Choice modelling and Conjoint Analysis

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Choice Modelling

- Non-market valuation technique that is becoming increasingly popular in environmental economics, but also in other fields, such as management of cultural goods, planning, etc.
- Stated-preference technique—elicits preferences and places a value on a good by asking individuals what they would do under hypothetical circumstances, rather than observing actual behaviors on marketplaces.
- Survey-based technique.
- Contingent valuation is a special case of choice modeling
- 3 main approaches to elicit preferences with choice modeling:
  - ranking (choose the most preferred, then the second most preferred, etc.)
  - rating (give to each alternative a number from 1 to X to indicate strength of preference)
  - choice (choose the most preferred→“conjoint choice”)

Contingent Ranking

Respondents are asked to rank a set of alternative representations of the good from the most preferred to the least preferred.

Suppose you are facing the choice of buying a new car. Rank the following alternatives for buying a new car according to your preferences. One of the following options is not buying any car. Assign 1 to the most preferred option, 2 to the second most preferred, 3 to the third most preferred and 4 to the least preferred.

Cars attributes	**Fiat Punto 1.2 16V ELX**	**Ford Focus 1.6 16V**	**Volkswagen Polo 1.4 16V**	**Do not buy any car**
Price	£ 9,750	£ 10,120	£ 12,935	
Number of Seats	5	5	5	
Cubic capacity	1242	1596	1390	
Gear	Manual	Manual	Automatic	
Maximum speed	172 km/h	185 km/h	171 km/h	
Number of doors	3	5	3	
Consumption (liters/100 km)	6	6.8	6.4	
Baggage car	1.080 dm^3	1.205 dm^3	1.184 dm^3	
Ranking:				

Limitations of ranking approach

- Heavy cognitive burden
- It is probably easy to identify the most preferred and the least preferred options, but it might be not so easy to rank the options in the middle → “noise”

Contingent Rating

Respondents are shown different representations of the good and are asked to rank each representation on a numeric or semantic scale.

<table>
<tr><td colspan="11">On the scale below, please rate your preferences in buying the following car.</td></tr>
<tr><th>Car attributes</th><th colspan="10">Fiat Punto
1.2 16V ELX</th></tr>
<tr><td>Price</td><td colspan="10">£ 9,750</td></tr>
<tr><td>Number of Seats</td><td colspan="10">5</td></tr>
<tr><td>Cubic capacity</td><td colspan="10">1242</td></tr>
<tr><td>Gear</td><td colspan="10">Manual</td></tr>
<tr><td>Maximum speed</td><td colspan="10">172 km/h</td></tr>
<tr><td>Number of doors</td><td colspan="10">3</td></tr>
<tr><td>Consumption
(liters/100 km)</td><td colspan="10">6</td></tr>
<tr><td>Baggage car</td><td colspan="10">1.080 dm^3</td></tr>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td></td><td colspan="4">Very high preference</td><td colspan="2"></td><td colspan="4">Very low Preference</td></tr>
</table>

Limitations of Rating

- One of the major drawbacks of this technique is the strong assumptions that must be done in order to transform ratings into utilities.
- For example, the same representation of a good might receive the same rate by two different respondents, but this does not necessarily mean that the two answers are identical: a rate of “8” by a respondent might be completely different by the same “8” given by another respondent.

Conjoint Analysis

Suppose you are facing the choice of buying a new car. Choose one of the following cars according to your preferences. You may even choose not to buy any of these cars.

Cars attributes	**Fiat Punto 1.2 16V ELX**	**Ford Focus 1.6 16V**	**Volkswagen Polo 1.4 16V**
Price	£ 9,750	£ 10,120	£ 12,935
Number of Seats	5	5	5
Cubic capacity	1242	1596	1390
Gear	Manual	Manual	Automatic
Maximum speed	172 km/h	185 km/h	171 km/h
Number of doors	3	5	3
Consumption (liters/100 km)	6	6.8	6.4
Baggage car	1.080 dm^3	1.205 dm^3	1.184 dm^3

Which would you buy?

Fiat Punto?	☐
Ford Focus?	☐
Volkswagen Polo?	☐
Would you prefer not to buy any of these cars?	☐

Conjoint Analysis (conjoint choice analysis, choice experiments, conjoint choice experiments)

- In a *conjoint choice* exercise, respondents are shown a set of alternative representations of a good and are asked to pick their most preferred.
- Similar to real market situations, where consumers face two or more goods characterized by similar attributes, but different levels of these attributes, and are asked to choose whether to buy one of the goods or none of them.
- Alternatives are described by attributes—the alternatives shown to the respondent differ in the levels taken by two or more of the attributes.
- The choice tasks do not require as much effort by the respondent as in rating or ranking alternatives.

- If we want to use conjoint analysis techniques for valuation purposes, one of the attributes **must be the "price"** of the alternative or the cost of a public program to the respondent.
- If the "**do nothing**" (or "**status quo**" option—i.e., pay nothing and get nothing) is included in the choice set, the experiments can be used to compute the value (WTP) of each alternative.
- Note that we only learn which alternative is the most preferred, but we do not know anything about the preferences for the options that have not been chosen → the exercise does not offer a complete preference ordering.

Example of conjoint choice question from Boxall et al. (1996).

Assuming that the following areas were the ONLY areas available, which one would you choose on your next hunting trip, if either?			
Features of the hunting area	**Site A**	**Site B**	
Distance from home to hunting area	50 km	50 km	Neither Site A or Site B I will NOT go moose hunting
Quality of road from home to hunting area	Mostly graved or dirt, some paved	Mostly paved, some gravel or dirt	
Access within hunting area	Newer trails, cutlines or seismic lines, passable with a 2WD vehicle	Newer trails, cutlines or seismic lines, passable with a 4WD vehicle	
Encounters with other hunters	No hunters, other than those in my hunting party, are encountered	Other hunters, on ATVs, are encountered	
Forestry activity	Some evidence of recent logging found in the area	No evidence of logging	
Moose population	Evidence of less than 1 moose per day	Evidence of less than 1 moose per day	
Check ONE and only one box	☐	☐	☐

Conjoint choice question from Hanley et al. (2001)

Which route would you prefer to visit in the summer, given the two routes described below?		
Characteristics of Route	**Route A**	**Route B**
Length of climb	100 meters	200 meters
Approach time	3 hours	2 hours
Quality of climb	2 stars	0 stars
Crowding at route	Crowded	Not crowded
Scenic quality of route	Not at all scenic	Not at all scenic
Distance of route from home	160 miles	110 miles
Prefer Route A? ☐		
Prefer Route B? ☐		
Stay at home? (Choose neither?) ☐		

Example of conjoint choice question from San Miguel et al. (2000).

Which surgical procedure would you prefer in the treatment of menorrhagia?		
Characteristics of the treatment	**Hysterectomy**	**Conservative**
Number of nights in hospital after operation	7	0
Time to return to normal activity (weeks)	11	2
Chance of complications following operation	45%	20%
Chance of re-treatment with Conservative	0%	15%
Chance of re-treatment with Hysterectomy	0%	30%
Cost of the treatment	$1,400	$5,000
Which treatment would you prefer? (tick one box only)	Prefer Hysterectomy ☐	Prefer Conservative ☐

Example of conjoint question from Alberini et al. 2005

1) Land use

- Shipbuilding
- Housing
- Research
- Offices
- Museum
- Navy
- Hotels

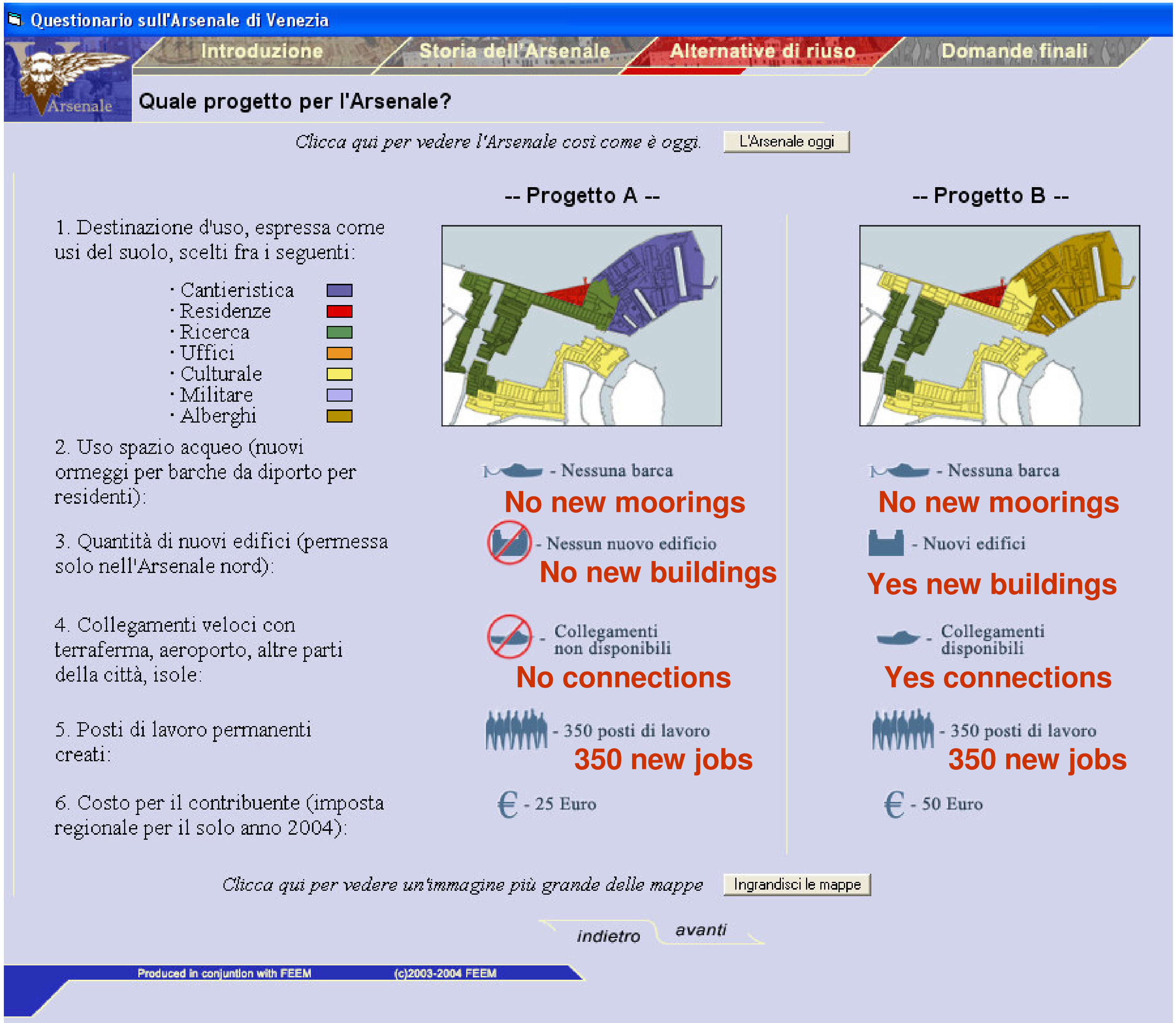
2) Moorings

3) New Buildings

4) Fast connections with other parts of the city

5) New jobs created

6) Cost (regional tax for year 2004)



Why is conjoint analysis useful?

- Useful in non-market valuation, because it places a value on goods that are not traded in regular marketplaces.
- It can also be used to value products, or improvements over existing products—popular technique in marketing research.
- Allows one to estimate WTP for a good that does not exist yet, or under conditions that do not exist yet—for example, a lake after water pollution has been reduced, but people have always seen the lake as a polluted body of water.
- Allows one to elicit preferences and WTP for many different variants of goods or public programs, and so it can help make decisions about environmental programs where the scope of the program has not been decided upon yet (e.g., EPA's arsenic in groundwater rule—should it be 50 ppb, 25 ppb, 10ppb?)
- An advantage of conjoint choice is that researchers usually obtain multiple observations per interview, one for each choice task from each respondent. This increases the total sample size for statistical modeling purposes, holding the number of respondents the same.

Designing a Conjoint Analysis Study

- **1st task**: select the **attributes** that define the good to be valued. The attributes should be selected on the basis of what the goal of the valuation exercise is, prior beliefs of the researcher, and evidence from focus groups.
- For valuation, one of the attributes must be the "price" of the commodity or the cost to the respondent of the program delivering a change in the provision of a public good.
- Attributes can be quantitative, and expressed on a continuous scale, such as the gas mileage of a car, or the square footage of a house. The price or cost attribute should be on a continuous scale. Attributes can be of a qualitative nature, such as the style of a house (e.g., Cape Cod, ranch, colonial) or the presence/absence of a specified feature.
- It is also important to make sure that the provision mechanism, whether private or public, is acceptable to the respondent, and that the payment vehicle is realistic and compatible with the commodity to be valued.

- **2nd step**: choose the levels of the attributes.
- the levels of the attributes should be selected so as to be reasonable and realistic, or else the respondent may reject the scenario and/or the choice exercise.

Attributes and levels used in the moose hunting study from Boxall et al. (1996).

Attributes	Levels
Moose population	Evidence of < 1 moose per day
	Evidence of 1-2 moose per day
	Evidence of 3-4 moose per day
	Evidence of more than 4 moose per day
Hunter congestion	Encounters with no other hunters
	Encounters with other hunter on foot
	Encounters with other hunter on ATV[a]
	Encounters with other hunter in trucks
Hunter access	No trails, cutlines, or seismic lines
	Old trails passable with ATV[a]
	Newer trails, passable with 4-wheel drive vehicle
	Newer trails, passable with 2-wheel drive vehicle
Forestry activity	Evidence of recent forestry activity
	No evidence of forestry activity
Road quality	Mostly paved, some gravel or dirt
	Mostly gravel or dirt, some paved sections
Distance to site	50 km
	150 km
	250 km
	350 km
[a]All-terrain vehicles	

Attributes and levels from San Miguel et al. (2000).

Attributes	**Levels**
Nights in hospital after intervention	0, 2, 4 and 7*
Time to return to normal activity	2, 3, 4 and 11*
Chance of complications following the operation	5%, 10%, 15%, 20% and 45%*
Probability of re-treatment with conservative surgery	0%*, 10%, 20% and 30%
Probability of re-treatment with hysterectomy	0%*, 10%, 20% and 30%
Cost	£500, £1200, £1400*, £2500 and £5000
*Levels defined for the fixed scenario of hysterectomy	

Attributes and levels from Alberini et al. (2005).

Attribute	Level 1	Level 2	Level 3	Level 4
Land use (4 levels)	Shipbuilding, research, offices, museum	Housing, research, museum	Hotels, museum, research	Shipbuilding, research, museum
Use of the water areas (2 levels)	No new moorings	200 new moorings		
New buildings in the Northeast portion of the Arsenale (2 levels)	No new buildings	Presence of new buildings on the 25% of the allowable area		
Access (fast transportation links with other areas of Venice, the airport, the mainland, other islands) (2 levels)	Available	Not available		
Number of new jobs created (3 levels)	150	250	350	
Cost to the respondent in Euro (4 levels)	25	50	100	150

- **3rd task**: be mindful of the **sample size** when choosing attributes and levels.
- Total sample size is given by the number of respondents × the number of conjoint choice questions in the questionnaire.
- The sample size should be large enough to accommodate all of the possible combinations of attributes and levels of the attributes, i.e., the full factorial design.
- To illustrate, consider a house described by three attributes:
- square footage,
- proximity to the city center, and
- price.
- If the square footage can take three different levels (1500, 2000, 2200), proximity to the city center can take two different levels (less than three miles, more than three miles) and price can take 4 different levels (£200,000, £250,000, £300,000, and £350,000), the full factorial design consists of $3 \times 2 \times 4 = 24$ alternatives. Fractional designs are available that result in fewer combinations.

- **4th task**: Once the experimental design is created, the researcher needs to construct the choice sets. The choice sets may consist of two or more alternatives, depending on how simple one wishes to keep the choice tasks.
- The “status quo” should be included in the choice set if one wishes to estimate WTP for a policy package or a scenario.
- This can be done in a number of different ways. For instance, one can ask the respondent to choose between A and the status quo, then B and the status quo, etc. Alternatively, one can ask the respondent to choose directly between A, B, and the status quo. Or, respondents may first be asked to indicate their preferred option between A and B (the so-called “forced choice”), and then they may be asked which they prefer, A, B or the status quo.
- When grouping alternatives together to form the choice sets, it is important to exclude alternatives that are dominated by others. For example, if house A and B were compared, and the levels of all attributes were identical, but B were more expensive, A would be a dominating choice.
- Such pairs should not be proposed to the respondents in the questionnaire, although some researchers believe that this is a way of checking if respondents are paying attention to the attributes of the alternatives they are shown.

Complexity

Should increase with:

- the number of attributes
- the number of possible levels for an attribute,
- how different the alternatives in each choice set are in terms of the level of an attribute,
- how many attributes differ across alternatives in each choice set,
- the number of alternatives in a choice set (A and B, or A v. B v. C v. D),
- the number of choice tasks faced by the respondent in the survey.

Fatigue or learning?

Model for the Conjoint Analysis

It is assumed that the choice between the alternatives is driven by the respondent's underlying utility. The respondent's indirect utility is broken down into two components. The first component is deterministic, and is a function of the attributes of alternatives, characteristics of the individuals, and a set of unknown parameters, while the second component is an error term. Formally,

1) $$V_{ij} = \overline{V}(\mathbf{x}_{ij}, \boldsymbol{\beta}) + \varepsilon_{ij}$$

where the subscript i denotes the respondent, the subscript j denotes the alternative, **x** is the vector of attributes that vary across alternatives (or across alternatives *and* individuals), and ε is an error term that captures individual- and alternative-specific factors that influence utility, but are not observable to the researcher. Equation (1) describes the random utility model (RUM).

We can further assume that the deterministic component of utility is a linear function of the attributes of the alternatives and of the respondent's residual income, (*y* - *C*):

2) $$V_{ij} = \beta_0 + \mathbf{x}_{ij}\boldsymbol{\beta}_1 + (y_i - C_j)\beta_2 + \varepsilon_{ij}$$

where *y* is income and *C* is the price of the commodity or the cost of the program to the respondent.
The coefficient β_2 is the marginal utility of income.

Respondents are assumed to choose the alternative in the choice set that results in the highest utility. Because the observed outcome of each choice task is the selection of one out of K alternatives, the appropriate econometric model is a discrete choice model expressing the probability that alternative k is chosen. Formally,

3) $$\pi_{ik} = \Pr(V_{ik} > V_{i1}, V_{ik} > V_{i2}, ..., V_{ik} > V_{iK}) = \Pr(V_{ik} > V_{ij}) \quad \forall j \neq k$$

where π_{ik} signifies the probability that option *k* is chosen by individual *i*.

This is very important!!!

This means that

4) $\pi_{ik} = \Pr(\beta_0 + \mathbf{x}_{ik}\boldsymbol{\beta}_1 + (y_i - C_{ik})\beta_2 + \varepsilon_{ik} > \beta_0 + \mathbf{x}_{ij}\boldsymbol{\beta}_1 + (y_i - C_{ij})\beta_2 + \varepsilon_{ij}) \ \forall j \neq k$

from which follows that

$$\pi_{ik} = \Pr(\beta_0 + \mathbf{x}_{ik}\boldsymbol{\beta}_1 + y_i\beta_2 - C_{ik}\beta_2 - \beta_0 - \mathbf{x}_{ij}\boldsymbol{\beta}_1 - y_i\beta_2 + C_{ij}\beta_2 > \varepsilon_{ij} - \varepsilon_{ik}) \ \forall j \neq k$$

5) $\pi_{ik} = \Pr[(\varepsilon_{ij} - \varepsilon_{ik}) < (\mathbf{x}_{ik} - \mathbf{x}_{ij})\boldsymbol{\beta}_1 - (C_{ik} - C_{ij})\beta_2) \quad \forall j \neq k$

Equation (5) shows the probability of selecting an alternative **no longer contains terms in (2) that are constant across alternatives**, such as the intercept and income.

It also shows that **the probability of selecting k depends on the differences in the levels of the attributes across alternatives**, and that the negative of the marginal utility of income is the coefficient on the difference in cost or price across alternatives.

From Alberini et al 2005

Dataset in LIMDEP

Left alternative

Right alternative

Status quo

nij=3 because in each choice task there are 3 options

Taxes*castello

12 obs per respondent because each respondent answers 4 choice questions and each choice question has 3 alternatives (A,B and status quo)

Status quo is chosen

Right alternative is chosen

Castello = dummy =1 if respondent lives in castello

Respon	i	picked	nij	taxes	castello	taca
1	1	0	3	25	0	0
1	2	0	3	50	0	0
1	3	1	3	0	0	0
1	4	0	3	100	0	0
1	5	0	3	25	0	0
1	6	1	3	0	0	0
1	7	0	3	50	0	0
1	8	0	3	100	0	0
1	9	1	3	0	0	0
1	10	0	3	50	0	0
1	11	0	3	150	0	0
1	12	1	3	0	0	0
2	1	1	3	100	1	100
2	2	0	3	150	1	150
2	3	0	3	0	1	0
2	4	0	3	150	1	150
2	5	1	3	50	1	50
2	6	0	3	0	1	0
2	7	0	3	100	1	100
2	8	0	3	150	1	150
2	9	1	3	0	1	0
2	10	1	3	150	1	150
2	11	0	3	100	1	100
2	12	0	3	0	1	0

Conditional logit model

If the error terms ε are independent and identically distributed and follow a standard type I extreme value distribution, one can derive a closed-form expression for the probability that respondent i picks alternative k out of K alternatives.

Since the cdf of the standard type I extreme value distribution is $F(\varepsilon) = \exp(-e^{-\varepsilon})$ and its pdf is $f(\varepsilon_i) = \exp(-\varepsilon_i - e^{-\varepsilon_i})$ choosing alternative k means that $\varepsilon_k + V_k > \varepsilon_j + V_j$ for all j≠k, which can be written as $\varepsilon_j < \varepsilon_k + V_k - V_j$. The probability of choosing k is, therefore,

6) $$\pi_{ik} = \Pr(\varepsilon_{ij} < \varepsilon_{ik} + V_{ik} - V_{ij}) \quad \text{for all } j \neq k \quad = \int_{-\infty}^{+\infty} \prod_{j \neq k} F(\varepsilon_{ik} + V_{ik} - V_{ij}) \cdot f(\varepsilon_{ik}) d\varepsilon_{ik}$$

Expression (6) follows from the assumption of independence, and the fact that ε_k is an error term and not observed, so that it is must be integrated out of $F(\varepsilon_{ik} + V_{ik} - V_{ij})$

The product within expression (6) can be re-written as

7) $$\prod_{j \neq k} F(\varepsilon_{ik} + V_{ik} - V_{ij}) \cdot f(\varepsilon_{ik}) = \prod_{j \neq k} \exp(-e^{-\varepsilon_{ik} - V_{ik} + V_{ij}}) \exp(-\varepsilon_{ik} - e^{-\varepsilon_{ik}})$$

$$= \exp\left[-\varepsilon_{ik} - e^{-\varepsilon_{ik}} \left(1 + \sum_{j \neq k} \frac{e^{V_{ij}}}{e^{V_{ik}}} \right) \right]$$

Now write:

8) $$\lambda_{ik} = \log\left(1 + \sum_{j \neq k} \frac{e^{V_{ij}}}{e^{V_{ik}}} \right) = \log\left(\sum_{j=1}^{K} \frac{e^{V_{ij}}}{e^{V_{ik}}} \right)$$

which allows us to rewrite (6) as

9) $$\int_{-\infty}^{+\infty} \exp(-\varepsilon_{ik} - e^{-(\varepsilon_{ik} - \lambda_{ik})}) d\varepsilon_{ik} = \exp(-\lambda_{ik}) \int_{-\infty}^{+\infty} \exp(-\varepsilon_{kk}^{*} - e^{-\varepsilon_{kk}^{*}}) d\varepsilon_{ik}^{*}$$

where $\varepsilon_{ik}^{*} = \varepsilon_{ik} - \lambda_{ik}$

The integrand in expression (9) is the pdf of the extreme value distribution and is, clearly, equal to 1. Equation (9) thus simplifies to $\exp(-\lambda_{ik})$ which by (8) is in turn equal to $\exp(V_{ik}) / \sum_{j=1}^{K} \exp(V_{ij})$

Recalling (2), the probability that respondent i picks alternative k out of K alternatives is

10) $$\pi_{ik} = \frac{\exp(\mathbf{w}_{ik}\boldsymbol{\beta})}{\sum_{j=1}^{K} \exp(\mathbf{w}_{ij}\boldsymbol{\beta})}$$

where $\mathbf{w}_{ij} = \begin{bmatrix} \mathbf{x}_{ij} \\ C_{ij} \end{bmatrix}$ is the vector of all attributes of alternative j, including cost,

and $\boldsymbol{\beta} = \begin{bmatrix} \boldsymbol{\beta}_1 \\ -\beta_2 \end{bmatrix}$

Equation (10) is the contribution to the likelihood in a conditional logit model. The full log likelihood function of the conditional logit model is

11) $$\log L = \sum_{i=1}^{n} \sum_{k=1}^{K} y_{ik} \cdot \log \pi_{ik}$$

where y_{ik} is a binary indicator that takes on a value of 1 if the respondent selects alternative k, and 0 otherwise. The coefficients are estimated using the method of Maximum Likelihood (MLE).

We can further examine the expression for π_{ik} in equation (10) to show that π_{ik} depends on the differences in the level of the attributes between alternatives. To see that this is the case, we begin by re-writing (10) as

12) $$\pi_{ik} = \frac{\exp(\mathbf{w}_{ik}\boldsymbol{\beta})}{\sum_{j=1}^{K}\exp(\mathbf{w}_{ij}\boldsymbol{\beta})} = \left[\frac{\exp(\mathbf{w}_{ik}\boldsymbol{\beta})}{\exp(\mathbf{w}_{i1}\boldsymbol{\beta}) + \ldots + \exp(\mathbf{w}_{ik}\boldsymbol{\beta}) + \ldots + \exp(\mathbf{w}_{iK}\boldsymbol{\beta})}\right]$$

which is equal to

13) $$= \left[\frac{\exp(\mathbf{w}_{i1}\boldsymbol{\beta}) + \ldots + \exp(\mathbf{w}_{ik}\boldsymbol{\beta}) + \ldots + \exp(\mathbf{w}_{iK}\boldsymbol{\beta})}{\exp(\mathbf{w}_{ik}\boldsymbol{\beta})}\right]^{-1}$$

and thus to

14) $$= \left\{\exp\left[(\mathbf{w}_{i1} - \mathbf{w}_{ik})\boldsymbol{\beta}\right] + \ldots + 1 + \ldots + \exp\left[(\mathbf{w}_{ik} - \mathbf{w}_{iK})\boldsymbol{\beta}\right]\right\}^{-1}$$

For large samples and assuming that the model is correctly specified, the maximum likelihood estimates $\hat{\beta}$ are normally distributed around the true vector of parameters β, and the asymptotic variance-covariance matrix, Ω, is the inverse of the Fisher information matrix. The information matrix is defined as

15) $$I(\beta) = \sum_{i=1}^{n} \sum_{k=1}^{K} \pi_{ik} (\mathbf{w}_{ik} - \overline{\mathbf{w}}_i)(\mathbf{w}_{ik} - \overline{\mathbf{w}}_i)'$$

where $$\overline{\mathbf{w}}_i = \sum_{k=1}^{K} \pi_{ik} \mathbf{w}_{ik}$$

Marginal Prices and WTP

Once model (11) is estimated, the rate of trade off between any two attributes is the ratio of their respective β coefficients. The marginal value of attribute *l* is computed as the negative of the coefficient on that attribute, divided by the coefficient on the price or cost variable:

16) $$MP_l = -\frac{\hat{\beta}_l}{\hat{\beta}_2}$$

The willingness to pay for a commodity is computed as:

17) $$WTP_i = -\frac{\mathbf{x}_i \hat{\boldsymbol{\beta}}_1}{\hat{\beta}_2}$$

where **x** is the vector of attributes describing the commodity assigned to individual i. It should be kept in mind that a proper WTP can only be computed if the choice set for at least some of the choice sets faced by the individuals contains the "**status quo**" (in which no commodity is acquired, and the cost is zero). Expression (17) is obtained by equating the indirect utility associated with commodity $\mathbf{x}_i$ and residual income $(y - C)$ with the indirect utility associated to the status quo (no commodity) and the original level of income *y*, and solving for *C*.

Is conjoint analysis better than contingent valuation?

- Several analysts believe that conjoint analysis questions reduce strategic incentives, because individuals are busy trading off the attributes of the alternatives and are less prone to strategic thinking (Adamowicz et al., 1998).
- The same reasoning and the fact that conjoint choice questions may appear less “stark” than the take-it-or-leave options of contingent valuation has led other researchers to believe that “protest” behaviors are less likely to occur in conjoint analysis surveys.
- Some valuation researchers (Carson, Hanemann) do not believe in conjoint analysis because they believe that much effort must be spent in stated preference studies to provide a scenario that is fully understood and accepted by the respondent. Changing this scenario from one choice question to the next, they point out, results in a loss of credibility of the scenario and may induce rejection of the choice task.

Descriptive statistics from Alberini et al. 2005

Table 2. Individual Characteristics of the Respondents (categorical variables).

Percentage of the sample who:	
Is a resident of the city of Venice	88.10
Has visited the Arsenale	72.35
Is a male	52.43
Is married	9.32
Is gainfully employed	25.40
Is currently looking for a job	14.79
Is a student	42.44
Is a homemaker	0.32
Is a retiree	3.86
Has a college degree	47.27
Owns a boat	19.61
Has gone to the theater at least once in the last 12 months	72.03
Belongs to an Environmental Organization	36.01
Belongs to a Civic Association	12.22
Has visited a museum or art exhibit over the last 12 months	91.64

Table 3. Individual Characteristics of the Respondents (continuous variables).

	mean	**Std. deviation**	**minimum**	**Maximum**
Age	31.90	11.32	17	78
Household income	29741.10	24600.99	7500	100000
Years of schooling	16.01	3.07	5	21
Household size	3.35	2.09	1	26

Results from Alberini et al. (2005).

Table 10. Conditional logit model of the responses to the choice questions. Obs 892.

	Specification A		Specification B		Specification C		Specification D	
	coeff	**t -stat**	**Coeff**	**t -stat**	**coeff**	**t -stat**	**coeff**	**t -stat**
STATUSQUO	-1.5838	-13.7415	-1.0411	-3.7415				
MOORINGS			0.2182	1.9270	0.2438	2.0807	0.2259	1.8985
NEW_CONS			-0.1175	-1.0741	0.2808	2.1674	0.2646	2.0237
CONNECTI			0.7095	6.9944	0.7673	7.1876	0.6311	4.9854
JOBS			0.0018	2.3532	0.0045	3.7096	0.0045	3.6275
TAXES			-0.0039	-2.7647	-0.0059	-3.7346	-0.0060	-3.7496
LANDUSE1					0.2725	0.7474	0.3034	0.8247
LANDUSE2					0.7762	2.6638	0.3495	1.0870
LANDUSE3					-0.9163	-2.2960	-0.6451	-1.5760
LANDUSE4					0.4768	1.2407	0.5315	1.3708
LANDUSE3 * (DUMMY TOURISTS)[1]							-0.7404	-2.3349
LANDUSE2 * (DUMMY ABITARE)[2]							1.1860	3.9800
CONNECTI * (DUMMY LINKS)[3]							0.3948	1.9814
							0.2259	1.8985
log likelihood	-836.8628		-804.442		-755.4047		-742.0907	

[1] DUMMY TOURISTS = dummy variable that takes on a value of 1 if a respondent rates the presence of tourists as 4 or 5 on a scale where 1 means not important at all and 5 very important.

[2] DUMMY ABITARE = dummy variable that takes on a value of 1 if a respondent rates the cost of housing as 4 or 5 on a scale where 1 means not important at all and 5 very important.

[3] DUMMY LINKS = dummy variable that takes on a value of 1 if a respondent rates the presence of fast transportation connections as a prerequisite for the optimal reuse of the Arsenale as 5 on a scale where 1 means not important at all and 5 very important.