1 will indicate that individuals are more likely to choose none of the nuclear energy scenarios, thereby providing a measure of overall opposition towards nuclear energy.
- **Bill** representing electricity bill reductions per household, per year, obtained by applying the bill reduction percentages to the average of the sampled respondents’ annual electricity bill.

Measuring preferences for nuclear energy scenarios in Italy

$$V_{ij} = \beta_1 \text{ASC} + \beta_2 \text{Distance}_{200} + \beta_3 \text{Distance}_{100} + \beta_4 \text{Distance}_{50} + \beta_5 \text{Waste}_{30} + \beta_6 \text{Waste}_{20} + \beta_7 \text{Waste}_{10} + \beta_8 \text{Emissions} + \beta_9 \text{Hospitals} + \beta_{10} \text{Land} + \beta_{11} \text{Bill}$$

- From these findings the analyst can obtain monetary value estimates by dividing the coefficient of each non-monetary attribute (e.g. b_2 , the coefficient of Distance 200 km) by the coefficient of the monetary attribute (i.e. b_{11}),
- As all the attributes are framed in terms of benefits, the valuations can be interpreted as WTP estimates for a utility-enhancing level of an attribute (for example, a nuclear power plant situated further away from home, or a reduction in emissions).



Measuring preferences for nuclear energy scenarios in Italy

$$V_{ij} = \beta_1 \text{ASC} + \beta_2 \text{Distance}_{200} + \beta_3 \text{Distance}_{100} + \beta_4 \text{Distance}_{50} + \beta_5 \text{Waste}_{30} + \beta_6 \text{Waste}_{20} + \beta_7 \text{Waste}_{10} + \beta_8 \text{Emissions} + \beta_9 \text{Hospitals} + \beta_{10} \text{Land} + \beta_{11} \text{Bill}$$

$$\text{WTP}_{\text{ASC no nuclear}} = \beta_1 / \beta_{11} = 1.60 / 0.00213 = \text{EUR } 751$$

$$\text{WTP}_{\text{Distance 200km}} = \beta_2 / \beta_{11} = 0.72 / 0.00213 = \text{EUR } 338$$

$$\text{WTP}_{\text{Distance 100km}} = \beta_3 / \beta_{11} = 0.579 / 0.00213 = \text{EUR } 272$$

$$\text{WTP}_{\text{Distance 50km}} = \beta_4 / \beta_{11} = 0.431 / 0.00213 = \text{EUR } 202$$

$$\text{WTP}_{\text{Waste 30\%}} = \beta_5 / \beta_{11} = 0.726 / 0.00213 = \text{EUR } 341$$

$$\text{WTP}_{\text{Waste 20\%}} = \beta_6 / \beta_{11} = 0.606 / 0.00213 = \text{EUR } 285$$

$$\text{WTP}_{\text{Waste 10\%}} = \beta_7 / \beta_{11} = 0.367 / 0.00213 = \text{EUR } 172$$

$$\text{WTP}_{\text{Emissions}} = \beta_8 / \beta_{11} = 0.274 / 0.00213 = \text{EUR } 129$$

$$\text{WTP}_{\text{Hospitals}} = \beta_9 / \beta_{11} = 0.326 / 0.00213 = \text{EUR } 153$$

$$\text{WTP}_{\text{Land recovery}} = \beta_{10} / \beta_{11} = 0.516 / 0.00213 = \text{EUR } 242$$



- On average, the results show that Italian households are willing to forgo a compensation of EUR 338 per year for a nuclear plant situated 200 km away (vis-à-vis a baseline of 20 km away); this reduces to EUR 202 for a distance of just 50 km. In addition, waste reduction is valued up to EUR 341 (for a 30% reduction), more than land recovery measures (EUR 242) and hospitals (EUR 153). Finally, emission reductions are found to be highly valued at EUR 129 for a 10% reduction. Of note, the ASC representing the status quo, with no nuclear energy, is positive and very highly valued (EUR 751), indicating a broad preference for scenarios not involving nuclear energy.