Padre Model in a Nutshell

Utility

A person chooses one of 65 beaches or no-trip on each choice occasion in the season. For a given individual beach *i* gives utility

$$V_i = \beta_{tc} tc_i + \beta_x x_i + \beta_{xy} x_i y + \varepsilon_i \qquad i = 1,...,65$$

where tc_i is the trip cost to reach beach i, x_i is a vector of site characteristics at beach i, and *y* is a vector of individual characteristics. No-trip gives utility

$$V_0 = \alpha z + \varepsilon_0$$

where *z* is a vector of individual characteristics which may include some of the same characteristics in *y*.

Probabilities & Likelihood

The model is estimated as a nested logit with the 65 beaches in one nest and no-trip in another. The probabilities of visiting beach *k* and taking no-trip are

$$\Pr(k) = \frac{\exp\{(\beta_{tc} tc_k + \beta_x x_k + \beta_{xy} x_k y)/\rho\}}{\exp(I)} \cdot \frac{\exp(\rho I)}{\exp(\rho I) + \exp(\alpha z)}$$

$$\Pr(0) = \frac{\exp(\alpha z)}{\exp(\rho I) + \exp(\alpha z)}$$

where $I = \ln \sum_{i=1}^{65} \exp\{(\beta_{tc} tc_i + \beta_x x_i + \beta_{xy} x_i y)/\rho\}$.

These probabilities are used to form the likelihood function. If a person takes multiple trips these are treated as independent. This gives the log-likelihood function

$$L = \sum_{n=1}^{N} \sum_{i=1}^{65} t_{in} \cdot \ln \Pr_n(i) + \sum_{n=1}^{N} (S_n - \sum_{i=1}^{65} t_{in}) \cdot \ln \Pr_n(0)$$

where there are *N* people in the sample denoted by *n* = 1, …, *N* and a person reports t_{in} trips to beach *i* during a season of length S_n. S_n varies across people due to sampling.

Expected Utility & Change in Welfare

A person's expected utility of a choice occasion is $E = \ln\{\exp(\alpha z) + \exp(\rho I)\}$. The choice occasion value for alteration in the choice set (loss of beach or change in beach characteristics) is

$$\Delta w = \frac{\ln\left\{\exp(\alpha z) + \exp(\rho I^{*})\right\} - \ln\left\{\exp(\alpha z) + \exp(\rho I)\right\}}{\beta_{tc}}$$

where I^* denotes the change in choice set.

* The original writer of this Nutshell is Dr. George Parsons.