LECTURE / DISCUSSION

Stated Preference (Conjoint) Market Research Data

Data for Estimation of Choice Models

Revealed Preferences (RP):

- observed or reported actual behavior

Stated Preferences (SP):

- observed or expressed in response to hypothetical scenarios (or "experiments")

Stated Preferences: Motivation

- Identification
  - new alternatives
  - new attributes
  - attribute levels beyond range of RP data
  - non-market applications
- Efficiency
  - limited variability of attributes in RP data
  - collinearity of attributes in RP data
- Choice set definition
  - choice set and attribute values are prespecified
- Data Collection Resources
  - RP data may be too expensive and time-consuming to collect

SP Approaches

Experimental setting:

- the context of the hypothetical scenarios
- alternatives or profiles are bundles of attributes
- respondents are presented with limited sets of alternatives

Expression of preferences:

- Rating
- Ranking
- Matching
- Choice

Potential Sources of Bias in SP Data

1. Indifference to the experimental task
2. Policy response bias (strategic misrepresentation)
3. Justification bias
4. Omission of situational constraints
5. Incomplete descriptions of alternatives
6. Cognitive incongruity with actual behavior
7. Context effects (anchoring, embedding)

Stated Preferences: Issues

- Validity -- SP response protocol vs. actual behavior
- Realism
- Complexity
- Difficulty
- Repetitions

Experimental Design for Three Attributes with Two Levels Each

Options	Attributes		
	Fare	Travel Time	Frequency
1	Low	Fast	Infrequent
2	Low	Fast	Frequent
3	Low	Slow	Infrequent
4	Low	Slow	Frequent
5	High	Fast	Infrequent
6	High	Fast	Frequent
7	High	Slow	Infrequent
8	High	Slow	Frequent

Numeric representation:

Options	Attributes (-1 = poor; 1 = good)		
	1	2	3
1	1	1	-1
2	1	1	1
3	1	-1	-1
4	1	-1	1
5	-1	1	-1
6	-1	1	1
7	-1	-1	-1
8	-1	-1	1

Presentation of Public Transport Options

Public Transport Service		(Option 1)
Fare = $0.30	Travel time = 15 mins	Frequency = every 30 minutes

Public Transport Service		(Option 2)
Fare = $0.30	Travel time = 15 mins	Frequency = every 15 minutes

Public Transport Service		(Option 3)
Fare = $0.30	Travel time = 25 mins	Frequency = every 30 minutes

Public Transport Service		(Option 4)
Fare = $0.30	Travel time = 25 mins	Frequency = every 15 minutes

Public Transport Service		(Option 5)
Fare = $0.50	Travel time = 15 mins	Frequency = every 30 minutes

Public Transport Service		(Option 6)
Fare = $0.50	Travel time = 15 mins	Frequency = every 15 minutes

Public Transport Service		(Option 7)
Fare = $0.50	Travel time = 25 mins	Frequency = every 30 minutes

Public Transport Service		(Option 8)
Fare = $0.50	Travel time = 25 mins	Frequency = every 15 minutes

(Note: Experiment attributes are:

Fare:	Low = $0.30;	High = $0.50
Time:	Fast = 15 mins;	Slow = 25 mins
Frequency:	Frequent = every 15 mins;	Infrequent = every 30 mins)

Examples of a Fractional Factorial Design Derived from a Full Factorial Design

Full Factorial Design

	Attributes			Interactions			
				(Two-way)			(Three-way)
	1	2	3	1 x 2	1 x 3	2 x 3	1 x 2 x 3
Options:							
1	+1	+1	-1	+1	-1	-1	-1
2	+1	+1	+1	+1	+1	+1	+1
3	+1	-1	-1	-1	-1	+1	+1
4	+1	-1	+1	-1	+1	-1	-1
5	-1	+1	-1	-1	+1	-1	+1
6	-1	+1	+1	-1	-1	+1	-1
7	-1	-1	-1	+1	+1	+1	-1
8	-1	-1	+1	+1	-1	-1	+1

Fractional Factorial Design:

2	+1	+1	+1	+1	+1	+1	+1
3	+1	-1	-1	-1	-1	+1	+1
5	-1	+1	-1	-1	+1	-1	+1
8	-1	-1	+1	+1	-1	-1	+1

A Definition of Attribute Levels Dependent on the Characteristics of a Respondent's Actual Trip

	Cost	Travel Time	Frequency of Service
Respondent's Actual Trip	$1.00	20 mins	Bus every 20 mins

Definitions of Attribute Levels

Stated Preference Alternatives	**Cost**	**Travel Time**	**Frequency of Service**
(As absolute changes)			
1	+30¢	+10 mins	-10 mins
2	-20¢	-5 mins	+20 mins
(As proportional changes)			
1	+30%	+50%	-50%
2	-20%	-25%	+100%

Presentation of Choices

	Recent Trip			**Alternative Trip**		
	Cost	Time	Frequency	Cost	Time	Frequency
1	$1.00	20 mins	1 every 20 mins	$1.30	30 mins	1 every 10 mins
2	$1.00	20 mins	1 every 20 mins	$0.80	15 mins	1 every 40 mins

Experimental Design

- Attributes z_k, $k = 1,...,K$.
- Levels $z_{k\ell}$, $\ell = 1,...,L_k$.
- Profiles $i = \{z_k(i), k = 1,...,K\}$.
- Full factorial: $\prod_{k=1}^{K} L_k$ possible profiles.
- Fractional factorial design: an "optimal" subset of profiles.

Analysis of Conjoint Data

- Individual specific vs. taste variation models.
- Part-worth utilities

$$u_{in} = \sum_{k=1}^{K} \sum_{\ell=1}^{L_k - 1} \beta_{k\ell n} 1(z_k(i) = z_{k\ell})$$

- Systematic taste variation:
  - include interactions of attributes $z_k(i)$ and socioeconomic characteristics of n.

Estimation Methods

- Rating and Matching Data

  least squares regression methods for individual or pooled data

- Ranking and Choice Data

  discrete choice models for pooled data

Application of MNL to Ranking Data

- IIA (or MNL) implies that the probability of an observed ranking is a product of MNL's with different choice sets as follows:

$$\text{Prob}(1 > 2 > \ldots > J) = P(1|\{1,2,\ldots,J\})\ P(2|\{2,\ldots,J\})\ \ldots\ P(J-1|\{J-1,J\})$$

  where

$$P(i|\{i,\ldots,J\}) = \frac{e^{V_i}}{\sum_{j=i}^{J} e^{V_j}}$$

- Estimate model by creating J-1 observations with choices and choice sets as shown above.

Data Structure for Ranking Data

Example: Rank Order of 4 Alternatives

Original Data

Individual	Ranking of Alternatives				Attributes of Alternatives			
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 1	Alt. 2	Alt. 3	Alt. 4
1	2	1	4	3	C_{11}	C_{21}	C_{31}	C_{41}
2	4	2	3	1	C_{12}	C_{22}	C_{32}	C_{42}
• • •								
N	1	4	3	2	C_{1N}	C_{2N}	C_{3N}	C_{4N}

Choice Data

Individual	Observation	Choice	Attributes				Censors			
			Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 1	Alt. 2	Alt. 3	Alt. 4
1	1	2	C_{11}	C_{21}	C_{31}	C_{41}	1	1	1	1
	2	1	C_{11}	C_{21}	C_{31}	C_{41}	1	0	1	1
	3	4	C_{11}	C_{21}	C_{31}	C_{41}	0	0	1	1
2	1	4	C_{12}	C_{22}	C_{32}	C_{42}	1	1	1	1
	2	2	C_{12}	C_{22}	C_{32}	C_{42}	1	1	1	0
	3	3	C_{12}	C_{22}	C_{32}	C_{42}	1	0	1	0
• • •										
N	1	1	C_{1N}	C_{2N}	C_{3N}	C_{4N}	1	1	1	1
	2	4	C_{1N}	C_{2N}	C_{3N}	C_{4N}	0	1	1	1
	3	3	C_{1N}	C_{2N}	C_{3N}	C_{4N}	0	1	1	0

Applications

1. Forecasting demand for telephone EAS

- Stated preference for EAS versus toll service at one experimental EAS price per subject.
- Population familiar with product, and aware that introduction was planned.
- Model based on economic consumer theory.
- Successful in forecasting both penetration of EAS and stimulation of usage.

Further reading: pages 182-190.

2. Contingent valuation of natural resources

- Stated willingness-to-pay for resource preservation, elicited directly (open-ended) or in a referendum format.
- Product is of limited familiarity and definition, and is not normally thought about in terms of economic tradeoffs.
- SP responses show strong anchoring and embedding bias, failing necessary conditions for consistent forecasts of preferences.

Further reading: pages 191-202.

Application:
Forecasting Demand for Telephone EAS

Reference: Don Kridel (1989) "A consumer surplus approach to predicting EAS development and stimulation rates", Information Economics and Policy, 379-90.

Problem: In 1987, the residents of Red Bluff, Texas, had only toll telephone service to nearby Dallas. The Texas PUC mandated the introduction of extended area service (EAS), giving Red Bluff customers the option of choosing a flat rate for non-toll calling to and from Dallas. Kridel designed a simple conjoint experiment. A random sample of customers were given a description of EAS, including monthly price (at one of eight treatment levels from $5 to $40 per month), and asked if they would choose this EAS tariff over their current toll service. This survey was done at a time when introduction of EAS service was a community issue, so that consumers were generally familiar with the product and had previously had time to form attitudes toward this type of tariff. The sample consisted of 840 observations, with data on intended CHOICE (= 1 if EAS), monthly EAS price (at one of the eight experimental treatment levels), historical Dallas toll rate (p_o), *perceived* historical Dallas toll calling volume (q_o), and a series of household variables, including household income, education of head, and an index of "interest" in EAS, defined as the sum of indicators for the following activities in Dallas: working, shopping, children in school, family or friends.

Model: Assume that calling quantity (minutes) to Dallas at a measured rate p per minute satisfies

$$q = q_o \cdot \exp[\alpha(p_o - p)] \cdot (y / y_o)^{\beta} \cdot \exp[(\varepsilon - \varepsilon_o) / \gamma] \quad ,$$

where p_o is the historical toll rate, q_o is perceived historical toll minutes, y is income with historical level y_o, and ε is a disturbance with historical level ε_o. The terms α, β, and γ are parameters.

Kridel makes α and γ parametric functions of household variables, education and index of interest in EAS, interacted with historical characteristics of the household's telephone usage. This demand function has the property that at historical levels of variables, one obtains the perceived historical level of demand. Thus, this is a demand system that contains a "household effect" which guarantees that forecasts pivot off perceived historical demand for each customer. The functional form displays an income elasticity of demand β, and has the property that demand is finite even if the toll price were zero. The last feature is consistent with economic theory of consumer purchase of commodities that have a time cost as well as an out-of-pocket cost.

From economic theory, the demand function above is related by ***Roy's identity*** to an ***indirect utility function***,

$$\left.\frac{dy}{dp}\right|_{u=\text{constant}} = q_o \cdot \exp\left[\alpha(p_o - p)\right] \cdot \left(\frac{y}{y_o}\right)^{\beta} \cdot \exp\left[\frac{(\varepsilon - \varepsilon_o)}{\gamma}\right] \quad .$$

This is a differential equation. You can verify by differentiation that the following equation is a solution:

$$u = U(y,p) \equiv \frac{y^{1-\beta}}{1-\beta} + \frac{1}{\alpha} \cdot q_o\, y_o^{-\beta} \cdot \exp\left[\alpha(p_o - p) + \frac{(\varepsilon - \varepsilon_o)}{\gamma}\right] \quad .$$

Under EAS, there is a flat monthly charge c , no measured service charge ($p = 0$), and possibly a compensating cost adjustment δ due to the elimination of monitoring cost, risk, and benefits to others from non-toll incoming calls. Then, the utility of EAS is

$$u = U(y - c + \delta, 0) = \frac{(y - c + \delta)^{1-\beta}}{1-\beta} + \frac{1}{\alpha} \cdot q_o y_o^{-\beta} \cdot \exp[\alpha p_o + (\varepsilon - \varepsilon_o)/\gamma] \quad .$$

Then, the utility of EAS exceeds the utility of measured service if

$$0 < U(y_o - c + \delta, 0) - U(y_o, p_o) \equiv \frac{(y_o - c + \delta)^{1-\beta}}{1-\beta} + \frac{1}{\alpha} \cdot q_o y_o^{-\beta} \cdot \exp[\alpha p_o + (\varepsilon - \varepsilon_o)/\gamma]$$

$$- \frac{y_o^{1-\beta}}{1-\beta} - \frac{1}{\alpha} \cdot q_o y_o^{-\beta} \cdot \exp[(\varepsilon - \varepsilon_o)/\gamma] \quad ,$$

or

$$\varepsilon - \varepsilon_o < -\gamma \cdot \log(p_o q_o / y_o) - \gamma \cdot \log\left(\frac{\exp(\alpha p_o) - 1}{\alpha p_o}\right) + \gamma \cdot \log\left(\frac{1 - (1 - (c - \delta)/y_o)^{1-\beta}}{1-\beta}\right) \quad .$$

If ε-ε_o has a cumulative distribution function $F(\cdot)$, then the probability that a consumer will <u>not</u> take EAS is

$$P = F\left(-\gamma \cdot \log(p_o q_o / y_o) - \gamma \cdot \log\left(\frac{\exp(\alpha p_o) - 1}{\alpha p_o} \right) + \gamma \cdot \log\left(\frac{1 - (1 - (c - \delta)/y_o)^{1-\beta}}{1 - \beta} \right) \right)$$

Reasonable assumptions for the application would be that F is standard logistic or standard normal.

The form above is not completely conventional because it is nonlinear in the parameters α, β, and δ. However, under the conditions $(c-\delta)/y_o << 1$, $\alpha p_o << 1$, and $\delta << c$, the model can be "linearized" by using the following approximations:

$$\left(1 - (c-\delta)/y_o\right)^{1-\beta} = 1 - \beta\left(\frac{c-\delta}{y_o}\right) - \frac{\beta(1-\beta)}{2}\left(\frac{c-\delta}{y_o}\right)^2 - \cdots$$

$$\frac{1 - \left(1 - (c-\delta)/y_o\right)^{1-\beta}}{\beta} = \left(\frac{c-\delta}{y_o}\right) + \frac{(1-\beta)}{2}\left(\frac{c-\delta}{y_o}\right)^2 + \cdots$$

$$\log\left(\frac{1 - \left(1 - (c-\delta)/y_o\right)^{1-\beta}}{\beta}\right) = \log\left(\frac{c-\delta}{y_o}\right) + \log\left(1 + \frac{1-\beta}{2}\cdot\frac{c-\delta}{y_o} + \cdots\right)$$

$$= \log\left(\frac{c-\delta}{y_o}\right) + \frac{1-\beta}{2}\cdot\frac{c-\delta}{y_o} + \cdots$$

$$= \log\left(\frac{c}{y_o}\right) - \frac{\delta}{c} + \frac{1-\beta}{2}\cdot\frac{c-\delta}{y_o} + \cdots$$

$$\log\left(\frac{e^{\alpha p_o}}{\alpha P_o}\right) = \frac{\alpha p_o}{2} + \frac{(\alpha p_o)^2}{6} + \cdots$$

Then, for example, with $\varepsilon - \varepsilon_o$ assumed to have a standard logistic distribution and these approximations substituted, one obtains a "conventional" logistic model

$$P \approx \frac{1}{1 + \exp\left[\gamma\cdot\log(p_o q_o/c) - \gamma\delta/c + \gamma\alpha p_o/2 - \gamma(1-\beta)(c-\delta)/2y_o\right]} \quad .$$

It is essentially this model, with α and γ functions of household characteristics, that Kridel estimates.

Starting from the model estimated on the sample data describing intended "penetration" under alternative EAS monthly charges, Kridel predicted both penetration and usage under alternative EAS rates. The forecasts for Red Bluff are given below:

EAS Monthly Charge	Predicted Penetration of EAS	Predicted Stimulation of Usage
$5	70%	130%
$20	54%	103%
$25	48%	91%

On the basis of these forecasts, the tariff was set at $20 / month. Twelve months after introduction of EAS, the observed penetration rate was 58 percent, and the observed stimulation rate was 100 percent.

The conclusions that can be drawn from this study:

- The use of a plausible model constructed from economic theory, combined with the use of historical data to establish a fixed effect for each customer, leads to a very accurate forecast, even though discrete choice information alone is used to predict both discrete and continuous demand behavior.

- In this context where the product is relatively well understood by consumers, and the proposed offering is relevant and immediate, there appears to be little difficulty in using stated rather than revealed preference data.

Application:
Contingent Valuation of Natural Resources

Reference: Daniel McFadden (1994) "Contingent Valuation and Social Choice", American Journal of Agricultural Economics, Vol. 76, No. 4, pp. 689-708.

Problem: The existence of natural resources such as spotted owls, wilderness areas, and rain forests have value to many consumers, but these values are not observable in economic markets or other revealed consumer behavior. A tool that has been developed to measure these values is *contingent valuation*, a simple form of conjoint analysis in which consumers are asked directly about willingness-to-pay (WTP) for the resource. The most common elicitation method is a *referendum* question in which the subject is asked whether or not she is willing to pay a bid level $*b* to preserve the resource. Often, a *double referendum* is used in which there is a follow up bid. Another *open-ended* elicitation method is to ask for a dollar willingness-to-pay amount.

Issue: The question is whether this simple survey approach is reliable for resource issues that consumers may not be familiar with or have given much thought to, and which are quite different than common commodities encountered in markets. CV studies often imply large social values. For example, the Nestucca study of WTP to prevent small oil spills off the Washington State coast that kill seagulls finds that the residents of Washington state that their WTP is $4025 per gull saved. Compare this to the $2 cost of hatching and releasing a gull. Taken at face value, this study would suggest high-cost seagull preservation programs.

THE SELWAY EXPERIMENTS

RESOURCE ISSUE: WTP TO PROTECT THE SELWAY-BITTERROOT WILDERNESS (IDAHO) FROM LOGGING (AT 1% PER YEAR)

OPEN-ENDED	DOUBLE REFERENDUM
OE1. Hh WTP FOR SELWAY	DR1. Hh WTP FOR SELWAY
OE2. Hh WTP FOR 57 AREAS	DR2. Hh WTP FOR 57 AREAS
OE3. Hh WTP FOR SELWAY, NO INFORMATION ON OTHER AREAS	DR3. Hh WTP FOR SELWAY PLUS TWO OTHER AREAS
OE4. INDIVIDUAL WTP FOR SELWAY, NO INFO. ON OTHER AREAS	DR4. Hh WILLINGNESS TO VOTE FOR SELWAY

Parametric Model

$$W = y - \left[y^{1-\alpha} - (1-\alpha)z\right]^{\frac{1}{1-\alpha}}$$

where W = WTP, y = income, and z = latent taste variable.

z ~ F(z)Log normal mixed with point mass at z = 0 .

$$P(W \le w) = F\left(\frac{y^{1-\alpha} - (y-w)^{1-\alpha}}{1-\alpha}\right) \qquad \text{OE}$$

$$P(\text{No}|B) = F\left(\frac{y^{1-\alpha}}{1-\alpha} - \frac{(y-B)^{1-\alpha}}{1-\alpha}\right) \qquad \text{SR}$$

For DR, bids B’ < B’’ :

$$P(\text{Both No}|B^{/},B^{//}) = F\left(\frac{y^{1-\alpha}}{1-\alpha} - \frac{(y-B^{/})^{1-\alpha}}{1-\alpha}\right) \qquad \text{DR}$$

$$P(\text{Bracket}|B^{/},B^{//}) = F\left(\frac{y^{1-\alpha}}{1-\alpha} - \frac{(y-B^{//})^{1-\alpha}}{1-\alpha}\right) - F\left(\frac{y^{1-\alpha}}{1-\alpha} - \frac{(y-B^{/})^{1-\alpha}}{1-\alpha}\right)$$

$$P(\text{Both Yes}|B^{/},B^{//}) = 1 - F\left(\frac{y^{1-\alpha}}{1-\alpha} - \frac{(y-B^{//})^{1-\alpha}}{1-\alpha}\right)$$

Mixed log normal with covariates x

$$F(z) = \begin{cases} 1 - \pi & \text{if } z = 0 \\ 1 - \pi + \pi\Phi\left(\dfrac{\log(z) - \beta_0 - \beta_1}{\sigma}\right) & \text{if } z > 0 \end{cases}$$

Log likelihood of observation for OE data

$$\ell = \begin{cases} \log(1 - \pi) & \text{if } W = 0 \\ \log\pi + \log\left[\dfrac{1}{\sigma z}\varphi\left(\dfrac{\log(z) - \beta_0 - \beta_1}{\sigma}\right)\right] & \text{if } W > 0 \end{cases}$$

$$\text{where } z = \frac{y^{1-\alpha} - (y - W)^{1-\alpha}}{1 - \alpha}$$

Log likelihood of observation for SR data

$$\ell = d \cdot \log F(z) + (1 - d) \cdot \log(1 - F(z))$$

$$\text{where } d = 1 \text{ if "No"}, \quad z = \frac{y^{1-\alpha} - (y - B)^{1-\alpha}}{1 - \alpha}$$

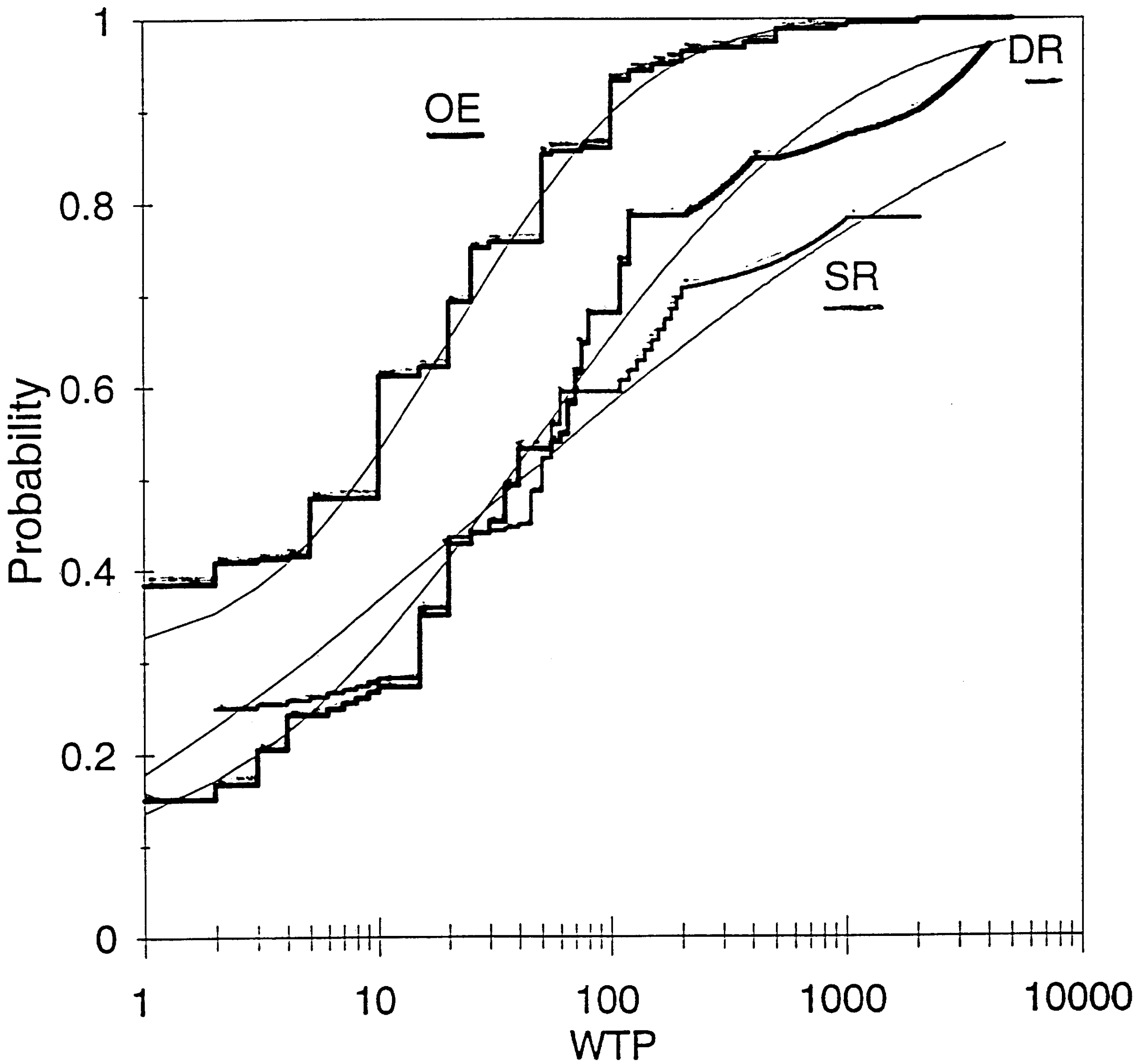
Log likelihood of observation for DR data

$$\ell = d_{NN} \cdot \log F(z') + d_{YY} \cdot \log(1 - F(z'')) + (1 - d_{NN} - d_{YY}) \cdot \log(F(z'') - F(z'))$$

$$\text{where } B' < B'', \quad z' = \frac{y^{1-\alpha} - (y - B')^{1-\alpha}}{1 - \alpha}, \quad z'' = \frac{y^{1-\alpha} - (y - B'')^{1-\alpha}}{1 - \alpha}$$

Estimated WTP
(Std. error)

	Mean		Median	
	Parametric	Non-param.	Parametric	Non-param.
OE1. Hh Selway N=256	44.92 (8.22)	46.60	8.25 (2.39)	10.00
DR1. Hh Selway N=356	529.70 (137.74)	429.90	36.00 (10.75)	35.90
OE2. HH 57 N=275	70.10 (10.89)	70.20	19.87 (4.80)	20.00
DR2. Hh 57 N=365	707.65 (176.41)	463.90	76.81 (20.86)	73.50
OE3. Hh Selway, low info N=279	38.16 (6.72)	-	6.21 (1.91)	-
DR3. Hh Selway + two N=376	345.81 (84.89)	-	46.90 (12.34)	-
OE4. Indiv., Selway N=72	28.95 (8.83)	-	5.83 (2.51)	-
DR4. Hh vote Selway N=368	369.11 (108.06)	-	33.38 (9.45)	-
(Pooled) income elasticity of WTP 0.32 (SE 0.06)				

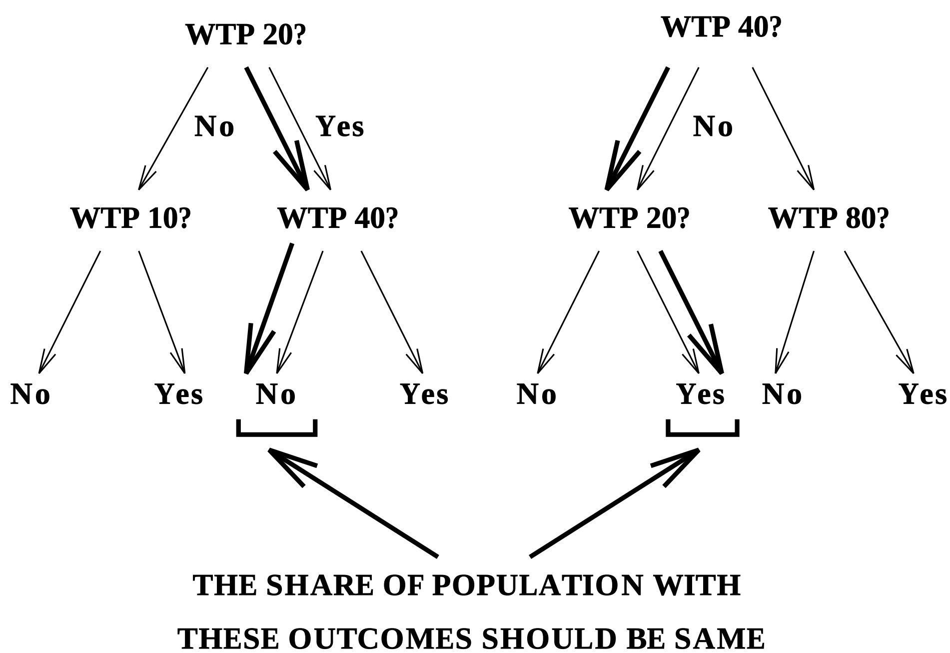

1
0.8
0.6
0.4
0.2
0
Probability
OE
DR
SR
1
10
100
1000
10000
WTP

Effect of Covariates

	OE1	DR1
Age	-.108 (.01)	-.069 (.013)
Sex	.267 (.222)	.972 (.322)
Education	.037 (.055)	.037 (.056)
log (HH size)	-.269 (.226)	-.386 (.338)
Outdoor activities	.043 (.133)	.595 (.214)
Location	.431 (.262)	-.165 (.375)
Visit area	.645 (.315)	.411 (.442)

Test for Consistency of DR Responses

P(Bracket | B’,B") Independent of whether B’ or B" ,
where B’ < B" , is presented first.



In experiments DR1 - DR4 and the bid pairs that have the configuration above [(10,20), (20,40), (100,200), 1000,2000)], the hypothesis that share bracketed does not depend on sequencing is ***rejected*** at 1%.

Ave. Prob. of Bracket for High B First		Ave. Prob. of Bracket for Low B First
0.088	<<	0.204

Willingness-to-Pay to Save 50,000 Off-Shore Seabirds per Year

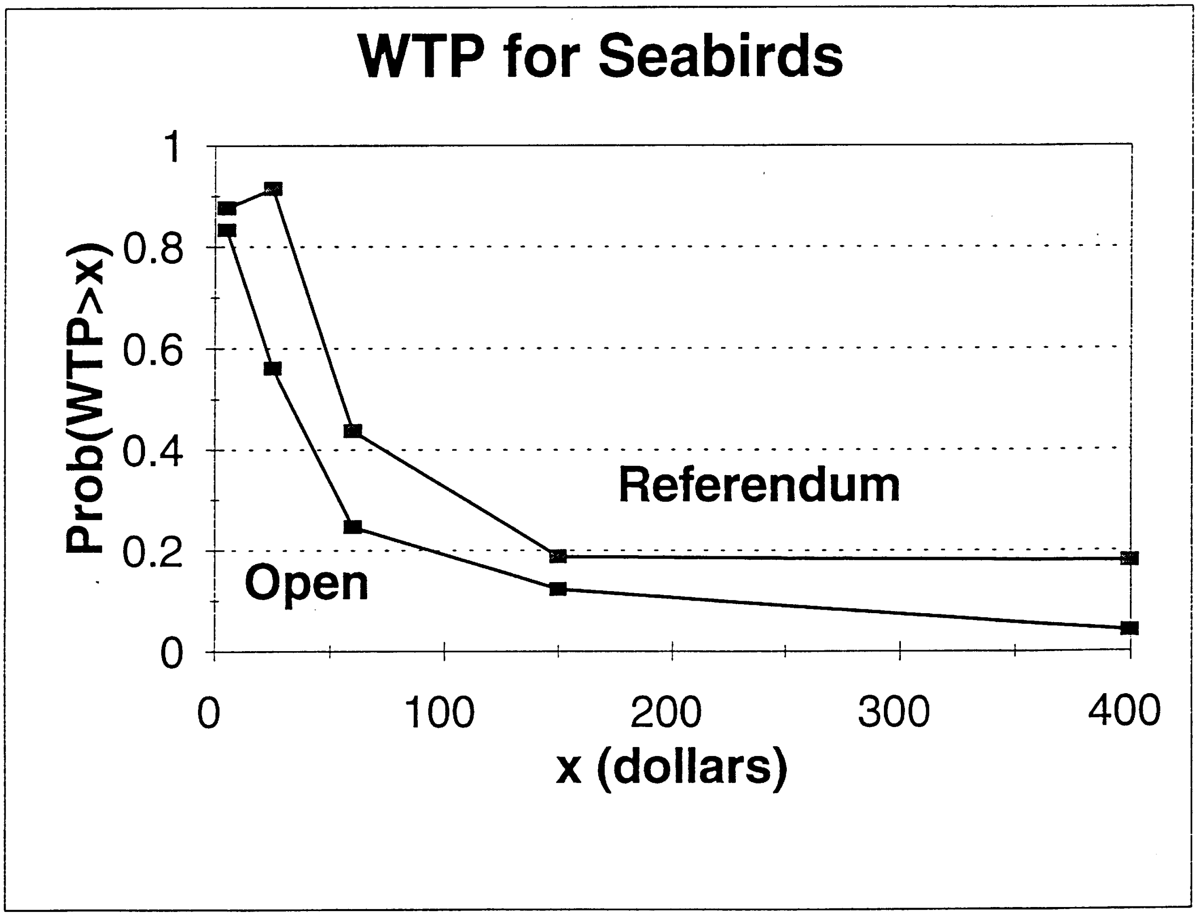
Kahneman-Jacowitz Experiments, San Francisco Exploratorium

Distribution	Open-Ended	Starting Point Bid				
		$5	$25	$60	$150	$400
$0-4.99	19.8%	12.2%	8.5%	0.0%	8.3%	12.0%
$5-24.99	27.3%	67.4%	25.5%	41.7%	29.2%	22.0%
$25-59.99	31.4%	12.2%	53.2%	14.6%	27.1%	20.0%
$60-149.99	12.4%	8.2%	8.5%	41.7%	16.7%	18.0%
$150-399.99	8.2%	0.0%	2.1%	2.1%	18.8%	10.0%
$400+	4.1%	0.0%	2.1%	0.0%	0.0%	18.0%
Sample	121	49	47	48	48	50
Mean WTP (a)	$64.25	$20.30	$45.43	$49.42	$60.23	$143.12
(Std. Error)	$13.22	$3.64	$12.61	$6.51	$8.59	$28.28
Median	$25.00	$10.00	$25.00	$25.00	$43.00	$50.00
P(OE>Bid)	$45.41	83.4%	56.1%	24.7%	12.3%	4.1%
P(WTP>Bid)	$99.87	87.8%	91.5%	43.8%	18.8%	18.0%

NOTES

a. One observation of $2,000,000 is excluded from the calculation of the open-ended mean.

b. If the open-ended mean WTP of $64.25 is representative of all Californians, then the implied value of protecting one seabird is $38,293.


WTP for Seabirds
Prob(WTP>x)
1
0.8
0.6
0.4
0.2
0
Referendum
Open
0
100
200
300
400
x (dollars)

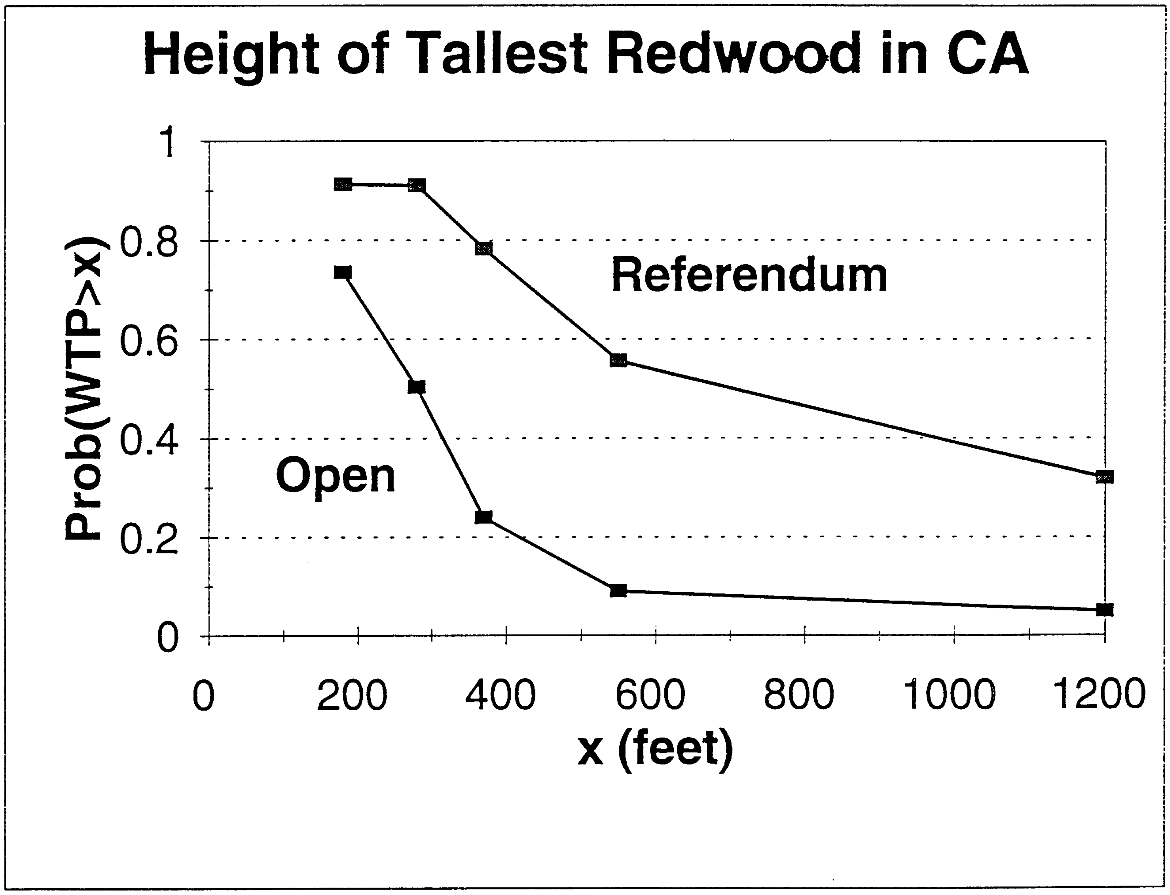
Height in feet of the tallest redwood in California

Kahneman-Jacowitz Experiments, San Francisco Exploratorium

Distribution	Open-Ended	Starting Point Bid				
		180	280	370	550	1200
0-179	26.5%	8.7%	8.9%	4.4%	2.2%	12.8%
180-279	23.1%	54.4%	8.9%	10.9%	11.1%	6.4%
280-369	26.5%	23.9%	42.2%	6.5%	26.7%	17.0%
370-549	14.9%	10.9%	26.7%	56.5%	4.4%	14.9%
550-1199	4.1%	2.2%	11.1%	19.6%	53.3%	17.0%
1200+	5.0%	0.0%	2.2%	2.2%	2.2%	31.9%
Sample	120	46	45	46	45	47
Mean WTP	406.8	282.0	407.0	465.7	570.4	442.2
(Std. Error)	67.7	21.4	38.4	31.0	43.9	100.8
Median	225.0	250.0	350.0	435.0	600.0	500.0
P(OE>Bid)	253.0	73.6%	50.4%	24.0%	9.1%	5.0%
P(WTP>Bid)	633.3	91.3%	91.1%	78.3%	55.6%	31.9%

NOTES

The tallest redwood in California is in truth 366.2 ft.


Height of Tallest Redwood in CA
Prob(WTP>x)
1
0.8
0.6
0.4
0.2
0
Referendum
Open
0
200
400
600
800
1000
1200
x (feet)

WORKSHOP ON CONJOINT DATA

Estimate Logit Model on Conjoint Data

A conjoint experiment was conducted to examine customer preferences toward electric power system reliability, i.e., willingness to pay premia or receive discounts for changes in service interruptions. Subjects were presented with alternative states of reliability represented by annual frequency of outages, their average duration, and an average monthly bill (stated in terms of a percent to the subject's current bill). Subjects were asked to score the alternatives, reflecting the order of their preferences.

Data set: conjoin.sav

Variables:

f1 - f5	Frequency of outages per year under each of the five alternatives. Frequency can be either 0.2 (i.e., two outages per decade), 1, 2, 4, or 30.
d1 - d5	Average duration in hours of outages under each of the five alternatives. Duration can be either 0.0833 (i.e., five seconds), 1, 4, or 48.
bill1 - bill5	Energy bill under each of the five alternatives, expressed as a percent of the subject's current bill.
rank1 - rank5	The rank assigned by the subject to each of the five alternatives. Subjects gave only their first and second choices. Therefore, each rank variable is either 1, 2, or -99 (for not first or second).

Data set contains two pseudo-observations for each subject. The variable:

set

identifies whether the pseudo-observation is for the first choice (set = 1) or the second choice (set = 2).

There are 162 subjects.

The data are arranged such that the first pseudo-observation for all 162 subjects are listed, followed by the second pseudo-observation for all 162 subjects. (That is, observation 1 and 163 relate to the same subject.

```
load file[conjoin.sav]

print var[rank1 rank2 rank3 rank4 rank5 f1 f2 f3 f4 f5 \
d1 d2 d3 d4 d5 bill1 bill2 bill3 bill4 bill5 set] if[obsno==1]

  Obsno          rank1             rank2             rank3
     1:        1.00000           2.00000         -99.00000

  Obsno          rank4             rank5                f1
     1:      -99.00000         -99.00000           0.20000

  Obsno             f2                f3                f4
     1:        0.20000           1.00000           1.00000

  Obsno             f5                d1                d2
     1:        4.00000           1.00000           8.33333e-002

  Obsno             d3                d4                d5
     1:        1.00000           8.33333e-002      4.00000

  Obsno          bill1             bill2             bill3
     1:        0.90000           1.50000           1.10000

  Obsno          bill4             bill5               set
     1:        1.50000           0.90000           1.00000

print var[rank1 rank2 rank3 rank4 rank5 f1 f2 f3 f4 f5 \
d1 d2 d3 d4 d5 bill1 bill2 bill3 bill4 bill5 set] if[obsno==163]

  Obsno          rank1             rank2             rank3
   163:        1.00000           2.00000         -99.00000

  Obsno          rank4             rank5                f1
   163:      -99.00000         -99.00000           0.20000

  Obsno             f2                f3                f4
   163:        0.20000           1.00000           1.00000

  Obsno             f5                d1                d2
   163:        4.00000           1.00000           8.33333e-002

  Obsno             d3                d4                d5
   163:        1.00000           8.33333e-002      4.00000

  Obsno          bill1             bill2             bill3
   163:        0.90000           1.50000           1.10000

  Obsno          bill4             bill5               set
   163:        1.50000           0.90000           2.00000

spool off
```

File **cj.cmd** performs steps 1 and 2. Be sure you understand the logic and commands.

1. Estimate a logit model on the highest ranked alternative only (ignoring the second choice). Enter frequency, duration, and bill as explanatory variables.

2. Estimate the same model using both the first and second ranked alternatives.

   Does the model seem to be better or worse?

3. Test whether the parameters in the first ranked choice are the same as the parameters in the second ranked choice.

DISCUSSION OF WORKSHOP RESULTS